

Forest Products, Livelihoods and Conservation

Case Studies of Non-Timber Forest Product Systems

VOLUME 1 - ASIA

Editors

Koen Kusters and Brian Belcher



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Office address: Jl. CIFOR, Situ Gede, Sindang Barang

Bogor Barat 16680, Indonesia

Tel: +62 (251) 622622

Fax: +62 (251) 622100

E-mail: cifor@cgiar.org

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Contributors

An Van Bay

Non-Timber Forest Products
Research Centre
8 Chuong Duong Do
Hoan Kiem, Hanoi
Vietnam
E-mail: bay1135@hn.vnn.vn;
ntfp.project@hn.vnn.vn

Catherine Aubertin

Centre IRD d'Orléans
Institut de Recherche pour le
Développement
Technoparc, 5 rue du Carbone
45072 Orléans cedex 2
France
E-mail:
Catherine.Aubertin@orleans.ird.fr

Irdez Azhar

World Wildlife Fund, Wallacea
Bali Jalan Hayam Wuruk 179
Denpasar 80235, Bali
Indonesia
E-mail: iazhar@wallacea.wwf.or.id;
irdez2001@yahoo.com

Brian Belcher

Center for International Forestry
Research
P.O. Box 6596 JKPWB
Jakarta 10065
Indonesia
E-mail: b.belcher@cgiar.org

Arvind A. Boaz

Chhattisgarh Forest Development
Corporation
D-252-253, Sector-5
Devendra Nagar
Raipur (Chhattisgarh)
India - 492004
E-mail: Draboaz@sancharnet.in

Nicolas Césard

IRD-Indonésie
Wisma Anugraha
Jalan Taman 32 B
Jakarta 12730
Indonesia
E-mail: ncesard@wanadoo.fr

Ying Long Chen

School of Biological Sciences and
Biotechnology
Murdoch University
Perth, WA 6150
Australia
E-mail: y.chen@murdoch.edu.au

Dinh Van Tu

Non-Timber Forest Products
Research Centre
8 Chuong Duong Do
Hoan Kiem, Hanoi
Vietnam
E-mail: ntfp.project@hn.vnn.vn

Sonya Dewi

Center for International Forestry
Research
P.O. Box 6596 JKPWB
Jakarta 10065
Indonesia
E-mail: s.dewi@cgiar.org

Joost Foppes

SNV Lao PDR/ Forest Research Center
National Agriculture and Forestry
Research Institute (NAFRI)
P.O. Box 345, Vientiane
Lao PDR
E-mail: jfoppes@loxinfo.co.th

Hubert de Foresta

Institut de Recherche pour le
Développement (IRD)
Current address: Centre ENGREF
Montpellier, 648, Rue Jean-François
Breton, 34093 Montpellier, Cedex 5
France
E-mail: foresta@engref.fr

Fu Maoyi

Research Institute of Subtropical
Forestry, Chinese Academy of
Forestry
73# Daqiao RD, Fuyang 311400
Zhejiang
P. R. China
E-mail: fmy@fy.hz.zj.cn

Carmen García Fernández

CIFOR-Embrapa Oriental
Trav. Enéas Pinheiro S/N. 66.905-780
Belém, Pará
Brazil
E-mail: cgarcia@cgiar.org

Krishna H. Gautam

Nepal Forest Service
Currently: Graduate School of
Environmental Earth Science
Hokkaido University
Sapporo, 060-0810
Japan
E-mail: khgautam@ees.hokudai.ac.jp

Syarif Hidayat

Forestry and Nature Conservation
Research and Development Center
Jln. Gunung Batu No. 5
Bogor
Indonesia
E-mail: syarif.hidayat@mailcity.com

Sounthone Ketphanh

NTFP Unit, Forest Research Center
National Agriculture and Forestry
Research Institute (NAFRI)
P.O. Box 7174, Ban Nong Vieng
Kham, Xaythani
Vientiane
Lao PDR
E-mail: sounthone53@yahoo.com

Koen Kusters

Center for International Forestry
Research
P.O. Box 6596 JKPWB
Jakarta 10065
Indonesia
E-mail: k.kusters@cgiar.org

Ahmad Kusworo

Department of Anthropology
Research School of Asia and Pacific
Studies
Australian National University
Australia

M. Govindan Kutty

Sylva conS
T.M. 16/417, Aiswarya
Kuttimakkool Road
Tellicherry, Kerala
India
E-mail: cnn_gkutty@sancharnet.in

Patrice Levang

Center for International Forestry
Research
P.O. Box 6596 JKPWB
Jakarta 10065
Indonesia
E-mail: p.levang@cgiar.org

Retno Maryani

Center for Social and Economic
Research on Forestry
Jln. Gunung Batu No. 5
P.O. Box 16610, Bogor
Indonesia
E-mail: retnomaryani@hotmail.com

Geneviève Michon

Institut de Recherche pour le
Développement (IRD)
Current address: Centre ENGREF
Montpellier, 648, Rue Jean-François
Breton, 34093 Montpellier, Cedex 5
France
E-mail: genevieve.michon@mpl.ird.fr

T.K. Raghavan Nair

Sylva conS
Vijaya Bhavan
Olai, Kollam-691 009
Kerala
India
E-mail: sylvacon@vsnl.com

Honorato G. Palis

Ecosystem Research Development
Bureau (ERDB)
Laguna 4031
The Philippines
E-mail: hgpalis@lgn.pworld.net.ph

Fadjar Pambudhi

Center for Social Forestry,
Universitas Mulawarman
Gd. Pasca Sarjana Magister
Kehutanan - Kampus
Gn. Kelua. Jl. Ki Hajar Deantara 7
Samarinda, Kalimantan Timur 75123
Indonesia
E-mail: csf@samarinda.org

Pipin Permadi

Forestry Research and Development
Agency, Ministry of Forestry
Manggala Wanabhakti Bld.
Jakarta
Indonesia
E-mail: permadi@indo.net.id

Nitin D. Rai

Department of Biology
Pennsylvania State University
University Park, PA 16802
USA
E-mail: nitinrai@vsnl.com

Dede Rohadi

Forestry Research Institute of Sumatra
Kampus Kehutanan Terpadu Aek Nauli
Jln. Raya Parapat
Km. 10.5, Parapat, Sumatera Utara
Indonesia
E-mail: drohadi@indo.net.id

Vannalack Sengsavanh

c/o Forest Research Center
National Agriculture and Forestry
Research Institute
P.O. Box 7174, Ban Nong Vieng
Kham, Xaythani, Vientiane
Lao PDR

Viloune Soybara

Village Investment for the Poor
Agricultural Development Project
Houay Yang Centre
National Agriculture and Forestry
Extension Service (NAFES)
Vientiane
Lao PDR

Vu Dinh Quang

Non-Timber Forest Products
Research Centre
8 Chuong Duong Do
Hoan Kiem, Hanoi
Vietnam
E-mail: ntfp.project@hn.vnn.vn;
Quang.vudinh@ntfp.org.vn

Michael Victor

Lao-Swedish Upland Agriculture
Research Programme
National Agriculture and Forestry
Research Institute (NAFRI)
P.O. Box 4298, Vientiane
Lao PDR
E-mail: omichael@loxinfo.co.th

Made Widiana

Forestry Research Institute of Bali
and Nusa Tenggara
Jln. Untung Suropati No. 7
P.O. Box 67, Kupang
Indonesia

Yang Xiaosheng

Research Institute of Subtropical
Forestry, Chinese Academy of
Forestry
73# Daqiao RD, Fuyang 311400
Zhejiang
P. R. China
E-mail: yxiaosheng@263.net

Yeo-Chang Youn

Seoul National University
Department of Forest Resources
Silim-dong San 56-1
Gwanak-ku 151-742 (postal code)
Seoul
Republic of Korea
E-mail: youn@snu.ac.kr

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Foreword

J.E. Michael Arnold

Products other than timber and other industrial roundwood have always constituted a large part of the forest economy in developing countries. Individual products provide inputs and income directly to huge numbers of rural and urban households. In many countries the aggregate of non-timber forest products (NTFPs) contributes as much, if not more, to national product as industrial roundwood. However, their designation as 'minor' forest products reflects their relative neglect until quite recently. Produced and consumed largely outside the monetary economy, they attracted only limited attention and even less in the way of measurement and research.

The recent increase in interest in NTFPs has been a consequence of a number of shifts in developmental focus. With the evolution in thinking about the importance of rural development and poverty alleviation has come growing interest in how forests and forest products contribute to households' food and livelihood security. Within this framework forest product activities have begun to attract particular attention as being often one of the larger income-generating components of the non-farm part of the rural economy. In recent years this interest has been reinforced by shifts in development policy and strategy towards more market driven activity within this part of the economy.

At the same time, concerns that development activities be consistent with environmental integrity, and not prejudice the future potential of forest and land resources, have highlighted arguments that managing them for NTFPs might be less environmentally damaging than alternative uses of forests. In addition, the policy shifts that encourage devolution of control and management away from central governments to local institutions have drawn more attention to NTFPs as a potentially important incentive to local forest management.

However, the state of knowledge about these aspects of NTFP activities has not kept pace with this emerging and evolving perception of their increased importance. Though quite a lot is known about the characteristics of many individual products, much less is known about their commercial performance and developmental linkages. Consequently, we are still at a quite early stage in the process of establishing general patterns of NTFP activity that could help us

understand the factors that determine the circumstances in which they are or are not likely to be commercially successful and appropriate.

This knowledge is so rudimentary not only because of the low priority attached to NTFPs in the past, but also because of the complexities of researching and understanding such a highly diverse group of products, produced in such a wide range of different ecological and socioeconomic situations. Some are generated within predominantly subsistence livelihood systems, in order to generate the limited amounts of cash income needed to fill seasonal gaps or tide households over hard times. Others form part of livelihoods that are integrated into the market economy, and can form important and growing sources of household income and improvement. Many NTFPs are goods that fall out of use as incomes rise, or that can no longer compete when more efficiently produced alternatives become available in their markets. Others, in contrast, face expanding markets and generate attractive returns. Consequently greater exposure to market forces may disrupt or even overwhelm some NTFP trades, while offering new or expanded opportunities for others. It is therefore important to understand more precisely the factors that shape such possibilities and threats, in order to be able to identify what types of intervention might encourage the one, or help avert or alleviate the other.

There are also different scenarios to be considered on the supply side. Some NTFPs are extracted from existing 'wild' resources, others are produced from forest resources under some form of management, while still others are outputs of cultivated tree resources within a predominantly agricultural environment. Issues that we may need to know more about include how different forms of management relate to the different roles particular NTFPs play in the associated livelihood and socioeconomic system; the extent to which different NTFP production systems conform to conservation objectives and concerns; and the capacity of existing governance mechanisms to effect desired outcomes.

These three volumes represent one output from a substantial pioneering exercise designed to help fill some of these gaps in our present knowledge base. The study set out to determine what patterns of interaction between factors such as those mentioned above can be discerned from existing information, based on comparative analysis across a substantial number of different products in different situations in Africa, Asia and Latin America. This is not a random, or necessarily representative, sample of case studies. Their choice reflects the availability of the needed information, but the selection covers a wide range of product, circumstance and situation.

The analysis of information provided by this body of work has shown that important patterns can be identified. These are summarised in the introduction chapter of Volume 1. Each volume complements this comparative analysis by providing a descriptive account of each case study that was contributed from a particular geographical region, prepared by the researchers involved. Together they provide a wealth of information about individual NTFPs and the situations in which they are being produced and traded, and indicate the extent of the research base drawn upon in the course of this important exercise. It is to be hoped that it will provide a starting point for further research and analysis to continue the process of improving understanding of the potentials for NTFP activities to contribute successfully to livelihood enhancement and sustainable forest use.

Chapter 1

Non-timber forest product commercialisation: development and conservation lessons

Brian Belcher and Koen Kusters

INTRODUCTION

Non-timber forest products (NTFPs) feature prominently in discussions of rural development and forest conservation. Poor rural people depend on a wide variety of plants, animals and fungi for their own direct use and for sale. Some of these products have important commercial markets and generate substantial revenues. In the search for ways to promote development while at the same time protecting the environment, the idea that forests can produce a flow of valuable products without being subject to the destructive harvesting often associated with industrial forestry has proven attractive to environmental non-governmental organisations, donors and development agencies.

Influential studies, such as the one by Peters *et al.* (1989) suggesting that harvesting NTFPs in tropical forests could generate higher revenues than logging, created a flurry of excitement. Many studies have since been done to document and analyse all aspects of NTFP use and management and projects have been launched to improve NTFP management and to help create and capture more value from NTFP production, processing and trade (see reviews such as Townson 1994; Ruiz-Pérez and Arnold 1997; Neumann and Hirsch 2000). The underlying assumption of many of these activities, implicitly or explicitly, was that NTFPs could be used to improve people's welfare in an environmentally friendly way. More ambitiously, some proposed that by making standing forests more valuable, NTFP commercialisation would create incentives for conserving forests.

Further research and practical experience tempered the early high expectations. Some commentators criticised the economics of the Peters *et al.* (1989) study (e.g., Sheil and Wunder 2002). Other studies found that NTFP values were much more modest (e.g., Godoy *et al.* 2000). Even so, enthusiasm for the approach has continued to grow without a commensurate increase in understanding of the role and potential of NTFPs to contribute to livelihood

and conservation objectives. This inconsistency reflects two interrelated problems. First, the concept of 'NTFP' remains ambiguous. There is no generally agreed upon definition and different groups use the term in different ways to suit their purpose (Belcher 2003). Secondly, research and development approaches have differed greatly in focus, scale, approach and methodology (Arnold and Ruiz-Pérez 1996; Belcher and Ruiz-Pérez 2001; Belcher *et al.* 2003; Marshall *et al.* 2003). Anthropologists, biologists and economists have all taken an interest in NTFPs, but have asked different questions, used widely different methods to answer those questions and, collectively, failed to provide a systematic understanding of the relation between NTFP commercialisation, poverty reduction and forest conservation.

The authors of this book, and the companion volumes from Africa and Latin America, have tried to fill this gap by comparing and contrasting a large number of NTFP case studies. The researchers, each equipped with a detailed understanding of one or more cases, documented 61 cases using a standardised set of variables. Each researcher has written a narrative description of the case to provide the contextual information necessary to understand the quantitative and qualitative data. Collectively these reports provide a rare and valuable resource—a set of NTFP case studies presented in a consistent and comparable manner. This volume presents the narrative reports of the Asian cases. The location of each case study is shown in Figure 1 and some of the more important characteristics of each case are presented in Table 1.

In this introductory chapter we analyse the patterns and key issues derived from the case studies in two ways. First we consider the general patterns that emerged from the analysis of the overall global set of cases. Then we look at the key elements of NTFP production-to-consumption systems that influence the role these systems play in development and conservation, with examples from the Asian cases. We conclude with a summary of the main lessons learned about how to use and support these kinds of systems.

GENERAL PATTERNS IN A GLOBAL ANALYSIS

The study approach

The comparative analysis included 21 cases from Asia, 17 from Africa and 23 from Latin America. They were selected to meet two key criteria: (1) the product has a demonstrated commercial value and (2) the production-to-consumption system (PCS) has been researched and documented, with data available for a large proportion of the variables. The cases were documented using 114 nominal, ordinal, interval and ratio variables organised in categories describing various aspects of the PCS including:

- geographic setting
- biological and physical characteristics of the product
- characteristics of the raw material production system
- ecological implications of production
- socio-economic characteristics of the raw material production system
- institutional characteristics of raw material producers

- policies affecting raw material production
- characteristics of the processing industry
- characteristics of the trade and marketing system
- outside interventions

The rich data set was then explored for relationships among different groups of cases and variables. Exploratory statistical techniques were used to find patterns, identify key context variables, and create a typology of cases. A detailed description of the methodology and variables can be found in Belcher and Ruiz-Pérez (2001).

NTFPs in household strategies

The relationship between the degree to which an NTFP contributes to household economy (measured as a percentage of total cash and in-kind income) and the degree to which households are integrated into the cash economy (measured as the percentage of total household income earned in cash) is very informative. Three main groups of cases can be identified (see Belcher *et al.* 2003 and Ruiz-Pérez *et al.* forthcoming):

1. Low contribution of the product to household economy in the context of low integration into the cash economy ('Coping Strategy');
2. Low contribution of the product in the context of high integration into the cash economy ('Diversified Strategy'); and
3. High contribution of the product with high integration into the cash economy ('Specialized Strategy').

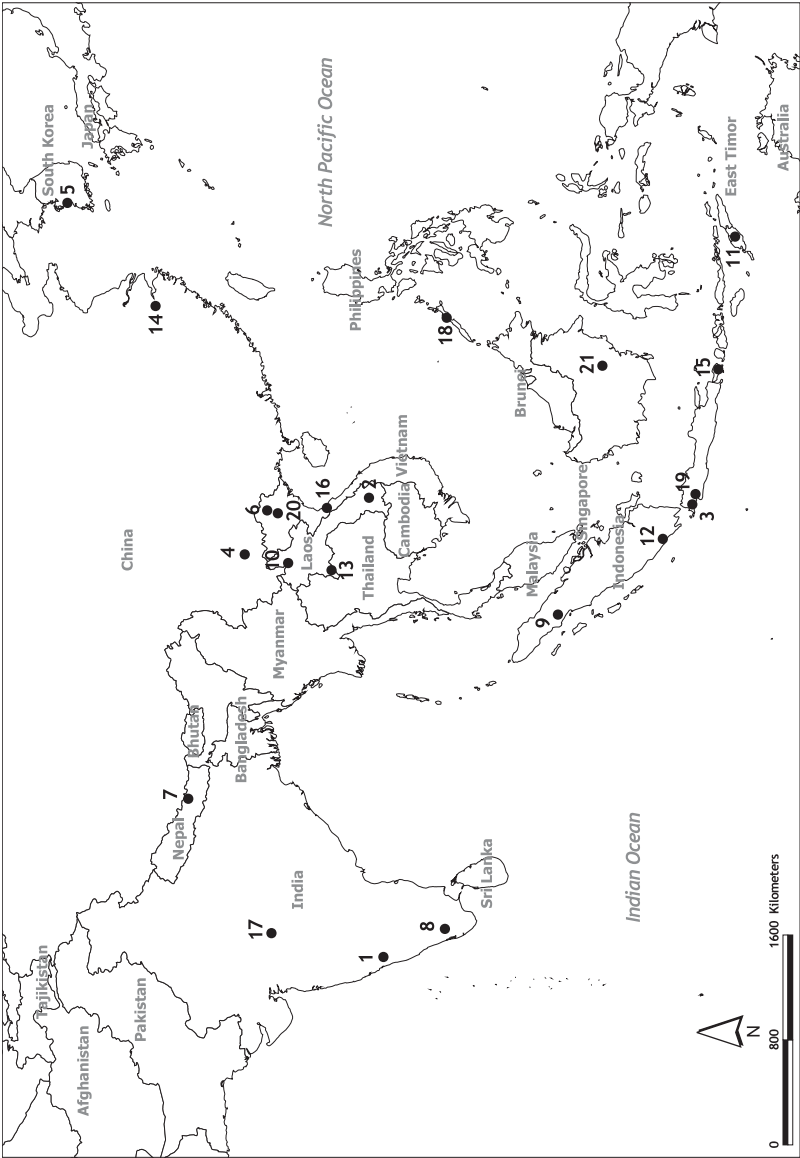
Each of these groups of cases is associated with a number of other characteristics that help describe and explain their socioeconomic and ecological performance.

Coping Strategy

In the first group the NTFP provide less than half of the total household income in subsistence-oriented households. Nevertheless, the NTFP is often the main or even the only source of cash income. Household incomes are low and NTFP producers have incomes that are lower than the local average. These NTFP producers also use a larger number of other forest products, either for their own consumption or (less often) for trade. These cases tend to be located in relatively remote areas, with abundant forests and limited transportation infrastructure. The land from which NTFPs are extracted is often owned by the state. In some cases traditional rules govern access, but in many examples access to the resource is open.

People in this group have limited opportunities for employment. They work as subsistence farmers and supplement their incomes with hunting and gathering. This kind of situation is described in the nonfarm rural economy literature (Lanjouw and Feder 2001), from which we borrowed the term 'coping strategy'. Off-farm activities, such as NTFP harvesting and sales, help make ends meet and provide important sources of cash, but often prove

Figure 1. Location of the case study areas



Source: ESRI Data and Maps 2002.

Table 1. Important characteristics of the cases

no.	country	species	common names	part of the resource used	dominant form of management	transformation*	scale of trade	national trade and export**	geogr. range***	author
1.	India	<i>Garcinia gummi-gutta</i>	Garcinia, Upagge	fruit	wild	high	international	high	small	Rai, N.D.
2.	Lao PDR	<i>Annonum</i> spp.	Cardamom, Makneng	fruit	managed/cultivated	high	international	medium	large	Aubertin, C.
3.	Indonesia	<i>Ocophylla smaragdina</i>	Semut rangrang, Weaver ant, Sireum sirarangge	larvae	wild	low	national	low	medium	Césard, N.
4.	China	<i>Tricholoma matsutake</i>	Matsutake, Pine mushroom, Song rong	mushroom	wild	low	international	high	small	Ying Long Chen
5.	Korea Republic	<i>Lentinula edodes</i>	Shitake, Oak mushroom, Pyo-go	mushroom	cultivated	low	international	high	large	Yeo-Chang Youn
6.	Vietnam	<i>Annonum villosum</i>	Cardamom, Sa nhan	fruit	wild	medium	international	low	large	Dinh Van Tu
7.	Nepal	<i>Choerospondias axillaris</i>	Lapsi	fruit	managed/cultivated	medium	national	low	medium	Gautam, K.H.
8.	India	<i>Elettaria cardamomum</i>	Cardamom, Elam	fruit	cultivated	low	international	high	small	Nair, T.K.R. and Kutty, M.G.
9.	Indonesia	<i>Styrax paralleloneurum</i>	Kemenyan, Benzoin, Hamjón toba	resin	cultivated	high	international	medium	medium	García Fernández, C.
10.	Lao PDR	<i>Boehmeria malabarica</i> or <i>Debreghesia longifolia</i>	Shui-mao-pi, Tout tiang	bark	wild	medium	international	low	medium	Foppes, J. et al.
11.	Indonesia	<i>Santalum album</i>	Cendana, Sandalwood, Haumeni	resin and wood	wild	high	international	medium	medium	Rohadi, D. et al.
12.	Indonesia	<i>Shorea javanica</i>	Damar kaca, White meranti	resin	cultivated	high	international	medium	medium	de Foresta, H. et al.
13.	Lao PDR	<i>Broussonetia papyrifera</i>	Paper mulberry, Rosa	bark	wild/cultivated	medium	international	medium	large	Aubertin, C.
14.	China	<i>Phyllostachys heterocycla</i> var. <i>pubescens</i>	Moso, Bamboo, Mao zhu	stem and shoot	cultivated	medium	international	high	large	Fu Maoyi and Yang Xiaosheng
15.	Indonesia	<i>Paraserianthes falcataria</i>	Sengon, Albizia, Belalu	wood	cultivated	medium	international	high	large	Rohadi, D. et al.
16.	Vietnam	<i>Calamus tetradactylus</i>	May nep, Rattan	stem	wild/cultivated	medium	international	high	small	Vu Dinh Quang
17.	India	<i>Diospyros melanoxylon</i>	Tendu	leaves	wild/managed	medium	international	high	large	Boaz, A.A.
18.	Philippines	<i>Calamus</i> spp.	Yantok, Rattan	stem	wild	medium	international	high	medium	Palis, H.G.
19.	Indonesia	<i>Agathis borneensis</i>	Damar, Agathis, Damar pilau	wood	cultivated	medium	national	low	medium	Permadi, P. et al.
20.	Vietnam	<i>Neohouzeaua dullooa</i>	Nua, Bamboo	stem and shoot	wild	medium	international	high	large	An Van Bay
21.	Indonesia	<i>Calamus</i> spp.	Rotan, Rattan	stem	cultivated	medium	international	high	large	Pambudi, F. et al.

* Degree of transformation (degree of processing that is required): low (e.g. fruit, bush meat or other products that can be used directly by the consumer); medium (e.g. fibre from grass used for weaving or handicrafts; wood for carvings); or high (e.g. essential oil extracted from plant and used in incense or as a chemical component in medicine).

** Value of national trade and export in 1998: low (< 1,000,000 US\$/year); medium (1,000,000 - 10,000,000 US\$/year); high (10,000,000 US\$/year).

*** Geographic range: total area (global) over which the target species lives: large (>1,000,000 km²); medium (<1,000,000-75,000 km²); small (<75,000 km²).

insufficient to lift people out of poverty. These households tend to invest very little effort in NTFP management. The products are harvested from natural forest or fallow fields in extensive systems. In almost all cases in this group the target NTFP resource was declining as a result of overexploitation, loss of habitat and insufficient or ineffective management.

Diversified Strategy

In the second group, the target NTFP provides supplementary income for households that earn the bulk of their income from agriculture or from off-farm labour or trading. It proved useful to subdivide this group into those cases in which the target NTFP is cultivated, and those in which the target NTFP is harvested from the wild (Belcher *et al.* 2003). In the first subgroup, NTFP production is often integrated with other agricultural production on lands over which the farmer has some control. The NTFPs are cultivated and managed on bunds and in hedgerows, integrated with other commodities in fields or combined with tree species in agroforests. In the second subgroup, NTFP producers tend to harvest the product from wild resources with little or no management.

NTFP production is generally important for diversifying sources of income, thereby helping to spread risk. Forest products can be especially important in times of the year in which income from other sources is low. NTFP production rarely competes with other agricultural activities because forest products are usually collected when labour requirements for agriculture are low.

Specialized Strategy

In the third group the target forest product contributes 50% or more to the total household income in the context of high integration into the cash economy. Generally (but with some exceptions) these producers have the highest incomes of the three groups, and also tend to have higher incomes than the local average in the case study area.

Products in this group tend to have the highest value per weight. They include a number of special foods—mushrooms, Brazil nuts, fruits—and medicinal products, and many of these products are traded internationally. These products are managed relatively intensively. Some are cultivated, but the majority are managed in naturally regenerated systems. Owing to the high management input combined with the high product value, these resources tend to have the highest value of forest-product production per hectare. And because it is an economically attractive activity, there are many local producers, resulting in a relatively large total trade in the study area. Overall, the characteristics of the specialized group of cases portray a situation of relative stability and mature markets, offering good incomes for producer households.

Economic geography

Our case groupings, and the related literature, show the importance of the local context in determining how people use forest and other resources. Some of the key variables identified in this study are property rights, size and accessibility of markets and the availability of alternatives, that is, the 'opportunity costs' of labour and land in the area. Transportation infrastructure and the availability of electricity, fuel and communication facilities also determine whether it is possible to produce, process and trade NTFPs. Soil quality, relief, climate and the land-tenure regime determine what other activities, competitive or complementary, are possible. In poor remote areas with open access to resources there is a tendency for overexploitation of marketable NTFPs and dissipation of rents. This trend is exacerbated where more households become involved in harvesting and trade in response to new opportunity (e.g., new market, increasing price) or need (e.g., contracting economies, drought or other factors limiting alternatives). In these situations, forestry (including NTFP harvesting) is often the default option and there are few alternatives for employment and income earning.

In areas that are less remote and have more agricultural development, typically with a high proportion of land under private ownership, NTFP production fits in with other land uses by making productive use of land that is marginal for agriculture (e.g., steep slopes, fence rows, water courses) and by using labour readily available at low periods in the agricultural cycle. In areas where the market is sufficiently attractive, the product is sufficiently valuable and tenure is secure, people invest in managing NTFP. Management options range from the very basic—weeding around desired plants—to intensive management of domesticated plants or animals. In the global analysis, households cultivating NTFPs tended to have higher incomes than the local average and higher returns per unit of land than noncultivators.

Regional patterns

The cases were grouped by region to look for patterns of association with other characteristics (Ruiz-Pérez *et al.* forthcoming). This yielded significant differences between the three regions. African cases tended to have lower household incomes and smaller volumes of trade in the forest product than the other two regions. Human populations are growing in the African case study areas (sometimes with reverse migration from economically faltering urban areas) and there is an increasing market demand for the NTFPs. This situation translates into increasing pressures on the resource base, but most production still comes from wild sources and cultivation efforts are relatively sparse.

The Asian cases reflect higher and more stable economic conditions and slower population growth in case study areas (urban migration absorbs large numbers), resulting in stable NTFP markets and more stable resource bases. In most cases this stability is achieved through intensified management (the Asian group has the highest representation of intensified management and cultivation). Government intervention tends to be more frequent and the percentage of cases with private investment is higher, reflecting the products' commercial

value. These findings are consistent with expectations, given that many NTFPs have been traded nationally and internationally for long periods (centuries in some cases).

Latin American cases have economic conditions and population trends that fall between the other two regions and exhibit more variability. There is a higher frequency of unstable markets ('boom and bust' situations) than in the other regions. Products are produced from a diversity of sources and there is no apparent tendency in terms of pressure on the resource base. There is some government and non-governmental organisation support but little private sector investment. Trade in many of the products has developed only recently. New products are coming to market every year, and many of the Latin American cases in our set have been the focus of recent market development activities.

PRODUCTION-TO-CONSUMPTION SYSTEMS: EXAMPLES FROM ASIA

The analysis based on household livelihood strategies shows that opportunities for NTFP-based activities, and the competitiveness of those activities, depend on the local biophysical, social and economic conditions, on the demand for the NTFP and on the functioning of the market. The regional analysis indicates a larger generalized pattern. Such general typologies and patterns help to understand and structure the great diversity of NTFP production systems, but subsume and mask many interesting and informative details. Therefore we now consider some of the more specific issues using the PCS framework, illustrated with examples from individual Asian cases. We refer to individual chapters with numbers in superscript.

Raw material production

There is a continuum of options available for the production of any biological resource, ranging from pure 'extraction', where naturally occurring resources are harvested without any management, all the way to intensified management in plantations or greenhouses. The Asian cases include examples at several points along this continuum.

Gathering from the wild

The gathering of forest products from the wild is associated with the coping group. These cases are characterised by subsistence-oriented livelihood strategies, remote settings and products that are mostly gathered from *de facto* open-access resources. Gathering from the wild does not necessarily mean gathering from an undisturbed natural forest. Many valuable products grow well in secondary forests. For example, some bamboo and cardamom species and the *tendu* tree prefer the more open environment of disturbed forests^{7,9,18,21}. In some cases valuable products are harvested from fallow agricultural fields^{3,11}.

Managing wild resources

NTFP producers may manage naturally regenerating resources in order to improve productivity or quality. An example of such an approach in the Asian set of cases is that of *tendu* leaves in Harda district, India¹⁸. The trees are kept close to the ground by pruning, and their roots are deliberately damaged to stimulate more vigorous growth. Thus the managed areas are gradually transformed into quasi-plantations dominated by *tendu* shrubs. These practices increase both the quantity and quality of leaves. But only a small percentage of the resource is managed in this way. Because the *tendu* grows on state-owned lands, harvesters have no individual control over the resource and may well be unable to reap the benefits of their management investments. Indeed, the management efforts in the district are initiated by a state-owned co-operative federation that pays groups of people to prune the *tendu* trees on public lands.

Cultivation

In about half of the cases presented in this volume the target species is harvested predominantly from planted populations. In all of these instances cultivation has been encouraged by strong demand—a good market exists and reasonable returns can be expected on investments in cultivating and managing. Confidence in the market is important as cultivation requires a reasonable period of investment. The average time to maturity for the planted species in the Asian set of cases is about eight years.

But cultivation needs more than market demand. It needs tenure security so that investments in planting and managing long-lived species can be recouped. Interestingly, there is a two-way relationship between NTFP cultivation and tenure in several of our cases in that NTFP cultivation is sometimes used to mark ownership and establish tenure. In Lao People's Democratic Republic (PDR), for example, the cultivation of NTFPs is used to redefine forestlands and fallows into 'gardens' to prevent government officials from redistributing these lands under the new land policy^{3,11,14}. Cultivation also has other social and economic functions, such as risk spreading, income diversification and labour maximisation. And often cultivation is done in combination with other production activities.

Management of cultivated NTFPs ranges from intensive management in single-species plantations to extensive management where the NTFP is integrated into a diverse system of several economically valuable products. Using hired labourers, large landowners in the Western Ghats of India cultivate cardamom in intensively managed plantations under planted shade trees. The high yielding varieties they use need more fertiliser and irrigation and give significantly higher production and profits per hectare⁹. This level of management is, however, not accessible to the small and poorer landowners (let alone the landless) who lack the necessary financial resources or credit. These cardamom producers manage less intensive systems in agroforestry gardens that retain some of the original secondary forest vegetation.

Several of the Asian cases integrate NTFP production into fallow forests in a shifting cultivation cycle. Valuable products such as cardamom, paper mulberry

and rattan are planted with field crops or after their harvest and mature within the secondary forest when the field is left fallow^{3,14,22}. Perennial species, which germinate easily and require little management, are particularly suitable for such extensive cultivation systems. Domestication in fallow systems may even result in permanent agroforests. Both the *damar* gardens in southern Sumatra¹³, which now provide more than 80% of the total resin production in Indonesia, and the rattan gardens in East Kalimantan²² emerged out of shifting cultivation systems. The results are complex agroforestry gardens that feature a mix of planted and self-established plants with high biodiversity and processes comparable to natural forests that produce and reproduce without much human input.

Dynamics

Regional developments quickly change the opportunities available to local people. New roads have enormous impacts (e.g., Chomitz and Gray 1996; Kaimowitz and Angelsen 1998). The loss of forest resources and/or the introduction of alternative sources of income, such as wage labour for mining or plantation companies, can quickly make NTFP growing or harvesting less attractive. Throughout the world, many people are shifting from the natural-resource-based activities of farming and forestry to wage-paying employment in the secondary and tertiary sectors. Perceptions of a modern lifestyle make such possibilities highly attractive, especially for younger generations²². *Benzoin* producers used to enjoy high status in northern Sumatra, for example, but with the introduction of more profitable cash crops and the decreasing market value of *benzoin* resin since the late 1960s, younger generations have come to consider its production as backwards¹⁰. In other places, young people tend to migrate to urban areas, looking for new ways to make a living. Youn describes how this trend has led to an ageing labour force in rural areas in western South Korea⁶.

Trade chains

As with production systems, the organisation of NTFP trade reflects the prevailing social, geographic and economic conditions. In remote areas with poor transport and communications facilities the costs of transporting goods to the market are high. In some cases, producers themselves act as traders on an opportunistic basis^{7,17}. In many instances, though, producers rely on middlemen to transport and market their produce. And it is still common in the NTFP literature to see middlemen accused of exploiting producers and taking excessive profits. Typically, such analyses compare the final market price of a product with the price at which it was bought from the raw material producers and conclude that the large gap must contain an unfair profit for the trader (and the typical recommendation is to try to bypass the middleman, or to 'shorten the trade chain'). In practice, NTFP traders don't seem to be a particularly wealthy group. Césard, for example, describes

how profits for traders who buy from raw material producers remain low because of the high cost of transporting small amounts of the product to market by public transport⁴.

Moreover, in many cases, especially in the less developed and more remote systems, traders play a critically important role. Most obviously, they provide or arrange for transport to get the product to market. In some villages in Kalimantan, farmers cannot sell their rattan unless a trader comes to the village. But traders also provide market connections and market information, grading and sorting, credit (often in the form of advance payments on future harvests) and the valuable service of collecting the small quantities of product from numerous individual producers to aggregate marketable quantities. Indeed, in some cases, quantities of product are so small and markets so insecure that traders must deal in several products. Aubertin argues that the trade in paper mulberry is feasible only because it is part of a panel of traded products¹⁴. Traders deal with bureaucratic requirements, including official permits and (more frequently) unofficial payments (bribes), which are so often required to transport NTFPs to market. They also absorb the considerable risk of shipments being lost, confiscated, or perishing en route and of falling prices in unpredictable markets. As Garcia Fernández writes, 'Moving up the trade chain, profits increase, but so do the risks'¹⁰.

This is not to argue that NTFP traders are a bunch of altruists. They have market advantages and they certainly use those advantages where they can. By offering advance payments and longer-term loans, traders secure the loyalty of producers and lower buying prices⁸. Traders have knowledge of the market, market connections and the capital needed to organise the collection and transport, storage, grading and semiprocessing that allows them to get the best prices when they sell. Producers, on the other hand, often have disadvantages that translate into weak bargaining power: open access resources, remote locations, small product lots, uneven quality and timing, poor knowledge of prices and quality requirements and poor storage facilities. Bargaining power of producers is higher in the more developed systems, where markets are more stable, better organised and larger.

Post-harvest processing and manufacturing

Post-harvest storage and processing can extend the economic life of the harvest, give producers more bargaining power (reducing urgency for selling, allowing collection of larger volumes), and reduce transportation costs by concentrating the valuable component (Belcher and Schreckenberg 2003). Several cases in this volume show the importance of post-harvest treatment. Some perishable products are dried immediately after harvesting, using either sunlight or firewood. When the product is not consumed fresh, drying may add value to it. In Ba Be, Vietnam, sun-drying cardamom doubles its value. In other cases the product is dried because it is the only option for marketing. Drying then prevents deterioration but the value of the dried product is lower than that of the fresh product.

Other forms of processing can also add value and profitability, though for small-scale producers to take advantage the technology must be affordable (Clay 1992; Arnold *et al.* 1994). Making bamboo chips, for example, requires only cutting and splitting of bamboo culms, but the price per kilogram of chips is up to three times higher than the price per kilogram of culms²¹. Yet, even when the technology does not require any investment, processing is not necessarily a good option for small-scale raw material producers, because it may have high opportunity costs. Processing of *lapsi* fruits into candy does not require investments, is simple and brings high returns, but subsistence farmers may not have enough time to take advantage⁸. Raw material producers often do not know what qualities the market wants. Paper mulberry bark processors in Lao PDR ask different prices for different qualities of raw material, but the farmers, unaware of the required qualities and associated differences in prices, sell the bark to traders without grading it, and thus miss the opportunity to increase their profit¹⁴. Misguided efforts at semiprocessing can actually reduce the value of a product. This happened in a village in Kalimantan, where people decided to semi-process (split) rattan themselves, only to discover that their main buyer could not use the quality they were able to produce.

Markets and demand

Market size and nature are critical determinants in how a particular product will be managed. Economists distinguish between goods and services that are consumed primarily within the producing region and those that have important markets outside the producing region, labelled 'non-tradables' and 'tradables', respectively (Haggblade *et al.* 2002). Tradables tend to have significantly larger markets. Assuming producers of tradables have access to the market, their most important challenge is to increase quality and quantity of production at competitive prices. The production of tradables can act as a powerful engine for economic growth as in the cases of bamboo production and processing in Anji county, China¹⁵, and woodcarving in Bali, Indonesia¹⁶. But for other NTFPs the market is restricted to the local area. The small-scale kitchen utensil industry described by Permadi *et al.* falls into this category²⁰. The main market for wooden kitchen utensils is formed by local department stores and due to decreasing demand during the economic crisis in Indonesia in the late 1990s more than half of the small-scale enterprises from the research area were forced to close.

Changes in demand, whether up or down, are driven by a wide range of factors. Changes in accessibility and transportation possibilities have huge impacts on forest product markets^{5,16,21,22}. Technological innovations can replace natural products or, conversely, create new uses for natural products^{10,13,15,21}. Also, consumers' preferences change over time. With the modernization of Indonesian society, for example, the demand for *benzoin* has decreased as rituals that use *benzoin* incense have become less common. And younger generations of Indonesians prefer modern cigarettes to the traditional cigarettes

that use *benzoin*¹⁰. A similar phenomenon is observed in India, where traditional cigarettes made from leaves of the *tendu* tree face increasing competition from modern paper-wrapped cigarettes. At the same time, the export volume of traditional Indian cigarettes is increasing, however, as Western markets grow for products with a 'natural' image¹⁸. The expanding domestic demand for oak mushrooms in South Korea is related to the same trend, with demand for oak mushrooms driven by a popular perception that they are a 'natural' food free of chemicals⁶. Future demand for many forest products may depend on such niche markets. But markets can be fickle, especially in the pharmaceutical and cosmetic industries. Trade in the rind of *Garcinia* fruit, for example, boomed when it started being used in weight loss pills in the United States, but decreased dramatically when scientific tests showed that the drug did not have the desired effect².

Gender roles in the PCS

Many NTFP production-to-consumption systems involve women, sometimes in a leading role (Hecht *et al.* 1988; Falconer 1990; Terry and Cunningham 1993). Most of the examples in this volume show a clear division of tasks by gender within systems, but there is no clear pattern among different cases. For example, women collect cardamom from the forest in Vietnam's Ba Be district⁷, while the cardamom harvest in the Lao case is typically a male activity³. In Cho Don district, Vietnam, men collect bamboo culms while women collect the bamboo shoots and do the primary processing (splitting culms and boiling, drying and packing the shoots)²¹. In Madhya Pradesh, India, women collect *tendu* leaves, and men process them¹⁸. In Sukabumi, Indonesia, men carve wooden kitchen utensils, and women polish and pack²⁰.

The Asian cases reconfirm that many NTFP systems are of particular importance to women. NTFP trade creates opportunities for women at all stages of the PCS; their involvement ranges from hired labourers for harvesting⁹ to independent traders⁷. From the literature we know that commercialisation sometimes leads to men taking over business from women (Tewari and Campbell 1996). The cardamom case in Vietnam shows how the trade of small quantities is dominated by women, but further up the trade chain, where quantities—and profits—are larger, men are in charge⁷.

Policy and regulation

The policy environment affects opportunities and choices. Governments can influence the opportunities and profitability of forest product harvesting through regulations, and the way these regulations are enforced (the payment of bribes to officials is common, especially where NTFPs are extracted from state lands). Research and extension, taxation and land tenure all affect land use options. So do export regulations. In Vietnam and Lao PDR economic liberalisation has created new export markets resulting in increased exports of forest products^{3,14,11,17,7}. Aubertin describes how in Lao PDR the export of bark from the paper mulberry

tree to Thailand increased when the Lao government started promoting a market economy in 1989¹⁴. And the boom in the bamboo sector in Anji county resulted directly from policy changes. Government regulations can also aim to restrict markets. Governments of raw material producer countries, for example, may restrict the export of raw materials in order to stimulate domestic processing activities, with possible negative consequences for raw material producers when the foreign market falls away^{17,22}. Heavy taxation in importing countries of imported processed materials, with virtually no taxes on raw materials, also distorts markets¹¹.

NTFPs have been largely overlooked by governments. Considered ‘minor forest products’, they are ignored or subjected to rules designed for timber, with high fees and inappropriate restrictions. In many cases it is unclear how regulations apply to NTFPs. The Indonesian Ministry of Forestry, for example, classifies the *benzoin* resin from cultivated trees as a ‘forest product’, while local regulations define it as a ‘garden product’ falling under jurisdiction of the Ministry of Agriculture¹⁰. In most countries a tax is levied on the trade of forest products to compensate for forest damage, but legislators seldom recognise the distinction between cultivated and noncultivated forest products^{3,10,14}. Likewise, there is the problem of distinguishing between products harvested from public and private lands⁷.

Tenure security

Tenure continues to be one of the most important points on the conservation and development agenda (Lynch and Talbott 1995; Peluso 1996; Colfer and Byron 2001; Pandit and Thapa 2003; Ribot and Peluso 2003). Experience presented in this volume underlines this importance. Colonial regimes in South and Southeast Asia established state control over forestlands and this arrangement was taken over by the national governments after independence. As a consequence, many forest-dependent people never received formal rights to own or use forest resources. Most NTFP management systems on state lands are vulnerable; conflicts arise when government-sanctioned land uses (e.g., forest concessions or plantations) compete with traditional uses. Over the last few decades tenure became not only a justice issue, with people claiming the rights to the lands they use, but also a key element in the concept of sustainable development. Effective management of a resource requires secure property or user rights to ensure that managers capture the benefits of management and to protect the resources from overexploitation.

Tenure has emerged as an important issue in most countries and governments have increasingly been formulating policies to formalise people’s access to land and forest resources. In China’s Anji county, the government granted long-term use contracts for bamboo stands to individual farmers, including provisions that guarantee inheritance of the contract and permit subletting¹⁵. In Lao PDR and Vietnam state lands have been allocated to individual farmers as part of land allocation programmes^{3,11,14}. Collective user rights are also on the agenda. In India various regulations differing from state to state were

instituted to grant rights to tribal communities¹⁸. According to a ministerial decree in Indonesia, communities can gain rights to manage forest areas based on customary law¹⁰. Tribal communities in the Philippines have been awarded user rights to their 'ancestral domain'¹⁹. And farmers living in and near Zixi National Park in China have been granted the collective right to harvest mushrooms⁵. Such regulations may look better on paper than they do in practice. Often, regulations are designed on the basis of unrealistic assumptions, lack proper implementation and procedures are onerous^{2,3,9,10,11,14,15,17,18,19,21}. In the Philippines, for example, the forest for which the Batak tribe has a land use certificate is also leased out to a private rattan concessionaire. Palis describes how this results in overexploitation of the rattan resources in the area¹⁹.

In Zixi National Park in China, despite the collective user right, organisation amongst collectors is weak. Competition between individual harvesters leads to the harvesting of immature mushrooms and a significant reduction in individual and collective earnings⁵. Such practices are associated particularly with the lack of clear tenure. Other examples are the harvest of immature *tendu* leaves¹⁸, cardamom^{3,7} and *Garcinia* fruits², and rattan canes¹⁹. The reasoning is rational from an individual harvester's point of view: 'If I don't take it, someone else will.'

Tenure status also influences investment behaviour, as people are willing to invest more when they know they can reap the benefits themselves. Efforts to reform land ownership and use rights for local people are promising, yet far from perfect, as described above. Furthermore, the highest quality forests usually remain in the hands of governments or large-scale enterprises (Scherr *et al.* 2003).

DEVELOPMENT AND CONSERVATION LESSONS

Commercialisation as a strategy for poverty alleviation?

There is a strong link between poverty and dependence on NTFPs, and forest products generally are more important to low-income than to high-income people (Jodha 1986; Hecht *et al.* 1988; Falconer 1992; Cavendish 1997; Pimentel *et al.* 1997; Neumann and Hirsch 2000; Angelsen and Wunder 2003). But, to what extent can NTFPs play a role in raising people's incomes?

The case comparison indicates that intensified NTFP management is associated with higher profits. But intensification is not always a good option for the poor. NTFPs are often elements in diversified portfolios and part of people's risk spreading strategies. Focusing on one product increases vulnerability to production failure or a fluctuating market. Moreover, poor producers may not have the labour or land available for intensification. For example, farmers in the primarily subsistence-oriented economy in Huaphan, Lao PDR, are uninterested in domesticating cardamom as it would require additional labour and thus compete with subsistence agriculture. Instead they prefer to harvest from the wild in periods of labour surplus³. Likewise, devoting

land to the cultivation of *lapsi* trees limits the land availability for subsistence purposes, so small landowners in Nepal cultivate this tree mainly on bunds and watercourses⁸. Intensification of NTFP production can even undermine the incomes of the poorest, because increased supply from those who can afford the required investment leads to reduced prices for wild gathered products, affecting those who still depend on the wild resource for additional income.

Sunderlin *et al.* (2003) distinguish between two types of poverty alleviation: (1) poverty avoidance, i.e., preventing people from falling deeper into poverty; and (2) poverty elimination, i.e., lifting people out of poverty for good. There is little doubt that NTFPs are of crucial importance in poverty avoidance, filling gaps during periods of low income, spreading risk, and functioning as 'safety nets'. But NTFP-based poverty elimination would require that increased trade results in a permanent increase in income and welfare. As discussed, the possibilities to do this are determined by the availability of a market, physical access, availability of skills and information, availability of labour and security of tenure. In the specialized group of cases, most of these conditions are in place, and producers have been successful in intensifying management and improving cash income from NTFP trade. But the conditions typically faced by the poor—on the community as well as the regional and global levels—limit the possibilities to increase trade or to benefit from increased trade.

Commercialisation and conservation of the target species

Increased commercial value of non-cultivated forest products can lead to resource depletion^{11,12,19}. The biology of the resource, and in particular the abundance and regeneration capacity of the targeted part of the resource (e.g., fruit of the *lapsi* tree, leaves of the *tendu* tree, bark of the *tout tiang* climber), determine the vulnerability to over-harvesting. Some species regenerate slowly after harvest^{12,16,17,19,20,22}, while others respond with more vigorous growth^{3,18}. Pressure on the target population can also be indirect. The harvest of fruits, for example, may affect the reproduction of the tree^{2,8}. The pruning of *tendu* prevents the trees from maturing and thus decreases propagation through seeds, which is important in terms of genetic diversity¹⁸. Cultivated NTFPs are usually not associated with threats to the target resource, but Aubertin points to the 'genetic' threat related to the replacement of local varieties with 'improved' high yielding varieties³.

Sometimes non-cultivated forest products are harvested in a way that compromises future availability. Examples of such deleterious harvesting practices are the removal of the topsoil layer when looking for mushrooms, which destroys the mushroom's habitat; the cutting of mature trees for their fruits, as has been reported in India with *Garcinia*; and the digging up of roots of the sandalwood tree and the *tout tiang* climber (for oil content and bark, respectively), which limits regeneration possibilities^{2,5,11,12}. Long-term impacts of harvesting practices are not always taken into consideration. Poor people may make decisions aimed at meeting immediate needs—a characteristic of

coping strategies—making future availability less of a priority. Such harvesting practices can also be related to a lack of knowledge concerning the regeneration properties and conditions of the target species, as is the case with the harvest of the *song rong* mushroom in China⁵.

The *tout tiang* case¹¹ shows that establishing user rights and devolution of responsibility and decision-making power does not automatically lead to sustainable harvest of the target species. Foppes *et al.* describe how, despite extraction rights and community-defined rules regarding quantity and quality of harvest, high demand still results in rapid depletion of the resource. As discussed above, people do not necessarily prioritise long-term availability of a resource and do not always have the knowledge required to change practices in a way that sustains the resource. Moreover, people may be unable to prevent extraction by outsiders. Rai, however, describes how informal arrangements allocating a piece of forest to individual households (using natural boundaries such as ridgelines) have positively changed behaviour for harvesting *Garcinia* fruit in some areas in the Western Ghats in India².

Conservation of the forest ecosystem

The notion that increased value of NTFPs can encourage environmentally sound forest management is based on questionable assumptions. First, it assumes that local people have control over local forests and that they are (potentially) responsible for deforestation. In practice the main agents of deforestation in Asia are large-scale logging and plantation development, outside the control of local communities (Scherr *et al.* 2003). Second, it assumes that extractive NTFP production is more valuable in the long term than the harvest of timber. Third, it assumes that NTFP production is 'environmentally sound'. Intensification of NTFP production (and related activities such as the gathering of firewood for drying NTFPs) may, however, have negative impacts on the forest environment. Thus, increased NTFP demand and higher prices may actually trigger a shift from diverse production systems toward intensively managed systems with lower diversity. Some bamboo plantations in China, for example, are managed as monoculture plantations with high inputs of labour and fertilisers. Compared with the natural forest they imply a drastic decrease of environmental quality. Fu, however, argues that such plantations contribute positively to the local environment when they are established on degraded lands by providing some essential forest services, such as soil and water conservation, and reducing people's dependence on the natural forest¹⁵.

This brings us to the important issue of benchmark: What point of reference do we use when assessing the conservation value of a system? Most NTFP production systems will have lower species diversity and other forest functions than the natural forest they replace, but they may be significantly better than the most likely land use alternative. Many of these systems provide ecological services that are similar to the natural forest. Sometimes the NTFP system is the only forested environment in an area, and so provides a refuge

for natural flora and fauna that would otherwise disappear. The *damar* gardens in Sumatra described by De Foresta *et al.* even have a global significance for biodiversity, since they are home to endangered species such as the Sumatran rhino and the Sumatran tiger¹³. Gautam describes how commercialisation of the *lapsi* fruit has stimulated farmers to grow these trees on agricultural lands, resulting in increased tree cover on private lands, contributing to soil and water conservation in the hills and reducing the pressure on natural forest, since branches of the planted trees are used for firewood⁸. Kutty and Nair stress the importance of the cardamom production system in providing forest functions⁹. They also argue that cardamom producers have a vested interest in preserving forest functions in nearby protection forest and they report that farmers work directly with the forestry department to help prevent poaching and encroachment. Youn argues that the increasing value of oak trees for use in mushroom production has stimulated a shift from planting conifers to growing native hardwood species, with government support for stand improvement of natural forests with native species⁶.

Supporting NTFP systems

In all of the cases we looked at, NTFPs provide valuable income sources, sometimes with substantial employment opportunities. Individual case studies and overall comparative analysis point to ways and means to help support NTFP systems to benefit local people and to encourage ecologically sound practices. When looking for ways to increase the benefits of NTFP trade for the forest-dependent poor, it is important to consider whole systems and all the actors involved to identify the most important bottlenecks and opportunities. To help development and conservation agencies and governments to formulate more appropriate interventions we identify general lessons at each stage of the PCS:

- Raw material production. If there is a strong market for an NTFP, producers can take advantage by improving the quality and quantity of their produce through improved management and/or expanded production area. But efforts to promote increased production have to beware that the required inputs do not compromise the producer's flexibility. Particularly in the coping and diversified cases, people tend to rely on many (forest) products as part of their risk spreading strategies. For them, too much emphasis on a single product is risky, and more so in an uncertain market. Furthermore, such projects should pay extra attention to groups that lack the assets required for intensification (land and labour), because they may be negatively affected by competition from the expanded production. For wild harvested species, basic ecological knowledge is needed, along with appropriate monitoring techniques to measure the impact of extraction, to facilitate management. Intervening institutions will also have to understand that it is not always possible to fully reconcile development and conservation goals; there are tradeoffs. Sometimes intensified management makes a system less environmentally benign and choices may need to be made.

- Post-harvest processing and manufacturing. Such activities are often attractive to producers only if they are cheap, simple and impose no risk. Drying and grading are good examples of post-harvest treatment with potential to increase benefits for producers. Providing information about market requirements, grading schemes and prices can help producers, and research to develop effective low-cost technologies may offer new opportunities. It is common in the literature to find recommendations to encourage raw material producers to take on more semiprocessing and processing activities to add and capture more value. In fact, this can be effective only where producers truly have a competitive advantage to do so. Such advantage may exist in the form of better access to raw materials, lower opportunity costs of labour or even a 'fair trade' market premium. But most activities beyond rudimentary processing also require access to electricity, good transport facilities (including port facilities for export products) and, very importantly, the knowledge, contacts and skills to manage the business.
- Markets and demand. Market size and structure are key factors determining what type of intervention is appropriate. Small local and regional markets can easily be saturated. In such cases, increased production of raw material can lead to reduced prices, while efforts to access new markets can create new opportunities. Larger markets present opportunities for producers to increase their market share by producing more and/or better quality product, and through better marketing. This often requires specialized skills that can be provided through training or dedicated support services. To improve bargaining power NTFP producers need access to information about pricing structures, availability of substitutes, quality requirements and consumer preferences. Small-scale producers may also gain strength through collective action. Co-operatives or other organisations that allow producers to pool resources (for storage, post-harvest processing or transportation, for example), share information and pool small lots of product for the purpose of grading and collective bargaining can be effective. Certification has become a hot topic for timber and also increasingly for non-timber forest products. There may be opportunities for NTFP producers to benefit from emerging markets for 'green' and 'fair' trade, but recent studies, such as by Shanley *et al.* (2002), have pointed out important limitations, including high costs, high level of organisation and information required and limited demand for certified products in many markets.

The comparative analysis showed the utility of classifying NTFPs according to their role in household economic strategies. Different roles imply different potential and indicate the need for different kinds of interventions. In specialized cases, NTFP production, processing and marketing is well developed and investment at an appropriate point in the production-to-consumption chain can stimulate further development. In many of the coping and diversified cases, NTFPs are important as supplementary sources of income,

but do not offer great potential for expansion due to larger, systemic constraints. Still, project- and policy-interventions can be aimed to take advantage of existing opportunities and to overcome some of the key constraints (as discussed above), but care is needed to avoid creating conditions that will actually disadvantage producers.

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Chapter 2

The socio-economic and ecological impact of *Garcinia gummi-gutta* fruit harvest in the Western Ghats, India

Nitin D. Rai¹

Common names	Part of the resource used	Management	Degree of transformation	Scale of trade	Geographic range
Garcinia, Upagge	Fruit	Wild	High	International	Small

OVERVIEW

The fruit of *Garcinia gummi-gutta* is a valuable product obtained from the rainforests of the Western Ghats of southern India. The dried rind has long been used in the kitchen as a souring agent, and that market continues to exist. Since more recently the rind is also used for the extraction of hydroxy citric acid (HCA), an active ingredient in human weight loss formulations. The sudden appreciation in value of the dried rind because of the newly discovered export markets has greatly enhanced the income of harvesters. The species is dioecious, and pollination is by weevils. The fruit is an important resource for primates, civets, and squirrels. The seeds are dispersed by primates and civets. The structure of harvested populations suggests that fruit collection has little impact on recruitment. However, intense fruit harvest is recent, and if current trends continue, the species and the forest ecosystem might experience grave impacts. The harvest of unripe fruit might affect frugivores dependent on the fruit, and subsequently the dispersal of seeds. The collection of large amounts of firewood from the forest, required to dry the fruit rind, might also have an ecosystem level effect. The open access nature of forests is a hindrance to the regulation of harvest and the implementation of sustainable practices. Changes in the current forest access laws, such as greater tenurial security for local communities, could reconcile the two, often conflicting outcomes—sustainability of ecological processes and the generation of economic benefits.

INTRODUCTION

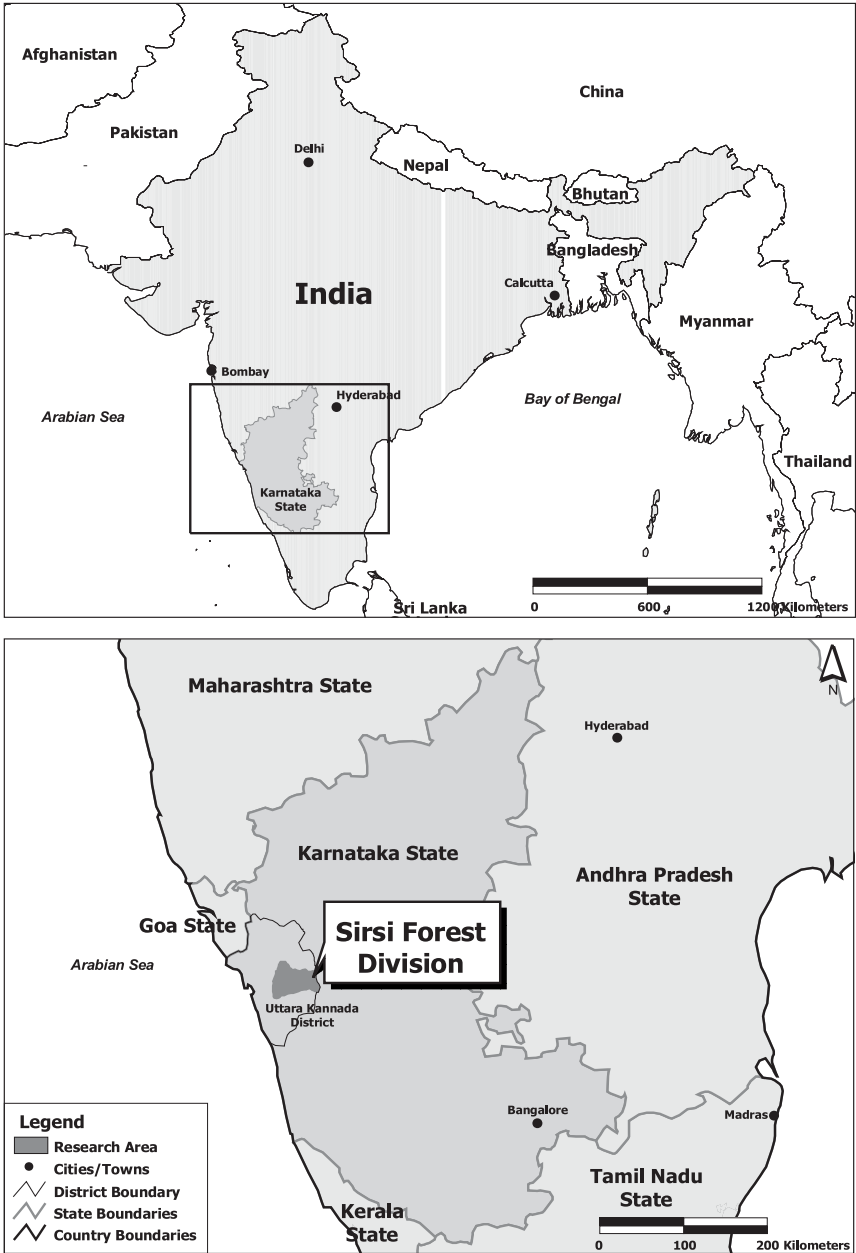
The fruit of the under-story rainforest tree, *Garcinia gummi-gutta* (L.) Robson (Family Guttiferae, *Uppage* in Kannada) has, over the last decade, assumed a major role in the economic landscape of villages in Uttara Kannada district in the Western Ghats of India. The rind of the fruit, traditionally used as a souring agent in food, is currently used for the extraction of a secondary compound that has been found to be effective in human weight loss programmes. The precipitous increase in demand for *G. gummi-gutta* fruits and the open access nature of forest, has however, resulted in destructive harvesting practices. Since *G. gummi-gutta* extraction has a recent history, there is great scope for the formulation and implementation of a sustainable harvesting strategy. In the face of forest degradation by external commercial forces, this economically valuable species could provide the right balance between conservation and resource extraction and give local communities a reason to conserve forests. I explored extraction behaviour and institutional structures that affect the trade and ecology of *G. gummi-gutta*. My results suggest that non-timber forest products (NTFP) policies of the state need to be revised if species like *G. gummi-gutta* are to be harvested in a sustainable manner.

G. gummi-gutta is endemic to the Western Ghats and Sri Lanka (Ramesh and Pascal 1997). It is common in evergreen and lower *shola* forests up to a height of 2000 m (Tissot *et al.* 1994). The species occurs only in forests on humid slopes and the crest-line and has, therefore, a restricted distribution. The species is androdioecious, with male flowers on one plant and hermaphrodite flowers on the other. The flowering season is from February to April, while the fruits ripen in June and are available until August. The fist-sized fruit weighs about 75 g and is a deep yellow when ripe. The fruit is an important resource for frugivores such as *Presbytis entellus* (common langur), *Macaca radiata* (bonnet macaque), and *Paradoxorus hermaphroditus* (palm civet). Frugivores are highly dependent on this resource, as few other tree species fruit at the same time. *Ratufa indica* (giant squirrel) is a seed predator, and local hunters claim that *R. indica* are unusually fat after the rains, having fed on the oil rich seeds of *G. gummi-gutta*. Small rodents are also dependent on this seasonal resource.

The geographic setting

The Western Ghats of South India are a 1,600 km long north-south oriented hill range that traverses the states of Maharashtra, Karnataka, Tamil Nadu, and Kerala. Uttara Kannada, where this study was conducted, is in northern Karnataka (Figure 1). The district of Uttara Kannada was chosen because a large proportion, 79%, of it is under forest. The area under forest is remarkably high for any district in India. The average annual precipitation of 3,500 mm in the production area is largely restricted to the monsoon months of June to October. The average altitude is 620 m. The tropical wet forests along the crest-line and the western slopes, in which *G. gummi-gutta* occurs, have high levels of endemism: 12% for birds and 60% for amphibians (Daniels 1991, 1996).

Figure 1. Map of India and Uttara Kannada district showing Sirsi forest division



Source: ESRI Data and Maps 2002.

Myers (1990) identified the Western Ghats as one of 18 hotspots of global biological diversity. More recently, Myers *et al.* (2000) considered the Western Ghats as one of eight global 'hottest' hotspots.

The vegetation that clothes the hills of the Western Ghats in southern India is a result of long use and habitation by humans, both subsistence use by local communities and intense exploitation by colonial and commercial forces. What remains is a mosaic of landscape elements arrayed in various combinations depending on the predominant land use and geographic location. In the district of Uttara Kannada the forest and cultivation mosaics are finely integrated, and the ensuing matrix provides a prime area for studies of human use of forest resources.

The area selected for the study (henceforth, the production area) is the tropical wet forest in which *G. gummi-gutta* trees occur within the Sirsi forest division. The production area measures 869 km² and falls in five forest ranges within the division. A forest range, with an area of about 250 km², is the basic administration unit of the Forest Department. The current human population size in the production area is 48,418 in 127 villages, with an average household size of 5.4 individuals. Although *G. gummi-gutta* is collected from other forest regions of the Western Ghats, the wet forests of Uttara Kannada account for a large portion of the rind production because of the high density of *G. gummi-gutta* trees there.

Photo 1. Collector carrying a bag of *G. gummi-gutta* fruits (Photo by Nitin D. Rai)



The main agricultural crop in the area is a palm, *Areca catechu*, the nut of which has a long tradition of use in India. The palms are grown in the well-watered and sheltered valleys of the wet coastal and hill tracts. A little over 100 years ago, the then British administration leased out to *Areca* orchard owners 9 ha of surrounding forest for every 1 ha of orchard owned. This allowed farmers to harvest leaf biomass, which was used as mulch for areca trees. These forest patches, which form about 20 percent of the forest area in the district, are referred to as *soppinabetta*, which roughly translates as ‘leaf providing forest’. Rice cultivation is the other major land use. However, with the recent increase in the price of the areca nut there has been a trend towards conversion of paddy land to other uses, predominantly the plantation of *Acacia auriculiformis*, a fast growing exotic tree used as fuel and pulpwood.



(*Garcinia gummi-gutta*)

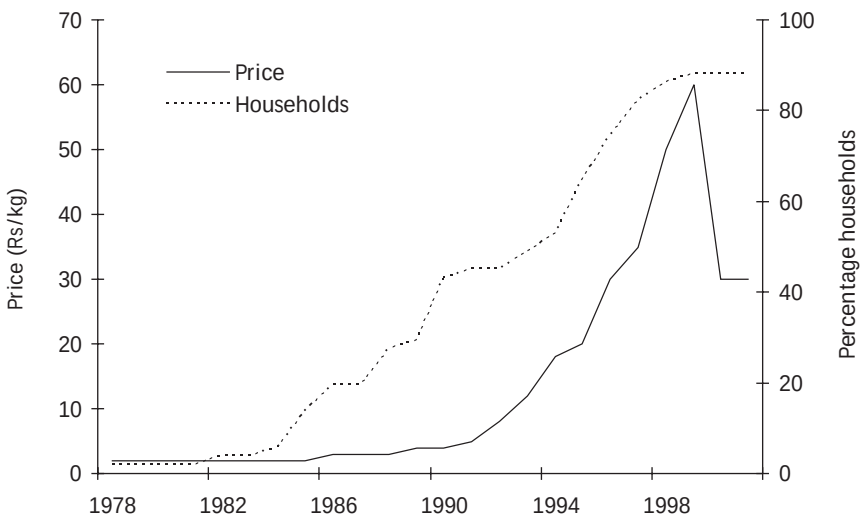
THE PRODUCTION-TO-CONSUMPTION SYSTEM

The Product

The fruit of *G. gummi-gutta* (*uppage*) has a variety of uses in different parts of its range. In Uttara Kannada district, oil extracted from seeds is used in the making of sweets. The process is labour intensive and practised by only a few communities, hence on a small scale. In the state of Kerala, which is south of the production area, the use of *G. gummi-gutta* is more intensive.

The dried rind is used as a souring agent in food. Several households in Kerala therefore grow *G. gummi-gutta* trees in their gardens. The collection of rind in Uttara Kannada commenced in the late 1980s with the realisation that a market for the rind existed in Kerala. However, the price of US\$0.24 per kilogram (US\$1 = Rs42) was not attractive enough to warrant much attention and labour. In the late 1980s, some studies showed that Hydroxy citric acid (HCA), a secondary compound present in the rind of *uppage* fruit, might be effective in weight loss (Sergio 1988). This finding interested drug manufacturers in the United States of America, who touted the drug as a natural solution to obesity (Majeed *et al.* 1994). Drugs such as *Citrin* and *Citrimax* were widely sold over the counter. These nutraceuticals, as drugs derived from natural products have come to be called, were aggressively advertised despite a lack of rigorous studies on their efficacy. As a result of the increased demand for these products in Western markets, the price of *uppage* rind increased rapidly in India. The aggressive advertising campaign did not go undetected by regulatory authorities. The U.S. Food and Drug Administration fined Home Television Network for making unsubstantiated claims regarding the product. A team of researchers from the Roosevelt Obesity Center, New York, however, delivered the biggest blow. The results of the institute's randomised clinical trial showed that the control group, which was given a placebo, lost more weight than the treatment group that was given HCA (Heymsfield *et al.* 1998). As the results of this study were disseminated widely, primarily on the Internet, demand for the product declined. The effect on the price of rind in India was dramatic (Figure 2).

Figure 2. The trend in price paid to *G. gummi-gutta* collectors and in household participation in *G. gummi-gutta* trade (n=51) from 1978 to 2002



The price fell from an average of US\$1.43/kg (Rs60/kg) in 1999 to US\$0.66/kg (Rs28/kg) in 2000, and the price of HCA exported to the US fell from US\$30/kg in 1999 to US\$8.50/kg in 2000. Subsequent warnings by various other agencies regarding the continued usage of the drug have further debilitated demand.

Species ecology

G. gummi-gutta is restricted to the narrow strip of rainforest that occurs on the crest line and western slopes of the Western Ghats (Pascal 1988). In the high canopy forests that occur on deep soils, *G. gummi-gutta* is an under-storey tree and occurs at low densities. In stunted forests, which are more prevalent in Uttara Kannada district, the species occurs in the canopy and is more abundant. The density of individuals with diameter at breast height greater than 10 cm varies from 5 trees per hectare in diverse high-canopy forest to 123 trees per hectare in stunted forest. In the southern part of the state, the relative density of *G. gummi-gutta* (the proportion of individuals of a species to the total number of stems in the sample) has been reported to be 0.25% for a wet forest plot in southern Karnataka (Claire Elouard, personal communication) compared to the relative density of 7.2% in Uttara Kannada (N. Rai, unpublished data). This suggests that the density of *G. gummi-gutta* is highly variable along its range.

Male *G. gummi-gutta* trees flower earlier and more profusely than female trees and continue to flower late into the season. Flowers open just before dusk. Male flowers open a little before female flowers. Pollination occurs at dusk and is by weevils. Although female flowers offer no rewards to pollinators, the strong aroma attracts weevils of the genus *Deleromus* to female and male flowers. The earlier anthesis of male flowers ensures that a certain proportion of weevils visit male flowers first and subsequent 'mistake' visits to female flowers ensures the deposition of pollen on the stigmatic surface of female flowers. The small size, smooth surface, and sphericity of the pollen suggests that wind pollination might also occur, but experiments have been unable to confirm this. Many *Garcinia* sp. in South-East Asia are known to be parthenogenic, but pollen exclusion experiments have shown that *G. gummi-gutta* is an outcrosser.

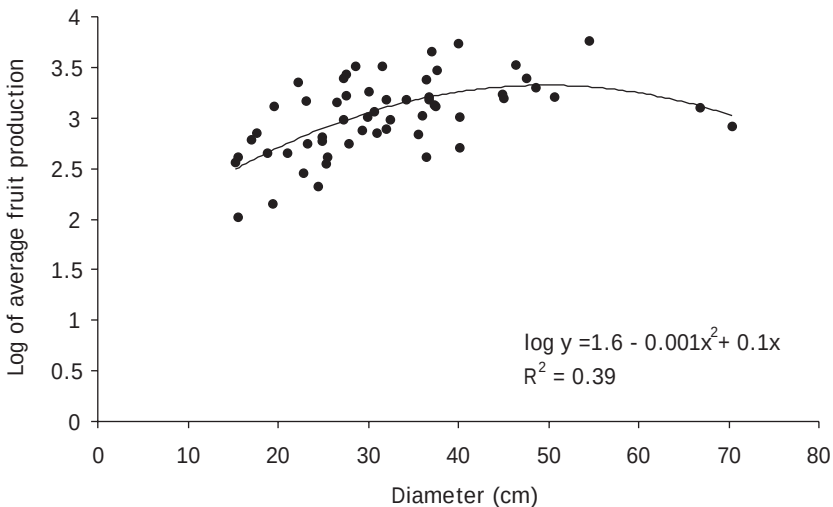
Fruits on a *G. gummi-gutta* tree do not ripen synchronously, with the result that when a few fruits are ripe and ready for harvest, the majority of the fruits is still unripe. This strategy ensures effective fruit dispersal by frugivores. By offering dispersers only a few fruits at a time the tree ensures that all fruits are consumed and few fall to the ground unconsumed—and thus undispersed. After consuming the pulp of ripe fruits, bonnet macaques, palm civets, and common langurs disperse the seeds. While langurs eat the pulp and disperse seeds close to the parent tree, macaques transport seeds farther by carrying them in their cheek pouches. Palm civets ingest the pulp and seeds and egest the seeds whole and undamaged. There may be other dispersers such as bats and the lion tailed macaque, a major frugivore in other parts of the range of *G. gummi-gutta*. Experiments show that seeds dispersed far from the parent

tree have a greater chance of surviving to germination (Rai 2003). Thus seed dispersal is an important mechanism in maintaining the population. The dispersed seed germinates after an eight-month dormancy period. The germination coincides with the advent of the monsoon rains.

The seeds are nutrient rich and weigh approximately 1.14 g with seed coat and 0.54 g without. The seeds are therefore an attractive food resource for insects and rodents. In an experimental study to estimate the amount of seed predation by insects and animals I found that 93% of the 950 seeds provisioned in the forest were eaten. The large seed, however, enables *G. gummi-gutta* to compete with smaller seeded species, as a larger seed provisions the emerging seedling with resources until the seedlings are large enough to tap into soil nutrients.

During dispersal, primates eat only the pulp and discard the rind to the forest floor. The rind is therefore undamaged by frugivores. If the fruit is allowed to ripen on the tree, primates can access the fruit, disperse seeds, and discard the rind for humans to collect later. Thus the rind can be collected with little effect on the ecology of the species. There is a curvilinear relationship between tree size and fruit production (Figure 3). Fruit production increases with tree size up to a diameter of about 60 cm. Trees greater than 60 cm in diameter produce fewer fruits than smaller trees, probably due to senescence.

Figure 3. The relationship between *G. gummi-gutta* fruit yield and tree diameter

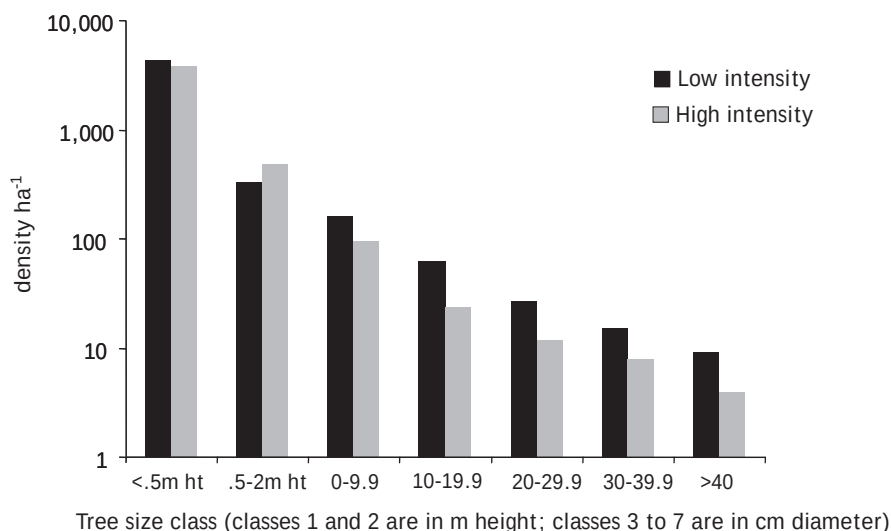


Impact of fruit harvest on species ecology

The hypothesised effect of fruit harvest is a reduction in seedling regeneration. The mediation of such a process could be failure to establish in dense, mixed species stands, aggravated by reduced seed input. Further, damage done to trees during harvest might result in reduced yield and increased tree mortality.

I established several plots in the study area to determine the population structure and seedling abundance. The size class distribution of individuals showed the 'reverse J' pattern typical of stable plant populations (Figure 4). The seedling density was high at all sites, and even sites that experienced high harvest intensity showed high seedling numbers. This implies that harvest does not have a large impact on recruitment.

Figure 4. Population structure of *G. gummi-gutta* in low intensity and high intensity harvest sites



I found that seeds that fall under adult trees have a higher mortality rate than dispersed seeds. Seeds falling under the parent tree may be more prone to predation while seeds falling far away may escape predation due to their being in low densities. As a consequence of density dependent mortality of seeds and seedlings, established saplings tend to occur far from adult females. The finding that seeds dispersed far from parents have a higher chance of survival has important implications for management of *G. gummi-gutta*. By manually broadcasting seeds far from parent trees and into low-density stands of *G. gummi-gutta*, the density of *G. gummi-gutta* in a forest could be increased.

The lack of tenurial security and the high price of the rind have resulted in the harvest of unripe and small sized fruits. The apprehension that other collectors might harvest fruits first encourages early harvest. This harvest practice truncates the seed dispersal scenario, with serious ramifications for future recruitment. In areas where harvesters have access security over trees, fruits are harvested after they ripen, a practice that ensures availability of seeds for future propagation and better quality rind. Moreover, rind obtained from ripe fruit attracts a higher price than rind from unripe fruit.

There is also an ecosystem-level effect of the harvest of *G. gummi-gutta* fruit. Once harvested, *G. gummi-gutta* fruits have to be preserved, as they are susceptible to decay. This is accomplished by drying the rind in rudimentary wood fired ovens. Fuel-wood for the ovens is obtained from the surrounding forests. The open ovens are inefficient and this inflates the amount of fuel wood required. I estimated the amount of wood required to dry rind at 10.5 kg of wood per 1 kg of dried rind produced, an estimate that was corroborated by collectors during interviews. Official estimates, however, place it at 25 kg of wood to obtain 1 kg of dried rind (Saibaba *et al.* 1996). The larger question of ecosystem degradation can be addressed by investigating whether this wood extraction is sustainable. The total wood above ground biomass production in the production area has been estimated at 1,100 to 3,100 kg/ha/year (Lele 1993). The amount of dried rind produced per hectare of forest in the production area is 34.5 kg. Using this estimate we get a fuel wood consumption of 362.3 kg/ha/year, well below the wood production from these forests. It is, however, important to note that the spatial distributions of wood collection and fruit harvest are not coincidental: while wood is removed from near habitation, fruits are obtained from farther afield.

Raw material producers and socio-economic context

Human habitation in the Western Ghats can be traced back to the Mesolithic Age, about 5,000 years ago. The land came to be settled between 1000 B.C. and 300 B.C., and the agroforestry practices of today probably commenced about 1,500 years ago (Chandran 1997). Areca (*Areca catechu*), black pepper (*Piper nigrum*), betel leaf (*Piper betle*), cardamom (*Elettaria cardamom*), and banana (*Musa sapientum*) were grown in multicrop orchards. Spices from these plantations have been traded with Arabia and Southeast Asia since the ninth century, and with Europe since the sixteenth (Achaya 1998). Pepper, destined for markets in Europe, came from the orchards and the surrounding forests, where vines were trained on trees.

The population density of Uttara Kannada district is among the lowest in the country. The density in the production area is 54 people per square kilometre. The region saw a drastic decrease in population in the early part of the twentieth century as a result of malaria epidemics. After India's independence from the British in 1947, the region saw a spurt in population growth. Largely because of the high value of the areca nut, the average annual cash income in Uttara Kannada is 1.2 times the national average suggesting that it is not an economically backward area.

The richest and most politically influential section of the village community is the Havyak Brahmin, who introduced the cultivation of the areca palm to the study area about 400 years ago. Other communities, which comprise the economically lower strata of society, are the Kare-Vokkaligas, Goudas, Acharis, Naiks, Siddis, and Kumri-Marathis. These communities are mostly paddy cultivators and farm labourers. Kumri-Marathis were involved in shifting cultivation until a century ago, when the British government stopped the practice. Areca gardens require labour throughout the year, which is provided

by people who migrated from the coast and plains. Over the past few decades, many non-Brahmin communities have established their own areca orchards by converting paddy or forested valleys. Havyak Brahmins have continued to increase their areca holdings by encroaching into adjacent forest and valleys (Nadkarni *et al.* 1989).

The most resource intensive and economically profitable land use of the area is the areca orchard. Ownership of these orchards is largely restricted to Havyak Brahmins. The other communities, mostly tribal, form the labour force for these areca orchards. Access to forests is inequitable. For instance, only the traditional areca growers have access to *soppinabetta*, while the landless and recently established farmers are dependent on the open access forests for all their needs.

In the mid 1980s the price of areca nuts increased appreciably, because of increased domestic demand. This put the rich areca farmers in an even stronger economic position. The effects on the social structure and the agricultural and forested landscape were great. Income disparities between low-income paddy cultivators and high-income areca plantation owners became even more marked. Brahmins, in the role of the clergy, have for centuries laid siege on the affairs of the village, effectively stifling participation of other communities in social discourse. With the increase in earnings from areca, this social hegemony has been augmented with economic clout. Areca growers converted their paddy land to areca gardens in well-watered sites, and to *Acacia auriculiformis* plantations where water availability was low. Adjoining forestland was encroached upon and the process continues to date. As nutrients for areca gardens are derived from the forest, the expansion of areca plantations has put pressure on the remaining forests.

The high value and availability of *G. gummi-gutta* in open access forests and *soppinabetta* has resulted in the participation of all sections of the community in the harvest. However, the relative contribution of *G. gummi-gutta* to the income of individual harvester households varies widely. Areca growers harvest fruit from trees that grow in their *soppinabetta*. The assured access to these trees means that they can follow harvest practices that are ecologically benign and economically beneficial, such as the late harvest of ripe fruit. The fruits in the Reserve forest are available to all sections of the village community who then compete with each other. The income thus generated is variable depending on one's success with harvesting fruit before others. Moreover, the processing of unripe fruits requires more labour and time, and attracts a lower price. Thus *soppinabetta* owners benefit disproportionately from *G. gummi-gutta* fruit harvest and are better positioned, by virtue of their ability to hire labour, to harvest fruits from the reserve forest.

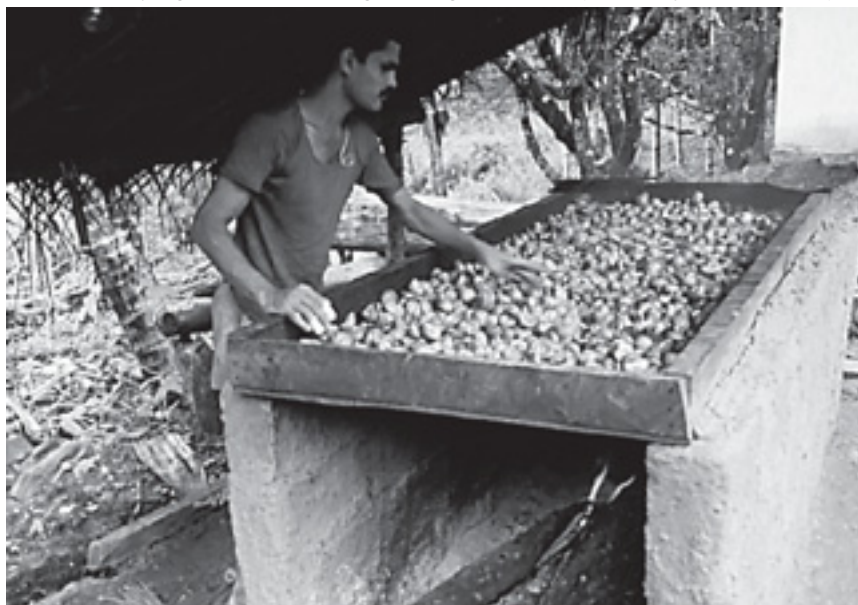
Processing industry

Fruits are either collected from the ground under the canopy of the trees or harvested by climbing them, and are then taken to the homes of the collectors where they are deseeded and the rind is smoke-dried in a wood-fired oven.

The contractor buys rind from the village agent for eventual sale to processing firms. The firms are capital-intensive industrial units with the necessary technology and expertise to extract HCA from the rind for subsequent export. Most of these firms are multiple product units that extract active ingredients from a variety of plant products, and hence are able to survive fluctuations in market and demand of any single product. As the market is recent, processing firms have not yet organised themselves. Processing and export firms are almost always integrated with the result that the trade chain at this end is short and profits high. Firms involved in the extraction of HCA have had previous experience with plant product extraction and export, and hence have been able to transition to HCA extraction with ease. Access to global markets, experience, and existing capital and infrastructure defines who can play a role in the processing and export of HCA.

About 35 processing firms are involved in the extraction of HCA. Sami Chemicals, situated in Bangalore, a subsidiary of Sabinsa Corporation, USA, was the first processor and continues to be the largest. Citing an international drop in demand, Sami did not buy any rind in 2000, with the result that prices fell to the pre-export level of US\$0.59 (Rs25). The price of HCA in the international market was US\$30 to US\$35 in 1994, while in 2000 it dropped to between US\$9 and US\$11. The drop in demand was largely due to findings that HCA was not as efficient in reducing human body weight as previously claimed (Heymsfield *et al.* 1998). Exporters also attributed the drop in prices to a steep increase in the number of processors, the low quality rind due to the harvest of unripe fruit, and the import of fruit from Sri Lanka at cheaper rates.

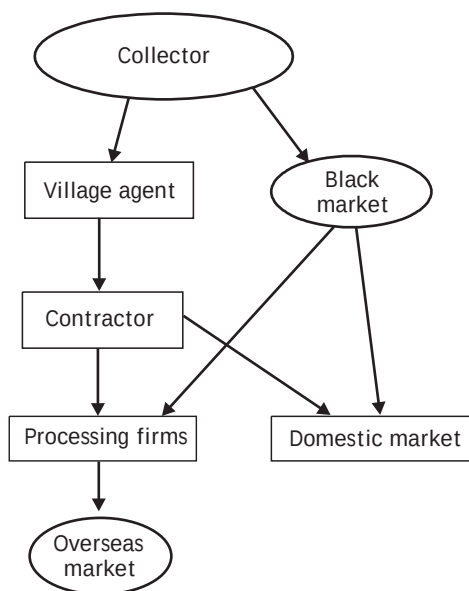
Photo 2. Drying the rind of *G. gummi-gutta* fruit (Photo by Nitin D. Rai)



Trade and marketing

The Forest Department auctions the rights to the harvest and trade of *G. gummi-gutta* biannually. Auctioning of the rights to NTFP trade has been a practice for several decades. Rights are auctioned for each forest range. These range-wise contracts, usually won by affluent business people from outside the area, give individuals, henceforth called contractors, marketing rights to all extracted fruit (Figure 5). Contract regulations require contractors to harvest fruits themselves, effectively marginalizing the local community. The task of collecting *uppage* fruit from vast areas of forest is impossible, even if the contractor employs people for that purpose. The harvesting of the fruit is therefore done by local people. Contractors announce that they will issue passes to local people and suggest a date for the commencement of harvest. Seldom, however, is a pass issued or a date announced.

Figure 5. The *G. gummi-gutta* trade network from harvester to overseas market



The fruit, after drying, is sold to the contractors, who find markets for the rind in larger cities such as Bangalore. The price paid to collectors is determined by the contractor. Great effort is made to ensure that the produce is not purloined to a neighbouring range, the domain of another contractor, where prices may be higher, even if marginally. Tensions therefore run high in the harvest season. This monopolistic marketing regime has spawned a black market in the rind that keeps prices buoyant. The short lease period of two years gives contractors little incentive to ensure that NTFP harvest is conducted with minimum impact to the resource base.

Official estimates of total rind production are not accurate, as contractors rarely disclose exact amounts. Deflating the actual value of the product enables contractors to keep bid rates down at auctions. Table 1 gives the official estimates for the past decade. The two-year periods reflect the duration of contracts. In 1995-97 the Forest Department earned US\$147,900 through its NTFP auctions, 57% of it from *G. gummi-gutta* alone. This illustrates the importance of *G. gummi-gutta* trade in the production area.

Table 1. Quantity collected from Sirsi division over two-year contract periods and harvest value

Period	1989-91	1991-93	1993-95	1995-97	1997-99
Rind (kg)	6,144	6,905	9,929	26,542	77,690
Auction amount (Rs)	9,245	9,155	21,450	84,419	41,667

Source: Gaonkar *et al.* 1998 for 1989-95 data; forest office records for 1995-99 data. My ecological and survey data suggest that actual amounts may be 1.5 times greater than Forest department figures.

The discovery of the weight reduction property of HCA and of overseas markets in 1993 had a dramatic impact on the price and harvest intensity. Under the present harvest regime there is little scope for regulating extraction. An alternate system of NTFP collection and marketing needs to be evolved wherein local people are given more tenurial security over forest land that would ensure their long term interest in the ecological viability of the species and landscape. The current monopolist contractual system and lack of tenurial security encourages rampant harvesting and price schedules not commensurate with actual market demand.

The collectors sell the dried rind to agents operating in the village, who in turn sell it on to the contractor. These agents are actually appointed by the contractor. The agent gets a commission on the basis of weight collected. Apart from the contractor appointed agent, there are other buyers who acquire small quantities of rind in a bid to make some fast money. These traders sell to either the legal contractor or to other traders who operate on the black market. Though contractors make great efforts to curtail this illegal trade there is little support either from villagers, who stand to benefit by selling at higher prices to the black marketers, or from the Forest Department which, having auctioned off the contract, does not interest itself in the actual harvest and trade. The rind is then sold to HCA processing firms, which are mostly situated in far off cities. About 10% of the rind, especially the illegally obtained rind, is sold to traders in the Kerala food market. The processing firms buy after inspecting the quality of the rind. After extraction the HCA is exported directly to overseas customers.

Forest access

In 1878, the British government set up Reserved and Protected forests to assume control over the forests and all resources therein. This arrangement

meant the demise of local control and free access to resources. The Forest Act of 1927 further intensified state control of forests. This act has continued to hold sway over all subsequent forest policies, even those framed after independence in 1947. The Wild Life (Protection) Act of 1972 provided protection for various species and also set the stage for the creation of protected areas such as sanctuaries and national parks. The establishment of protected areas for wildlife conservation is based on the assumption that human habitation is inimical to wildlife, and hence local people are viewed as hurdles to conservation and are seldom involved in conservation planning or implementation. This basic premise has ruled over most forest policies framed in the country.

It is beneficial to understand the forest access regime in place in the production area. The history of access rights in the district is unique. During the last century the then British government passed a series of land laws that continue to affect, to this day, forest access by local communities. The three tenurial regimes that exist in the forests are 'reserve' forest, 'minor' forest, and *soppinabetta*. Though all forest is owned by the state the different classifications come under different use regimes. Reserved forests are the largest of the three categories and the state has the greatest control over these lands. While local populations are allowed to harvest fuel wood, graze cattle and harvest NTFP, these privileges could be withdrawn at any time. Minor forests comprise forest that was awarded to villages in the early 1900s in the ratio of approximately 2 acres of land for every head of cattle. These lands are used for the extraction of fuel wood, fodder, leaf manure and NTFP. After decades of intense use, the condition of these forests is very poor.

The third tenurial regime, *soppinabetta*, is more exclusive. This status was awarded to areca orchards at a ratio of 9 ha of forest for 1 ha of areca. The collection of fuel wood, fodder and NTFP, lopping of trees, and some timber for personal use is allowed. The farmer maintains control over use and management of these forests. Thus farmers have control over all *G. gummi-gutta* trees and the harvest on their *soppinabettas*. The forest policies of the last century continue to dictate the resource access regime of today, and this has a bearing on the extraction of *G. gummi-gutta* fruits. Reserve and minor forests face the greatest pressures, while *soppinabetta* is not affected by the intense harvest. However, the condition of *soppinabetta* forests, whose main role is to provide leaf litter, is far from what can be considered a functional forest.

In what has been touted as a major breakthrough for local governance, the Extension to Scheduled Areas Act was enacted in 1997. It confers rights of collection of NTFP to tribal *panchayats* (village governments). However, it is valid only in designated tribal areas, even though a large number of tribal people live outside the scheduled areas. A committee set up by the Ministry of Environment and Forests in 1998 suggested that only usufructuary rights be extended to all *panchayats*, tribal and nontribal, excluding those in protected areas. This is a climb down from what was proposed for the tribal areas, a slightly positive move for nontribal areas, and a real setback for inhabitants of protected areas.

NTFP trade policy

The Karnataka State Forest Policy document (Karnataka Forest Department 1999) outlined the following policy objectives for NTFP use and management in natural forests: a) ensure the sustainable use of forest resources; b) give local collectors first rights on forest produce and manage the resource through local bodies (such as NTFP societies); c) in tribal areas, trade NTFP through tribal co-operatives; and d) motivate and train forest dependent communities in the protection, improvement, harvesting and disposal of NTFP, including nondestructive collection, processing and marketing of value added products.

The government NTFP policy states that the state will explore the possibility of providing seed money or funding to establish societies. In a report prepared for the state forest department, Gaonkar *et al.* (1998) suggest that the current contractual system be replaced by a NTFP society that undertakes the trading of the product directly, thus eschewing the contractor and earning higher rewards for collectors' efforts. This, they propose, should be combined with key policy changes such as a reduction in sales tax, forest development tax and income tax, and the payment of a small royalty to the Forest Department. The current equitable sharing of profits between Village Forest Councils and the Forest Department is a disincentive to collectors. The report states that revenue lost to the Forest Department as a result of these changes will not impact its functioning since revenue from NTFP in the production area accounts for less than 1% of total revenue.

No clear NTFP policy exists at the national level. The National Forest Policy 1988 was aimed at 'conserving the natural heritage of the country by preserving the remaining natural forests with the variety of flora and fauna, which represent the remarkable biological diversity and genetic resources of the country'. The policy, however, says little about the people who live in and around protected areas. The establishment of a protected area is a great hindrance to resource use by local communities.

TRENDS AND ISSUES—DEVELOPMENT AND CONSERVATION LESSONS

The economics of unsustainable practices

Several observers (Saibaba *et al.* 1996; Gaonkar *et al.* 1998) have noted that trees are being extensively damaged during collection and even hacked down to facilitate collection. I observed the cutting of lateral limbs of *uppage* trees during harvest in heavily used areas. Out of the six sites I sampled, I observed tree damage at two sites. Of the 187 trees observed at these two sites, some branches were cut on 57% of trees, all branches on 8%, and 11 trees (6%) were cut at the trunk at a height of 1 m with the bole of the tree lying near the stump. Because of the short history of fruit harvest such extreme impacts are currently confined to the forest patches close to high-density villages below the Western Ghats from where migrant harvesters originate. An increase in the price of *uppage* could result in these impacts rapidly spreading to larger areas, if local villagers are not given more control and access rights to *uppage* trees.

In the absence of local control over harvesting, *G. gummi-gutta* might go the way of species such as nutmeg (*Myristica malabaricum*), which was overharvested to the point where the government banned the harvest of fruits (Saxena *et al.* 1997).

In a report prepared by the Forest Department, Saibaba *et al.* (1996) suggested that the firewood used for the drying of *G. gummi-gutta* rind was a huge loss to the Forest Department. They estimated the loss in revenue at US\$22,023, or three times the revenue earned from the sale of contracts for *G. gummi-gutta* trade. They concluded that the sale of *uppage* fruits by tender sales should be banned in order to conserve the limited stocks available and to prevent further damage to the forest. That a mere loss of revenue, and a hypothesised reduction in resource base due to overharvesting, can be cited as reason enough for the cessation of all harvest is evocative of the disregard shown by the government for local use of the forest and the hegemonic control the state has over the forest and all resources therein.

The harvest of unripe fruits is a threat to sustainable harvest, and if markets refused to accept unripe rind then the harvest might become more sustainable. This change might force communities to evolve modes of resource partitioning. In some areas with low population density, households have informally partitioned the forest based on such natural boundaries as ridgelines, and harvest fruit from within their respective patches. These informal arrangements greatly change harvest behaviour. Long after collectors in other areas have exhausted their resources, having prematurely harvested all fruit, households with informal partitioning arrangements continue to harvest ripe fruit.

Recent trends suggest that the *G. gummi-gutta* case might be waning in importance. Even when prices declined precipitously in 2000, the harvest of unripe fruit continued despite warnings that this would affect the quality of the product, and both collectors and contractors continued to deal in unripe fruit. The rind that reached processors had lower proportions of HCA than economically viable, with the result that when the option of getting rind from other sources was available, processors availed themselves of it (Suresh Kumar, Sami Chemicals, Bangalore personal communication). Rind was then imported from Sri Lanka with governmental approval. In addition, there was a drop in demand for HCA because of the collapse of the export market. However, the domestic market in Kerala state, although not as lucrative as the export market, has been steadier. The ecological fallout of this changing scenario is positive, since competition for resources may be lower and thus harvesting may become more benign. During interviews, several harvesters spoke about their hope that prices would decrease resulting in a reduction in competition and resource abuse.

Are harvesting practices detrimental to the long-term survival of *G. gummi-gutta*?

Data on regeneration and population structure show that harvested populations are not experiencing depletion in numbers that threaten the population. I used a stage structured matrix model to determine the population growth

rate of a harvested *G. gummi-gutta* population and found that the population was not declining (Rai 2003). Ratsirarson *et al.* (1996) used stage structured demographic models to predict sustainable yields for the palm *Neodypsis decaryi* in Madagascar and estimated that 95% of the seeds could be harvested without any impact on population growth rates. During *G. gummi-gutta* fruit harvest a portion of the fruit is left behind because of difficulty in accessing remote branches, and my estimates show that about 5% to 10% of the fruits remain on the tree. Collectors, mostly women, scour the forest floor long after fruits are harvested from trees to collect rind from the fruits that were left on the trees. One collector claimed he made twice the daily labour rate per day by collecting fallen rind late in the season. If fruits are left on the tree to ripen and the rind that falls is then gathered from the base of trees, all rind can be picked with virtually no effect on the ecology of the species or dependent frugivores. However, there is no information on the role of the rind in the forest ecosystem, and what effect large scale removal of rind might have on the forest.

Drying the rind

One major concern is the process employed to dry rind. Fuel wood is obtained from the vicinity of the household or village, areas that are already impacted by biomass removal. Wood extraction at the scale seen in the production area may be sustainable since that harvest is less than the estimated annual wood biomass increment. The area from which wood is extracted is small, however, and thus local effects may be high. One solution may be to install more efficient dryers that use a fraction of the wood used now. Since such dryers may well be too expensive for a small harvester, villages could install one or two dryers in convenient locations, but ground realities may discourage people from using communal dryers. The rind takes anywhere from 5 to 7 hours to dry. The logistics of waiting by the dryer as the rind dries, the partitioning of space and time, and the distance to dryers may discourage their continued use. Another solution might be the establishment of a village co-operative, where profits are distributed based on the amount of rind collected by each harvester. The quantity of fresh fruit obtained by each harvester could be recorded, and the drying carried out collectively by members of the co-operative. The profits from the sale of the dried rind could then be proportionally disbursed based on the quantities collected.

Conclusion

G. gummi-gutta has played a major, although short-lived, role in the economic landscape of the production area. Low-income farmers have benefited from the sale of the product. The skewed distribution of resources within the village, whereby richer farmers access a larger portion of the rewards from *G. gummi-gutta* harvest, can only be addressed through the establishment of local, democratic institutions. The continued trade in *G. gummi-gutta* will benefit the community as a whole, but to ensure ecological sustainability and

equitable resource distribution, measures such as resource monitoring and changes in the trade system have to be made. If the current harvest and trade regime were to continue, the resource and the forest may be adversely affected. Assistance from the state with storing, transporting, and marketing the product is needed. Recent government policy suggests that the state is interested in establishing and sustaining community forest initiatives and co-operatives. This will go a long way in helping the ecological and economic welfare of the community.

If extracted in a sustainable manner, NTFPs can be economically beneficial to local communities and aid in the maintenance of biotic integrity of forests (Peters *et al.* 1989; Peters 1994). *G. gummi-gutta* is a good example of such an NTFP. If rights of harvest and trade are given to local communities, there is hope that institutional structures may evolve to manage the resource. The nature of the resource is such that by merely following a regime of delayed harvest, both economic and ecological outcomes can be simultaneously improved, as both the seed dispersal scenario and markets prefer ripe fruit. The beneficiaries of trade in *G. gummi-gutta* rind are numerous. Most deserving are the harvesters, especially the landless and small rice farmers, for whom the additional income is crucial. The decrease in the price of the product adversely affected this community of harvesters, who are dependent on the resource. A change is therefore required in the access and trade regime to one where control over the resource is local and a larger portion of profits from the sale of the resource is distributed amongst the harvesters rather than amongst a handful of traders in the cities. Control over resources will mean unprecedented empowerment of forest users and the opportunity for ecological monitoring and management by the local community.

ENDNOTES

1. 1743, 17th Main, 9th Cross, J. P. Nagar II Phase Bangalore 560078 India. At the time of the study the author was a doctoral candidate in the Department of Biology, Pennsylvania State University, USA. E-mail: nitinrai@vsnl.com

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Chapter 3

Cardamom (*Amomum* spp.) in Lao PDR: the hazardous future of an agroforest system product

Catherine Aubertin¹

Common names	Part of the resource used	Management	Degree of transformation	Scale of trade	Geographic range
Cardamom, Makneng	Fruit	Managed/ Cultivated	High	International	Large

OVERVIEW

Medicinal cardamom spontaneously sprouts anywhere in Lao People’s Democratic Republic (PDR) under the cover of the forest canopy, at elevations upwards of 700 m. Wild cardamom gathering and domesticated cardamom planting take place in traditional agroforestry systems based on shifting agriculture. Cardamom is a non-timber forest product for which the harvesting process tends not only to maintain, but even to augment, yields without any damage to the local natural environment. Cardamom is exported to China and Thailand, where demand is high as it has been for more than a millennium. Curiously, cardamom is not used in the developed herbal medicine of Lao PDR. Cardamom offers the main cash revenue for upland farmers and is second to coffee in value as an agricultural export product. In the government’s struggle to reduce or eradicate the practice of slash-and-burn with land allocation policies, traditional cardamom production is now threatened. Furthermore, the land allocation policies result in declining rice yields, thus increasing cash needs of farmers and stimulating both the harvest of wild cardamom from natural forests and intensified production of standardised varieties of cardamom in monocultures. The preference for imported standardised varieties in development projects seems to be leading to imported standardised cultivars being generally favoured over local varieties.

INTRODUCTION

Cardamom, of which there are several species in the genus *Amomum*, is an herbaceous, perennial plant within the family Zingiberaceae (the ginger). It attains a height of one to two meters and is commonly found in humid forest environments in certain parts of Southeast Asia. The seeds of medicinal cardamom (*Amomum* spp.) are highly sought after in Lao People's Democratic Republic (PDR) for traditional Chinese medicine, whereas edible cardamom (*Elettaria cardamomum*), which is valued world-wide as a cooking spice, particularly from the Middle East to India, is not found or known in Lao PDR. Medicinal cardamom is one of those rare forest products of Lao PDR that are produced in sufficient tonnage to easily enter export markets. All production is exported—indeed, there is no domestic consumption—primarily to Thailand and China. The export of Lao medicinal cardamom to China dates back perhaps a millennium. Even though official statistics probably reflect only one quarter to one half of the actual export volume of medicinal cardamom, it is still second to coffee in value as an agricultural export product.

Completely wild cardamom is still found in secondary forests in Lao PDR, but for the last 50 years, certainly, it has been domesticated (i.e., intentionally planted and cultivated), both in the forest and in newly established *ray*² (swidden). More recently cardamom has also been cultivated in village plantations, exclusively using cultivars imported from China. In 1997, it was estimated that no more than one third of cardamom production originated from plantations, the remainder being harvested from wild, naturally occurring forest populations. As rural development plantings are becoming productive, it is likely that in 2002 two thirds of the harvest came from plantations.

As a premier, export-oriented non-timber forest product (NTFP) Lao cardamom faces no marketing problems. Light in weight, greedy neither for labour nor for input (investment and chemicals) and environmentally friendly in its exploitation, cardamom has recently been touted as a 'miracle species' across a host of rural development projects. Nevertheless cardamom development in Lao PDR seems to be threatened by land use and tenure policies.

Medicinal cardamom allows us to study the relationship between agroforestry activities and the necessities of forest conservation, as well as the process of domesticating formerly wild-gathered NTFPs. In Lao PDR, such a study allows us to broach the crucial questions of land allocation and land use policies including forest regulatory zoning. Add the 'struggle' against the continued practice of slash-and-burn, and we can examine the aggregate impact of all these factors on the traditional way of life of upland populations.

Research area

Fieldwork on the production of cardamom was undertaken at three sites (Figure 1):

- in the north-east in the *tasseng* (an old, smaller administrative area) of Muang Peu, Viengthong district of Huaphan province, a gathering-only site in a remote mountain area on the Vietnamese border, where the

- main ethnic groups—the Tai dai, Tai deng, Khamou and Hmong—practice shifting agriculture and where the population density is less than 3 people per km²;
- in the far north in Phongsaly district, Phongsaly province, a mountainous area close to the Chinese border where gathering sites—and more recently plantations of imported cultivars—have to compete with shifting agriculture and opium eradication projects and where the population density is about 15 people per km²; and
 - in the south on the Bolovens Plateau in Champassak province, a dynamic and central coffee production area integrated into the international market and the site of long-time domestication of cardamom, where the main ethnic group is the Lao Loum and the population density is about 50 people per km², high for Lao PDR.

Figure 1. Map of the study site



Source: ESRI Data and Maps 2002.

THE PRODUCTION-TO-CONSUMPTION SYSTEM

Cardamom

Cardamom can be found throughout Lao PDR at elevations upwards of 700 m. It sprouts spontaneously under cover of the forest canopy. The botanical literature contains only superficial studies on wild cardamom. In the field, the basic distinction is made between green cardamom, *Amomum ovoidum*,

which has an ovoid seed capsule and small spines or thorns, and cardamom proper, which is less widely distributed and smaller and has a round, slightly wrinkled capsule containing red seeds. There also exists a 'black cardamom' in the northern region of Phongsaly, and in the south of the country another species occurs, *Amomum kravanh*, which is common in Cambodia.



(*Amomum villosum*)

Cultivated cardamom, with red fruits borne in a smaller capsule, has been encountered for the past 40 years on the Bolovens Plateau (Photo 1). It is closer to the so-called 'Chinese cardamom' (*Amomum villosum* var. *xanthoides*), a cultivar recently imported for rural development projects from the Xishangbanna Botanical Garden in southern China, about 60 km from the Lao border. The fruit may vary a lot from village to village, however, and identification remains difficult (Table 1).

All species of cardamom are happiest in secondary forests, near watercourses, at altitudes between 700 m and 1400 m. Cardamom demands consistent rainfall of about 100 days of precipitation annually and a highly humid environment. Notwithstanding the full sunlight in new *ray* fields, as on the Bolovens Plateau, cardamom prefers shady sites. The ideal temperature for cardamom is around 19°C to 22°C, and the plant does not tolerate temperatures below 12°C. The best soils for cardamom are those rich in organic material with a pH of between 5 and 7, fairly acidic to neutral (Zhou Shouqing 1993; Xishangbanna Tropical Botanical Garden 1999).

Photo 1. Cardamom on Bolovens plateau (Photo by J. Pollini)



Table 1. Cardamom in two villages on the Bolovens Plateau

Conditions	Ban Houaychiate, Pakxong	Ban Kouangsi, Bachieng
Altitude	1,000 m	350 m
Relative humidity	80-90%	60-70%
Mean temperature	27° C	25° C
Average rainfall	3,000-4,000 mm/year	2,000-3,000 mm/year
Size and appearance of cardamom fruit	Big, elongated, hairy, thick-skinned	Small, round, short hairs, thin-skinned
Dry weight of one <i>touque</i> * of fruits	1.0-1.2 kg	1.5 kg
Quantity of capsules per <i>touque</i>	visibly more	visibly fewer

*One *touque* is equal to about 20 litres.
Source: Aubertin 1998.

The mature plant attains a height of 1.5 m to 2 m, with a foliage breadth of about 1 m. Its elongated, pointed leaves range in length from 15 cm to 40 cm and have a width of about 3 cm. The coveted seeds are about 3 mm in diameter, enclosed in an egg-shaped capsule about 2 cm in diameter. These are borne on stolons several centimetres below the soil surface. The roots are relatively shallow and rarely extend below a depth of 10 cm. Stoloniferous propagation occurs naturally. Certain insects are recognised as pollinators of cardamom species including *Apiscerana indica*, *A. dorsati* and *Nomia strigate*. The plant flowers from April to June.

One hectare of wild cardamom can yield about 50 kg of whole (i.e., in capsules) dried fruits. This is of course an extrapolation since under natural conditions there could never be a full hectare of forest entirely occupied by wild cardamom. A single plant yields approximately 50 capsules, amounting to about 10 g to 50 g per year. Under plantation conditions, the yield may attain 200 kg/ha/year, and Chinese farmers have obtained yields as high as 750 kg/ha/year. The feasibility of new cardamom cultivation projects is ordinarily predicated on the basis of expected yields around 100 kg/ha/year.

Cultivated cardamom plants produce their first fruits in their third year, and annually thereafter. The yield generally increases until somewhere between the 8th and 10th years, when normally a figure of 100 kg/ha/year is achieved, and then begins to diminish. It has ordinarily been the practice of cardamom cultivators to uproot or destroy plants upon reaching their 15th year and to replant the site with new cultivars, not necessarily including cardamom. This practice follows the traditional rhythm of long-fallow slash-and-burn. On the Bolovens Plateau within secondary forests, however, it is common to see cardamom plants that were planted as long as 40 years ago, but which are still yielding in the order of 20 kg/ha/year.

Gathering

Cardamom is harvested at the end of the rainy season, during the break just prior to the rice harvest (a period of labour availability), if weeding of cleared lands is finished. The entire village may participate in the harvest, which is done at the family level; for example, some 70% of the families in Muang Peu and some 30% of the families in Phongsaly are involved in picking capsules. In Lao PDR cardamom gathering is primarily the work of males, and in Muang Peu about 60% of the harvesters were men or boys. There are no special rites or ceremonies associated with the cardamom harvest.

In the less populated regions cardamom gathering takes place over two to four days per year. According to the time available to each individual and to the likelihood of encountering the best plants, villagers devote between half an hour and eight hours per day to seed-gathering. An individual harvester may amass, on average, between 2 kg and 3 kg per day, for a seasonal total of between 5 kg and 20 kg (Schlemmer 1999).

Often it is the village chief who signals that the time for harvesting cardamom has arrived and who organises the harvesting groups, but sometimes villagers also gather cardamom in a more dispersed manner because 'there isn't enough cardamom for everybody'. In another village, however, this same rationale may be given for a more collective mode of cardamom gathering.

Recently we observed at our three field sites a tendency towards premature harvesting of cardamom to avoid the possibility of neighbouring villages helping themselves first, although prematurely harvested fruits are smaller and of lower quality. Normally, villagers have customary harvesting rights within the village forest, but a new system of forest classification nominally prohibits harvesting within conservation zones, which are no longer under anyone's accountability or responsibility.

If the cardamom harvest is done carefully by using a knife to detach mature fruits, leaving in place undeveloped fruits and refrain from uprooting the plant, it remains uninjured and its capacity to produce new shoots is actually promoted. Harvesting and some rough weeding around each plant are the only conservation measures ordinarily taken. Thus cardamom is one of those rare species of NTFPs for which the harvesting process tends not only to maintain, but to augment the yield. Cardamom is also considered to be an excellent cover crop in terms of soil erosion protection and for its ability to choke out undesirable plant growth.

Culture

Cardamom culture requires neither particular onerous input nor much labour. The land simply needs to be prepared and then weeded from time to time. When the cardamom culture is established within *ray*, i.e., at the same time as the land is prepared for upland rice and various other vegetables on a parcel of land that has been slashed and burned, it is difficult to distinguish the specific labour requirements of cardamom. Studies show a 30 man-days/ha/year requirement for an average yield of around 30 kg/ha/year on the Bolovens Plateau. For cardamom under monoculture plantations, as promoted in development projects, approximately 100 man-days/ha/year are required (Table 2).

Table 2. Labour requirements for a cardamom plantation project in Phongsaly

	Man-days/ha/year
Planting seedlings	10
Weeding	60
Harvesting	30
Drying (with dryer)	1
Total	101

Source: Pelliard and Ducourtieux 2000.

For the cardamom projects in Phongsaly (i.e., in cardamom plantations established from the Chinese varieties) the Xishangbanna Botanical Garden in Yunnan supplied the initial cultivars, but thereafter the plantations used new shoots for extending the project. The Chinese varieties are considered less tolerant of full sun than the varieties planted on the Bolovens plateau. The plantation density norm is one plant per square meter, i.e., about 10,000 plants per hectare.

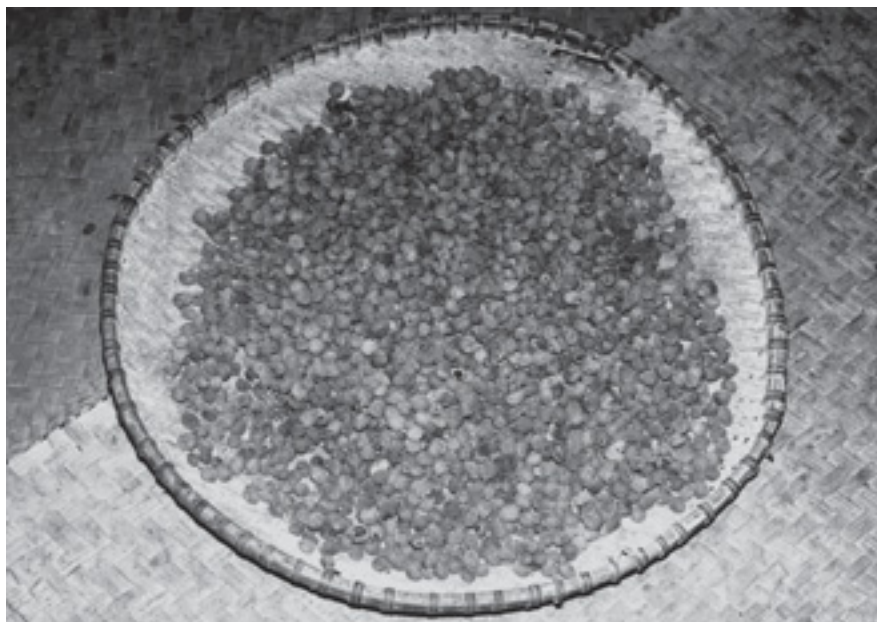
Propagation is either by cuttings or by planting seeds. For cuttings, a shoot about 20 cm in length, including the root, is prepared. Cuttings are planted in 1.5 m x 1.5 m spacing, but if the farmer grows rice on the *ray*, the spacing will be as wide as 4 m x 4 m. For seeds, a good quality cluster rich in mature fruits is chosen. The farmer removes the seed covers and lets the seeds dry for two to three days, then with one dry hand squeezes the fruit in

order to separate it from the seeds. The seed is planted in a plot previously prepared and sheltered from the sun. It is imperative to establish the nursery within the week following the harvest or successful germination is diminished. In fact the germination success rate declines with each additional day until it fails completely about a month after the seed has been gathered. If shoots are planted, fruits can be harvested after only three years compared to five years required for plants established from seed.

Processing

Gathering cardamom is undertaken from August to September, at the end of the rainy season but before harvesting the paddy. This arrangement allows for the adequate drying of seed capsules that is necessary for their preservation. Drying occurs in the village on the ground or on a tarpaulin in the sun, or the product is smoked on a metal sheet or on a bamboo platform. It takes 15 days of sun-drying to achieve satisfactory dryness. As drying is done during the rainy season, peasants consider it generally preferable to smoke the product. It still requires five to seven days for smoke-drying 50 kg of seed capsules. The ratio of fresh weight to dry weight is about 5:1; thus 5 kg of harvested capsules will yield 1 kg of dry capsules (Photo 2).

Photo 2. Dry red cardamom capsules (Photo by J. Pollini)



Every family that participates in the harvest will undertake their own drying. Apart from drying and bagging—and exceptionally the removal of the outer capsules—there is no local processing within Lao PDR. The manufacture of cardamom essential oil is done entirely in the importing countries.

Marketing

Producers market cardamom primarily in the form of dried capsules, although Korea buys a small quantity of decorticated cardamom seeds. Marketing follows immediately after the cardamom harvest during the two-month period at the close of the rainy season, which represents both a break in labour demand and a time at which producers are most vulnerable economically while cardamom capsules are most abundant. There exists little real possibility of storage to hedge against short-term price declines as the supply peaks (Saint-Pierre 1998). We did not observe any apparent difference in market price in relation to product quality.

The buying price for whole dried capsules varies between US\$1³ per kilogram around Huaphan in the north (far from communications and transport routes) to about US\$3 per kilogram for cultivated cardamom originating in less remote regions, as offered by middlemen who come directly to the villages. There are many such middlemen and competition between them tends to keep prices steady. In general, it is the village women who negotiate cardamom sales. The middlemen sell to wholesalers, on whom they are dependent. Wholesalers sort the cardamom fruits, dry them for another two or three days and rebag them into 60 kg sacks. The export price hovers around US\$5 per kilogram. On the Bolovens Plateau, the marketing chain for cardamom is essentially identical with that for coffee. The Chinese market has a high demand for cardamom and absorbs more than 1,500 tonnes annually from Lao PDR as well as another 1,000 tonnes produced domestically.

The system of quotas and trade licenses is difficult to understand, as regulations are applied most opaquely and in a highly diverse manner from province to province, and even district to district. It appears that the administration gives preferential licenses to buyers who provide certain financial incentives. As are all forest products, cardamom is nominally subject to a special excise tax of 3% for exported 'forest resources', even if the cardamom originates from plantations. Monopoly rights for marketing, and sometimes even producing, cardamom are handed out by the Lao provincial administration.

For upland families, the collection of cardamom is one of the many contributions to the ensemble of products exploited from slash-and-burn sites and secondary forests. The logic of its harvesting is contingent upon the valuation of labour. Trade does not so much depend on the availability of cardamom, but rather on the labour required for harvesting it. In forested areas the peasant economy is essentially a subsistence economy. The sale of cardamom and buffaloes is often the only actual source of cash. Such remuneration is hardly negligible, amounting to between US\$3 and US\$20, or 10% to 40% of total annual household cash income. While the harvesting of cardamom is done by a group, the resulting profit is generally paid to an individual.

Nevertheless, that income may sometimes be turned over, in whole or in part, to the village. In the region around Viengthong revenue flow from forest products often comprises the sole source of income for the village treasury.

Under plantation conditions, based upon an estimated land parcel size of 0.1 hectare per family leading to an annual production of about 10 kg of fruits, our study indicates a typical income of about US\$50 per year. Nevertheless, the quantities of land and labour allocated to cardamom culture are subordinate, in the Bolovens, to those devoted to coffee and rice, and in Phongsaly, subordinate also to opium growing.

Usages and exportation

In its processed state as an essential oil cardamom serves numerous purposes in traditional Chinese herbal medicine. Alone or with other ingredients it is regarded as a curative for stomach pains and digestive disorders. While we sometimes find such medicines imported from China in the form of vials or gelatine pills of cardamom oil in Lao markets, for the most part the cultivators and gatherers of raw cardamom have little knowledge of what eventually becomes of their unprocessed product. Interestingly, cardamom does not figure in the highly developed herbal medicine of Lao PDR.

Lao cardamom production is exported in its entirety to China and Thailand primarily, but also to Vietnam, Myanmar and Korea. Export statistics are unreliable, however, to a fantastic degree. It appears that the authorities at the national level have no interest in establishing a credible database on cardamom exports, though provincial authorities gather a lot of information. Accordingly, while the countrywide exports of cardamom probably come close to 2,000 tonnes annually, the official customs records indicate a total of no more than 500 tonnes. The statistics from the Vientiane Chamber of Commerce presented in Table 3 may allow us to grasp a trend.

Table 3. Cardamom exports, 1995-1998

Year	1995	1996	1997	1998
Quantity (kg)	140,142	171,453	571,433	424,347
Value (US\$)	630,639	829,611	3,333,359	2,376,343
Price per kg (US\$)	4.50	4.84	5.83	5.60

Source: Adapted from Foppes and Ketphanh 1998.

TRENDS AND ISSUES—DEVELOPMENT AND CONSERVATION LESSONS

Cardamom is a plant associated with the traditional practice of slash-and-burn and its corollary, long-rotation fallow. It is characteristic of the plant community of secondary forests in Lao PDR. Cardamom gathering, no less than its culture, poses issues directly related to tenure and land use in the contexts of land

allocation and the definition of forest zoning, as are presently underway in Lao PDR. The study of cardamom production presents questions regarding the ownership both of the plants themselves and of the land on which they grow; and moreover, questions regarding agricultural and environmental policies that bear directly on upland populations.

Cardamom: a plant threatened by land use and tenure policies

The government's land use and land tenure policies, presented to the donor community as a token of its commitment both to environmental protection and to the emergence of private property, have amounted to a death sentence for a widely practised traditional agroforestry system. Land tenure formalisation individualises usufruct over fixed and definitive land parcels, thereby putting an end to the traditional upland villages and a flexible collective land management system.

The recent governmental strategy for the agricultural sector shows a clear distinction between 'modernising lowlands' and 'backward uplands', leaving the former freely subject to market forces but declaring the latter as duly within the scope of public intervention (MAF 1999). Within that scheme cardamom hardly plays any role at all. The agroforestry system practised by Lao upland farmers is ignored and its key element of slash-and-burn unreservedly condemned in order to meet the twofold objective of modern agriculture (i.e., irrigated rice fields) on the plains and preservation of forests in the mountainous region by supposedly protecting it from 'ethnic minorities'. Any economic development model so requiring sedentary and 'industrialised' agriculture is clearly maladapted to most upland ecosystems (Aubertin 2001). These interventions are actualised by a system of forest zoning, by the creation of National Biodiversity Conservation Areas (NBCA), by favouring private ownership, by prohibiting the practice of slash-and-burn and by the displacement of populations—i.e., ethnic minority highlanders—downslope towards the plains (Goudineau 1997). Such solutions seem to effectively put into question the very survival of these peoples.

Accordingly, 20 NBCA now cover more than 30,000 km² of Lao PDR, amounting to some 12.4% of its land surface. In the Viengthong district, two thirds of the land area is classified under some category of forest reserve. Nation-wide, under present forestry law, 8 million ha of land is classified as either Conservation Forest or Protection Forest. Thus, over 70% of the forested areas of Lao PDR are ascribed today under one or another categories of protected forest.

Otherwise, the process of land allocation goes on. It consists of distributing three land parcels per family for rain-fed or dry rice. With the former rotation calendar spanning 15 years, a farmer would typically have lands in every stage of regeneration, from new *ray* to well-forested and ready for initiating the next slash-and-burn cycle. With the present 'three parcels per family' rule, but without technical improvements in rice culture, we see both a decrease in soil fertility and an increase in the labour required for weeding (Jouve 1999). This new system is incompatible with the lifecycle of certain key NTFPs such

as cardamom and *benzoin*s, which would spontaneously sprout on fallow fields and be productive from the 4th through 15th year following the rice harvest.

The system of forest zoning and the establishment of reserved and conservation forests and NBCA has not yet been translated into rights permitting upland communities both to exploit and to defend their protected zones; nor do the regulations recognise the previously practised agroforestry activities (Koning 2000). Peasants no longer have the right to collect NTFPs in protected forests. Numerous witnesses have attested that certain lands long since characterised by agroforestry practices have not figured at all in the new land allocation process. In this way, the cardamom-bearing forests themselves are now classified as conservation zones and thenceforth put off-limits to cardamom gathering. Even certain projects aimed at cultivating cardamom in older degraded forests have not moved forward after colliding with the prohibition of slash-and-burn necessary to open the clearings required for establishing young cardamom plants. This situation has engendered numerous conflicts between the government's new land laws and traditional land allocation and tenure rights. According to the latter the land belongs to the first person who clears it, idle pasturage and free gathering of NTFPs are authorised within forest clearings after the rice harvest and access to the village forest is reserved only for the inhabitants of that village.

A slash-and-burn species integrated into agroforestry systems

In Lao PDR the harvesting of NTFPs is inseparable from the traditional lifestyle of upland populations. In such villages more than half of the cash income comes from the sale of forest products, and the greater part of the animal protein supply is obtained from fishing and trapping or shooting small wildlife (Aubertin 1998; Foppes and Ketphanh 1998). The climatic and topographic conditions disfavour perennial agriculture. About 20% of the total land area of Lao PDR is comprised of plains, primarily the lowlands of the Mekong Valley, while the rest of its territory is 'mountainous', with slopes exceeding 12% and still largely forested. The population, about 80% rural, still lives for the most part on a subsistence economy.

The low human population density, about 20 inhabitants per km², allows for swidden-grown upland rice as the primary cereal crop, which, contrary to the dogma of the Lao authorities, by no means can be dismissed as archaic and predatory. In such an environment, resorting to slash-and-burn is a good choice. Given the limitations on land tenure and ownership and the difficulties in mobilising capital and labour, the production of dry upland rice is an adequate strategy for achieving both security and a good return on labour input. Indeed, swidden can be the most appropriate response to a milieu unable to support more intensive agriculture and needs to be considered on its own terms as an agroforestry system.

The ecology and economy of cardamom cannot be separated from the peasant agroforestry systems and the environment that these agricultural practices engender. The gathering of cardamom has been thoroughly integrated into the cycle of upland rice production. It is a swidden plant,

which is harvested as it matures during the emergence of secondary forest on fallow upland rice fields. The collection of 'wild' cardamom is done at the end of the rainy season on older fallow sites, as the final weeding of the swidden field is completed just before the rice harvest. The labour force's free time is allocated to cardamom gathering at exactly the period during which there otherwise is a critical gap in the availability of food and money with which to buy it. Cultivated cardamom, when planted at the same time as upland rice, can produce satisfactory yields for some 15 years during the long fallow period required to restore soil fertility.

Relations with the cultivation of opium and coffee

At all three studied field sites we observed that the investigation of cardamom production provides a key to understanding the entire productive system of upland farmers. In Phongsaly we noted an almost perfect concurrence between the culture of cardamom and the culture of opium. The added value of opium can reach US\$1,200 per hectare per year. Pressed by American donors, however, the Lao government aims to eradicate opium. The cultivation of cardamom, which may contribute up to US\$500 per hectare per year, appears as a possible alternative crop, and in any case it is a good indicator of the success, locally, of the antidrug struggle.

On the Bolovens Plateau, the same remarks are true in relation to coffee production. There we find cardamom plantations on soils disavouring successful economic yields of coffee. The principal exporters of Bolovens coffee are also the buyers of cardamom, and they finance—on credit extended from coffee production—the 'cardamom projects' campaign. Cardamom thus benefits the same commercialisation networks as coffee does. Yet seeing how the price of coffee has recently crashed, following the glut of production, we can expect a land conversion in favour of cardamom.

Increasing commercialisation as a result of land policies

Despite the unfavourable factors described above there is a growth in the commercialisation of NTFPs owing in part to improved data management, the opening of penetrating roadways and the liberalisation of enterprise. We can analyse this phenomenon first as a response to new pressures on land use and land ownership. Three larger categories of such reactions have been noted:

First, because of the reduction in land area devoted to rice and the lower yield that followed the ensuing reduction of fertility, pressures have been growing on forest resources. Because less rice is being produced under the changed situation of limited land access and disabled long-fallow refertilisation, it has become necessary to buy rice in the market, which requires cash. We noted that overexploitation of resources arises out of competition amongst gatherers of certain forest products in regions where access rights are especially ill defined (e.g., wild cardamom in Phongsaly and Huaphan). As mentioned above, in order to counter the harvesting of cardamom by people from other villages, there has been a tendency to collect immature seed capsules.

A second response has been to play with the status of land. Gardens (*swan*, in Lao) and rice fields (*na*) have not been included in the lands subject to redistribution. They remain the property of their occupants and, unlike newly distributed land parcels, may be resold. When so called 'cultivated' or 'maintained in good condition' NTFPs are converted, legally if not horticulturally, into garden plants, their cultivation becomes a strategy to head off the consequences of land use and land tenure reform. Thus it is up to village chiefs and the proponents of NTFP projects to play the 'garden definitions game' with the officials in charge of land allocations. The cultivation of cardamom on slash-and-burn areas or within unburnt forests, thereby redefined as 'gardens', escapes the condemnation weighing on *ray* and cultivation within protected forests. Where such manoeuvres are successfully passed off, these gardens will be fine-and-well privatised. Thus they are not included in the lands being distributed and indeed added to the three land parcels allocated to each family.

Finally—once the land allocation process is executed—the domestication of NTFPs answers likewise to the need for perennial crops suitable for rice substitution. In development projects one is always looking for imported varieties to put into cultivation as new sources of revenue more apt to respond to the requirements of the market, rather than trying to domesticate or adapt indigenous biotypes. On such an occasion the method of appropriating outputs also changes: if we often observe the collective harvest and collective distribution of revenues from certain NTFPs 'belonging to the village', we have also seen the privatisation of both the revenues and the plants themselves, once they have become cultivated. Medicinal cardamom is thus in the process of becoming an agricultural commodity like any other, which simply needs a little more forest cover.

Closing arguments: a plant for sustainable development?

For the profitable exploitation of naturally occurring medicinal cardamom the forest cover needs to be maintained. Beyond that cardamom requires little additional care and local farmers even regard cardamom as weed tolerant. As we have seen, cardamom is one of those rare NTFPs for which harvesting and exploitation actually tend to favour its growth and development. The cardamom resource remains barely threatened so long as the forest itself is not destroyed. In the case of cultivated cardamom the situation is slightly different: here, it is necessary to prepare the land surface and to keep up a minimum of weeding. This would indicate sensitivity to competition from other species, all the more so when cultivation has been stoloniferous, where the young cardamom may easily be overwhelmed. In any case, cardamom is considered as benefitting subsequent cultivation of the site. It enables the quick preparation of the soil for planting while also choking out invasive weeds. Within a conceptual framework of sustainable development such ecological factors can easily be combined with the basic economic concerns of the highlanders to present medicinal cardamom as an ideal species. Nevertheless, as we will see, it's not so simple.

Issues regarding domestication

The transformation from wild plant to domesticated cultivar has practically never been observed within a gathering-dominant context, as in the case of Huaphan. The households we interviewed never expressed interest in domesticating cardamom. They well know that, because of land tenure policies, they would have to dedicate scarce land to cardamom. They would have to provide labour at fixed times and grow more dependent upon the cardamom buyers' requirements. Why would they renounce the income derived from wild cardamom during a period of local labour surplus? Indeed, the families given most to cardamom gathering are either the poorest ones—those already making their living from NTFPs because they have no alternative—or the better-off families that have land available to plant cardamom or enough labourers to gather wild cardamom from the forest.

Neither can domestication of cardamom be observed in the context of plantation cardamom projects. As project team leaders are looking for secure outlets they prefer buying seedlings produced at the Xishangbanna Botanical Garden. With these standardised seedlings they get concomitant guarantees that they will be able to sell their production to Chinese merchants. This choice leads to the replacement of local varieties of cardamom with standardised cultivars and so threatens the local varieties' very existence.

Measures to promote cardamom development

The measures to promote cardamom development are well identified. It is of utmost importance to assure tenure and usufruct rights for communities in order to prevent premature picking and squabbling between neighbouring villages. Small size and poor quality characterises cardamom fruits that are collected too early, and a differential pricing system, which duly rewards the better quality producers, appears absolutely indispensable. Because price negotiations are made individually, cardamom sellers associations could be mobilised in order to obtain quality-keyed prices. Finally better, more energy efficient technologies for drying harvested fruits and allowing at least some stockpiling to avoid production gluts, thus strengthening the producers' position in negotiations, could be introduced at a relatively modest price. Solar drying kilns are already being tested in Luang Namtha.

Government policies help or hinder?

The existing legislation is inadequate and vague on key issues like the right of access to the land, the nominal state monopoly over cardamom, the mechanism and application of production quotas and the unfavourable taxation system (Enfield *et al.* 1998). But above all, the Lao government's agricultural and economic policies seem to go contrary to the development of mountainous regions. How, then, with the government's condemnation of agroforestry systems can the objective of poverty reduction and forest protection be reached by establishing cardamom? How can upland communities organise

themselves towards exploiting and commercialising NTFPs without recognition of their rights and a guarantee over their tenure and usufruct?

The systems that we have been discussing here cannot be inscribed under 'natural evolution' where humans patiently improve the state of their resources and their milieu. These spring instead from ruptures caused by altering the legal status of the land, the resources, and the actors themselves. In every case the market has not been the sole determinant. We can interpret the systems undergoing mutation in response to external threats bearing essentially upon secure land tenure and ownership, and on the rights of upland populations more generally. These systems are sharply different in their social and historical determinants. The evolution towards intensification is due to a break up in the production systems. The latter comes from the restrictions on access to the land and from the condemnation of traditional practices, especially shifting cultivation. It is essential to note that such a rupture, paradoxically, is the result of governmental policies put forward in the name of the environment! These policies, implemented by a government that sets agriculture apart from forestry and ignores agroforestry systems, have the opposite effect of intensifying, on the one hand, the harvest of wild plants, while on the other hand, moving towards the cultivation of standardised varieties.

We must stress that it is impossible for us to put forward comparative advantages in terms of specificity of Lao cardamom to account for its development. If there are any comparative advantages, they would lie in the opportunity costs of land and labour compared to those in neighbouring countries. The cardamom boom in Lao PDR is rooted both in market expansion and the scarcity of land for cardamom production in Yunnan, China. As a result of the homogenisation of tastes and the process of globalisation, Lao medicinal cardamom is becoming a commodity like any other, seldom sought for its specific genetic or ecological characteristics. As it discloses the problems with land tenure, and with the rights of upland populations, our study of cardamom prove to be eminently political. The central issues remain, actually, the modes and norms of social regulations and national integration of forest dwellers as well as the control of natural resources, the ecological management of the landscape and the creation of wealth.

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ENDNOTES

1. Institut de Recherche pour le Développement. 5 rue du Carbone 45072 Orléans cedex 2, France. E-mail: Catherine.Aubertin@orleans.ird.fr

2. *Ray* is an area where the forest has been cut and burnt for temporary cultivation of rice and other crops. It is the cornerstone of shifting cultivation, a form of agriculture in which soil fertility is maintained by rotating fields rather than crops. New plots are usually cleared by slash-and-burn and cropped until soil exhaustion. The land is then left to regenerate naturally while cultivation is conducted elsewhere.

3. Exchange rate July 2000: US\$1 = 7500 kips.

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Chapter 4

Harvesting and commercialisation of *kroto* (*Oecophylla smaragdina*) in the Malingping area, West Java, Indonesia

Nicolas Césard¹

Common names	Part of the resource used	Management	Degree of transformation	Scale of trade	Geographic range
Semut rangrang, Weaver ant, Sireum sirarange	Larvae	Wild	Low	National	Medium

OVERVIEW

The Asian weaver ant (*Oecophylla smaragdina*) larvae and pupae are collected in the wild from trees and commercialised as songbird food and fishing bait in Java, Indonesia. The produce called *kroto* brings substantial income to numerous rural households throughout the year. The resource’s durability is until now ensured by the species’ distribution (various ecosystems and polycalic structure of nests), the constraints for collection (inaccessibility of small nests and ants’ aggressive behaviour) and the limited number of collectors. However, constraints related to storage and transportation of the resource, retailer’s margins and a policy on animal trade (i.e., birds) are limiting the benefits of commercialisation for collectors.

INTRODUCTION

Kroto is the Javanese name given to a mixture of Asian weaver ant (*Oecophylla smaragdina*) larvae and pupae, which is sold in animal markets and small shops as food for songbirds or fishing bait. By extension, the term *kroto* also refers to a range of dried preparations made of small quantities of ants, chicken eggs and honey used as birdfeed. Ant larvae and pupae are not always included in this mixture, which is sold in the markets. Indeed processing companies keep the well-known name of the resource for commercial reasons.

Studies on insects as forest products are limited, but insects and their by-products are popular forest resources in Southeast Asia. Most of these insect products are eaten, some are commercialised (De Beer and McDermott 1996), but few are traditionally managed (De Jong 2001). Honey (*Apis* spp. mainly) is collected mostly from the wild and sold in marketplaces, as are beeswax, pollen and venom (Chuntanaparb *et al.* 1985; Giesen 1987; Marsh and Gait 1988). The resinous secretion of several species of tiny louse (*Laccifer lacca*) is a source of lac with a wide variety of uses (Gupta and Guleria 1980).

This study focuses on the Malingping area of Banten Province, one of the main *kroto* production areas, as well as locations where the resource is commercialised, such as Jakarta and to a lesser extent, Bogor. Asian weaver ants can be found almost anywhere in Indonesia. Thus, many poor people in rural parts of the country harvest *kroto* in order to earn extra money or as a regular source of income. Collection is locally based and is an organised activity led by a collector/trader or by small groups of individuals. But *kroto* production is not confined to organised groups: numerous collectors, songbird owners and amateur fishermen prefer to collect the fresh larvae rather than buy it.

Context and uses

Kroto is an animal product well known all over Java and on other Indonesian islands. Although the name is familiar in other parts of the archipelago, local communities have used ant larvae as bird food for a long time but not called it *kroto*. In Java especially, the resource is strongly related to the population's enthusiasm for captive songbirds such as *murai* (varieties of blackbirds and thrushes), *kutilang* (*Pycnonotus aurigaster*) and *perkutut* (*merbock* or zebra dove, *Geopelia striata striata*). The call of each of these birds is distinct, with its own melody, structure, pitch, base and treble. Songbirds have been a part of the Javanese way of life for a long time and have provided their owners with a symbol of their social status.

According to bird lovers, most songbirds can be fed *kroto* with the exception of granivorous birds. People buy the old *kroto* (*kroto tua*), i.e., two- or three-day old larvae, regarded as the lowest quality *kroto* (*kroto kasar*), for feeding chickens since it is believed to accelerate both feather growth and flesh production. Lacking freshness, this *kroto* is also called *kroto busuk* (rotten *kroto*) by songbird owners, as well as *kroto hitam* (black *kroto*) for its poor quality.

A diet of ant larvae is known to provide vitamins, proteins and other mysterious, but essential nutrients, which are believed to improve a bird's performance. Songbird owners nourish their most beautiful and skillful birds with ant larvae in order to prepare them for singing contests, but also for the sole satisfaction of listening to the warbling of their favorite birds at home. Some bird owners occasionally collect the larvae, but most buy the resource from their local shopkeeper or pet shop.

Freshwater anglers also use the fresh *kroto* as bait. In some locations, depending on the fishing season, the ant larvae are used fresh in a home-made mixture of chicken eggs, honey, maize and beans. Most of the *kroto* sales in Bogor are for this purpose.

Box 1. Weaver ants as food and medicine

In Thailand and the Philippines, the larvae and pupae of Asian weaver ants are commonly eaten. The taste has been described as creamy. The adults are also eaten; their taste has been described as lemony or creamy and sour. In Malingping, another species of small ant is eaten. *Oecophylla smaragdina* is used as medicine in India. In the Bastiar region (Chhattisgarh), the adult ants are directly used in the treatment of rheumatism, as oil to cure stomach infections and as an aphrodisiac (Oudhia 1998).

Two other uses have been reported in Malingping and in Pelabuhanratu. The excrement of weaver ants is harvested to make a multipurpose varnish (in addition to turpentine), locally used to protect wooden furniture. In Malingping, a few shops (*toko besi*) sell from time to time a home-made varnish made of dry adult ants, called *malam serim*, in small packages for US\$0.05² per package.

Collection sites

In West Java and Banten Province, the larvae of weaver ants are collected from locations such as Cianjur, Purwakarta, Banjar, Cirebon, Indramayu and Lebak. The collecting grounds in the Malingping area are Cihara, Cimadur, Cisihi, Bayah, Cibaliung, Muara Binuangeun, Bagendur and even the Ujung Kulon National Park area (Figure 1). The *kroto* production area studied is located in the subdistrict of Malingping (Lebak District) in Banten Province. The Malingping subdistrict measures 166.76 km² and includes coastal areas, extensive agricultural lands (mostly rice fields) and, in addition to Ujung Kulon National Park, secondary and divided forests.

Most collectors have a good knowledge of the different production areas, which is especially important for frequent harvesting. They make the decision about their next harvest based on the season, abundance of the resource, accessibility of the area, climate and length of time since last harvest. If an area is harvested only during a certain time of the year, regular collectors may know more than 15 places in that area from which to harvest, but every year they try new places or, sometimes, they just go further in their explorations in the same areas.

PRODUCTION-TO-CONSUMPTION SYSTEM

Distribution and species habitat

The *kroto* sold in West Java comes from various ecosystems: from coastal areas and gardens to secondary forests and agroforests. Larvae at different stages of development as well as pupae (*telur semut*; 'ant eggs' being the direct

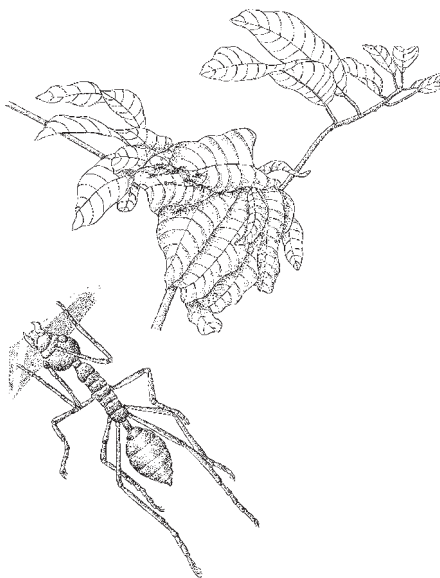
Figure 1. Collection sites around Malingping



Source: ESRI Data and Maps 2002.



translation) are taken from the high nests of weaver ants (Hingston 1923). The distribution of the most common species, *Oecophylla smaragdina* (Fabricius) (Hymenoptera: Formicidae) is wide, throughout the Indonesian archipelago. The Asian species is known as *semut rangrang* in Indonesian, while in the central and western part of Java it is known as *sireum sirarangge* (in the Sundanese language).



(*Oecophylla smaragdina*)

Box 2. Other ant species consumed as *kroto*

Informants reported two other species besides the Asian weaver ant that are occasionally consumed as *kroto*. Their larvae are difficult to find and harvest, however, and therefore seldom collected. Those species are humpback ants (*semut bongkok*), which live in bamboo culms and crevices of dead trees, and ground ants (*semut telas*), which live in soft soil layers. Most of these ants' larvae are not sold, but used by individual collectors to feed their birds; this product should be distinguished from the traded *kroto*.

The distribution of the most common species, *Oecophylla smaragdina*, ranges from India to Australia and extends to most of the rainforests in Asia (Wheeler 1922; Hölldobler 1983). This weaver ant is well known as an unusually aggressive predator, as well as for the construction of complex arboreal nests (or calies). The ant colony may occupy various nests in a single tree (polycalic

structure) or even occupy several trees. Way (1954) mentions having observed a colony that had 151 nests spread over 12 trees.

The queen is located in one nest and her eggs and larvae are distributed to other nests. The ants feed on nearly all insects that attack the host tree, mainly Dipteran, Coleopteran and Hymenopteran (Dejean 1991). Weaver ant nests are among the most complex of social insect nests. *Oecophylla* species use the extremely well developed silk glands of their larvae for connecting living leaves to form their nests. Workers carrying larvae between their mandibles pull leaf edges and weave them together with the silk the larvae produce when pressured lightly. Gradually more and more leaves are connected to the nest.

Weaver ants have delimited territories with a mosaic distribution (Majer 1972; Leston 1973) in a wide range of habitats, both natural as well as plantation areas, and are the dominant species in their habitat. They occupy a great variety of trees from large bananas to small *petai* (*Parkia speciosa*). Collectors harvest the *kroto* in fruiting trees, such as *jengkol* (*Archidendron pauciflorum*, syn. *Pithecellobium jiringa*), jackfruit (*Artocarpus* spp.), mango (including *Mangifera indica*), *duku* (*Lansium domesticum*), *rambutan* (*Nephelium* spp.), *jambu air* (*Syzygium aqueum*) and other trees such as rubber (*Hevea brasiliensis*), teak (*Tectona grandis*), *buni* (*Antidesma bunius*), *kedondong* (*Spondias* spp.) or cacao (*Theobroma cacao*). According to collectors, some of the best places for harvesting *kroto* are in coconut and oil palm plantations (see Way and Khoo 1991; Way and Bolton 1997), in which the *kroto* is described as abundant and of good quality.

Harvesting

The ants are active during the day, their activity peaking about noon. The best time for collection is during early morning, from six to ten o'clock, and then in the afternoon from two to five o'clock if the morning harvest was insufficient. During the wet season, the best time to harvest is between two rainfalls, allowing the sun time to dry the nests.

In Malingping, as in other locations, collectors go together to the field since travelling together is often easier. The harvesting site is chosen the day before or on the morning of departure. Once they arrive at the collection site, they split into groups of two to three and may divide again at another point, since collectors often look individually for trees with nests, but will try to stay within earshot of fellow collectors. A collector who finds an ant nest will search the host tree and its vicinity for further nests.

Some of the study area consists of former agricultural lands on rolling hills, some of which are fallow lands covered in a mixture of large herbaceous vegetation, dotted with a variety of trees and bushes. This open, seemingly discarded landscape abounds in *kroto* host trees. The openness of the area makes collection much easier than in the woods. (Perhaps this is the reason why weaver ants are more likely to be found in agroforestry systems, orchards and sometimes gardens in the vicinity of houses.) Although an abundant harvest is possible from plantations and untapped forest areas, even if the host trees

are rather scattered, collectors are a bit reluctant to harvest *kroto* in areas that are less familiar to them. The parts of primary forests not dedicated to cultivation are located on hillsides (often difficult to access) and in a protected area (where collectors are not allowed to gather forest resources, although, discreetly, they do enter). Thus, the harvest in unknown areas is expected to be exhausting and less bountiful. Another criterion apparently decisive to collectors is the remoteness of forested areas from the village. The difficulty of access even by road leads to high transportation costs and lost time.

Kroto harvesting is marked by two climatic seasons, which partly intersect the biological cycle of the ants: the dry season with final-stage larvae and the wet season, when the pupae of the future queens, males and worker larvae are smaller. During the dry season the resource is less abundant and consequently more difficult to find, according to collectors, and the *kroto* consists of big larvae, pupae and sexual forms (future queens and males) that collectors call 'capsule' (*kapsul* in Indonesian) for their similarity to capsules used to hold medicines. Big larvae are considered as of poor quality since they are too big for use as birdfeed, and the dry season is known as low quality season for that reason. *Kroto* harvested at that time of year is also described as black (*hitam*), because the pupae are almost adults, and moist (*basah*), because of the weight of the mixture.

Songbird owners prefer the 'rice' type of *kroto*, which is the most valuable and marketable product of its kind. Rice *kroto*, or *kering* (dry) because of its appearance, is made up of small larvae and pupae that are common during the rainy season. Paradoxically, *kroto* harvesting decreases during this season, as collectors are busy with other subsistence or economic activities. The peak season for harvesting *kroto* is in the transition period between two monsoons (the *pancaroba* season), in particular during parts of July and August.

For the harvesting of *kroto* collectors require stamina, patience and a lot of dexterity. The collector bursts the nest and then shakes it with the tip of his 5 m or longer bamboo stick, to which a conical paddy bag is attached. Most of the larvae, as well as many ants, fall into the bag. The collector repeats the procedure multiple times until almost all the biggest nests of a tree are collected. Some collectors will add an extension of 2 m or 3 m (added to the 5 m bamboo stick) to get to the top of the tallest trees. Nevertheless, the highest nests often remain out of reach and are sometimes hidden by the vegetation. The collector will memorise the location of a bountiful tree for a future trip, waiting a couple of weeks for the ants to move to more accessible nests or to build new nests.

The harvest often turns into a painful ordeal for collectors. During the harvesting many larvae and ants fall from the nest to the ground. Trying to defend their nests and save their larvae, the thousands of aggressive ants bite anything under the tree, the collector included, making the harvest a dangerous operation. After the collector's departure, the ants climb back up the host tree with the remaining larvae and pupae to rebuild the ripped open nests or to start new ones.

Up to 60% of the harvested produce may be lost before arriving at the trader's house. About 40% of the *kroto* of harvested nests is lost at the site

Photo 1. *Kroto* is collected with a long bamboo stick to reach the nest in the trees (Photo by N. Césard)



and during the rest of the day while the collector is working other sites. Adult ants, larvae and various organic fragments fall from the bag during the harvest and during the trip from the one site to another. The insects in particular will continue to escape from the bag during the trip, leaving behind most of their larvae. At the end of the day the collector will remove another 20% of the initial weight in the form of debris. After having quickly removed the undesirable debris, collectors transfer the contents of their bags to a container or appropriate box, eventually cleaning the bag of the last ants using a synthetic feather duster (*kemoceng*). Twigs and small leaves, but also dead insects or their remains, are graded and separated from the larvae.

Many fruit tree owners welcome collection in their orchards and plantations³ as they see weaver ants as a nuisance, especially during fruit harvesting, which can become a painful operation. Collectors and fruit tree owners are unaware of the positive role these ants play in the eradication of insect defoliators (caterpillars, larvae and adult coleoptera) and Heteroptera (Majer 1972; Leston 1973; Room 1975; Dejean 1991).

Raw material producers and socio-economic context

In Indonesia, numerous rural families earn part of their living from the collection and commercialisation of *kroto*. Most collection takes place by individual, self-employed collectors who sell directly to merchants, bird owners or fishermen. Small producers sometimes also play the role of middlemen, buying *kroto* from other collectors, and selling it on to other middlemen or merchants.

Box 3. The use of weaver ants in agriculture

In other parts of their range *Oecophylla* have frequently been used as a natural control agent in the prevention of insect pests for many tropical crops: cashew (Peng *et al.* 1995), citrus (Way 1954, Huang and Yang 1987), mango (Way 1954), coconut (Vanderplank 1960; Way and Khoo 1992), cocoa (Room 1975) and coffee (Leela 1961). In the Mekong Delta in Vietnam, citrus farmers also appreciate the benefits of ant husbandry in terms of the improvement of fruit quality—a direct response to the fertilising properties of the excretions deposited by weaver ants patrolling the fruit (Stapley 1980). In Sri Lanka, however, the weaver ants' utilisation as a biological control agent has been given up because of their aggressive behaviour during the coffee harvest (Leela 1961).

Kroto is harvested and sold throughout the year, although there are periods of the year during which the harvest is more productive and of better quality than others. Some collectors harvest only the larvae from December to May, when the quality of larvae ranges from fair to good. Others will collect the larvae from August to October. Farmers in Malingping usually collect *kroto* between the two rice harvests (each rice-harvesting season lasts for two to three months). Several collectors harvest the larvae daily all year round and have no other source of revenue. Others harvest *kroto* maybe two or three days a week and engage in other activities the rest of the week.

Nowadays in Malingping only eight collectors are involved full-time, six days per week throughout the year. The collection takes place outside Malingping subdistrict in places such as Karang Taraje (Bayah subdistrict) and villages near Ujung Kulon (Labuhan). Collectors sell their production to a local trader, who has been in business for 15 years. They leave their harvest at the trader's house at the end of each day. During the month of Ramadan, collectors limit their harvesting to only a few hours a day.

Over the last few years production has been low compared with 8 or 10 years ago. Formerly, there were more than 15 collectors from Malingping and surrounding villages who harvested the nests every day. The trader used to hire several collectors. Relatives, neighbours, and friends were also welcome, on the single condition that they sold their collection to the trader. At that time, a group of collectors could harvest 30 kg to 50 kg in one day, an average of 2 kg to 5 kg per collector.

Today, harvesters still collect the *kroto* in the same way, choosing large nests made of fresh leaves and avoiding old nests known to be poor in larvae. One of these fresh nests can contain 1 oz. to 2 oz. (28 g to 56 g) of *kroto*. A collector may harvest from 6 to 10 trees per hectare. During the rainy season (the high season) collectors are able to collect up to 2 kg per person (an average of 1.5 kg per day) and the price may be US\$1.2 per kg depending on demand. It often gets harder for collectors at the end of the high season,

when the *kroto* is a bit moist and less plentiful, but on the other hand the price is better and can reach on average US\$1.4 per kg.

The collection of *kroto* offers not only additional but also substantial income to numerous families. Generally speaking, farming is the main activity in Malingping. Collectors and their families use the money they earn from *kroto* for daily subsistence, not luxuries. They buy meat, fish, rice and sometimes clothes for everyone in the family. Among those higher up in the trading chain, however, there are cases where the income is used to acquire luxury goods, such as one of the main traders who bought a television set a few years ago after saving for a long time. He is the one who organises the market chain to Jakarta, and therefore earns more than the collectors.

During the months of July and August collectors obtain higher income from *kroto* and might save the money for harder times. Additional money is especially welcome during the month of Ramadan (fasting month) in order to buy food and presents for relatives at *Idul Fitri* (end of Ramadan). Exhausted by the fasting, collectors' harvesting activities are considerably reduced during Ramadan.

There is the belief that *kroto* is *haram* (unclean, almost immoral, according to Muslim law), even if it is not consumed directly by humans. Therefore, many people think that the money earned from selling *kroto* is also *haram*. A collector told the author there was no benefit from *kroto* in terms of prosperity as long as collectors considered the resource immoral. For many people, collectors or not, the money from the sale of *kroto* is deemed dirty money that must be quickly spent and not saved. In view of this, it is relevant to ask why people would still harvest *kroto*. The answer is simple. The product is regarded as a chance to earn cash, and according to a collector, poor households will always try to make a living from a free resource.

Trade and Marketing

In Malingping, *kroto* is widely used for fishing bait, but demand for this purpose is modest—about 5 kg per day. The main outlet for *kroto* in West Java is the capital Jakarta where up to 100 kg of *kroto* are sold every day for both birdfeed and fish bait⁴.

At the trader's house, after cleaning the larvae and separating out the last debris, collectors pack the *kroto* in a *beseq*, a 1 kg box made from raw bamboo collected in the surrounding area. The trader usually buys the boxes from other families for a few cents. The trader, or occasionally a friend or relative, takes the boxes to Jakarta every day. Sometimes a trader may wait another day to gather more *kroto* from his collectors, but he will go or send it as soon as he can. Freshness assures the quality of the produce and thus appears to be commercialisation's main restriction. Indeed once collected, *kroto* can be kept fresh for only two days, but according to a trader, a freezer may help to maintain the resource longer before transportation.

During the wet season, larvae are very small and the risk of losing the resource during transportation to Jakarta increases as they deteriorate rapidly. Heat and storage change the colour of larvae to pale yellow; because

Photo 2. A *besek* of ant larvae equals 1 kg of ‘wet’ quality *kroto* (Photo by N. Césard)



of the quick deterioration of *kroto* it is again subjected to grading in Jakarta. More than 10% of the produce may have to be thrown out. From experience collectors know that weaver ants produce fewer larvae during the hottest months of the year, but that the nests contain the biggest larvae (sexed larvae). This *kroto* can be kept longer than the *kroto* composed of smaller larvae.

In Pasar Pramuka, Jakarta's main animal market, there is a rule among merchants that during the low season (the season of bad quality *kroto*), the price should be fixed. However, conflicts may arise among middlemen who sell *kroto* to merchants. Indeed, there is competition among middlemen as to who gets better sources (fresh *kroto*) first. Some middlemen are willing to pay collectors more for fresh, good quality larvae. A few individual collectors and some traders enforce their bargaining position by following the classic supply and demand system: they know that a good quality resource is difficult to find and try to increase the margin. Nevertheless, the maximum price set for the low season rarely exceeds US\$1.4 per kg at the collector level.

In Malingping one middleman has been in business for more than 15 years and is still co-ordinating the harvesting and packaging of fresh *kroto* from Malingping to Jakarta. His production now goes to the Pramuka market whereas it used to be sold in Bogor. The middleman sells the *kroto* at US\$1.6 to US\$1.7 per kilogram to two merchants in the Pramuka market, one of whom is an old acquaintance. Depending on the season, quality of the produce and amount of supply in the market, the merchant sells the *kroto* at US\$0.3 to US\$0.6 per ounce. This means there are regular variations for 1 kg ranging from US\$3.5 to US\$5, which is two to three times as much as the buying

price. According to its aspect and composition, two categories of *kroto* are distinguished in the market by various descriptions: *kroto basah* (wet) differs from *kroto kacang* (literally meaning ‘peanut’ in Indonesian, i.e., dry) and *kroto kasar* (inferior quality) from *kroto halus* (superior quality). Middlemen pay between US\$5 and US\$7.5 for transportation to Jakarta per trip, thus profits appear low.

There are three main markets where *kroto* is sold in Jakarta—Pasar Pramuka, Barito and Jatinegara—and many small shops and stalls all over the city sell small quantities. Those retailers buy the resource from individual collectors who deliver directly to their shops or they buy *kroto* from bigger shops or at bus stations in the early morning for resale. Bus stations are attractive places for local men who specialise in various produce (*kroto* included) because of their central locations and good connections to different production areas. Middlemen in Kampung Rambutan Terminal (South Jakarta) buy *kroto* from collectors not only from Malingping but also from other areas in West Java, especially Banten and Lampung provinces in south Sumatra. It also serves as a place for distribution to bird shops in Jakarta, and even to surrounding cities, such as Bogor, Bekasi, and Tangerang (see Figure 2).

Figure 2. Main trading flows of *kroto* in West Java



Merchants have tried to find more reliable sources in South Sukabumi, Cianjur, and Lampung in order to meet demand. This year especially, collectors from Malingping were competing with collectors from Lampung. The province

of Lampung has a few competitive production areas and has an effective transportation system to the capital. Collectors harvest the ant larvae during the day, then their trader leaves for Jakarta in the evening, travelling all night by boat and bus (seven to eight hours altogether) to meet merchants the next day at the market.

Processing the resource

Fresh *kroto* from harvest to the produce being sold in the marketplace requires little to no processing—only cleaning and grading are necessary—but the raw material can also be processed to obtain dried *kroto*, a less perishable produce. Prepared at home, dried *kroto* does not require sophisticated processing by the collectors' families: the larvae are boiled for one hour and dried for two or three days. Five kilogram of fresh *kroto* make 1 kg of the dried variety (20% of the original weight). It is a *kroto* that contains many adult ants and can be kept for at least six months. The price for dried *kroto* is usually half that of the fresh variety.

A few sources report that some small companies have commercialised a mix of dry larvae and ants, chicken eggs, maize, honey and beans as songbird food. This product is often labelled as *kroto* even though it contains only a small quantity of ants. The processing and packaging of this product may need more investment in time and capital. The product is sold in national animal markets and may be exported. No gatherers in Malingping seem to be selling the product for this purpose. According to birdfeed sellers, some of the *kroto* used is produced in the Sukabumi area, south-east of the capital.

Policy environment

Collecting *kroto* is a solitary job, even if collectors go to the forest in groups of two to four people. If they find the same resources in the same areas, conflicts are unlikely to occur, as there is a sort of customary law which states that whoever finds the resource first has all rights to it. This is open access tenure where no land title deed is required. *Kroto* is considered public property that can be collected wherever it is found: even in another collector's garden. However, in the early 1990s, the demand for *kroto* was diminished by a policy that limited the trade in songbirds. There is little government interest in the conditions of *kroto* production. In fact, local officials ignore the whole process.

TRENDS AND ISSUES—DEVELOPMENT AND CONSERVATION LESSONS

Trends

There is high demand for *kroto*, in particular for fresh larvae. Good quality *kroto* is quickly sold from street stalls and market shops. For instance, 5 kg of fresh product is sold within a few hours in Bogor every day. Even old larvae are sold in two or three days in Jakarta. The merchants in Pasar Pramuka

often complain of irregularities and delays in traders' deliveries. Consumers, songbird owners and fishermen often have to wait for the produce to arrive. Demand for first-rate *kroto* has increased. Because more people are getting involved in collecting *kroto*, the competition for the resource has increased in the last few years. Collectors are going back to sites where *kroto* is easy to find more frequently than they used to and thus collect from the same host trees more often. They collect all the nests they can find, even the smallest ones. Collection is often still organised as it was before, with small groups of collectors and middlemen, but in addition many individual collectors are now looking for *kroto* on their own. They know where to look for nests and then sell directly to retailers, who are often willing to pay more for fresh *kroto*. People collecting *kroto* seem to be less regular in their activities than before, seeking other opportunities first, and spend only a few days per week or month harvesting *kroto*.

Ecological implications

Under normal conditions, weaving ants have a quick population recovery. Regeneration takes between 17 and 24 days (Paimin and Paimin 2001). According to collectors, it takes five days before new nests appear and around 20 days for the ants to produce new larvae. It underlines the collectors' knowledge of the resource: they know that rotations in space and time allow the ants to build new nests with larvae. Nowadays, both old and new collectors less often respect the necessary harvesting rotations, thus harvesting becomes destructive and the resource is becoming scarce in several exploited areas.

When discussing resource regeneration, it should be taken into account that one colony can extend to several trees and that the queen's nest is often unreachable. We assume that if not all larvae are harvested, this will allow the resource to partially regenerate (under specific and nondestructive harvesting conditions of the nests). The medium sized nests of queen ants are located near the tree canopy, being indeed the most inaccessible of nests. The queens apparently stay in one nest from which eggs are distributed to the other nests in the colony. Each tree contains many nests, but only one nest contains queens. There are commonly multiple queens in mature colonies (Peng *et al.* 1998).

Weaver ants prefer fruit trees, and therefore so do *kroto* collectors. The tree owners are only too happy to let the collectors remove the nests from their trees, as discussed earlier. The impact of harvesting nests on tree growth and fruit production in the region may well be worth evaluating.

The importance of *kroto* in livelihoods

Income gained from *kroto* does help collectors, but it hardly brings major economic changes to their lives. Households spend the money earned to cover basic needs. Small amounts of money may be saved so as to start other economic activities or to buy useful equipment or accessories to help the production (i.e., a refrigerator or motorcycle). Transportation from the

production area to the market places proves to be an important limitation. Collectors or traders have to sell the product to shops that are located in large cities far from the production areas. They use public transport, which implies they have to wait for long periods of time and change vehicles several times. This is especially difficult with the fresh larvae: profits are dependent on the rapidity with which collectors can deliver the resource to the sellers. The alternative to fresh *kroto* is dried *kroto*. However, the production of dried *kroto* means more pressure on the resource, since it requires larger quantities of both ants and larvae, and results in a poor quality end product.

As with many other non-timber forest products, *kroto* collectors cannot take advantage of an increase in demand (Dove 1993). Merchants establish the product's price and appear to be the main beneficiaries of the commercialisation of *kroto*. Most middlemen are in the same situation as the collectors (Padoch 1992). Both collectors and middlemen could have more power over selling prices, since the resource is becoming scarce, but they do not negotiate with merchants to increase their profit margin. We may see this attitude as a lack of consensus between collectors and middlemen, and between middlemen and merchants, to the detriment of both collectors and middlemen. Many collectors never meet merchants and ignore the extent to which *kroto* is in demand.

In terms of livelihoods, harvesting *kroto* does not present an alternative to agriculture conversion or logging. For most collectors, harvesting *kroto* complements other economic activities, principally agriculture. Moreover, the agricultural extension does not seem to prejudice the colonisation of weaver ants so long as trees are left to host the nests. One may consider the resource and its collection as adapted to a very modified natural landscape, which is prevailing in Java, and in that sense, one may think of *kroto* as a forest resource as much as a post-forest resource.

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ENDNOTES

1. Institut de Recherche pour le Développement (IRD), Wisma Anugraha, Jalan Taman 32 B, Jakarta 12730, Indonesia. E-mail: ncesard@wanadoo.fr

2. Exchange rate (September 2001): US\$1 = Rp10,000.

3. In the 1970s, an informant reported that before insecticides were widely used in orchards and plantations to eradicate weaver ants and other small fruits predators, local villagers used buffalo bones to kill ants. A bone would be hung on a tree branch, where the targeted ants were swarming.

Once gathered, bone and ants were set on fire in order to kill all the ants. This procedure was repeated for three days in a row.

4. According to some bait merchants the trend is changing. Fish caught with *kroto* have bruises in their mouths as *kroto* contains a heating agent, and merchants think about changing to another animal bait if demand for *kroto* decreases.

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Chapter 5

Song rong (*Tricholoma matsutake*), a valuable forest mushroom from China: consumption, development and sustainability

Ying Long Chen¹

Common names	Part of the resource used	Management	Degree of transformation	Scale of trade	Geographic range
Matsutake, Pine mushroom, Song rong	Mushroom	Wild	Low	International	Small

OVERVIEW

Growing only in parts of East Asia, *song rong* [*Tricholoma matsutake* (Ito et Imai) Singer] is the most important edible fungus in the region, with farm gate prices of up to US\$370 per kilogram. This chapter is based on a case study of *song rong* in the Zixi mountain area of Yunnan province, China. More than half the farmers in the research area are involved annually in the harvest of *song rong*, which contributes, on average, 62% to their annual cash income. The bulk of the harvested mushrooms reach the most important consumer market, Japan, within two days; the mushrooms are most valuable when fresh. The increasing Japanese demand for fresh *song rong* (a result of declining *song rong* yields in Japan) and the increasing price have resulted in rampant harvesting. An important side effect of the harvest is that the ecological conditions for this fungus are negatively affected. Moreover, because of intense competition between collectors, harvesters also collect young buttons, which fetch much lower prices than mature buttons. The decline of *song rong* has become a serious problem that needs to be addressed.

INTRODUCTION

China has had a long tradition of mushroom consumption, especially in rural communities. It is approximately 2,000 years since the function and usage of wild edible mushrooms as a food and medicine for humans was first recorded.

Today a wide variety of edible mushrooms, including a number of symbiotic forest fungi (wild mushrooms) with edible fruiting bodies, are consumed in large quantities around the world, especially in East Asia and Continental Europe. The worldwide consumption of mushrooms was over 4,273,000 tonnes in 1991, including 200,000 tonnes of edible mycorrhizal fungi (Chang 1993; Hall *et al.* 1994). Trade in forest mushrooms has recently expanded into a multimillion-dollar industry. The world market value of these mushrooms has been estimated at somewhere between US\$3 billion and US\$6 billion (Huang 1993; Hall *et al.* 1994; Chen 2002a).

Nearly 900 fungal species have been documented as valuable edible mushrooms, of which 352 species (belonging to 60 genera) are ectomycorrhizal fungi (Huang 1993; Gong *et al.* 1997; Chen 2000; Mao 2000). The most valuable mushroom in China, in fresh weight price paid to harvesters, is *song rong* [*Tricholoma matsutake* (Ito et Imai) Singer, i.e. Matsutake], which is available in relatively large amounts only in south-west and north-east China². The natural production of *song rong* has dramatically declined in the past 60 years in Japan and other production sites in China, and consequently the price has increased. For this case study we chose the Zixi mountain area (25°09'N and 101°21'E) of Yunnan province in south-west China (Figure 1), a production site where the harvest and sale of *song rong* brings significant economic gain to rural communities in the region.

The study site is situated about 20 km south-west of Lu Cheng, the capital city of Chuxiong Prefecture. It consists of Zixi Forest Park and four villages around the mountain. In 1998, there were 1,633 households with a total population of 6,793, of which 32% belonged to minority groups, mainly Yi and Hui people. This area has a subtropical, monsoon climate with elements of temperate and tropical climate. There are distinct rainy and dry seasons and the annual precipitation is about 909 mm, over 90% of which falls between May and October. The mean temperature is 8.3°C in January (winter) and 20.9°C in July. These climatic characteristics are suitable for the growth of wild mushrooms.

The spatial extent of the *song rong* raw material production area is 11,360 ha (113.6 km²), which is the sum of the collection area, Zixi mountain (1,712 ha), and the adjacent villages (9,644 ha). The raw material production area includes 664.5 ha of agricultural lands and 9,107.1 ha of forest; 77.9% of the total land area (8,844.5 ha) is well covered by forests, mainly conifers. The state owns 95% (1,627.2 ha) of the Zixi mountain area, which covers the conservation area. A community legally occupies the remaining 5% (85.6 ha).

Song rong in the Zixi mountain area

Until about 50 years ago Zixi mountain was covered in luxuriant natural forests consisting mainly of conifers, but in the 1950s most of the forest was destroyed by human activities. In 1958, for instance, trees were cut down to provide charcoal for the iron and steel industry. This was followed by another local initiative to develop yam. The establishment of the Zixi Mountain Forest Farm in 1962 brought hope to the forests. Forest farms, like the Zixi Mountain Forest Farm, were mostly state-run at that time and engaged in the establishment of

Figure 1. Location of the study area



Source: ESRI Data and Maps 2002.

plantations and the restoration of forests. Both government and local farmers became aware of the importance of forest preservation, and many steps have since been taken to develop forests. Now, as a result of the establishment of the forest farm, Zixi mountain is again covered in green trees, almost all secondary coniferous forests. There are approximately 389 ha of secondary *Pinus armandii* forest in the reserve park.

The specific highland climate of the Zixi mountain area, located on the Yun-Gui plateau, is ideal for the growth of edible fungi. Furthermore, the mixed conifer and hardwood forests support a large number of edible fungi, most of which are symbiotic and capable of forming mycorrhizal associations with host plants. The predominant tree species are *Pinus yunnanensis* Franch., *P. armandii* Franch., *Quercus* spp., and *Castanopsis* spp., but other trees of the genera *Fagus* and *Alnus* intermingle with Pinaceae and Fagaceae. These mixed forests have a moderate number of shrubs in their understorey including *rhododendron* species, but lack herbs.

The mean elevation of the Zixi mountain area is about 2,200 m, the highest elevation being 2,502 m a.s.l. The organic litter layer is usually thick, up to 6 cm in the coniferous forests. *Song rong* (*Tricholoma matsutake*) fruits abundantly under coniferous trees, especially at elevations from 1,800 m to 2,300 m. The dense layer of litter protects buttons of *song rong* from predation by birds and animals.

The collection season of *song rong*, an autumn delicacy, begins in the middle of June and extends over four months to late October. Though *song rong* produces harvestable fruiting bodies throughout this period, the most effective harvesting months are July and August because of climatic limitations,

Photo 1. *Song rong* (Photo by Ying Long Chen)



such as rain, in the other months. Other edible fungi, such as cep (*Boletus edulis* Bull. Fr.), *B. speciosus* Frost, yellow morel [*Morchella esculenta* (L.) Pers.], *ganbajun* (*Thelethora ganbajun* Zang), chanterelle (*Cantharellus cibarius* Fr.), termite mushroom [*Termitomyces albuminosus* (Berk.) Heim] and cow spunk [*Suillus bovinus* (L.:Fr.) Kun.], also occur commonly in the forests in this area and are sometimes collected for international or domestic consumption. Most of these fungi are mycorrhizal mushrooms, which mainly grow in pine stands or mixed forests.

THE PRODUCTION-TO-CONSUMPTION SYSTEM

Resource Base

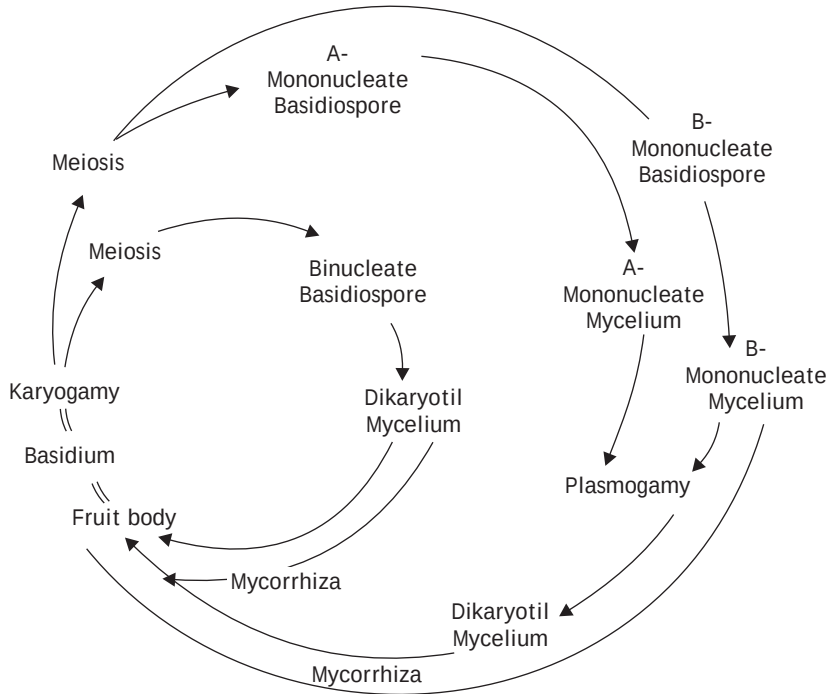
Song rong is the local name and trade name of *Tricholoma matsutake* in China (Photo 1). The word 'matsutake' is a Japanese collective name for a group of similar mushrooms growing in coniferous forests (*matsu* = pine, *take* = mushroom) with fruiting bodies closely resembling *Tricholoma* spp. Though the name *matsutake* has been extended to a number of other species of genus *Tricholoma*, especially the American *matsutake* [*T. magnivelare* (Peck) Redhead, i.e., white *matsutake*] and foolish pine mushroom (*T. bakamatsutake* Hongo), it actually refers to Japanese *matsutake*, i.e., *song rong* (*T. matsutake*), which grows naturally in East Asia.

The first description of *song rong* in China was printed in 1094 in a book on Chinese herbal medicines compiled by Tang Shenwei, a scholar in the Song Dynasty. The Japanese later adopted the Chinese character for *song rong* but use a different pronunciation.

As mentioned above, *song rong* is principally an Asian species, which grows widely in red pine (*Pinus densiflora* Sieb. et Zucc.) forests throughout Japan, South Korea, North Korea, north-east and south-west China and Primorsk Kray, Russia. With the dramatic decline in *song rong* production in Japan, Yunnan province has become a major *song rong* producer and exporter in Asia.

Song rong develops fruiting bodies and forms mycorrhizal associations with the roots of *Pinus densiflora* Sieb. et Zucc., but it also has symbiotic relationships with various other species such as *P. thunbergii* Parl, *P. pumila* Regel, *Tsuga sieboldii* Carr, *T. diversifolia* Mast, *Picea glehnii* (Fr. Schm) Mast in Japan; *Pinus karaiensis* Sieb. et Zucc. on the Korean Peninsula; *Abies mariesii* Mast in Sakhalin; and *Pinus yunnanensis* Franch, *Pinus tainanensis* Hay, *Pinus massoniana* Lamb. and *Pinus armandii* Franch in China (Tominaga 1978; Zhao 1986; Zang 1990; Lake and Read 1997). The mechanism of *song rong*'s symbiotic behaviour is still unclear, but studies prove that the establishment of mycorrhizal associations between *song rong* mycelium and the fine roots of trees is essential for the development of fruiting bodies. The mycorrhizal stage is a distinct characteristic of the life history of *song rong*, in which *song rong* obtains photocarbons from plant roots through inner hyphae and, in return, transfers mineral nutrients from soils to plants. Figure 2 shows the life history of *song rong*.

Figure 2. The life history of *song rong*



Implications of harvesting

There is great pressure on *song rong* because of overharvesting. Local farmers mostly collect *song rong* using a curved blade on a short stick (Photo 2). They walk around in the forests, every now and then removing the litter layer to seek *song rong* mushrooms. The practice of removing the litter from the forest floor while searching is detrimental to the mushrooms. The *song rong* mushrooms require good leaf litter in which to grow and reproduce (Hosford *et al.* 1997). The harvesting practices also have a negative affect on the development of *shiro* (the fruiting place with hyphae mats in the litter, amongst tree or plant roots). So this practice does not only negatively change the microhabitat on which the fungus depends but also damages the propagating hyphae in the litter. Moreover, in the intense competition between collectors, harvesters collect almost all *song rong* buttons, even the very young, out of fear that the next collector will harvest them. The value of immature *song rong* buttons on a weight basis is as much as one tenth less than that of first-rate mushrooms, though still at least five times the price of fresh vegetables in the local market.

Photo 2. Collectors usually use a sharp iron tool to remove the litter to reveal *song rong* mushrooms (Photo by Ying Long Chen)



The use of *song rong*

Song rong has been used and revered by the Japanese for over a millennium and both the Japanese and the Chinese consider it an autumn delicacy. It also symbolises fertility and by extension represents good fortune and happiness in the culture of local communities in both Japan and China. In China, the Naxi minority in Lijiang, Yunnan, traditionally eat *song rong* at wedding feasts. In Japan, it has been considered a royal tribute since ancient times and is used in diplomatic transactions.

The sporocarp of *song rong* has great nourishing value as a food. Its fruiting bodies are an abundant source of nutrients, especially amino acids, when compared to other popular edible fungi. *Song rong* is well known for its delicious taste and smell. The special flavour results from specific amino acids such as tricholoma acid, L-matsutake-ol, iso-matsutake-ol, ethyl-amyl-ketone and methyl-cinnamate acid, which make the food palatable and tasty. There are diverse methods of cooking *song rong* depending on the cultural background. In Japan, for example, the mushrooms often are cooked with rice (or rice with mixed vegetables and meat) or stewed with fish, vegetables, sauce and vinegar, to which they impart a strong aroma and characteristic rich taste. In Yunnan, *song rong* is often served as soup or combined with green vegetables. In addition to its culinary attributes, studies have also demonstrated its medicinal properties (Huang 1993).

Prices of *song rong* compared with other mushrooms

The most expensive edible fungi are European truffles, especially the Périgord black truffle (*Tuber melanosporum* Vitt.) and Italian white truffle (*T. magnatum*

Pico), which are only available in western European markets (Hall *et al.* 1994; Chevalier and Frochot 2000; Chen and Gong 2000). *Song rong* is a comparable edible fungus in Asia and is the best-selling mushroom in the region. The farm-gate price of *song rong* can be as high as US\$370³ per kilogram fresh weight at the start or end of the season. The price of *song rong* is much higher than that of any other mushroom in Asian markets. For example, it costs at least 10 times as much as ceps (*Boletus edulis*) in Yunnan province, even in the peak harvesting season. A value comparison between *song rong* and other high priced edible fungi is provided in Tables 1 and 2, reflecting markets at the domestic and worldwide level, respectively (Hall *et al.* 1994).

Table 1. Average value of various forest mushrooms in three major mushroom markets in Yunnan province, late July to mid August 1999

Scientific name	Common name	Baoshan (west)	Chuxiong (centre)	Kunming (east)
<i>Tricholoma matsutake</i>	Song rong, matsutake	36.6-61.0	61.0-67.1	79.3
<i>Thelephora ganbajun</i>	Ganbajun	6.1	4.9-11.0	15.9
<i>Termitomyces arbutinus</i>	Termite mushroom	2.2	2.1-2.4	1.7-4.3
<i>Boletus edulis</i>	King bolete or cep	2.2-3.7	2.6	3.0
<i>Boletus speciosus</i>	Fen jianshou	1.0	—	2.7
<i>Boletus aereus</i>	Black cep	0.7	2.4	2.0
<i>Russula xanipilinus</i>		1.1	1.1	1.0
<i>Russula virescens</i>	Virescent russula	1.0	1.0	1.5

Note: All prices in US\$ per kilogram fresh weight. All of these mushrooms are mycorrhizal except *Termitomyces*, which is associated with termite nests.

Socio-economic context

The Zixi mountain area consists of Zixi Forest Park and four villages (Zijin, Yunqing, Lengshui and Muzhang) around the mountain. In 1998, the average household size was 4.16 people. Previously, there were seven families living on the mountain, but they were displaced by the park. The value of land is relatively low in this poor area. The price is about US\$100 per ha per year if rented. The transportation infrastructure is poor in part because of the difficulty of negotiating the mountainous terrain.

The local economy in the study area is dominated by agriculture, including low productive forestry, and living conditions are poor. The average annual household income (subsistence + barter + cash) in the research area was US\$714.3 in 1998. In the same year 62% (6,793 people) of the people in the research area were involved in the commercial extraction of mushrooms, and the average total annual income of these producer households was US\$917.6. Producers of *song rong* products have high status in the local community. For an average producer household, US\$571.4 came from mushroom production and US\$107.1 from other agricultural activities including tobacco and poultry. Most farmers are unwilling to work outside of their

Table 2. Some high priced edible mycorrhizal mushrooms on the world markets

Scientific name	Common names	Markets	Prices (US\$/kg)
<i>Tricholoma matsutake</i> (Ito et Imai) Singer	Matsutake (Japan);	Japan	110-1,100 (wholesale, domestic produce)
	Song rong (China);		114.4 (wholesale, from China)
	Song koumo (China)		103.4 (wholesale, from South Korea)
<i>Tuber melanosporum</i> Vitt.	Perigord black truffle;	Worldwide	797.5 (wholesale, London)
	Truffe du Perigord		4,950 (retail, London)
	(France); Tartufo nero		165-660 (picker, France)
	pregiato (Italy); Schwarze		1,650 (canned; retail, Auckland)
	Truffel (Germany); Hei		1,320 - 2750 (bottled; retail, London)
	kuaijun (China)		770 (canned; wholesale, Cahors)
<i>Tuber magnatum</i> Pico	Italian white truffle;	Worldwide	1,567.5 (bottled; retail, London)
	Truffe d'Alba;		1,210 (wholesale, Bologna)
	Tartufo bianco pregiato;		
	Bai kuaijun (China)		
<i>Boletus edulis</i> Bull. Ex Fr.	Cep, penny bun; Porcino;	Europe, North America	66 (retail, Hamburg)
	Steinpilz; Meiwei niugan		16.5 (retail, Bologna)
	(China)		93.5 (dried: retail, Zurich)
<i>Cantharellus cibarius</i> Fr.	Chanterella; Jiyoujun (China);	Europe, North America	16.5 (retail, Hanover)
	Girolle; Gallinaccio; Pfifferlinge		

Note: Priced at fresh weight unless stated otherwise.
Source: Hall et al. 1994.

village, perhaps because of their isolation from the outside world and local traditions. The local labour rate ranges from US\$1.8 to US\$3.6 per day.

Song rong production is the most essential activity for cash income for local families. There is a general increase in the trend of household involvement in production, processing and marketing of the product. A few other non-timber forest products, including some other forest mushrooms, pine nuts and medicinal herbs, are also collected in the study area. Household income from the collection of forest products has increased over the past 10 years.

Processing industry

The degree of transformation of *song rong* from raw material to finished product is relatively low. Harvested *song rong* sporocarps are sold to first order buyers fresh after grading by the harvester, who distinguishes several qualities based on size, maturity etc. The first order trader sells the fresh mushrooms to the upper level buyers from the local town. Apart from fresh mushrooms, a small proportion of *song rong* is dried, salted or canned. There is one factory in China that produces *song rong* wine and another that produces *song rong* cookies, but both have low outputs. (The processing of *song rong* into wine and cookies is not included in this report as these side products are still at an early stage of the industry when compared to the trade in fresh mushrooms.)

Trade and marketing

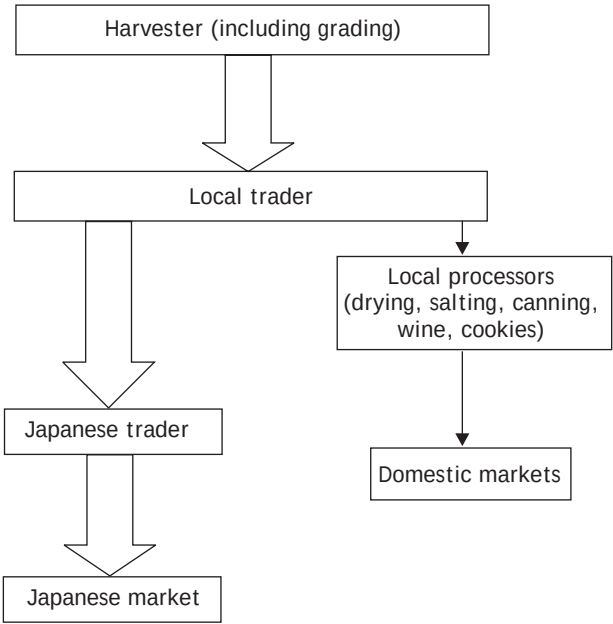
The *song rong* market in Zixi came into existence in the late 1980s. In the 1970s, north-east China produced and exported *song rong* to Japan. When the production from north-east China decreased dramatically (as did the production in Japan), Japanese entrepreneurs opened a business in Kunming after having been told that south-west China also had *song rong*. The late start of the *song rong* trade in this area can be attributed to poor information and transportation connections between the remote production area and the outside world. Before the export to Japan started, the mushroom was used for local consumption only. At first there was only a simple buying station temporarily established on the side of the road during harvesting season. With the awareness of the value and increasingly high price of *song rong* and other mushrooms (mainly *Boletus* and *Termitermices*), the market expanded and became well known to local collectors and farmers.

During the study years (the harvesting seasons of 1997, 1998 and 1999), the number of traders in the production-to-consumption system varied between 15 and 40 first order traders, between 5 and 10 second order traders, and between 2 and 5 third order traders. However, sometimes it was difficult to distinguish a trader's real position in the trading order as some collectors have a number of choices as to whom they sell their product to. Normally collectors sell their produce to two to four buyers. Some middle buyers are from local towns and collaborate with upper order buyers in the area or in Kunming.

Under normal storage conditions *song rong* stays fresh for two days without any treatment, six months when canned and 12 months as a dried, vacuum packed product. Some important attributes such as flavour, taste and colour are lost in storage, which in turn may mean a 50% drop in value.

The markets in the study area are located in the fast-food restaurant areas and shops in the Zixi Forest Park, where several food and mushroom products are sold. The middle buyers buy *song rong* from these local markets and transport the mushrooms to Kunming immediately, where the mushrooms are sold to Japanese businesses or their agents. The product then is flown to Japan. Fresh mushrooms may be served at a table in a Japanese restaurant on the same day or just a few days after they were harvested. In Figure 3 a trade diagram is presented; only about 5 percent of the *song rong* production is processed in China while the remaining 95% is traded fresh to the Japanese market.

Figure 3. Trade diagram



As *song rong* is almost always traded fresh, the shape of the fruiting bodies is considered the most vital factor controlling market price. Grade 1 buttons (above 20 cm long) are sold at US\$250 to US\$370 per kilogram, whereas the lowest quality buttons may fetch only US\$6 or less per kilogram despite there being no great loss in taste. The average farm gate price is about US\$54 to US\$75 per kilogram for *song rong* originating from Zixi mountain.

As a forest product, *song rong* brings great economic benefits to the local communities in Yunnan province. According to the Yunnan Department for Foreign Trade, from June to August 1997 about 350 tonnes of fresh *song rong*

were exported from Yunnan province to Japan. From this figure the annual income from *song rong* in Yunnan is estimated at US\$4 million, which would be 48.8% of the national *song rong* income. It clearly has become an important source of income for the relatively undeveloped province.

Policy environment

To date there is no specific law or regulation on harvesting, processing and dealing in *song rong* in China. But some policies, including national laws, regional regulations and industry product standards, may influence the *song rong* sector indirectly. *Song rong* is a forest resource, according to the Forestry Law of the People's Republic of China (PRC) released in 1984 by the National People's Representative Congress. Other national laws, including the Wildlife Protection Law, the Law on Water and Soil Conservation, and the Environmental Conservation Law of PRC, underscore the importance of natural resources and the necessity for their conservation and protection. The latter also decrees that environmental protection be taken into consideration as fundamental during economic development and resource utilisation. The Land Management Law of 1999 describes the property rights of landowners. In the case of Zixi mountain area the legal rights of producers to harvest the product for commercial purposes have improved in the past decade. *Song rong* collectors have no legal rights to change the land use to another production system, but they do have recognised legal rights to harvest the product from open forestland for trade. There is no entry fee into the reserve for the local people like there is for tourists. Anyone who has the relevant skills may harvest *song rong* from the reserve, while no one seems committed to maintaining the resource in a sustainable way.

Producers in the community are generally aware of their legal rights to harvest the product for commercial purposes and over the last 10 years there has been no official claim by producers to increase land or resource rights. Some legal aspects of *song rong* production and trade are still unclear, however, especially for local residents. For instance, who is responsible for the sustainability of both forest and mushrooms? And: does the resource belong to the state, forest owners, leaseholders, or the public? Local producers have requested special regulations to restrict the entry of 'illegal' harvesters (harvesters from other villages, though not officially illegal, are considered 'illegal' by the local people of the Zixi mountain area), but such regulations would be difficult to enforce.

The government's revenue policy is not intended to influence the production of *song rong*, but local authorities collect a tax of 8.8% of the total product value from the middle buyers. This tax rate is similar to that of agricultural products in the PRC. The tax regulation has no clear effect on the production of the mushrooms.

Both the national and local governments in charge of forestry management recognise the importance of production and sustainable development of *song rong* in the area. The Chinese Forestry Administration funded a five-year research project to verify ecological impacts on the

growth of *song rong*, to seek potential solutions to production problems and to improve production. The Association of Science and Technology of Chuxiong Yi Autonomy Prefecture also (initially) supported a local forestry research institute to study this species in the region. The local forestry department and private companies, dealing with agricultural products, provide local farmers and buyers with some advice. There also is an organisation working with collectors and buyers that provides local buyers with general information on the price of each product. Only a small number of producers participates in the organisation, however.

TRENDS AND ISSUES—DEVELOPMENT AND CONSERVATION LESSONS

Dynamic changes in time

The yield of *song rong* is declining because of overharvesting in the case study area. In the past decade, production has decreased at an estimated rate of 5% per year, especially in the first half of the 1990s. This trend is true for the rest of the country and other East Asian countries as well. Hosford *et al.* (1997) and Wang *et al.* (1997) reported that the yield of *song rong* in Japan, which had been 6,500 tonnes in 1950, had declined to less than 200 tonnes in the late 1990s. The decrease was caused by two factors. First, the ecological changes wrought by a fast moving parasite, the pine nematode (*Bursaphelenchus lignicolus*), which attacks the roots of pine trees, consequently killing the whole tree, have been devastating. Second, certain forest practices such as increased firewood harvesting and the cutting of living trees further diminished the pine population. To compensate for the local decline Japan started importing *song rong* in the 1970s from China and Korea, and also imported white *matsutake* from North America (Zhao 1986; Hosford *et al.* 1997; Redhead 1997).

Destructive harvesting techniques

Current practices for *song rong* collection have greatly affected the growth of the fungus. *Song rong* is being collected in the button stage and the duff and near-surface root horizons are removed, exposing the bare soil to rain-wash. This is a consequence of harvesting for short-term gain. Unfettered access encourages collectors to harvest sporocarps early because of competition between collectors. A survey of fresh products at the buying station (market) in Zixi Forest Park showed that only 50% of harvested *song rong* sporocarps were grade 1 to grade 3, while about 35% were young buttons sold as out-of-grade product with a low market value. Also, site disturbance resulting from the gathering of mushrooms is leading to increased soil erosion here as elsewhere in Yunnan. Researchers and local forest managers are urgently appealing to the legislature and forest administration to establish trade and harvesting regulations for *song rong*. In addition to the lack of appropriate regulations, collectors generally lack basic knowledge of the biology of *song rong*. It is important to educate local collectors to enhance their understanding of the fungus and the impacts of harvesting in order to prevent the harvesting

of immature buttons and to improve the techniques for harvesting to prevent the occurrence of soil erosion. It is necessary to educate local collectors to enhance their understanding of the life history of fungi and appropriate harvesting techniques so that production sites and development areas will be consciously protected during collection.

Access rights

How access to the resource is balanced between competing interests often determines the long-term sustainability of the harvest. The tenure regime for collection and trade of *song rong* and other forest mushrooms is still not clear as they are regarded as common property. Therefore there is a need to clarify the ownership of this property, according to the current laws and regulations, lest no one will invest while everyone harvests. At the same time, specific regulations to guide access control during the fruiting season need to be legislated to promote sustainable harvesting.

Further research

During the study period there have been some efforts to improve the production and conservation of *song rong*, including the transplant of pine seedlings colonised by *song rong* hyphae in selected forest areas. This is just a beginning, however, and further research is absolutely necessary. Some issues to be covered by further research include: (1) the biology and ecology of *song rong*, and in particular the multiple values of *song rong* as a non-timber forest product that, apart from its attribute as a food, also has a function in the cycling of carbon, water and nutrients; (2) the ecological and socio-economic effects of harvesting and intensive fungi farming; and (3) feasibility of intensively managed plantations for the cultivation of *song rong* by transplanting mycorrhizal seedlings in the forests. The progress in developing intensively managed plantations so far is unsatisfactory with this specific mycorrhizal fungus (Tominaga 1978; Ogawa and Ito 1989; Zang 1990; Chen 2002b). Knowledge of European truffles (*Tuber melanosporum*, *T. uncinatum*, *T. magnatum*, *T. brumale* etc.), which can be harvested in plantations after transplanting inoculated plants (as is being done in France, Italy, USA, New Zealand and Australia), would also be useful for other forest fungi (Hall *et al.* 1994; Dell *et al.* 1999; Chevalier and Frochot 2000; Chen 2002c).

ENDNOTES

1. Research Institute of Tropical Forestry, Chinese Academy of Forestry Longdong, Guangzhou 510520, China. E-mail: yinglong@pub.guangzhou.gd.cn And: School of Biological Sciences & Biotechnology. Murdoch University, Perth, WA 6150, Australia. E-mail: y.chen@murdoch.edu.au
2. These mushrooms are also reported in several other provinces in China, but there the availability of the mushrooms is too low for commercialisation.
3. Exchange rate (1998): US\$1 = Yuan 8.2.

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Chapter 6

The production of oak mushrooms (*Lentinula edodes*) as a source of farmers’ income in the Republic of Korea: the case of Cheongyang-Gun

Yeo-Chang Youn¹

Common names	Part of the resource used	Management	Degree of transformation	Scale of trade	Geographic range
Shitake, Oak mushroom, Pyo-go	Mushroom	Cultivated	Low	International	Large

OVERVIEW

This chapter describes the current situation and trend of oak mushroom [*Lentinula edodes* (Berk.) Pegler] consumption and cultivation with special reference to the case of Cheongyang-Gun in the Republic of Korea. Oak mushroom cultivation has a history of more than 400 years in Korea. The consumption of oak mushrooms is increasing because it is considered to be a natural food, free of toxic chemicals. The government has been promoting the cultivation of oak mushrooms because they are an important source of income for rural communities. The production of oak mushrooms in Korea has tripled during the last 10 years. The import of oak mushrooms is also steadily increasing because domestic demand is outstripping domestic production. Oak mushroom cultivation has provided the basis of oak stand improvement, which is more ecologically sound than establishing softwood plantations for fibre production. Mushroom cultivators in Korea face an uncertain future because of an ageing labour force in rural communities and increasing competition from overseas producers.

INTRODUCTION

As South Korea becomes industrialised and urbanised, the people have become more concerned about their health and food safety. Mushrooms are considered a natural product free of chemicals. Over the last two decades the demand for

oak mushrooms [black forest mushroom, *Lentinula edodes* (Berk.) Pegler] has been increasing steadily (Youn 2000). Even though the production of oak mushrooms has been increasing the growth has been slower than the increase in demand. Mushrooms imported from China therefore have to meet much of the domestic consumption. In 2000 there were 6,888 oak mushroom producers in South Korea who produced 17,531 tonnes of fresh mushrooms (Korea Forest Service 2000). The locally produced oak mushrooms compete well with imported products and have contributed to the increase in the farmers' income.

The importance of non-timber forest products (NTFPs) is demonstrated in the statistics of forestry production in the Republic of Korea. According to statistics, the value of NTFPs produced in 1999 was US\$10.5 billion accounting for 92% of all forestry outputs. The value of oak mushrooms accounted for 11% of the NTFP production, a share that is increasing.

The consumption of oak mushroom has long been restricted to East Asia, but people in other regions of the world are now starting to eat them too. The world-wide production reached 1.57 million tonnes in 1997, which was 7.8 times that of 1983. Most of the growth occurred in China, which is the most important oak mushroom producer in the world, while Japan is the leader in oak mushroom cultivation technology (Chang undated).

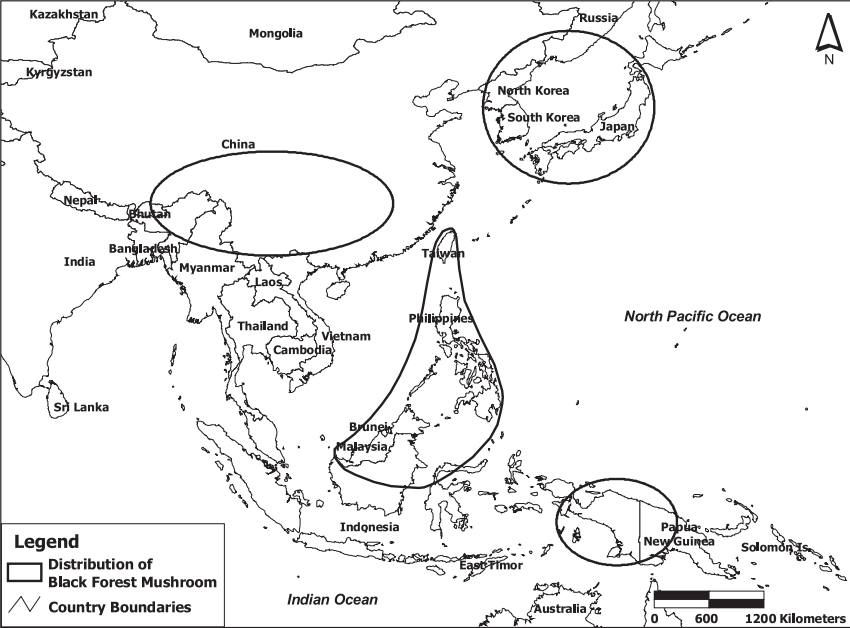
The study area: Cheongyang-Gun

This case study is set in South Korea (Republic of Korea, ROK), a country that has experienced dramatic changes both economical and ecological since the late 1960s. Korea is a peninsula of mountains and forests where about 70 million people reside. The Demilitarised Zone between North and South Korea divides the peninsula into two. Forests cover two thirds of the country's land area. The main type of forest is mixed stands of natural species, with exotic conifers such as pitch pine and Japanese larch. The hardwood forests cover more than a half of the Korean forest lands. The main native forest species are the Japanese red pine (*Pinus densiflora*) and oak species. The oak forests provide a good soil for mushroom production.

As country people live in close contact with nature, their diet tends to develop in close relation to nature. Forest mushrooms have been collected as a food for a very long time. Oak mushrooms and pine mushrooms (song rong, *Tricholoma matsutake*) are most preferred among forest mushrooms. Oak mushrooms have been cultivated in China, Korea and Japan for the last 1,000 years. The biological distribution is much wider than the cultivation area, as shown in Figure 1.

The study area, Cheongyang-Gun² is located 150 km south of Seoul, the capital of ROK (see Figure 2). It is a mountainous region and forests cover 67 percent of the land while another 23 percent is agricultural lands. Agriculture and forestry are the major sources of income, and more than half of the households are farmers. The population density is 88 inhabitants per square kilometer, one fifth of the national average. The population distribution resembles a hanging bridge since the most productive body of the population (those 25 to 54 years of age) has left the countryside to find work in urban areas.

Figure 1. Distribution of oak mushrooms

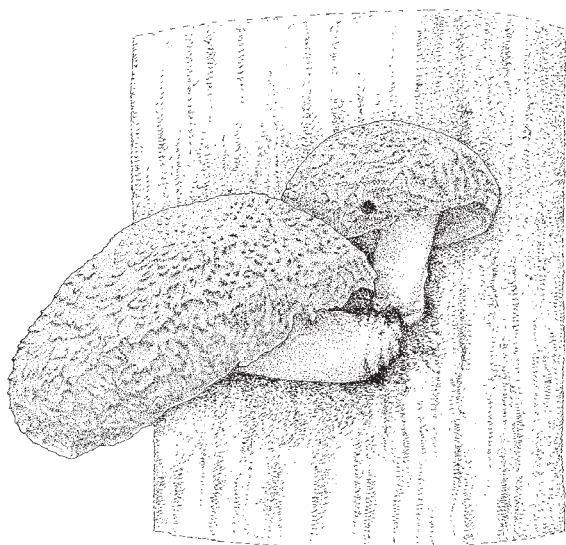


Source: ESRI Data and Maps 2002.

Figure 2. Location of the study area



Source: ESRI Data and Maps 2002.



(*Lentinula edodes*)

THE PRODUCTION-TO-CONSUMPTION SYSTEM

Mushroom production

Oak mushrooms grow naturally in southern parts of the Korean peninsula, while most mushrooms destined for the market are grown by farmers with modern production technology. The traditional oak mushroom production technology was first developed in China and introduced to Korea and Japan, where newer technologies have been developed. There are basically two types of oak mushroom production technology in widespread use in Korea. In one system the mushrooms are cultivated on oak log beds, while the other uses sawdust bags on which to cultivate the mushrooms. In Cheongyang-Gun the latter is still in the early stages of adoption. Mushrooms raised on log beds are grown either outdoors or in greenhouses like the sawdust production system. In general larger producers build greenhouses while smaller ones still cultivate mushrooms outdoors. Other species that can be used for mushroom cultivation are *Carpinus laxiflora*, *Castanea crenata*, *Ficus crenata*, *Castanopsis cuspidate* and *Acer* spp., these species can be found in Korean forests in abundance. However, farmers use almost exclusively the oak tree. In 2000 about 200,000 m³ of oak logs were used for mushroom production.

The producers of oak mushrooms are farmers living in rural areas where oak logs can be secured. There were 6,888 households cultivating oak mushroom in South Korea in 2000. The 60% majority of these growers do not own forests and normally grow their mushroom crops in agricultural fields, with purchased logs, under artificial shade. Most of these growers purchase bed logs from loggers or timber traders, but some use sawdust imported from China. The other 40% of oak mushroom production households have

Photo 1. Freshly cut oak logs for mushroom cultivation (Photo by Yeo-Chang Youn)



Photo 2. Oak logs inoculated two years earlier are ready to produce mushrooms (Photo by Yeo-Chang Youn)



some forestlands from which they obtain their logs for mushroom cultivation. In 2000, the average production was 686 kg per mushroom grower, with an average volume of 11.5 m³ of oak logs inoculated per mushroom grower.

There are 398 mushroom growing households in Cheongyang-Gun. Most of them have their own forests of 1 ha to 3 ha nearby, but most mushroom growing businesses here are small compared to producers in other parts of the country. Seventy-eight percent of mushrooms are produced in greenhouses while 21% are grown under natural shade outdoors. Mushroom growers are usually entrepreneurs, unlike farmers who grow rice and other traditional crops. The average income per mushroom growing household is about 20% higher than the average farmer's in the study area.

Mushroom growing relies on the labour force within the family, in which female members play an important role. The women participate in activities such as inoculation, picking mushrooms and drying.

Processing Industry

Oak mushrooms are best cooked when fresh, but since they are a product that perishes easily half of the oak mushrooms produced in Korea are dried prior to being sold. Oak mushroom farmers usually have their own dryers, which use petroleum as the source of energy. There are a few factories that process oak mushrooms into drinks and snacks and others that use oak mushrooms as an ingredient in Korean soybean and red pepper preserves. Only a small percentage of the oak mushrooms are thus processed; the majority are consumed unprocessed either fresh or dry.

Trade and Marketing

The import of oak mushrooms to Korea has increased rapidly over the last decade as the country has liberalised the agricultural commodity markets for most commodities (rice is one of the few exceptions) in compliance with a World Trade Organization (WTO) agreement. The import of oak mushrooms increased from 329 tonnes in 1990 to 1,139 tonnes in 2000 (see Table 1). Almost all of the imported mushrooms come from China. Meanwhile some Korean oak mushrooms are exported to overseas markets including Japan, Hong Kong, USA and Singapore. The quality of exported oak mushrooms is higher than that of imported ones.

Most of the mushroom cultivators are members of a co-operative or of the so called Mushroom Growers Club. These organisations facilitate the sale of mushrooms and provide cultivators with marketing and loan services, while the government provides technical support. The marketing channels are different depending on whether products are dried or fresh (see Figure 3 for the trade diagram of fresh mushrooms).

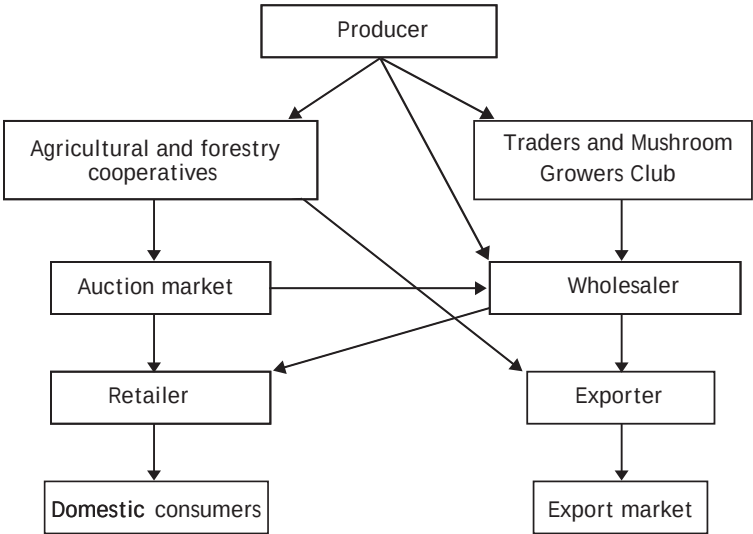
Mushrooms for fresh consumption are usually cultivated near the urban consumers, while farmers located farther from consumers market their product after drying. The marketing costs for fresh mushrooms, including transportation and storage, are higher than those of dried ones.

Table 1. Import trends

Year	Total		Dried		Fresh		Manufactured	
	Quantity (tonnes)	Value (US\$1,000)	Quantity (tonnes)	Value (US\$1,000)	Quantity (tonnes)	Value (US\$1,000)	Quantity (tonnes)	Value (US\$1,000)
1990	329	477	-	-	-	-	-	-
1991	652	1,403	-	-	-	-	-	-
1992	1,240	3,826	1,205	3,751	35	75	-	-
1993	514	832	514	777	6	55	-	-
1994	922	1,635	866	1,538	56	97	-	-
1995	495	867	495	867	-	-	-	-
1996	840	2,462	837	2,135	3	147	-	-
1997	1,318	3,260	1,298	3,201	20	59	-	-
1998	1,143	2,054	1,136	2,024	3	7	4	23
1999	1,103	2,543	1,041	2,422	57	100	5	21
2000	1,139	2,738	1,079	2,639	59	95	1	4

Source: Korea Forest Service 2001.

Figure 3. Trade diagram for fresh oak mushrooms



Policy Environment

There are several laws supporting mushroom farmers and rural development in the Republic of Korea. Foremost among them are the Forest Law of 1961 and the Forest Co-operative Act of 1980, both of which support the production of NTFPs such as mushrooms. Based on these laws, the government provides mushroom growing farmers with technical and financial support. Farmers can get loans for the purchase of bed logs and greenhouse construction at favourable rates. Forest co-operatives as well as agricultural co-operatives provide mushroom growers with marketing support for example in the form of collective shipment. The government also supports mushroom growers by developing new technologies through research and development, and information dissemination through the Internet. The Korean government has also tried to manipulate the tariff rate levied on imported mushrooms in order to protect domestic producers.

The Korean government forest policy has been biased toward timber production for the last three decades. This has led to a lack of appreciation of the native species such as oak. Oak seedlings were treated as weeds while conifers were given priority in planting and tree improvement. Increasing demand for oak logs for mushroom cultivation has created an incentive for the growing of native hardwood species in South Korea.

Recently the government started to promote the production and consumption of organic farming products in order to provide incentives for environmentally friendly agriculture. Oak mushrooms were included in the categories of products supported by this policy, and there are some oak mushroom producers who are certified producers of environmentally friendly products.

TRENDS AND ISSUES—DEVELOPMENT AND CONSERVATION LESSONS

Trends

The increase in production of oak mushrooms in Korea stems in part from the country’s consumers’ increasing interest in food safety. The rising production and decreasing export figures presented in Table 2 show how dramatically domestic consumption has risen since the early 1990s. The demand for oak mushrooms is expected to increase further in Korea as well as other countries, including Western countries. Although production of oak mushrooms has increased to meet the growing demand, an increasing share of the demand in Korea is met with imports from China. Due to the rapid expansion of supply from both domestic and overseas producers, the price of oak mushrooms has decreased over the last 10 years. As consumers prefer fresh local mushrooms to dried imported ones, the price of fresh mushrooms is higher than that of dried ones, which has led domestic mushroom growers to shift from marketing dried mushrooms to fresh ones in recent years. Therefore, producers located near the final consumers enjoy a more favourable marketing position than those in remote areas.

Table 2. Production and export of oak mushrooms

Year	Production (tonnes)	Exports	
		Total (tonnes)	Value (US\$1,000)
1990	1,648	1,056	23,258
1991	1,761	864	25,178
1992	2,254	710	18,386
1993	2,580	615	13,481
1994	2,694	467	11,612
1995	2,824	727	14,658
1996	3,403	356	9,415
1997	3,800	329	8,292
1998	4,049	376	8,703
1999	4,591	417	7,711
2000	4,722	228	5,012

Source: Korea Forest Service 2001.

Ecological implications of oak mushroom production

The increasing production of oak mushrooms has led to an increase in oak logs consumed. The logs, for mushroom bedding timbers, are extracted mostly from publicly owned natural forests where the demand for other public functions of forests is high as well. There have been a number of complaints from environmental conservationists about logging in natural forests, which diminishes both the ecological and landscape values.

There are not enough oak stands near major mushroom cultivation regions like Cheongyang-Gun, because forest policies have favoured coniferous species over hardwoods. Therefore, most oak logs are produced in other regions nearby. Recently forest owners as well as national and local governments

have come to understand the importance of oaks and that growing them is more profitable than growing conifers. This new thinking is resulting in an increase in hardwoods and a decline in conifers.

Competition with imported oak mushrooms

Mushrooms are tradable goods, which can be moved in a fresh or dried state. Imports from China dominate the Korean dried oak mushroom market, while the fresh mushroom market is highly competitive. There is presently a 20% tariff rate against imported mushrooms, which is expected to decline. The traditional export markets, such as Japan, have been eroded mostly because Chinese producers export mushrooms at a lower price. It remains to be seen whether the mushrooms imported into Korea will erode the domestic mushroom market in the future.

Ageing labour and technical innovations

Most oak mushroom producers are quite old and there are only a few younger farmers. The aged farmers will soon retire from mushroom cultivation because the traditional cultivation methods using timber beds requires physical strength. Therefore, oak mushroom cultivation will need to be more mechanised to reduce the need for labour. However, the uncertainty of the profitability of oak mushroom cultivation makes capital investment unlikely.

There are a number of forestry extension staff in Korean Forest Co-operatives, supported by the national government, but few of them are competent in the technology of mushroom cultivation. Mushroom crops sometimes fail for lack of sound mushroom cultivation techniques and because of the poor quality of purchased spores.

Lessons of this case

The growth of oak mushroom cultivation has succeeded in providing farmers and forest owners in rural areas with an important source of income. In the last two decades the number of farmers has increased, as has the output from oak mushroom cultivation. Since the implementation of the aforementioned WTO agreement, few Korean agricultural commodities remained competitive with overseas suppliers. The competitiveness of oak mushrooms stems from the strong demand from both domestic and international markets for natural food, which is influenced by growing environmental awareness and concern. This case presents a good example of a NTFP that can be marketed as a green commodity to affluent urban consumers.

The price of oak timber is more than twice that of softwood produced in Korea. This has made forest policy makers change their perception on native species, which have never before been thought of as candidates for timber production in Korea. In recent years the government started to advance stand improvement in natural forests. This effort promotes conservation of native species and natural forests, which can support the production of NTFP.

If mushroom cultivators and farmers were not in the habit of using oak logs, oak trees and oak-bearing native forests would not be valued by forest owners. Therefore, the mushroom cultivation boom has had a positive influence on the conservation of forest ecosystems in Korea.

ENDNOTES

1. Seoul National University, Department of Forest Resources, Silim-dong San 56-1, Gwanak-ku, 151-742 (postal code), Seoul, Republic of Korea. E-mail: youn@snu.ac.kr
2. 'Gun' denotes an administrative unit akin to a county.

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Chapter 7

Extraction and trade of Cardamom (*Amomum villosum*) from Ba Be National Park, Vietnam

Dinh Van Tu¹

Common names	Part of the resource used	Management	Degree of transformation	Scale of trade	Geographic range
Cardamom, Sa nham	Fruit	Wild	Medium	International	Large

OVERVIEW

Medicinal cardamom (*Amomum villosum* Lour) occurs naturally in the strictly protected area of Ba Be National Park, Vietnam. Women from neighbouring villages enter the park to collect cardamom illegally. The picking and drying of cardamom does not require any investment, so it is accessible to everyone. Because of competition among gatherers for the same plants, collectors are tempted to pick young fruits, even though these are much less valuable than the ripe fruits. Cardamom extraction in the district has very little impact on the ecosystem and is a source of additional income for many households, but park management and local government largely overlook cardamom production. Trade in cardamom is dominated by women, who buy dried cardamom from harvesters and take it, in small quantities, to the district capital. The cardamom is bought by a few big buyers, who smuggle the product into China, where it is used to produce traditional medicines. The prohibition of non-timber forest product extraction from the park keeps the cardamom trade outside the legal system and thus maintains the state’s inability to capture any benefits from the cardamom trade.

INTRODUCTION

The cardamom species *Amomum villosum* Lour is used in traditional medicines for curing digestive diseases, rheumatism, malaria and toothache, among other maladies, and as an ingredient in the production of soap and shampoo.

In Vietnam the plant has a wide distribution, mainly in secondary forests. This study focuses on Ba Be district, where cardamom² is collected from natural forests. The trading and marketing of cardamom has existed for decades in Ba Be, largely as a result of the location, which is relatively near the main market, China.

Ba Be district and Ba Be National Park

Ba Be is a mountainous district located in Bac Kan province, near the Chinese border (see Figure 1). The district covers 115,173 ha, comprising 24 communes. There are 70,620 people living in Ba Be, about half of whom belong to the Tay ethnic group, a third to the Dao ethnic group and the remainder to minority groups living scattered in the foothills and high mountains (Ba Be District Department of Statistics 2000). Most households in the district are predominantly subsistence oriented. It is estimated that cash income constitutes less than half the total income of most people. Cash income is earned from a number of sources such as the sale of fish, livestock (e.g., chickens, ducks and pigs), agricultural surplus and various non-timber forest products (NTFPs) such as cardamom, mushrooms, rattan, bamboo, medicinal plants, fuel wood and fruits. Farmers most often have a small paddy field and a garden with vegetables and fruit trees. Some farmers practice shifting cultivation with crops such as maize, green beans, soybean, indigo and cotton. Households in Ba Be, especially those of ethnic minorities living in and near forested areas, are heavily dependent on forest products. Income from the sale of forest products makes up more than one quarter of the cash income of households living in and near forested areas.

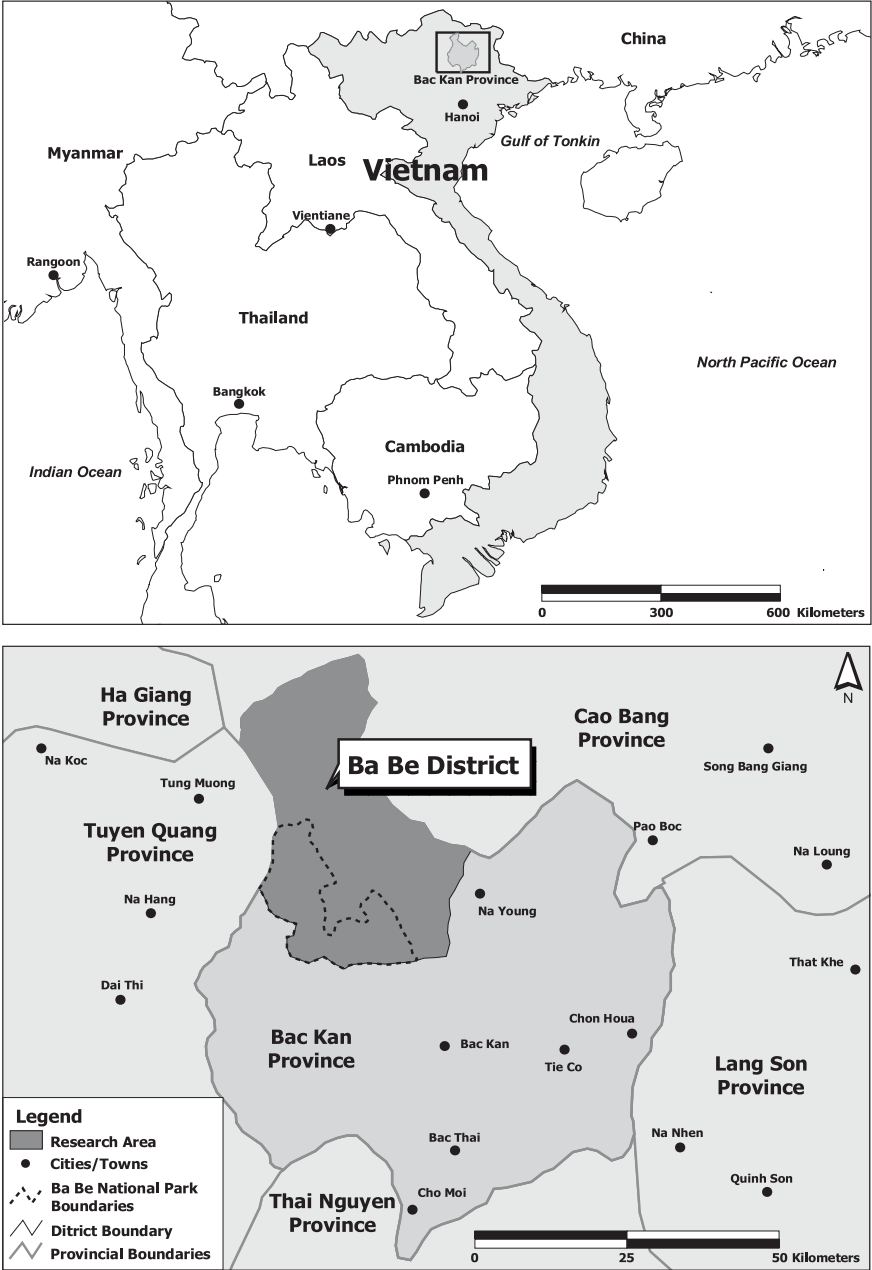
The most important source of forest products in Ba Be district is the forest of Ba Be National Park. The park covers an area of 7,610 ha, of which 614 ha is primary forest. One village of 520 households is located within the park (Nong The Dien personal communication). Collection of forest products from the park is prohibited, but people from both within the park and the surrounding villages do harvest illegally. Park management has made an effort to stop hunting through a 'food for guns' programme, exchanging rice for firearms. Efforts have also been made to promote agroforestry in the most degraded parts of the park.

THE PRODUCTION-TO-CONSUMPTION SYSTEM

Wild cardamom

In Vietnam, there are 14 different cardamom species, only three of which provide fruits of high quality and are commercially used: *Amomum villosum* Lour, *Amomum xanthioides* Wall, and *Amomum longiligulare* T.L.Wu. This study focuses on *A. villosum*, which is widely distributed in Bac Kan Province and occurs in the secondary forests of Ba Be. Commercially *A. villosum* is referred to as 'wild cardamom' and the local name is *sa nhan*. It is an herbaceous perennial plant, which grows to a height of approximately 1 m

Figure 1. Location of the study area



Source: ESRI Data and Maps 2002.

to 2 m and requires shady, humid conditions. The availability of harvestable cardamom fruits from the wild depends on the status of the forest; cardamom grows well in forests with 50% to 70% shade and along streams and rivers with good shade (Dinh Van Tu 1990, 1997).



(*Amomum villosum*)

Cardamom extraction

Fewer than 10% of the households in the district are involved in cardamom extraction, but in the villages near forested areas the share is estimated to be more than 50%. Most of the cardamom extraction occurs in Ba Be National Park. A small percentage of the district's cardamom comes from forested areas located outside of the park; lands managed by Ba Be State Forest Enterprise, communal forests and forestlands for which households have user right certificates. In some other areas of Vietnam people have started growing *A. villosum* in the shade of plantation forests, but in Ba Be it is not planted (Dinh Van Tu 1990).

Harvesting takes place in the rainy season, from May to July. The fruits ripen in sequence and ideally only ripe fruits are picked, leaving the younger ones for the next picking. However, because of competition between gatherers for the same plants, there is the temptation to collect younger fruits as well, even though they fetch a much lower price or are even rejected by the buyer. The harvesting does not have a negative impact on the growth of the cardamom plant, nor does it result in significant disturbance of the ecosystem.

According to the collectors, cardamom fruiting peaks every two years, implying that producers' income also fluctuates.

The harvest of cardamom is done by women, sometimes assisted by children. It is a sideline activity conducted when the labour demand is relatively low. The collecting is done individually and the decision to harvest depends, to a large part, on the availability of the collector's time. It is estimated that about 5% of the cash income of the average cardamom-extracting household comes from cardamom. Only very small amounts of extracted cardamom are kept for subsistence use; the cardamom is boiled and mixed with some other ingredients and used as traditional medicine by pregnant women and to cure stomach aches.

Processing and trading of cardamom from the park

After harvesting, the fruits are taken to the collector's home, where they are dried in the sun or over a wood fire. Sun drying is preferred, and only for large amounts or in the case of bad weather is a wood fire used. Drying of the fruits is a profitable activity, which can increase the value by as much as 100%.³ Traders collect the cardamom at the harvesters' houses or buy it in a nearby local market. Virtually all first order traders are women and they are often involved in the trade of other forest products as well. The trader sorts the cardamom and pays lower prices for low quality fruits, i.e., mainly those that have been picked too young. When fresh fruits are bought, the trader takes care to dry them before selling them on. First order traders, who buy cardamom in small quantities from collectors in the villages near the forested areas of the district, take the cardamom to bigger traders in the district capital. Quantities of cardamom sold are usually not more than 5 kg at a time. There are many small traders that operate between the producers in the villages and the bigger traders in the capital.

The main market for cardamom from Ba Be is China, where the dried seeds are used to produce traditional medicines. The distance from Ba Be district to the Chinese border is about 150 km on good roads. In Cao Bong, a province located on the border, there are ethnic links with the neighbouring people of China, which plays an important role in trade relations. Often a Chinese buyer will contact a Vietnamese trader in Cao Bong. The trader from Cao Bong then contacts traders in Ba Be district to place an order and comes to Ba Be to collect the cardamom by truck. The cardamom is transported to the Chinese border, where it is transferred onto the Chinese buyer's truck. All this is done illegally. Second and third order cardamom traders may also be involved in the illegal trade of other forest products like snakes, turtles, bamboo shoots and mushrooms.

Local processing usually involves mainly drying. A minor portion (<1%) of the cardamom is further processed locally, using simple methods to produce medicines for the local market. Most of the cardamom, however, is processed into medicines outside the country. Producers in Ba Be have generally little knowledge of where and how the cardamom is further traded, how the cardamom is further processed, and the prices that are paid along the trade

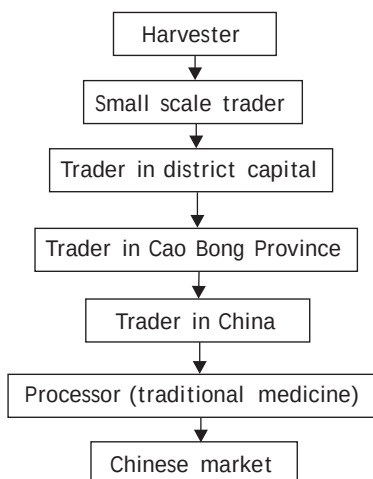
Photo 1. Cardamom harvester selling a basket of cardamom to a trader (Photo by K. Kusters)



chain (NTFP-RC 1999) (Figure 2). Prices of cardamom are determined by the market in China and tend to fluctuate. Both second and first order traders may therefore decide to store the cardamom and wait for a better price. Storing facilities are usually not good, however, which means greater risk of being attacked by fungi. The product can lose as much as 50% of its value in three to five months of storage.

Park regulations

Ba Be National Park employs several protection units to prevent illegal cultivation and harvesting of forest products. If the guards patrolling the park and its boundary catch a harvester, they confiscate her tools and the illegal products and sometimes assess a fine. The effectiveness of the forest patrols is rather limited, however, and in practice they do not scare or prevent harvesters from going into the park to collect cardamom and other products. In addition to the patrols in the forest, local markets are being inspected for the sale of illegal products, and this practice has reportedly caused 'considerable problems' for people selling cardamom in larger quantities.⁴ Thus, though the control of illegal harvesting is mostly ineffective (with only a few harvesters per year being caught), the trade of large quantities of illegally harvested cardamom near the park is risky and there is a high chance that it will be confiscated.

Figure 2.Trade diagram

Land use certificates

In 1998, the government started allocating land use certificates for forestland to households. The main objectives of the allocation programme are to stimulate rehabilitation, reforestation and agroforestry activities (MARD 1996). The Ba Be district government has had difficulties implementing the programme and therefore land allocation is proceeding slowly. So far only a small portion of the district's forestlands have been allocated to households.

Further forestland allocation could theoretically mean an incentive for sustainable harvesting of cardamom by reducing the competition amongst harvesters for the same resources. However, outside Ba Be National Park, most lands classified as forestlands are barren or scrub⁵, which implies that the lands that are (potentially) to be allocated have no cardamom⁶. Furthermore, the lack of forest cover makes these lands unsuitable for cardamom cultivation in the short term. The land allocation process will thus have little direct impact on cardamom production in the research area.

TRENDS AND ISSUES—DEVELOPMENT AND CONSERVATION LESSONS

Availability of cardamom

It can be argued that some of the logging activities in the past have resulted in a slightly higher density of wild cardamom in the remaining forests of Ba Be, since the plant prefers an open canopy. Nevertheless, over the last 20 years the availability of cardamom in Ba Be district has been decreased dramatically as a result of absolute deforestation. Presently, the annual trade is around 10 tonnes, while annual trade in the 1970s was said to have been

much higher⁷. Since the early 1990s, thanks to a series of new policies and interest from the government (e.g., land allocation and reforestation programmes), the overall trend has been towards forest regeneration and this development may positively influence the future production of cardamom in the study area.

Changing trade in response to the establishment of the park

With the establishment of Ba Be National Park in 1992, control of the harvest and trade of forest products became tighter. In practice access to the resource did not change much; cardamom has been 'free for all' both before and after the establishment of the park. The trade system, however, does seem to have changed significantly. Previously, traders came to the village to collect large quantities of cardamom by truck. Now, harvesters sell their cardamom to traders who transport the product in small quantities to the district capital, where it is bought by bigger traders and then smuggled to China in large quantities. The most important reason for the trade flow change would appear to be the fact that transporting large quantities in the vicinity of the park has become a risky business since forest guards have the task of checking all trade in forest products. Thus, the transaction of large quantities has spatially shifted away from the villages near the park towards the district capital in order to reduce the risk of fines and confiscation by park staff.

Women and cardamom

One of the striking features of this cardamom case is the dominance of women in both production and trade. The collection of forest products like cardamom, mushrooms, and medicinal plants is women's business, while rattan and bamboo are the responsibility of men. The involvement in production and first order trading of cardamom gives women control over part of the household money, providing them with decision making power over household expenditures. One collector explained the female dominance in the cardamom trade by saying that men were uninterested in first order trading because it involved going from household to household to buy small quantities of cardamom and take it to local markets. Of the three biggest traders in Ba Be district, however, only one is female.

The need for recognition

The well-established illegal trade network attracts illegally harvested cardamom from the park as well as legally harvested cardamom from elsewhere in the district. Although the explicit prohibition of cardamom collection from the park may not have given rise to the illegal trade network (cardamom was being smuggled into China long before the park came into existence), it has not helped the recognition and formalisation of cardamom production and trade either. As a result, the government is unable to obtain any benefits from the cardamom trade; nor can it regulate harvesting and

trade activities. Since the harvesting of cardamom has an insignificant impact on the plant and its surroundings, it can be reconciled with the conservation objectives of the park. Recognition by park management and government would, for example, open possibilities for the regulation of harvesting activities and designation of cardamom extraction areas, which could result in more appropriate harvesting activities and higher profits. Presently, *de facto* open access to the remaining resources and the lack of regulations induce people to collect immature fruits in order to be ahead of the competition.

ENDNOTES

1. Non-Timber Forest Products Research Centre. 8 Chuong Duong Do, Hoan Kiem, Hanoi, Vietnam. E-mail: ntfp.project@hn.vnn.vn
2. In this chapter the term cardamom refers to the species *Amomum villosum*.
3. In 2003 it was reported that collectors sold fresh fruits for US\$0.2 per kilogram, while dry fruits were sold for US\$2 per kilogram. Since 5 kg of fresh fruits equals 1 kg of dry fruits, drying increases the value of the fruits by 100%. Exchange rate in 2003: US\$1 = VND15,000.
4. It is unclear how cardamom can be recognised as coming from within the park.
5. In the Vietnamese land qualification system the term forestlands is used not only for lands that are covered with natural or plantation forests, but also for lands that are barren with the intention of having them reforested.
6. This is in contrast to the Vietnamese bamboo case presented elsewhere in this volume (Chapter 21), where most of the allocated forestlands do contain bamboo.
7. Estimates of the amount of trade in 'wild cardamom' in the 1970s are hard to make because district statistics did not differentiate among cardamom species.

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Chapter 8

Lapsi (Choerospondias axillaris) emerging as a commercial non-timber forest product in the hills of Nepal

Krishna H. Gautam¹

Common name	Part of the resource used	Management	Degree of transformation	Scale of trade	Geographic range
Lapsi	Fruit	Managed/ Cultivated	Medium	National	Medium

OVERVIEW

The *lapsi* tree [*Choerospondias axillaris* (Roxb.) B.L. Burtt & A.W. Hill], a native species to the Himalayan range, is traditionally grown by Nepali hill farmers on slopes between terraces mixed with other fruit and fodder trees, and recently on terraces too. The tree used to be grown mainly for its timber, but over time the marketing of its fruits has become much more important. The commercialisation of the *lapsi* fruit has encouraged people to plant the tree. On the basis of a study in Sindhupalchok and Kavrepalanchok districts, it is concluded that farmers have not been able to reap the full benefits of *lapsi* due to several constraints. *Lapsi* growing demands a long-term perspective, as investments do not pay off immediately. Investment security can be improved when the techniques to distinguish fruiting female trees from male trees are improved. Markets for *lapsi* fruits in the region are expanding, but, because of a lack of information and credit possibilities, small landholders and the landless are still deprived of such emerging opportunities. The absence of a growers' institution limits growers' bargaining capacity, and traders are getting the larger share of the benefits. Incorporating *lapsi* in community and leasehold forestry may create an appropriate avenue for benefiting poor farmers.

INTRODUCTION

The fruits of the *lapsi* tree [*Choerospondias axillaris* (Roxb.) B.L. Burtt & A.W. Hill] are widely used in central Nepal. Having long been pickled and used for subsistence consumption, in the last four decades the fruits have also become important commercially. The fruit is used in several products: (i) *manda*, a dried mixture of *lapsi* pulp and salt used as a snack and to make pickles;

(ii) candy, made of *lapsi* pulp and sugar; and (iii) 'ground-skin', a powder made by grinding the fruit's skin, which is widely used as sour topping in restaurants and hotels in Kathmandu. In addition to these uses of pulp and skin, the seed is used as fuel, especially in brick kilns. *Manda* and candy are the most important commercial *lapsi* products, and are traded in domestic markets. Most of the sweet shops, grocers and supermarkets in Kathmandu sell both. Diplomats, expatriates, tourists and trekkers favour the candy, indicating prospects for an export market (Gautam 1997). Traditional use of *lapsi* for pickles is still popular in both rural and urban areas of Nepal.

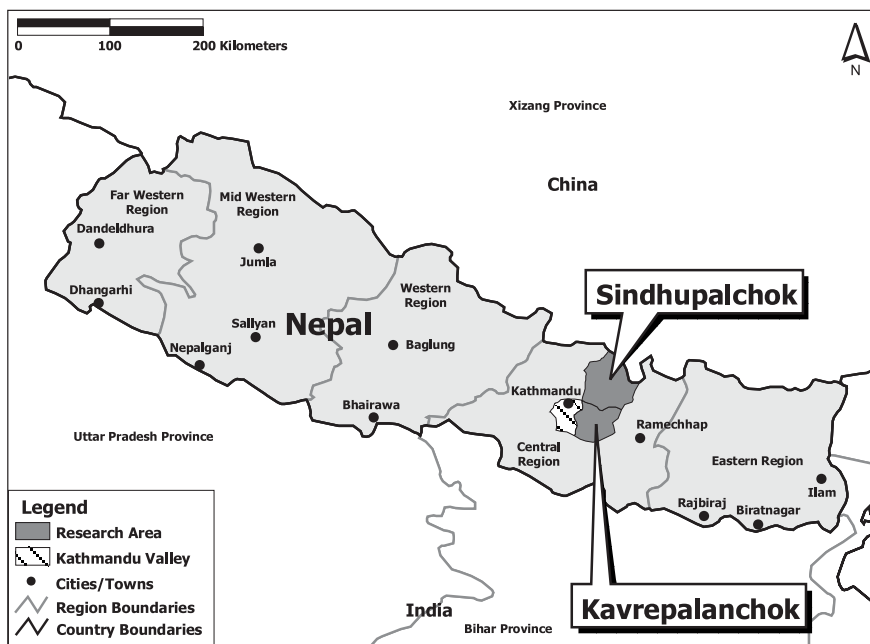
Study area: Sindhupalchok and Kavrepalanchok districts

Nepal is broadly divided into three physiological regions—mountains, hills and Tarai, the plains of southern Nepal. Of Nepal's population, approximately 45% live in the Tarai region, another 45% in the hill regions, and about 10% in the mountains (CBS 1998). Administratively, the country is divided into five developmental regions and 75 districts. The Central Development Region is the most accessible and developed of the five. It extends across the country from north to south, covering high mountains, mid-hills, Siwalik (low hills) and Tarai. About 33% of the total population resides in the Central Development Region, which covers 19 districts. The Kathmandu valley, consisting of Bhaktapur, Kathmandu and Lalitpur districts, and the surrounding districts of Dhading, Nuwakot, Sindhupalchok and Kavrepalanchok are located in the central mid-hills of the Central Development Region, though some surrounding districts extend into the higher mountains (Figure 1).

The study area covers Sindhupalchok and Kavrepalanchok districts, which are the main districts for commercial *lapsi* production. Although the study area is close to the Kathmandu valley, the literacy of the population six years and older is only 45% (60% among males and 31% among females). There are few towns, and only about 5% of the population is urban. Brahman, Kshetry, Tamang and Newar are major ethnic groups in the area; several other ethnic groups such as Sherpa, Gurung, Damai, Kami are scattered all over the area. Hinduism and Buddhism are the most important religions. The construction of the Arniko highway from Kathmandu to the Tibet border has 'opened up' the area and some farmers are now engaged in trade by importing goods from China and selling them locally or in Kathmandu. The Helambu valley in the northern part of Sindhupalchok and the Sunkosi river, which flows through the research area, are top tourism spots which attract many people for trekking and water rafting, generating employment opportunities for local farmers, for example, as guides. Nevertheless most farmers in the area are still subsistence oriented.

Most of the resources of the districts surrounding the Kathmandu valley were used in the infrastructure development of the valley. Forests in these districts were severely affected by the expanding population in the valley and their needs, after the nation's capital was moved from Gorkha to Kathmandu ca 200 years ago (Gautam 1991). At the same time, the urbanisation of Kathmandu valley created opportunities for the development of adjoining districts. The increasing demand for agricultural and forestry products from Kathmandu

Figure 1. Map of study area



Source: ESRI Data and Maps 2002.

stimulated the increase in production and intensive harvesting of such products in the adjoining districts. Amongst others, medicinal and aromatic plants and *lapsi* have been harvested from the forests to feed the markets in Kathmandu. Through the trade in these products contacts were established between traders in adjoining districts and traders/exporters in Kathmandu valley. Although *lapsi* is grown all over the mid-hills of Nepal, it is mostly in the districts surrounding the Kathmandu valley that it has become a commercial product. Increased demand for *lapsi* fruits in Kathmandu led forestry programs to initiate its production. Accordingly, the cultivation of *lapsi* trees has increased as part of forestry activities since the early 1970s, and processing industries have been developing in and around the Kathmandu valley in response. At present the *lapsi* tree is widely used for private planting in the hills, as part of the community forestry programme². It is a highly preferred species for agroforestry in the study area because of the high demand for the fruits in Kathmandu valley.

THE PRODUCTION- TO-CONSUMPTION SYSTEM

Lapsi fruit

Lapsi, a medium to large deciduous and dioecious tree, grows between 900 m and 2,000 m a.s.l. in the Himalayan range (Jackson 1994). Its distribution is not restricted to the Himalayas, however, and the tree is also found in Thailand

(Jackson 1994), Vietnam (Nguyen *et al.* 1996) and China (Hau *et al.* 1997; Zhou *et al.* 1997; Feng *et al.* 1999; Zhou *et al.* 1999; Lin *et al.* 2000). In the hills of the study area, *lapsi* trees stand in small patches in the natural forest or scattered in the farmlands and at religious sites (see Box 1). The tree does not occur in the lower-lying parts of the study area, since they are unsuitable for *lapsi*. In forests, associated species are, amongst others, *dhalne* (*Castanopsis indica*), *kafal* (*Myrica esculenta*), *chilaune* (*Schima wallichii*), *chutro* (*Berberis asiatica*), *mahuwa* (*Engelhardtia spicata*), *phalame* (*Homalium nepaulense*), *lankuri* (*Fraxinus floribunda*), *jamun* (*Syzygium jambos*) and *jhingan* (*Eurya acuminata*). The *lapsi* tree has a low tolerance of shade and frost and is moderately tolerant of low fertility and drought (Tyystjarvi 1981).



(*Choerospondias axillaris*)

Box 1. The use of *lapsi* trees at religious sites

Lapsi is mentioned in various religious documents of Hinduism. The fruits are used in Hindu rituals, for example, as an offering to the gods. *Lapsi* trees are maintained at most of the religious sites in Kathmandu valley, and the fruits are crucial to the survival of monkeys and birds in many temples in the capital.

Because of the superstition that the presence of *lapsi* tree makes a site prone to lightning strikes during thunderstorms, people have tended not to plant the tree around their homesteads. However, *lapsi* trees have been protected, as fruit trees, for a long time and stray old trees—the oldest ones over 100 years old—stand on farms, in forests, or religious places. The planted trees found all over the study area are usually less than 30 years old, indicating that people started growing *lapsi* trees in the last few decades. In the natural forest *lapsi* trees are sparsely distributed.

Growing *lapsi*

Lapsi is one of the major tree species used in community forest nurseries established in the early 1980s as part of the government's community forestry programmes, the district forest office and community managed nurseries. There are over 100 village nurseries in the study area and the bulk of seedlings for growing *lapsi* come from these nurseries. Nurseries supply seedling for planting both on private lands as well as in community forests. Most of the seedlings go to private lands, and consequently the bulk (about 90%) of fruits collected in the study area are from private lands. The rest is gathered from *lapsi* trees in public (community or government) forests. Survival of planted seedlings has been recorded as 67%, which shows it is a species relatively suitable for cultivation (Campbell and Bhattarai 1983; Hannah 1984; Nielsen 1985). The practice followed in forest nurseries in the district is described in Box 2.

Box 2. Nursery technique for the propagation of *lapsi*

Ripe fruits are picked from November to January and put on a polythene sheet in the bottom of a pit 1 m² to 3 m² in size and 1 m deep. The fruits are covered with soil and left for two to four weeks. The fruits are then dug up, mixed with sand and rubbed until the seed-stones are separated from the flesh and skin. The seed-stones are washed in water and dried for five to seven days. The seeds are then stored in jute or polythene bags. They need to be dried in the sun once a month to prevent fungus. The seeds stay viable for nine months. Seedbeds have 5 cm of gravel on the bottom, covered with 2.5 cm of local soil and on top of that 7.5 cm sieved, fertile-soil. The seeds are sown 3 cm to 5 cm apart and covered with sieved sand. The seedbeds are watered twice a day. Germination starts after two weeks and is complete in six. Two to three weeks after germination, the seedlings are transplanted into polythene bags 7.5 cm by 18 cm. The seedlings are ready for transfer to the plantation in five to eight months. The number of plants per seed-stone varies with its size: on average 1 kg of seed-stones produces 600 seedlings, but large seed-stones can sometimes produce up to 1,500 seedlings.

The average number of established trees of any species on farmland is 33 per household, out of which 14 (42%) are maintained mainly for fruit. *Lapsi* trees constituted 36 percent of total trees and 86 percent of fruit trees. *Lapsi* trees used to be grown on slopes between terraces, mixed with other fruit trees and fodder trees. Today, medium to large landholders have started growing trees in upland terraces as a long-term investment. Even city dwellers from Kathmandu and other towns in the district are buying land in rural areas to start *lapsi* orchards. Small landholders cannot afford to convert all of their terrace lands into *lapsi* plantations, because these lands are largely used for subsistence.

Farmers who want to plant *lapsi* obtain seedlings from a nearby nursery or collect wild seedlings. As described, *Lapsi* propagation in nurseries is mainly from seeds. Although Napier and Robbins (1991) indicated that vegetative propagation is easily possible, no such instance has been recorded in the nurseries in the study area, and attempts at tissue-culture propagation have been unsuccessful (H.K. Saiju, personal communication). Farmers have domesticated the tree by selecting seedlings from good trees: seeds not dispersed by wildlife and ruminant cattle (the main dispersal agents) germinate under fruit-bearing trees. Farmers assume that the quality of the seedling depends on the quality of the mother tree and intend to domesticate the better product through adoption of seedlings regenerated under the best-recognised trees. Local people consider factors like size of fruit and seed, taste of fruit, thickness of skin, age of first fruiting and probability of fruit-bearing (female) tree for the selection of the best trees. These factors are very much valid. Selection of female plants is a vital part of domestication, and farmers have developed their own techniques for identifying male and female trees. Their assumptions in this regard are: (i) female plants sprout earlier than male plants under the same conditions at the beginning of the growing season; (ii) only female plants release milky latex when leaves are pricked; (iii) wood from female plants does not blast while burning whereas that from males does so loudly; and (iv) wood from male trees splits easily. Though these assumptions were found to be valid, they are yet to be studied further.

***Lapsi* collectors and their socio-economic context**

Most people in the two districts live in hilly areas and there are relatively few settlements in the valleys. People are mainly subsistence-oriented farmers growing maize, mustard, millet, wheat and dry rice. The average size of the landholdings in Sindhupalchok and Kavrepalanchok are 0.62 ha and 0.81 ha, respectively. Cash flow is very scarce and collection and selling of *lapsi* is an important source of cash. Other non-timber forest products (NTFPs) collected include medicinal and aromatic plants from the forest at high altitudes, which are sold to traders. Some farmers collect bark from *Daphne* species, which is sold to local small-scale paper factories. In addition to collection of NTFPs, cash income is earned by selling surplus agricultural produce, from tourism and through wage labour.

It is estimated that between 10% and 30% of people living in the study area use *lapsi* for commercial purposes. *Lapsi* fruits are a reliable product for barter or cash income, as confirmed by comments from various *lapsi* growers (Box 3). *Lapsi* is grown on private lands by both poor and richer farmers, and usually both men and women are involved in the picking of fruits. Some of the poorest farmers, however, prefer to use all their land for subsistence crops instead of making the long-term investment of planting *lapsi*, which demands protection of seedlings from grazing cattle and thus extra work for the farmer. Farmers who do not own *lapsi* trees may be involved in *lapsi* picking from (community) forests and are sometimes hired for picking from private lands and processing work.

Box 3. What *lapsi* growers say about the impact of *lapsi* on their daily lives

- “Two of my neighbours were visiting Chautara, the district headquarters of Sindhupalchok district, for some other business. They asked me for *lapsi* fruits. I advised them to pick the fruit themselves from the tree and bring me two *pathis* (9 litres) of salt when they returned. They collected the fruits in one hour and the quantity of fruits came to about 16 *pathi* (72 litres). In the evening they returned with the said quantity of salt. Thus I bartered *lapsi* fruits of one tree for 9 litres of salt.”
- “My daughter took about a *dhwang* (18 litres) of *lapsi* fruits to the market and bought six notebooks for her studies.”
- “During the last *dasain* (the biggest Hindu festival) I had the goat I needed at home for meat but had no money to buy spices. A local shop-owner supplied me with the spices I needed in exchange for fruits from one *lapsi* tree.”
- “Whenever I have to buy smokes or sugar I take *lapsi* fruit to the local shops and exchange it.”
- “As I had no money to pay the school fees for two of my children, I asked them to collect *lapsi* fruits on Saturday and take them to market on their way to school. They each took a small bag of the fruits and sold them so that they could pay their school fees.”

Processing

The two main *lapsi* processing industries in the study area are the processing of *lapsi* to *manda* and candy (Photo 1). These are cottage industries, operating at the household level. There are less than 100 processing households in the research area. Most of these households are also engaged in other activities and are involved in processing only part time. Some producer household also process their own fruits.

Photo 1. *Manda* and candy made from *lapsi* fruit (Photo by K. Kusters)



Two qualities of *manda* are available, one handmade where only the flesh of the fruit is used and another machine made where flesh and skin is mixed. For most of the processors of handmade *manda* it is a part time activity in addition to farming (even in urban areas most people farm), while processors owning a machine (for separating the flesh and the skin from the seed) are often engaged in processing full time. The technology of making *manda* is simple, and *manda* processors are located in various parts of the area, though most of the factories operate in Sanga, a town in Kavrepalanchok on the highway going to Kathmandu valley. Processing of *manda* started in Sanga, where the processing techniques were developed. Only recently some households started processing *manda* in other villages.

Lapsi fruits for making *manda* are procured from September to January, sometimes till February; even unripe fruits are procured. The fruits are boiled in water for two hours in a drum, and salt is added up to 30% of the volume of fruits. Seeds are separated from the boiled fruits manually or by use of a power splitter. The pulp is placed on a polythene sheet and laid in a pit in the ground, where it can be stored for a longer time. Whenever it is convenient, the pulp is taken out, spread on wooden planks and dried in the sun for two days, after which the *manda* is ready.

There are only about five candy processors, and all of them are located in Sanga. These are household level enterprises as well, but some of them employ a few labourers. All the candy processors are involved full time. Candy producers separate flesh, skin and seed-stone manually. Only the flesh is used to produce candy, the ground-skin is sold separately.

The fruit for making candy is collected at the same time as that for *manda*, but only fully ripened (not dried, rotten or exposed) fruits are selected. They are washed thoroughly three times. Eighteen litres of *lapsi* fruits are boiled in

2 litres of water for 20 minutes. The boiled fruits are then emptied into a bamboo basket for filtration. The fruits are peeled and the seeds separated. A quantity of sugar equal to the quantity of pulp is mixed in, and the mixture is stored in a polythene container. A veneer 30 cm x 45 cm is framed with a 4 mm thick lining on all sides (like a tray), and the upper surface is greased with cooking oil. Two kilograms of stored mixture is then spread over the greased surface of the veneer and solar dried for 4 to 19 days depending upon the intensity of sunlight. The degree of dryness can be checked by testing the stickiness of the surface. Once dry, the mixture is diced and packaged.

Leftovers from *manda* and candy processing are usually sold to brick and tile kilns, which use the seeds as fuel. The processing industry in the research area is growing with the increasing production of *lapsi*. No organisation among processors was reported, although some processors expressed a need for some form of organisation. *Lapsi* processors have not encountered any policy hurdle to processing and selling their products.

Trade

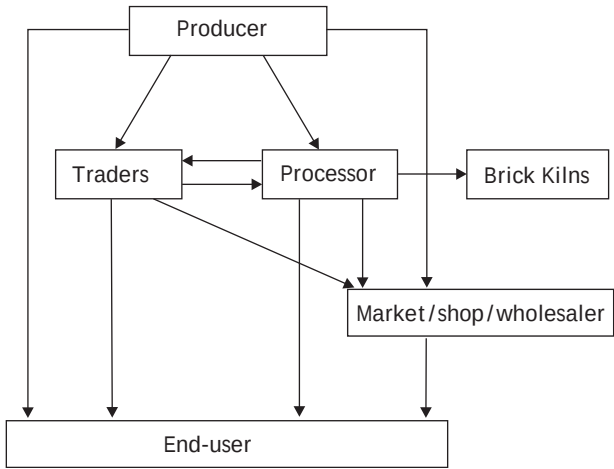
Lapsi fruits entered the market in the mid 1960s and trade increased rapidly buoyed by brisk demand in Kathmandu for unprocessed fruits as well as candy, *manda*, seeds and ground-skin. Figure 2 is a generic diagram of the trade in *lapsi* fruit and its processed products. Sometimes producer households may also take care of the processing; these producer/processor households are not represented in the diagram. Sometimes several traders are involved, for example, first order traders provide the *lapsi* in large quantities to second order traders, who then sell it to candy factories. The markets (including fresh-fruit markets, wholesalers and retail shops) are located both in the study area and in Kathmandu. End users who buy the fruit in the unprocessed form do not necessarily consume the fruit in its raw form but will often process it themselves to pickles or *manda*.

The average annual income from the sale of *lapsi* fruit is US\$14.30³ per tree, and ranges from US\$1.60 to US\$32.10 (1996). Raw material producers sell fruits per *dhwang* (18 litre containers that hold about 12 kg of fresh fruit). The highest price so far paid is US\$0.80 per *dhwang*, but the average comes to about US\$0.70 per *dhwang*.

Traders may reserve trees by paying the owner of the tree a certain amount as an advance payment for the fruits of that harvesting season. When farmers are paid in advance they often end up accepting lower rates for the fruits, but it is an attractive option when the owner of the tree is in need of money, for example during the crop planting season or festivals.

Manda is sold mainly in local markets in packages of 25 g for US\$0.10 each, which is equivalent to US\$4.00/kg, while candy is sold mainly in supermarkets and department stores in Kathmandu in packets of 200 g for US\$1.00 each. Foreigners from diplomats and expatriates to tourists and trekkers are the main consumers of the candy. The most important outlets are the Kathmandu hotels and trekking agencies.

Figure 2. Trade diagram



In Tables 1, 2 and 3, examples are given of profits and costs that have been recorded in the study area. The table figures represent only monetary inputs, not the value of labour, and show that processing and trade in processed products are the most lucrative activities.

Table 1. Costs and profits for 1 *dhwang* (12 kg) of *lapsi* fruit in the study area

Actor	Monetary costs (US\$)	Selling price (US\$)	Margin (US\$)
Producer	0.00*	0.70	0.70
Trader	Purchase lapsi fruit: 0.70 Jute bag for packing: 0.05 Transport, load, unload: 0.25 Tax: 0.05 Total: 1.05	1.80 at Kathmandu market	0.75

* Tree growing cost is not included.

Table 2. Costs and profits for *manda* made out of 1 *dhwang* (12 kg) of fruit in the study area

Actor	Monetary costs (US\$)	Selling price (US\$)	Margin (US\$)
Producer	Jute bag for packing: 0.05	0.75	0.70
Local <i>manda</i> processor	<i>Lapsi</i> fruit in bag: 0.75 Salt (1.8 kg): 0.35 Total: 1.10	<i>Manda</i> (7.8 kg): 7.70 Seeds: 0.20 Total: 7.90	6.80
Trader selling in Kathmandu market	<i>Manda</i> : 7.70 Transport and packing: 1.80 Total: 9.50	7.8 kg <i>manda</i> in packets of 25 g: 31.20 Total: 31.20	21.70

Table 3. Costs and profits of Candy made out of 1 *dhwang* (12 kg) of fruit in the study area

Actor	Monetary costs (US\$)	Selling prices (US\$)	Margin (US\$)
Producer	Jute bag for packing: 0.05	0.75	0.70
Local candy processor	Lapsi fruit in bag: 0.75 Sugar (5 kg): 2.00 Total: 2.75	Candy (10 kg): 14.30 Seed: 0.20 Skin-ground: 1.90 Total: 16.40	 13.65
Trader selling in Kathmandu market	Candy: 14.30 Transport, packing: 2.70 Total: 17.00	10 kg candy in packets of 200 g: 50.00 Total: 50.00	 33.00

Government policies

The Nepalese government has been supporting the growing of trees on communal and private lands for a long time. In 1957, His Majesty's Government enacted the Private Forest Nationalisation Act, intending to nationalise large blocks of forests owned by former feudal rulers (HMG 1957). However, it was not communicated to the people which areas would fall under the act. As such, the act unintentionally damaged scattered small blocks of private and communal forests because their owners converted these lands so they would not fall under the act. The community forestry legislation (HMG 1977, 1989) put emphasis on the development of private forest resources by planting trees on private lands. In the late 1970s the forestry authorities started programmes and projects in the district to stimulate the planting of trees, including *lapsi* trees because *lapsi* was seen as a promising product for sustainable forestry. These programmes and projects were funded partly by the government and partly by donors, and focussed on the establishment of nurseries for the propagation and free distribution of seedlings for private planting, mainly in hill districts. In 1994 a charge was introduced for seedlings in Sindhupalchok district, aiming to achieve self-sustainable seedling production. Other projects have provided training and extensions. Most of the forestry projects are still active in the research area, managed by either the district authority, local communities or 'user groups'. Local users maintain the User Group Nurseries but nursery materials are supplied by forestry offices under the Department of Forestry. For other nurseries all costs (including labour) are paid for from project funds through the forestry office.

Forestry legislation in Nepal was designed to increase the tree cover on private lands along with the development of forest resources on communal lands. Forest legislation (HMG 1993, 1995) categorised timber and other forest products, and fixed the levy for collection and export of these products. *Lapsi* fruit has not been listed by forest legislation as a forest product, since most of the fruiting *lapsi* trees are not in forests and picking of fruits does not involve felling trees. As a result a levy is not charged on collection and sale of *lapsi* fruits. Sometimes such levies are fixed by local user groups for products collected from community forests they manage, but these levies are modest

and have so far not resulted in substantially higher prices than *lapsi* from private lands.

The increase of planted *lapsi* trees in the last 20 years can largely be attributed to government initiatives encouraging tree planting on private lands. The community forestry programmes have been equally successful in converting degraded lands into forests and their subsequent management. Efforts to stimulate sustainable forestry have been most successful in the hills of Nepal, whereas the forests in the southern plains of Nepal are threatened by illicit felling and encroachment. Government efforts to stop further deterioration of those forests have had little effect.

TRENDS AND ISSUES—DEVELOPMENT AND CONSERVATION LESSONS

Intensification of *lapsi* fruit production

Over a century ago, farmers in the study area started protecting *lapsi* trees on their farmlands mostly to make use of their timber. These days the trees are used mainly for their fruit; they are only occasionally cut for timber and never the fruiting trees. As such the use of *lapsi* trees in agroforestry systems has made a gradual shift from agrosilviculture to agrohorticulture.

The commercialisation of *lapsi* fruit since the 1960s, driven by the development of the Kathmandu valley, has caused considerable changes in land use in the study area. Since farmers started to grow *lapsi*, they have gradually intensified production on private, communal and leasehold lands. More and more farmers have been introduced the *lapsi* tree into their agroforestry systems and the trend towards intensification is continuing. Although the system of free distribution of seedlings from forest nurseries was terminated in Sindhupalchok in 1994, the demand for *lapsi* seedlings in the district is still increasing. Farmers are now planting *lapsi* trees on terrace boundaries, slopes, marginal lands, thatch-lands and terraces. Absentee landholders are also investing in the development of *lapsi* orchards in the study area, planting thousands of seedlings. Such changes indicate that people realise the potential of *lapsi*. In addition to the rising number of growers, numbers of processors and traders are also increasing in the research area, which is reflected by the increasing availability of *manda* and candy in the markets of Kathmandu.

Importance of *lapsi* production in the study area

For most raw material producers the growing of *lapsi* is a sideline activity and a source of income to cover incidental expenses. Beyond the direct economical benefits people derive from the fruit, the commercialisation of *lapsi* has also created opportunities for rural people to begin some sort of business, and it can be argued that it has provided some entrepreneurship to local people. In Box 4 it can be seen that the development of a processing industry can have important socio-economic impacts in certain areas as well.

Box 4. The importance of the *manda* industry in Sanga

Sanga, a small town located in one of the four passes into Kathmandu valley, has become renowned for its *manda* industry. A resident of Sanga stated: “There were many people here without work. Houses were in poor condition. The *manda* industry has changed the face of this area. Thirty years ago one person started this work, now there are more than 80 households involved in it. All the reinforced cement concrete buildings have been put up with the income from the *manda* industry and most of the industrialists send their children to boarding school. *Lapsi* fruits raised the standard of living of this locality. However, the hygiene standards for processing *manda* have yet to be improved. The authorities need to be aware of hygiene standards and the industrialists need to be concerned for public health for the long-term.”

Development and conservation lessons of the case study

Lapsi has a high potential for further domestication and commercialisation in agroforestry systems in the hills of Nepal. The fruit has already been adopted in the agroforestry systems of many farmers, a market within the country has been established and further market opportunities—including export markets—are promising.

Lapsi growing demands a long-term perspective, since investments do not pay off immediately. Investment security can be improved when selection of the fruiting female trees is improved. Farmers would be ready to invest more in planting if they were more certain that the trees will fruit. At present there is a wait of several years to find out whether a tree that has been planted is male or female. Local people are now approaching forest offices looking for research results that would help them to identify female trees and to select the best seedlings, but the forest offices have limited experience with domestication techniques. Therefore there is a need for research regarding identification of the fruiting tree and its management. Efforts should also be made to ensure that more benefits go to the growers, as the benefits so far have gone more to those beyond the tree growing farmers (see for example Tables 2 and 3). An important issue in this regard is the lack of marketing information for *lapsi* growing farmers, since farmers with market information may fetch a higher price for their fruits. Ensuring that benefits go to the farmers may include providing market information and making credit available. Groups managing community and leasehold forests may play an important role in the further domestication and commercialisation of *lapsi*. These groups, supported by the forestry authorities, could organise *lapsi* producers into co-operatives or associations and so strengthen their position. Furthermore, since the planting of *lapsi* on private lands is not very attractive to the poorest farmers because it is a long-term investment, the growing of *lapsi* in community and leasehold forests may be of particular importance to them.

The number of producer households involved in processing is increasing. Processing activities are very simple, have high returns and do not demand big investments. However, becoming engaged in processing is attractive only for farmers owning many *lapsi* trees or those with enough cash to buy *lapsi* fruits from other farmers. Some of the farmers have shown interest in forming a co-operative to run *manda* enterprises, which could work out to be very beneficial for the growers, since processing is a profitable business (see Tables 2 and 3). The organisation in a co-operative would make processing activities accessible and feasible for individual growers without the necessity to have a large number of *lapsi* trees.

The technology for processing *lapsi* fruits could be effective and easily adopted elsewhere. The extension of these simple technologies to other areas is preferable to looking for highly sophisticated technologies. Further research should aim to increase efficiency of processing techniques based on local knowledge and skills.

Regarding the ecological effects of commercialisation of the *lapsi* fruit, it can be argued that the harvesting of *lapsi* has some averse effects, since there is less fruit available for animals to feed on. Harvesting of fruits may also affect natural regeneration, which in turn affects traditional ways of domesticating *lapsi* from well-known trees because it reduces the number of seedlings under the best trees. However, with regard to the role of *lapsi* commercialisation in conservation of forest resources in the study area, it is clear that commercialisation of *lapsi* fruit has helped to motivate local people to plant trees. The trend towards the planting of more *lapsi* for fruit production has increased the tree cover on private lands, contributing to soil and water conservation in the hills, and branches of planted *lapsi* trees are used for firewood, which reduces use of wood from natural forests. Though the planting of *lapsi* has been more prevalent on private lands than in community forests, the introduction of *lapsi* trees in community forestry projects has helped to encourage community participation in these forestry activities. Based on recent promising results it is expected that the role of these community forestry activities in the conservation and development of forest resources and the improvement of local livelihoods will further increase and that *lapsi* can play an important role in this development.

ENDNOTES

1. Graduate School of Environmental Earth Science, Hokkaido University, Sapporo, 060-0810, Japan. E-mail: khgautam@ees.hokudai.ac.jp

2. Community forestry programmes were implemented in most of the hill districts of Nepal in the early 1980s with support from bilateral and multilateral donors. Programmes included establishing and operating nurseries in villages in order to produce seedlings of preferred species for planting in community and private forests. Australian Aid played a significant role in developing community forestry in Sindhupalchok and Kavrepalanchok since the early 1980s.

3. Exchange rate (1996/1997): US\$1 = NR56.

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Chapter 9

Cardamom (*Elettaria cardamomum*) in Kerala, India

T.K. Raghavan Nair¹ and M. Govindan Kutty²

Common names	Part of the resource used	Management	Degree of transformation	Scale of trade	Geographic range
Cardamom, Elam	Fruit	Cultivated	Low	International	Small

OVERVIEW

In this case study we look at the production and processing of cardamom (*Elettaria cardamomum* Maton) in the High Ranges and Nelliampathy hills in the state of Kerala, India. At present virtually all produced cardamom is grown in managed forest plantations. Some 90% of the households in the study area are involved in production or processing of cardamom in some way or other, deriving most of their cash income from cardamom. Of the cardamom produced, most is sold dry as a food additive while a small percentage, mostly of poor quality, is processed further into oil, oleoresin, medicinal preparations and ground cardamom (powder). The growing of cardamom involves the use of chemicals, disturbance of undergrowth and shade regulation. Still, the cardamom agroforests are considered less detrimental to the local ecology than most alternative agricultural land uses. Further expansion of the growing area in the natural forest is prohibited by strict and enforced regulations.

INTRODUCTION

Cardamom through the ages

Since time immemorial India has been known as the land of spices, and cardamom is the most important spice the country produces and trades. Its known history dates back to first millennium B.C., when the ancient Assyrians, Egyptians, Arabians, Mesopotamians and Chinese established a wide network of trade arrangements for cardamom and other spices with India (Mitra 1987).

It was the Indian spices, particularly cardamom and pepper, that attracted Europeans to this part of the Asian continent. This subsequently led to the opening of a sea route from Europe to the East around the Cape of Good Hope, which was first used by Vasco de Gama in 1498, the first European to arrive in India by this route. Traders from the ancient Indian ports of Alleppey, Cranganore and Calicut were already shipping cardamom to Arabia and Europe. Competition among European forces to acquire supremacy over the spice trade with India resulted in many a battle leading to the rise and fall of empires. Cardamom has been, over the centuries, a witness to vigorous political activities staged among Western forces and between them and the East.

Today the most common use of cardamom is as a food additive, and it is also widely used in Indian medicine. Essential oil and oleoresins extracted from cardamom are used as food additives and in medicines and cosmetics.

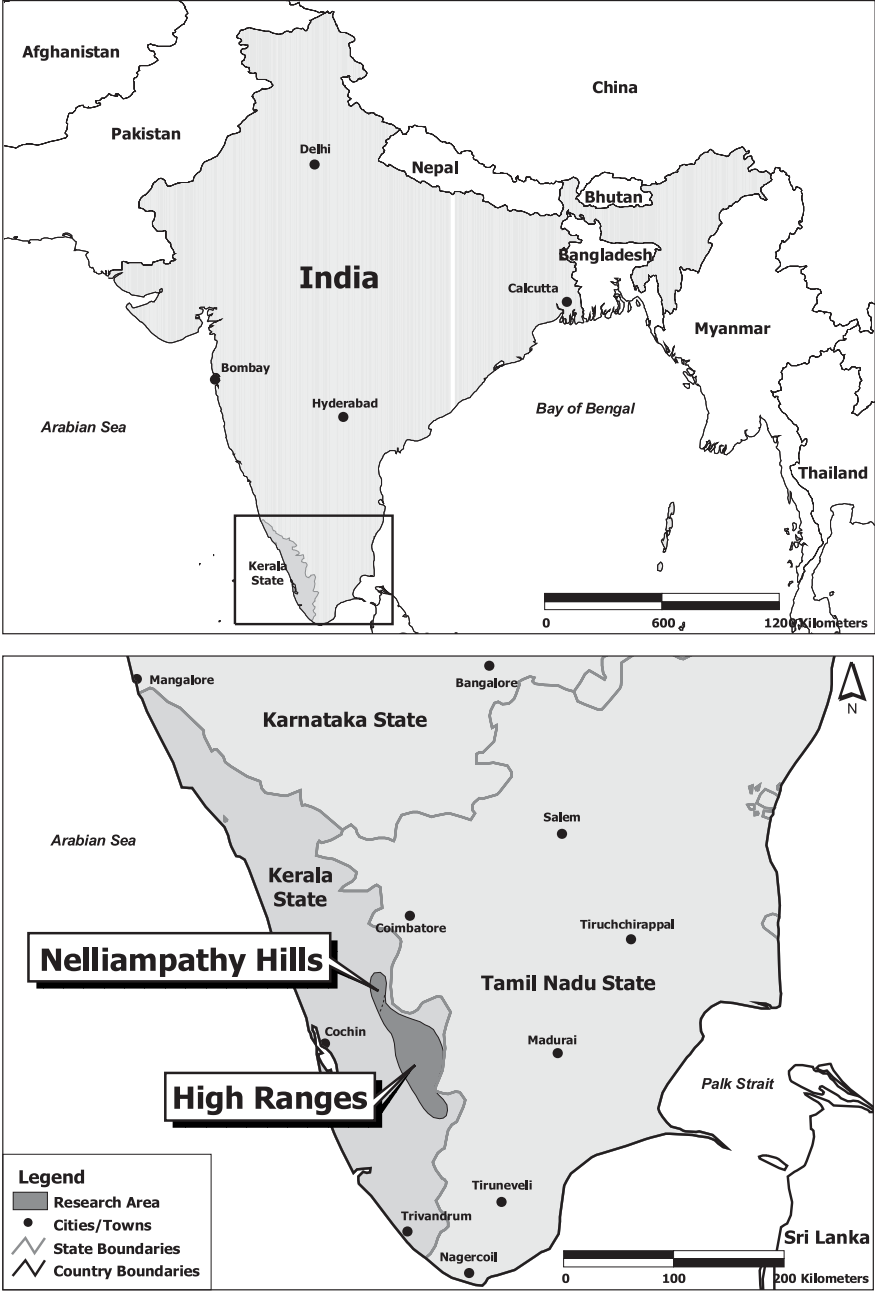
The study area

The cardamom zone, the area in India where cardamom naturally grows and is commercially cultivated, is located in the forest belt of the Western Ghats mountain range. Of the cardamom zone, 60% lies in Kerala, 30% in Karnataka and 10% in Tamil Nadu (APK 1999). The study area (Figure 1) is located in the state of Kerala, in south-west India. In Kerala, cardamom is cultivated mainly in the High Ranges of Idukki district, in the Nelliampathy hills of Palakkad district, on the Wynad Plateau in north Kerala and in Kochu Pamba in Pathanamthitta district. The High Ranges and the Nelliampathy hills, constituting 85% of the cultivated area of Kerala, are taken as the study area (GOK 2000).

The forest in this area can be classified as primary tropical rainforest, disturbed to a certain degree because of shade control, tillage, soil improvement activities and removal of rank weed growth. The soils are deep, well drained and rich in humus, and belong to the group of Ultisols. The climate is warm and humid with a mean annual temperature of between 10°C and 30°C and a mean annual rainfall varying from 2,500 mm to 3,850 mm, which falls mostly from the end of April through December. The study area terrain is highly undulating with good drainage and an elevation ranging from 600 m to 1,500 m a.s.l. Thinly populated, the study area has a total population of 78,061 in an area of 350 km² (GOK 1996, 1998; GOI 2001). The cardamom zone, in particular the study area, is fairly well served by a network of roads; the average distance to a trafficable ('vehicle worthy') public road from any raw material production holding is estimated at only 2 km.

Human settlements in the cardamom zone could be called cardamom villages. About 90% of the households of the study area are in one way or another connected to the production, processing and/or trade of cardamom. Of the total number of households in the study area, 50% can be classified as cardamom labour households, while 40% are producers and/or involved in the cardamom trade.

Figure 1. Map of the study site



Source: ESRI Data and Maps 2002.



(*Elettaria cardamomum*)

THE PRODUCTION-TO-CONSUMPTION SYSTEM

Cardamom: a description

Small cardamom, scientifically known as *Elettaria cardamomum* Maton, takes its name from the word *elattari*, which means ‘seeds of cardamom’ in Malayalam, the language of Kerala. The plant is indigenous to the tropical rainforests of the Western Ghats of India and Sri Lanka. It is also cultivated in Guatemala, Tanzania, El Salvador, Vietnam, Laos, Cambodia and Papua-New Guinea. The product is known by different names in different parts of the world. In Italian, Spanish and Portuguese it is known as *cardamomo*. The Arabs call it *hal*, while the Chinese call it *pai-tou-k’ou*. In trade, it is generally known as ‘cardamom (small)’. A sister species, *Amomum subulatum* Roxb., known as ‘large cardamom’, is grown in the Darjeeling district of West Bengal in India, Nepal, and Bhutan. Large cardamom is a cheap substitute for small cardamom. Here small cardamom shall be simply referred to as cardamom.

Cardamom grows in clumps, 3 m to 5 m tall with long, narrow leaves (Photo 1). The normal commercial life of a clump is 10 to 12 years, though the rhizome is almost perennial. Tillers that produce fruits die out within two years of producing new rhizomes and aerial shoots, and so growth is perpetuated (Joseph and George 1998). Cardamom grows best in tropical wet/moist rainforests, deep, fertile soils and around 50% filtered overhead shade. These are the typical local (microclimatic) conditions for optimum growth of the plant, so much so, that it grows well in disturbed primary forests.

Photo 1. Cardamom plant (Photo by K. Kusters)



Flowering normally starts in March to April. The white, violet striped flowers, locally known as *saram*, are hermaphrodite, appear on a long flexible stalk arising from the base of the plant and are pollinated by the honeybee. This characteristic of the species encourages cultivators to practice bee-keeping to increase production. The lowermost flowers open first and develop into fruits. It then takes 75 to 80 days for flower buds to form fruits ready for harvest. Fruits are small and ovoid in shape, with a green leathery husk. Each fruit has many small, round, dark seeds inside, covered by a thin layer of pulp. Propagation is mostly through tillers with rhizomes. In its natural state, in the undisturbed primary forests, the population density of cardamom is low, ranging from 250 to 300 clumps per hectare. As a result, productivity from undisturbed primary forest is low.

Management practices

In the study area, 99% of the cardamom produced comes from managed cardamom lands on which cardamom plants are planted. Management systems range from small forest gardens with a few plants to large intensively managed plantations. Plant density on holdings varies from 1,200 to 3,000 per hectare, 1,600 on average. Around 40% to 45% of the cardamom holdings are under intensive management in its strict sense, which means fertilisers and pesticides are used on a regular basis and irrigation is applied. Other growers apply chemicals irregularly and irrigation is partial or nil. In intensively worked

areas productivity has been increased up to 1,000 kg/ha/yr. However, the average yield in such areas can safely be taken as 400 kg/ha/yr, whereas the yield from ordinary cardamom lands is approximately 125 kg/ha/yr. A relatively small portion (less than 20%) of the growers can be classified as marginal cardamom farmers, which means they have a financial resource crunch that restricts them from intensive cultivation. Smallholders usually keep 10% to 30% of their land for cultivation of other agricultural crops (intercropped with cardamom in agroforestry gardens), as an additional safeguard to spread their risks in case cardamom prices drop.

Till the 1960s, cardamom was propagated mainly from seed, but now only tillers are planted. The Indian Cardamom Research Institute, Myladumpara, and the Indian Institute of Spices Research, Calicut, have done elaborate work on the improvement of planting material and have developed a number of varieties that are high yielding and reasonably disease resistant (Spices Board 1999). The latest scheme is to propagate using tillers (rhizomes with aerial shoots) selected from superior individuals with proven qualities. This has the advantage that the planting stock already has a mature root system enabling early and easy establishment. Offsets are cheaper than seedlings or plantlets. New plants will have all the characteristics of the mother plant and will bear fruits earlier than those originating from seedlings or plantlets. The latest tiller cultivars in the field are reasonably disease resistant, high yielding and early bearers, but demand higher inputs. They readily respond to fertiliser application and irrigation. Higher expenditure on inputs is then adequately compensated by higher production (KCPMC 2001). Tillers are collected at the beginning of the rainy season from 'superior' type plants in the same or different plantations and are planted in pits immediately after collection. Management further requires periodic shade control to the desired level by lopping branches of trees and the replacement of dead, low productive and diseased plants with new ones. Applying manure, weeding, forking³, trashing⁴ and the application of fungicides and pesticides to all plants are conducted periodically (Spices Board 1997). The cardamom plant is susceptible to fungal and insect attacks, the worst problem being a fungal disease called *katte*. Fungicides and pesticides are applied whenever deemed necessary. Irrigation is beneficial during hot months and in low rainfall areas and may increase productivity by 50%, but only the intensively managed plantations have irrigation facilities, to varying degrees.

Mature cardamom plants flower and fruit every year and the harvesting (picking) season extends from May-June to November-December depending on local conditions, especially the availability of water. In irrigated areas the harvesting season is likely to be extended to 8 to 10 months. Fruits are collected just before they are fully ripe, because fully ripe fruits may split and lose the much-desired green colour on drying. Only mature fruits are picked, which are at the bottom end of the panicle (fruit stalk). In normal plantations the harvest is spread out over a number of pickings at intervals of 14 to 21 days. There are about seven to eight pickings per year. With intensive cultivation using high yielding varieties, manure application, irrigation and plant protection, the number of pickings will increase.

Cardamom is cultivated on private lands or in areas that are leased out by the government for cardamom production. Local tribal communities harvest wild cardamom in areas that are not specifically designated for cardamom production, but this activity constitutes less than 1% of total production of cardamom in the study area (FWLD, GOK 1999). The state government has given tribal communities permission to collect wild cardamom on certain conditions, from time to time. As this cardamom, from undisturbed forests is not contaminated by chemicals (fertilisers, pesticides and fungicides), it is valued more highly for some medicinal preparations.

Cardamom producers

Cardamom producers—the holding-owners with a lease or ownership title to their land—are a diverse group in terms of the size of the holdings (Table 1). The producers are the ones making financial and technical investments in their cardamom lands. Cardamom cultivation is highly labour intensive, the average annual requirement of labour per hectare being 444 workdays. Most producers hire labourers to assist them, but small owners do a considerable amount of the work by themselves.

Table 1. Pattern of cardamom holdings in study area

	Holdings							
	<2 ha		2-20 ha		>20 ha		Total	
	No.	Area	No.	Area	No.	Area	No.	Area
Nelliampathy	28	29	47	398	27	2,522	102	2,949
Idukki	15,383	12,561	3,661	13,920	77	5,526	19,121	32,007
Total	15,411	12,590	3,708	14,318	104	8,048	19,223	34,956

Source: APK 2001.

In 1998, the average annual income for a plantation owner household was US\$3,408.⁵ The average value of the annual production from intensively managed plantations was US\$4,912 per hectare, total expenses amounting to about US\$2,717 per hectare per year. Under less intensive management systems, the value of the average annual production of 1 ha was US\$1,535, with total expenses of US\$1,087.

To increase their inputs growers can avail themselves of financial assistance from various public and private financial institutions. All producers who have legal rights over their holdings can get financial assistance subject to the usual restrictions put forth by the financial institutions. However, not all farmers go in for finance for various reasons. Some of the chief factors determining whether a farmer will go in for high investment through interest bearing loans are the geographical location of the plantation (e.g.,

the location's potential for responding to treatment), the readiness of the grower to take risks related to financial credit (mental preparedness of the farmer to take out a loan) and the grower's socio-economic situation.

Cardamom producers occupy the upper strata of local society financially, socially and politically. Most are reasonably well educated: 83% of the owners of more than 20 ha and 73% of the owners of less than 2 ha have at least passed middle school (Joseph and George 1998). On a national scale producers enjoy an upper middle level status. Some owners and workers have become people's representatives in the *Panchayat* (a local self-government administrative unit comprising a group of villages) and state legislature. There are a number of technocrats and bureaucrats among them. A few large owners are non-resident producers and have other agri-horticultural businesses or other occupations elsewhere.

Box 1. Financial assistance

The Spices Board, a government institution, has come up with several promotional measures to help those in the field. Financial institutions like the National Bank for Agricultural and Rural Development, Village Co-operative Banks, Industrial Development Bank of India, Industrial Finance Corporation of India and local private financing agencies are also in the field of helping producers, processors and traders. There are several schemes for aiding replanting, irrigation, plant protection works, fertiliser application and the building of infrastructure for processing and trade.

Cardamom workers

Workers on cardamom holdings are generally better off than their fellow workers in other agricultural fields. The harvest season itself extends to more than 210 days and hence a worker is assured of employment almost throughout the year, while in other agricultural sectors the average number of workdays per year may be only around 90 to 130. This keeps cardamom workers at an advantageous position much above their fellow workers. The annual income of a cardamom worker also is higher than that of other agricultural workers. A cardamom worker's annual household (consisting of two workers) income is approximately US\$904 (89% of which is derived from cardamom related activities alone), while that of the general household (consisting of two workers) in the study districts is only US\$729. Approximately 75% of cardamom workers are women. Planting, harvesting and cleaning are dominated by female labour, while men dominate in shade control, pitting, soil conservation works, drying and rub cleaning.

Because the study area is thinly populated, holders rely partially on imported labour from neighbouring areas (seasonal labour in-migration), especially in the peak season (roughly from July to October). Also, temporary

labour is imported from adjacent areas for highly skilled work such as shade control, which needs to be carried out every few years. Approximately 43% of the total workforce in the study area is seasonal.

Primary processing

Harvested fruits are sent for primary processing (curing/drying) immediately after harvesting. Primary processing is an integral part of the production process as fruits in the raw form will start to decay within two days. Of the producers 85% have their own facilities for curing, the remaining 15% use another producer's facilities, on a payment basis. The primary processing consists of five stages: preliminary cleaning, drying, rub cleaning, final cleaning and grading, and packing. Harvested fruits are first cleaned removing parts of inflorescence and then taken to the drying unit, which mostly uses firewood to produce hot air. Dried fruits are brought out while they are still hot and the fruits are rubbed till the chaff is separated from the fruits (Photo 2). Winnowing to remove any further waste material is the final cleaning process for cardamom. Because of a shortage of firewood and out of environmental considerations⁶, some producers have begun using other fuels (e.g., oil, LPG, and electricity) for primary processing. The process of improving dryers and rub-cleaning machines is ongoing through trial and error. Some of the newly developed drying units are superior to firewood units in terms of ease of use, speed of drying and quality of end product.

Photo 2. Manual rub cleaning (Photo by T.K.R. Nair)



Final-cleaned fruits are graded using sieves and also by separation by hand of substandard ones in terms of colour, size and shape. Graded cardamom is packed in double gunny bags with a coloured polythene bag in

between. These are then sent to auction centres and entrusted to auctioneers approved by the Spices Board. Some owners send their produce to auction centres without final cleaning and grading. In such cases the auctioneers will arrange cleaning and grading at the owner's expense.

Of the total cardamom production, 95% is sold after primary processing (in the cured fruit form) as a food additive. The remaining 5%, particularly lower quality cardamom, is used for secondary processing.

Secondary processing

In the secondary processing sector essential oil and oleoresins are extracted and the dried cardamom is ground into a powder. All three products are used in the preparation of medicines. Until recently the extraction of the essential oil and oleoresins was done by distillation. Now, 'supercritical fluid extraction technology' is being used in most of the processing units, using carbon dioxide as the solvent for extraction. The processing industries involved in the extraction of the essential oil and oleoresins from cardamom usually process several raw materials, cardamom being only one of them. These industries are medium-scale, technologically intensive and require high investments. At present there are 23 such units in India, 18 of which are located in Kerala.

There are also smaller industries, where dry cardamom is husked and ground into powder, sieved and packed for the market. In addition to medium and large units with mechanical production systems, there are a large number of small home-level producers of medicine throughout the country using cardamom⁷. Kerala alone has 888 such medicine-producing units (Thomas 2000).

Box 2. Extraction of oil

The oil content of cardamom is around 7% of dry weigh. The oil content of the seeds does not depend on the grade of the fruits, which is based mainly on shape, size and colour. Fourteen kilogram of dry fruit will give 1 kg of oil. Cardamom oil is valued at US\$118 per kilogram. The average price of low quality fruit is only US\$6.54 per kg. The percentage of oleoresins and other derivatives distilled from cardamom oil does, however, vary.

Trade and marketing of cardamom

Most holding-owners sell their cardamom at public auction through auction houses registered with the Spices Board, which arrange the auctions at specified times and days. There are 296 registered (first order) traders in India, 118 of whom are in Kerala. About 30 to 50 registered traders take part in each auction. The producers can sell their product to any trader. The sale

value is paid to the producer within 21 days after the auction. If any delay occurs, the producer is entitled to interest as well. The producer has to pay 1% of the sale value to the auctioneer as a service charge and US\$0.02 per kg to the Welfare Fund. If by chance a producer's product is not sold at auction, the material is returned within three days and the producer is at liberty to offer it again for sale. A prospective seller may withdraw his produce from sale at any time before the conclusion of the sale.

Only about 5% of the cardamom produced in India is exported (Table 2), most of it going to the United Arab Emirates, Saudi Arabia and Japan, while the domestic market consumes the rest. A simplified trade diagram, representing the most important trade channels, is given in Figure 2. The bold arrows represent the bulk of the traded cardamom. There are more than 500 retailers in the study area and the number of retailers in India is well above 50,000. Producers also sell their produce directly to traders at negotiated rates. These traders may or may not be registered with the Spices Board. The system is locally known as *kaivella vyaparam*, meaning 'hand-to-hand trade'. This type of marketing takes place only rarely as the price obtained is less than that at auction and payment is not guaranteed. These are arrangements made between two individuals without adequate legal cover, based on mutual trust. Hence payment in time or quantum has no guarantee. But when immediate cash is required, this system may be helpful. These traders sometimes extend financial help to the producers for cultivation and processing and usually sell the material to second order traders or retailers. Less than one percent of the product is marketed in this way.

Table 2. Production, export and value of cardamom (small) in India

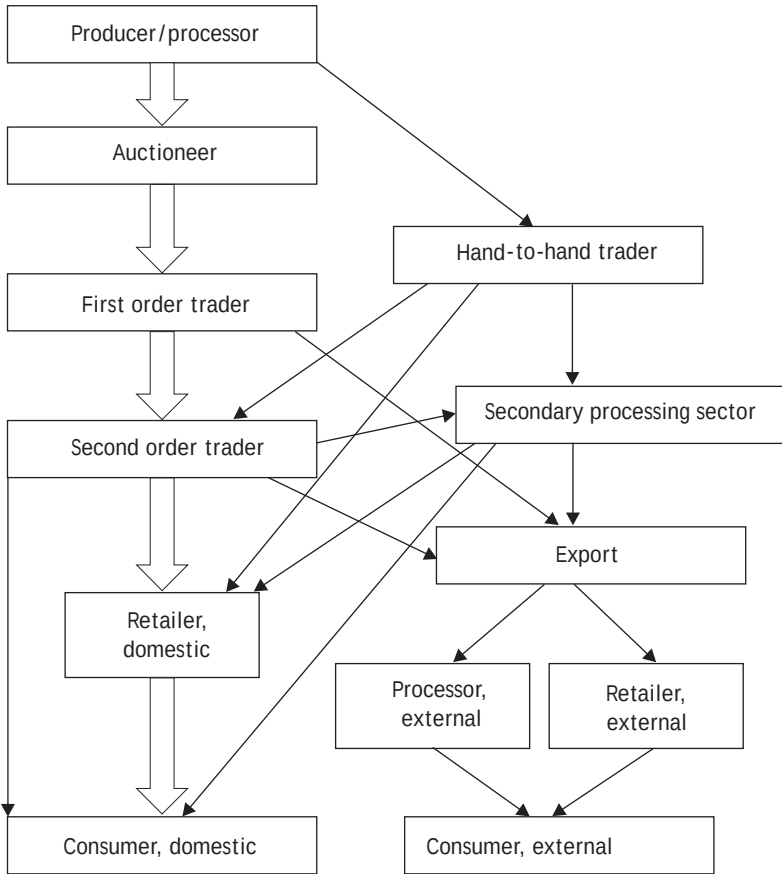
Year	Production (tonnes)	Export (tonnes)	Export value (US\$million)
1988-89	4,250	785	2.55
1989-90	3,100	175	0.68
1990-91	4,750	400	2.36
1991-92	5,000	540	3.39
1992-93	4,250	190	1.63
1993-94	6,600	385	3.16
1994-95	7,000	255	1.66
1995-96	7,900	527	2.82
1996-97	6,625	226	1.89
1997-98	7,900	370	2.75
1998-99	7,170	476	5.49

Sources: Ministry of Commerce, Government of India/Centre for Development Studies, Trivandrum, India Association of Planters of Kerala, <http://indianspices.com/html>

Policy regulations

The entire forestland cultivated with cardamom in the study area had been under government ownership until demand for land for cardamom cultivation increased in the latter half of the nineteenth century. The government started to assign or lease out a major portion of its forestland suitable for

Figure 2. Trade diagram



the cultivation of cardamom since it wanted to encourage cardamom cultivation in a systematic manner. Some areas were given on permanent assignment while others were on lease for different periods. Today, 69% of the area cultivated with cardamom in the study area is under private ownership, assigned by the government, and 31% is state owned, but on lease. Both assignments and leases are governed by a number of regulatory conditions. Cultivators are not authorised to cut or remove the tree growth or switch to another crop without prior permission from the government. These restrictions are to protect the tree growth and to eliminate the chances of the area being cleared⁸. Before 1980 people were allowed to extend cardamom production in forest areas if approved by the state government. Since cardamom is by and large a rather remunerative crop, there was a tendency to open up more and more fresh areas for its cultivation. The government of India did not want to sacrifice any more forest areas and therefore introduced the Forest (Conservation) Act in 1980, banning the use of fresh forest areas for non-forestry purposes including cardamom cultivation.

Box 3. Organisation of producers, workers and traders

Cardamom producers are well organised and have formed various organisations, of which the most important ones are the Cardamom Planters Association (over 60 years old), the Kerala Cardamom Growers Union (since 1974) and the Cardamom Growers Association (since 1992). Of the producers 98% are members of one or another formal organisation, registered with the government. All workers are members of a labour organisation backed by a political party—so much so, they enjoy a lot of political support and possess considerable bargaining power. First order traders have also formed various organisations. Active ones are the Small Cardamom Traders Association (64 members), the Cardamom Merchants Chamber (32 members) and the Thevaram Cardamom Chamber (200 members). Second order traders and retailers are members of local and state merchants associations.

The state government has also taken several measures to protect the interests of cardamom growers. In May 1971 the government of Kerala took over all forests possessed by individuals and companies without paying any compensation and free of all liabilities. These forests thus got the status of government forests. Forest areas principally cultivated with cardamom were exempt from such vesting. Thus, the owners could retain the land because of the presence of cardamom on it. Another concession was granted under the Kerala Land Reforms Act (introducing restrictions to the maximum size of certain agricultural holdings per household to 6 ha) in order to exempt cardamom growers from the land ceiling. The government makes loans and extends subsidies to the cultivators for planting, infrastructure development, water harvesting and the purchase of fertilisers, manure, and plant protection chemicals. Besides this, the government provides technical support through its R&D network.

With the expansion of the market within and outside the country it became necessary to insist on quality control for the product. In order to maintain the traditional quality of the Indian cardamom, and in keeping with modern developments in the standardisation of agricultural products, the Government of India introduced Cardamom Grading and Marketing Rules (Agmark, a symbol of assured quality) in 1962. There are 30 grades for cardamom fruits, 3 for seeds, and 1 for powder (ground cardamom) (Spices Board 1996). The grading of cardamom ensures the quality of the produce, resulting in higher returns for producers. It also encourages producers not to harvest immature fruits.

Box 4. Cardamom exploitation versus selective logging

Logging of timber in natural forests has been prohibited in Kerala since 1987. Only trees that are dead, fallen or standing but dangerous to human life and property may be felled. Nevertheless, it may be interesting to (hypothetically) compare profits from selective logging with those from cardamom cultivation. As per silvicultural principles applicable for selective felling in rain forests, which is usually advised in such forests, following a 30-year felling cycle with an upper ceiling limit of 25 m³/ha, the annual working area is limited to one-thirtieth of the total extent. The maximum volume of timber that could be harvested from 1 ha of forest would be 25 m³. Considering an average price of US\$270 per cubic meter of timber (mainly low priced semi-hardwoods) and taking a forested area of 30,000 ha, the value of total annual removal would be US\$6.75 million. Compare this to the gross annual income from cardamom if the tract is left for production of cardamom alone, which would amount to US\$46.05 million.

TRENDS AND ISSUES—DEVELOPMENT AND CONSERVATION LESSONS**Dynamic changes**

Till the end of the nineteenth century cardamom was not cultivated. It was then purely a forest product of natural origin, and tribal communities residing in the forest used to collect, dry and sell or barter wild cardamom thus collected. Local rulers and chieftains developed the earliest regulations, according to which the produce could only be sold to particular agents. These agents, with prior permission from the local ruler, traded with retailers or foreign buyers on behalf of the local ruler. Since the late nineteenth century the demand for cardamom, and its value, has increased considerably, which led to its 'scientific' cultivation, initially by the British, who were the first to start cultivating cardamom in an organised and systematic manner. At present cardamom can better be designated as an agricultural product since the bulk of it comes from cultivated lands and not from forests as a wild product.

Increase in production and trade of cardamom had a positive impact on the lives of the people associated with it. Major auction centres have been developed during the last 20 to 30 years and presently the economy of the study area depends largely on cardamom. Over the last three decades there has been an appreciable increase in the use of cardamom, in both domestic and international markets, and this trend is continuing.

Conversion of cardamom lands by smallholders

As per Kerala Land Utilisation Order, the conversion of a cardamom crop into other crops without prior permission from the government has been deemed illegal. However, because of the fluctuations in market prices and

the occurrence of diseases, some of the small farmers (especially those with privately owned land) have shown a tendency to switch clandestinely to other crops such as coffee, rubber or pepper. Many of these farmers have experienced that the fate of the alternative crops is not much different and that cardamom does not return easily after lands have been cleared. Farmers have also attempted mixing cardamom with other crops like coffee and pepper, but these attempts have not been very successful because cardamom is highly sensitive to its environment and treatments: it requires 'near natural forest' conditions in and around the growing area and small changes in the microclimatic conditions can destroy a cardamom crop. Excessive removal of shade and clearance of surrounding forests also have an immediate negative effect on the cardamom plant.

The switching of smallholders to other crops has resulted in a reduction of the area under cardamom. At present few cardamom farmers switch to other crops because prices are reasonably steady, varieties that are better resistant to pests and diseases are available, and farmers have access to plant protection techniques. If the price decreases, however, illegal conversion can be expected to increase again.

Possibilities for further development of the cardamom sector

Even though demand is still rising, no further forest area in India can be converted into cardamom plantations because of the restrictions introduced through the Forest (Conservation) Act of 1980. This makes an increase in production possible only through enhancing the productivity of existing cardamom plantations. Attempts to increase production have been successful, as total production has risen while the area under cardamom has decreased. Still, there are several ways in which production, processing and marketing can be further improved.

Conservation of microclimatic conditions, timely application of appropriate fertilisers, plant protection chemicals and sufficient water are essential for optimum production of cardamom. Though organic manures and pesticides are more eco-friendly, experience shows that by themselves these are inadequate to keep up or increase production levels. Judicious combinations of organic and chemical manures and fertilisers have to be further developed if the progeny is to be continued. Improvement in primary processing techniques is necessary, since the curing of cardamom requires huge quantities of firewood, which is becoming scarcer by the day. As per studies conducted by the Regional Engineering College, Calicut, 1 kg of firewood is required for drying 1 kg of green cardamom. Substitutes like oil, electricity or solar power are needed and in a few cases producers have already turned to the use of diesel and electricity. As cardamom areas are bestowed with bright sunshine it should be possible to make use of solar energy for curing work. Also, improvements are possible regarding the storage of cardamom. As production and price are subject to large-scale annual fluctuations, it would be helpful for producers and traders if it could be held in stock for a longer duration, waiting for better days. Cardamom can retain its qualities (e.g., its green colour, which is very important in the market) for more than a year if stored properly. Finally, there should be

a vigorous search for new uses and markets for the product. In this regard it may be of interest that Japanese consumers prefer lower quality (less colour, shrivelled and less than 400 g to a litre) cardamom called the 'sick variety'.

Socio-economic importance

In the study area, vigorous agrocommercial activities associated with cardamom production, processing and trade have caused fast development of the tract in all aspects. Locations that even in the recent past were mere forest camps for transit storage of wild gatherings have grown into townships with all modern amenities including technical higher education and health care facilities and a good network of roads, which is reflected in the lifestyle of the people as well. These developments can be attributed mainly to the commercialisation of cardamom. Had the product not been so valuable, perhaps the present 'cardamom villages' would have remained remote forest camps without modern facilities and high standards of living. In the present situation, cardamom production—being economically more feasible than production of other agricultural crops or logging—provides the livelihoods of the majority of the population in the research area. The collapse of this sector would render thousands of people jobless and result in a social and economic crash of the study area.

Environmental considerations

The intensive management of cardamom causes disturbance to the ecosystem by way of clearance of under-storey and middle-storey vegetation, shade control through the cutting of branches, removal of trees and climbers undesirable to cardamom cultivation, and widespread application of chemical fertilisers and pesticides. Heavy demand for firewood for drying cardamom has also had its impact on the environment. However, as cardamom does not tolerate exposure beyond a certain limit—it needs specific microclimatic conditions and its favoured habitat is primary forest with 50% filtered high shade—lopping of trees has a built-in limitation. Furthermore, it is only the fruit that is harvested, which causes no harm to the individual plant or to the environment and there are no organisms that depend solely on cardamom. The fauna is less plentiful in cardamom forests than in undisturbed forest areas because of constant disturbance and application of chemicals such as fertilisers and pesticides. But cardamom does not exclude wildlife altogether and several species seem to enjoy the additional water and forage facilities available in cardamom plantations. The sambar deer, several monkey species, the great Malabar squirrel and a large variety of birds have been spotted in cardamom estates in Nelliampathy and the High Ranges.

Natural cardamom occurs in the undisturbed rainforest and moist forests of the Western Ghats, one of the well-known ecological hot spots of the world. If original natural vegetation is considered the benchmark of environment, managed cardamom plantations definitely have a negative effect on the ecosystem and regional landscape. However, managed

plantations came into existence more than 150 years ago and disturbance to the primary ecosystem can therefore be taken only as a *fait accompli*. If this argument is accepted, the eco-friendliness of cardamom has to be viewed from a different angle. Had there been no cardamom, the present cardamom lands would have been utilised for alternate purposes, namely, cultivation of mono-crops like rubber, coffee and tea or even for human settlements, resulting in greater environmental deterioration. Considering this scenario, managed cardamom plantations have a positive effect on the ecosystem, insofar as their presence helps to ensure that the current condition of disturbed primary forests is maintained and the environment is protected from further degradation. Further, there are strict regulations against the extension of cardamom plantations into fresh forest areas and cardamom plantations that border natural forests function as a buffer helping to prevent illegal activities such as logging and encroachment. Growers are legally bound to inform the forest department about illegal activities and have an interest in protecting neighbouring natural forests, because degradation of these forests would disrupt the microclimate necessary for cardamom production.

ENDNOTES

1. Sylva conS, Forestry Consultants. Vijaya Bhavan, Olai, Kollam-691 009, Kerala, India. E-mail: sylvacon@vsnl.com
2. Sylva conS, Forestry Consultants. T.M. 16/417, Aiswarya. Kuttimakkool Road, Tellicherry-670 103, Kerala, India. E-mail: cnn_gkutty@sancharnet.in
3. 'Forking', the raking of soil to a depth of 9 cm to 12 cm to a distance of 90 cm around each plant, promotes root proliferation and better growth of the plant.
4. 'Trashing', the removal of old tillers, dry leaves and leaf sheaths, improves the hygiene of the plantation.
5. Exchange rate 1998: US\$1 = Rs46.
6. Cardamom is highly sensitive to the environment and its impacts. If the local environment is damaged, it will affect the performance and very existence of the cardamom crop itself. Therefore the producer who is keen to get maximum net returns from cardamom will be interested in maintaining the tree cover.
7. Cardamom is an ingredient in many Indian medicines, ranging from medicated oils to concoctions and powders.
8. As a result, fuel wood has become a rare commodity, which in turn has stimulated the use of alternative fuels for cardamom processing.

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Chapter 10

Benzoin, a resin produced by *Styrax* trees in North Sumatra Province, Indonesia

Carmen García Fernández¹

Common names	Part of the resource used	Management	Degree of transformation	Scale of trade	Geographic range
Kemenyan, Benzoin, Haminjon toba	Resin	Cultivated	High	International	Medium

OVERVIEW

Sumatran *benzoin* is a resin produced by *Styrax* trees, managed in forest gardens in the highlands of north Sumatra. The resin is used in incense, perfume and pharmaceutical preparations and as a flavouring agent. Trade with foreign countries has existed for over a millennium, first with China and later with Arab countries and Europe. The economic and cultural roles of *benzoin* have undergone major changes in the last few decades. Previously *benzoin* gardening was considered a high status activity which generated high income and made farmers proud. Nowadays some villages have abandoned the practice as other more profitable cash crops have displaced *benzoin* as an income source. The younger generations perceive *benzoin* cultivation as a backward activity, preferring to work in their annual crop gardens or for wages. Nevertheless some farmers remain attached to *benzoin* as they recognise it as the product that gave life to their settlement and provided the means to educate generations of relatives. From a conservation point of view, *benzoin* management represents low-intensity disturbance of the ecosystem and allows the effective accumulation of a forest species while maintaining the forest environment.

INTRODUCTION

Benzoin, a resin produced by several species of *Styrax* trees, is used as a component in incenses, perfumes and medicines. In South East Asia two types

of this resin are produced: Siam *benzoin*, extracted from *Styrax tonkinensis* in Laos, Vietnam and southern China, and Sumatran *benzoin*, extracted from *Styrax paralleloneurum* and *Styrax benzoin* in Sumatra, Indonesia. In the ninth century both types of resin were already being traded in China and used as components of traditional medicine (Sumatran *benzoin*) and perfumes (Siam *benzoin*) (Hirth and Rockhill 1911). Arabs introduced the resin to Europe around the fifteenth century and were instrumental in the expansion of its trade as it was fast becoming one of the most expensive trade products from the East (Burkill 1935). This study focuses on Sumatran *benzoin*, which has the bigger market share of around 4,000 tonnes per year compared to 70 tonnes for Siam *benzoin* (Katz *et al.* 2002), though Sumatran *benzoin* is less valued on the international market.

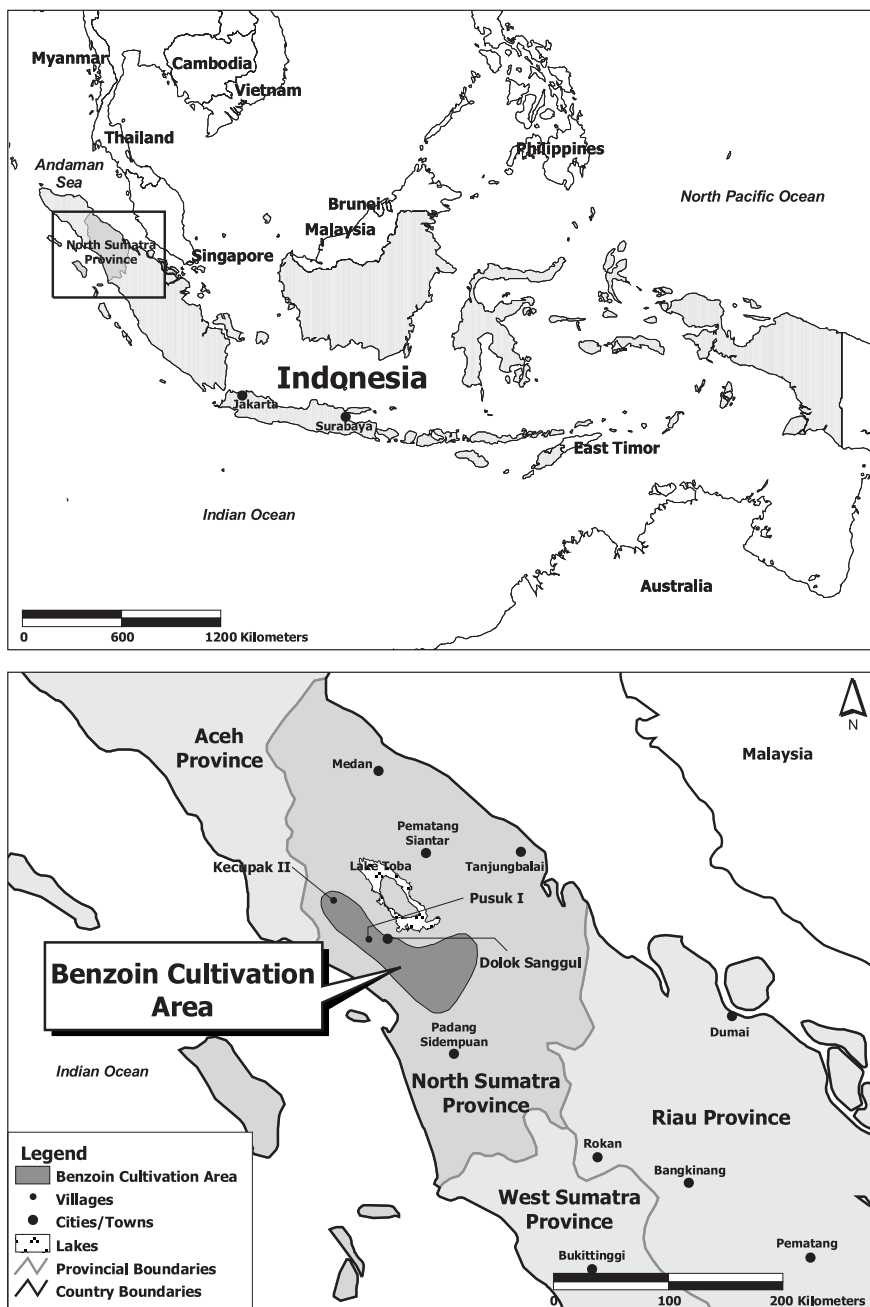
The resin has been extracted for centuries from wild trees that occur naturally on Sumatra Island, and as the market expanded local people started to plant *benzoin* trees in their gardens. It is not clear when cultivation began but it has existed for at least 200 years (Marsden 1986). The management system was already described in Dutch reports in the late nineteenth century, and today's practice does not differ much from the one reported then. These accounts mention *Styrax benzoin* Dryand as the main cultivated species, as its resin was considered to be of better quality and more fragrant. The area then under cultivation reached into the Sumatran lowlands, but nowadays *benzoin* is cultivated only in the highlands (700 m a.s.l.) of North Sumatra province (Figure 1) inhabited by the Batak ethnic group. The dominant species is *Styrax pararelloneurum* Perk, a forest species.

In the Indonesian language *benzoin* areas are called *kebun kemenyan*, which means 'benzoin garden', but the plantation structure is closer to secondary forest, where *benzoin* tapped boles are easily recognisable. The cultivation area covers around 20,000 ha between 700 m and 1,400 m above sea level, 87% of which is in the district of North Tapanuli (Perkebunan 1996). The road network in the region has grown considerably in the last few decades, and most *benzoin* resin is transported south on the Trans-Sumatran highway for over 2,000 km from the town of Dolok Sanggul to Java (Muhtaman *et al.* 1998). Some *benzoin* is transported to the North Sumatra provincial capital of Medan, wherefrom it is shipped to Singapore or Java.

The original submontane and montane broadleaf and *Pinus merkusii* forests have a long history of conversion to agricultural uses and cattle grasslands (Boomgaard 1994). *Benzoin* gardens not only play an important role as forest remnants in an area where major land use changes are taking place, but also represent an important source of income for around 18,000 households in over 100 villages in the region.

Incense, which is the main use for the resin both in Indonesia and internationally, is used in traditional ceremonies and rituals as a link to the spiritual world, especially so in Java and Sumatra. Buddhists, Christians, Hindus and Muslims in religious ceremonies burn incense with *benzoin* resin among its components. Even so, few consumers would recognise the original product extracted from the trees. *Benzoin* incense is rarely pure as factories mix it with *damar* resin (from *Shorea spp.*) and other ingredients to make incense blocks, which burn more slowly and reduce the final price (Katz *et al.* 2002).

Figure 1. Location of the study area



Source: ESRI Data and Maps 2002.

In Central Java there are a few local industries that still produce a traditional cigarette called *Klembak menyan*, smoked mainly by older men (Goloubinoff 1998), the main components of which are tobacco enriched with *benzoin* resin, *klembak* (*Rheum officinale*) and cloves (*Syzygium aromaticum*). *Benzoin* resin is also used as a flavouring agent in the clove cigarettes industry, which represents an important national market. In 1993, 140 billion cigarettes were produced in Indonesia (Tarmidi 1996). It is also used in pharmaceutical preparations as an expectorant tincture for bronchitis and laryngitis, and as an antiseptic to prevent infections (Burkill 1935). The resin is also an important component of traditional Chinese medicine (Coppen 1995). In the area where it is cultivated people use it for stomach ache and skin diseases, and local shamans burn it during curing ceremonies (Katz *et al.* 2002). Nevertheless, the number of applications of *benzoin* as a component of Western medicines has decreased as synthetic products are replacing many natural substances. The same situation is also true for the perfume industry.

The research reported here started in 1996 and was completed in 2000. The teams involved in the study covered different areas of expertise in order to get a global view of the current situation of the *benzoin* system. Two villages were selected as subjects of in-depth studies, Kecupak II in Dairi district and Pusuk I in Tapanuli Utara district, both in the province of North Sumatra (Figure 1). These villages were chosen to represent a cross-section of *benzoin* cultivating communities. In Pusuk income from *benzoin* still plays an important role in the village economy, while in Kecupak *benzoin* is a marginal activity as other cash opportunities are available (Table 1).

Table 1. Characteristics of study area village (Extracted from Lutnæs and Løken 1999)

	Pusuk I	Kecupak II
Number of households	330	170
Village extension (ha)	3600	1100
Altitude (m)	1100	950
Sawah (wet ricefield) extension (ha)	300	55
Ladang (fallow land) extension (ha)	250	110
Benzoin gardens extension (ha)	700	108
Active benzoin households 1988 (%)	82	48
Active benzoin households 1998 (%)	76	17

THE PRODUCTION-TO-CONSUMPTION SYSTEM

Species ecology

Styrax is a genus with 120 species distributed over Asia, Europe and America. They are evergreen trees of medium size, up to 35 m tall and 100 cm in diameter. Leaves are simple and alternate, with bisexual flowers disposed in terminal to auxiliary inflorescences, and globular fruits, rarely dispersed by

animals, usually with only one seed (Hoesen 2000). Sumatran *benzoin* resin is extracted from *Styrax paralleloneurum* and to a lesser extent *Styrax benzoin* trees. According to farmers *S. paralleloneurum* needs shade during the first stages of growth and is therefore planted under forest cover. The tree grows well in irregular terrain. *S. benzoin* on the other hand is planted in dry rice swidden in flatter areas with good drainage.



(*Styrax paralleloneurum*)

S. paralleloneurum (the species on which this report focuses) flowers from May to August. Flowers are bisexual, small and disposed in racemes or panicles. Farmers use flowering together with leaf colour as indicators to determine whether trees are ready to be tapped. Fruiting lasts from July to December, mature fruits are globular or oblong berries, 2 cm to 3 cm in diameter. *S. benzoin* flowering and fruiting are not periodic, and thus flowers and fruits are found all year round.

Benzoin resin is an exudate produced when the cambium is wounded, most probably from newly formed cells at the end of rays in the xylem (Hoesen 2000). The resin is soft and sticky when collected from the trees, melts easily when heated and has a pleasant smell with a touch of vanilla. *Benzoin* trees can be used only for temporary construction, as the wood is rather soft and non-durable. It has a coarse grain and a density of 470 kg/m³ to 710 kg/m³ at 15% moisture content (Hoesen 2000). Rather than cutting trees that have become unproductive with age, most farmers prefer to abandon the area as *benzoin* is of cultural importance and the trees are believed to be inhabited by spirits.

Garden management

S. pararelloneurum Perk (*haminjon toba* in Batak Toba language) propagules are planted under forest cover. Farmers select a plot ranging from 1 ha to 3 ha in primary or old secondary forest and clear away small and medium shrubs and trees by slashing with a machete. According to the farmers, the gardens are established during the rainy season, preferably from seedlings. Planting material is collected from other gardens, from the best parental trees. Seedlings have to have at least two leaves, be below 50 cm in height and be young enough to avoid root damage and to facilitate transport to the new location. Seeds are also used for propagation as they can be easily stored for a longer period. Farmers collect seeds from old gardens and submerge them in water, discharging those that float. However, few farmers choose the option of using seeds for planting.

The garden is weeded every two to three years until tapping commences, when weeding becomes an annual activity. Tapping starts when the trees are 7 to 10 years old, coinciding with the first flowering, and can continue for 60 years if the trees are kept in good condition. Farmers frequently plant other species besides *benzoin* as part of a *benzoin* garden to provide additional food for the household. Some of the species planted besides *benzoin* are *petai* (*Parkia speciosa* Hassk.), *jenkol* (*Pithecellobium jiringa* [Jack] Prain) and some fruit trees like mango (*Mangifera indica* [Dalz.] Airy Shaw) and *rambutan* (*Nephelium lappaceum* L.). During the tapping and harvesting seasons a farmer usually stays for several days in a hut near the *benzoin* garden (away from the family home). Bananas, chilli plants and other food plants are usually grown close to the huts. At lower altitudes farmers also grow some other species like coffee (*Coffea* spp.), cinnamon (*Cinnamomum porrectum* Kosterm.) and rubber (*Hevea brasiliensis* [Willd. ex A. Juss.] M.A.). Although these species also have a commercial value, *benzoin* remains the main cash crop in the garden. Farmers favour the growth of wild species with subsistence value, for example, species that can be used for their fibres or medicinal properties.

Plantation density varies widely ranging from plantations like G1, with an average density of 500 *benzoin* trees per hectare to forestlike gardens (G3) with around 250 *benzoin* trees per hectare on average (Table 2). Along this exploitation gradient the decrease of *benzoin* density implies the gain in density of other tree species and therefore in species richness.

The tapping and harvesting of *benzoin* trees

Benzoin trees are tapped once a year and up to three flows can be collected, the first of which provides the highest quality resin. Not all the trees in a garden are tapped depending on the farmer's cash needs and the trees' physiological condition. For example, trees that, for whatever reason, have not changed their foliage throughout the year and trees that have just recently changed foliage are not tapped. Farmers generally will not attempt to tap a tree that is not yet ready, according to their criteria, as doing so may result in the death of the tree, but some overexploit *benzoin* trees by increasing the number of wounds per tree. This results in a weakening of the tree, which then becomes more susceptible to disease.

Table 2. Average values for some variables in the different structural groups of gardens along a gradient of exploitation (G1 to G3)

			
	G1: Plantationlike gardens	G2: Gardens with intermediate characteristics	G3: Forestlike gardens
<i>Benzoin</i> dbh ^a ≥10 cm (trees/ha)	477	357	270
Other trees dbh ≥10 cm (trees/ha)	113	263	318
Tree species richness ^b (1,000 m ²)	26	41	44
Labour input (hour/ha*year)	447	245	166

^a Diameter at breast height.

^b Considering all diameter classes (dbh ≥ 2 cm).

Once a *benzoin* tree is selected farmers clear away small to medium size trees and shrubs within a 1 m radius of the tree to facilitate access, reduce competition for nutrients, increase light etc. The tree's bole is then cleaned of mosses and lichens and dead bark removed from the wounds of the previous year, collecting the last flow of resin. An adult tree receives between 20 and 30 wounds, in two to four rows. Ropes of sugar palm fibre are used to climb to a height of 5 m to 6 m (Katz *et al.* 2002). Additional care includes cutting dead branches and the removal of parasitic plants from the branches as they damage the *benzoin* bark, resulting in a decrease in production (Jayusman *et al.* 1998).

Benzoin resin is harvested manually using simple tools but the activity requires skills to climb the trees (Rohadi 1999). The first flow is collected three months after tapping. Farmers know that a tree produces around 200 g of high quality resin for the first flow, while second and third flows produce a little less. For a good producer the figure can go up to 500 g, depending largely on the farmer's management practices. The production per hectare per year ranges from 40 kg to 120 kg for *takasan*, the first flow. On average a farmer can collect between 2 kg and 3 kg of resin per day, a full rattan basket, or *bakul*. Jayusman (1997) gives higher values of 300 kg of total resin per hectare and 6.45 kg to 7.5 kg of resin collected per person per day. Production can be increased by changing the commonly practised tapping technique from vertical incisions, which on average yield 11.9 g per incision per year, to horizontal ones yielding 15.6 g on average (Sasmuko 1999).

The *benzoin* management system implies a transformation of the natural forest in its structure and floristic composition. Three main groups of gardens can be discerned, with density, diameter and height of *benzoin* trees progressively declining from G1 to G3 (Table 2), marking a clearly defined structural gradient along the three groups. At the same time, the higher

Photo 1. Farmer climbing a *benzoin* tree to collect resin (Photo by E. Katz)



the density of *benzoin* trees the lower the density of other trees with a diameter at breast height of 10 cm or more in the garden. These differences in structure are strongly correlated with management activities. Management practices also determine diversity levels in gardens, with species richness increasing as intensity of management (defined as density of trees plus man-days of management per year) decreases (Table 2). The *Benzoin* management model implies frequent (annual) but low intensity disturbance, especially in gardens in G3. The removal of competitor species around selected *benzoin* stands by machete allows species with vegetative growth a means by which to persist in the garden. This will influence not only the garden diversity but also the diversity value of the resultant secondary forest, once management stops, with diversity values similar to those of primary forest (García-Fernández *et al.* in press). No studies have been conducted on the impact of *benzoin* gardens on animal populations, though it is most probably negative as farmers are in the habit of putting traps close to their gardens to capture birds and monkeys, among others, to sell in city markets.

Box 1. Wild *benzoin*

Wild *benzoin* trees are locally exploited in some areas of Sumatra. The first farmer to tap a wild tree gains the property right to it. Production, as described by farmers, is significantly higher for wild trees approximately 20 years old. With the first tapping it is possible to collect up to 5 kg of resin compared to 0.5 kg from a top producing cultivated tree. The explanation given by farmers is that wild trees are more vigorous because, unlike cultivated trees, they have not been tapped annually since they were 7 to 10 years old. Nevertheless the amount of resin collected from wild *benzoin* trees is negligible and impossible to track down in the production system.

Socio-economic context of raw material producers

The economic role of *benzoin* in the study area has declined over the last few decades and it is currently facing some challenges that may have an important impact on the future of the system. Up to the early 1970s *benzoin* production was considered an activity with a good profile, providing high income and well perceived socially. Cultivation of more profitable annual cash crops and the loss of market value have slowly undermined *benzoin*'s position. While in the early 1970s 1 kg of high quality resin was exchanged for 32 kg of rice, by the late 1990s one needed 2 kg of resin to buy the same amount of rice. Moreover, the younger generation perceives forest activities, including *benzoin* gardens, as backwards and of low status. Few new gardens are opened nowadays and the existing gardens are getting too old to be exploited. To date farmers have opted to rejuvenate gardens by introducing *benzoin* seedlings to replace old trees, with a decrease in total production.

The contribution of *benzoin* to household income can amount to as much as 70% of total income (Rohadi 1998). This value represents one extreme and the average is around 30% to 45% of total income, still a significant share. The middle-income group² has an average annual household income of US\$482³ and *benzoin*'s contribution ranges from US\$144 to US\$216. Money from *benzoin* is traditionally used to pay school fees. In the past when prices were higher it served to put several generations of Bataks through university.

*Benzo*in exploitation is a male dominated activity. In the case of death of the household head, the wife may get involved in *benzoin* exploitation directly, but as a rule she would rent out the garden. Though women are not directly involved in the exploitation of the resin, they have a very active role in managing the money provided by its trade and in some cases they get involved in trading the product.

Labour inputs vary widely from 15 man-days/year/ha to 120 man-days/year/ha reflecting two opposite ends of the *benzoin* system in relation to its relevance as a source of income. Farmers with a more diversified production system and other cash options are situated at the bottom level of this range. The same is true for low-income households where labour is a limiting factor

and most efforts are directed towards ensuring a good rice harvest. On average, farmers spend 60 days/year/ha on benzoin related work, divided between slashing and clearing away undergrowth and other vegetation, preparation, tapping and resin collection. In a day's work a farmer can tap five to eight trees or harvest 10 to 15 trees since less time is required for harvesting than for tapping.

Trade and Marketing

Benzoin has been traded for centuries. The trade system has developed over this long period of time and remains quite traditional and secretive for some of the processing steps. It relies on trading networks and relationships established over several generations as well as on specific technical knowledge. In Indonesia, several groups are involved in the market chain: village collectors, regional traders, retailers, inter-island traders and exporters (Katz *et al.* 2002). Along this chain *benzoin* resin is sorted and transformed, and the further up *benzoin* moves in the chain the more complicated classification becomes (Goloubinoff 1999). Most farmers do not sort out the resin so lumps of resin of different sizes and flows are mixed. The first flow of resin is collected from inside and outside the wounds and the second and third flows are usually sold together. At the traders' level and without considering the volume of *benzoin* traded, *benzoin* processing may involve sorting or further transformation. In the sorting process resin lumps, once they are cleaned and dried, are separated and classified according to size, quality (according to the harvesting period) and colour. Besides sorting the *benzoin*, some traders, especially the big ones, carry out further processing by shaping the resin into blocks. To this end the *benzoin* resin is mixed with a certain amount of *damar* resin, the mixture rinsed with hot water until it melts, poured into a box and then pressed until it solidifies (Muhtaman *et al.* 1998). Quantity and quality of *benzoin* resin, and the amount and nature of other substances used, will determine the final quality of the block. Most of the industries where natural *benzoin* resin is transformed into blocks are located in Central Java, others are in Singapore and North Sumatra.

Around 120 villages still have productive *benzoin* gardens. The villages have 5 to 10 middlemen, some of whom are also *benzoin* farmers. The total number of village first order traders is approximately 840 and the volume of resin traded is around 300 kg/month/trader.

Village middlemen sell their *benzoin* to district traders or dealers. District traders collect 500 kg to 2,000 kg per month. Their main providers are village middlemen and, to a lesser extent, farmers. Dealers have large scale businesses with 8 tonnes to 18 tonnes per month, which they buy from village middlemen and district traders. At the exporters level, normally several individuals are associated in a joint venture to run the business as large amounts of capital are involved. Most of the resin exported is shipped to Singapore where it is processed before being exported to a third country. A study by the Indonesian non-governmental environmental organisation Lembaga Alam Tropika Indonesia on the *benzoin* market estimated that there are 10 to 15 district traders and dealers, and fewer than five export firms. Farmers are more numerous than traders and have low bargaining power.

Photo 2. The *benzoin* market in Dolok Sanggul (Photo by G. Michon 1997 © IRD)



To estimate the forest product's value in the finished product is difficult in the case of *benzoin* resin. In *Klembak menyany* cigarettes the proportion of the value of the raw material in the final product is around 27% (Alwy and Djatmiko 1999). For incense this calculation becomes harder as the industry is more secretive and the end product is more heterogeneous, involving different amounts and qualities of *benzoin* resin. For the lower qualities of incense, the value of *benzoin* in the end product ranges from 20% to 40%. For special ceremonies incense with a higher content of *benzoin* resin may be burned, in which case the *benzoin* proportion may range from 50% to 100% of the final value, though a realistic average can be established around 60%. Perfumes and pharmaceutical preparations use small quantities of *benzoin* and no estimations for the proportion of raw material value in the finished product were found.

Drying, cleaning and resorting along the trade chain all add value to the product (Goloubinoff 1999). Marketing profits increase as we move up the trade chain and so do the risks. Traders require good technical knowledge of the product, particularly when transacting with sellers, since they have to determine the composition of the *benzoin* mixture they are buying. The ability to estimate quality and quantity of different grades of *benzoin* in a mixture largely determines the buyer's profit (Muhtaman *et al.* 1998). At the farmers' level there are four established qualities based on resin flows and the amount of impurities, whereas at the traders' level one may find up to 16 qualities as more complex criteria are involved in the classification (Muhtaman *et al.* 1998).

The difficulty in entering the trade chain increases as we move up, as larger volumes of resin and capital are involved. Family ties play an important role in *benzoin* transactions as through clan relationships a trader can establish a strong

network of suppliers (Muhtaman *et al.* 1998). Nevertheless the lack of family ties is not a barrier to entry into the business.

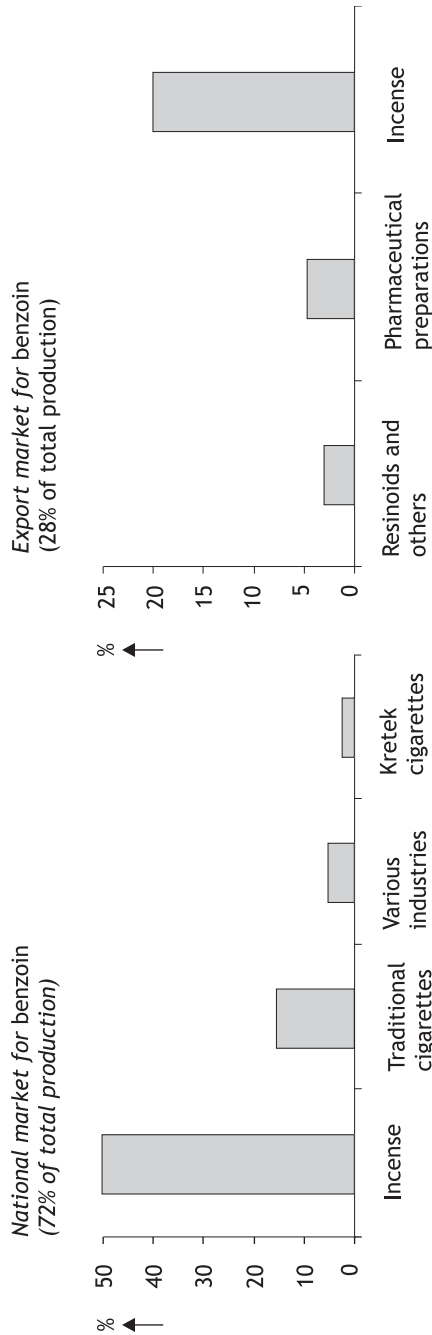
Official data show that 4,970 tonnes of *benzoin* resin from North Sumatra was traded in 1993, of which 4,700 tonnes were produced in Tapanuli Utara district, with a value of around US\$6 million (BAPPEDA 1995). In 1996 Tapanuli Utara produced 4,200 tonnes of *benzoin* resin (Perkebunan 1996). Production in this district dropped further to 4,000 tonnes in 1998, at a value of US\$4.8 million (assuming a price of Rp10,000/kg and an exchange rate of Rp8,300 to the U.S. dollar). The *benzoin* trade volume is decreasing as a result of replacement of *benzoin* with other substances and the erosion of ritual ceremonies diminishing demand for incense, combined with farmers shifting towards other, more profitable activities. Most *benzoin* is used in the production of incense for both the national and international markets (see Figure 2).

Policy Environment

Over the centuries communities have developed various types of communal land management systems, which were regulated by customary laws or rights. These traditional tenurial systems were first overridden by the Dutch colonial government taking control of forestlands in areas that were not under permanent cultivation. After Indonesia's independence a land reform took place, and the new Basic Forestry provisions (Act No. 5/1967) stated that 'all the forests within the territory of The Republic of Indonesia, including the natural resources they contain, are controlled by the state'. The law failed to include customary rights of communities living in forest areas. Local government, however, recognises these customary (*adat*) tenurial systems where the planting of trees indicates tenurial rights and unused land reverts to the state⁴ (McCarthy 2000). Thus *benzoin* trees confer property rights to land where the garden is established. *Benzoin* garden rights include the right to use, sell or rent out the land (in whole or part). Farmers were allowed to use and manage these forests according to their traditional laws even before the forestry reform but ownership of the forests remained with the government. For the time being state and traditional laws coexist without conflict. *Adat* (customary regulations) does not work as a co-operative unit dealing with the *benzoin* market or the establishment of resin quality standards, but as a regulator in conflict resolution and land adjudication. Farmers are well aware of their customary laws, but in some communities these are becoming less respected as the *adat* system is beginning to break down (Michon and Saragih 1999).

There are no formal barriers to impede access to *benzoin* production other than traditional regulations to control access to land. Farmers do not require a large amount of capital to start a *benzoin* garden as simple tools are used and no external inputs are needed. Labour and land availability are the main constraints. The permit to open a *benzoin* garden is in theory granted by the *adat* representative accountable for the forest area where the plot is located. Originally the different clans living in a village owned separate forest areas inside the communal or *adat* forest, but nowadays these forest areas are more heterogeneous and it is possible to find *benzoin* farmers of different clans who have accessed areas by marriage or by purchase of the land.

Figure 2. National and export markets for benzoin (percent of total production)



Source: extracted from Katz *et al.* 2002.

There are few government regulations concerning *benzoin*. The Ministry of Forestry Decree No. 20/1997 established a tax of 6% of the average price at the local level to be levied on forest products including *benzoin* resin. However, this regulation has never been implemented. Farmers have refused to accept it as they consider *benzoin* trees to be within their communal lands, not within public lands, thus *benzoin*, for them, does not belong to the category of other forest products (rattan, bamboo etc.) extracted from public areas (Rohadi 1999). Moreover, regulations at the local level identify *benzoin* as a garden product, and therefore regulated by the Ministry of Agriculture, not by the Ministry of Forestry.

The law allows communities to utilise customary forest management systems as long as they do not conflict with forest sustainability (McCarthy 2000). According to a recent ministerial decree on 'community forestry' (*kepmen* 677/1998), communities could gain rights to manage areas of forest based on community practices and *adat* law. The new legislation has put in place the procedures for gaining community forestry concession rights and co-management strategies, advocated by non-governmental organisations, but they are onerous and therefore unlikely to be extended on a wide scale (McCarthy 2000).

TRENDS AND ISSUES—DEVELOPMENT AND CONSERVATION LESSONS

Efforts to promote *benzoin* production

Interest in *benzoin* resin conservation and development potential has increased over the last few decades (Simanjuntak 1996; Parsell 2000). Attempts were made to find new end products and to establish processing factories in the raw material area (Edison *et al.* 1983; Sagala *et al.* 1989), but so far results have not materialised. In 1992, a joint venture was initiated to help *benzoin* traders to export the resin to Japan, the Netherlands and France (Muhtaman *et al.* 1998). The program called 'Development of Small Ventures' was still ongoing in 1997 with 3 tonnes exported that year.

Government investments to support *benzoin* production are limited and in most cases have failed because of mismanagement. In 1974 a program to replace old *benzoin* trees was started, and the government provided funds to village co-operative units to support *benzoin* marketing but it failed to follow up (Muhtaman *et al.* 1998). The local government issued soft loans to stabilise the *benzoin* market through the Indonesia National Bank in 1980 and through the Bank of Central Asia in 1986. These efforts met with poor results as the lack of a standardised system for grading resin, resulting in erroneous estimations, and the mismanagement of funds were considered to be the main causes of failure (Muhtaman *et al.* 1998; Rohadi 1999).

Official data indicates a reduction in the number of hectares under *benzoin* cultivation in the study area, as many of the gardens are getting old and unproductive and consequently become abandoned. Few new gardens are being established as *benzoin* prices are not as good as before and farmers opt to plant other more profitable crops introduced to the area in the late 1960s and early

1970s. A few official research institutes and extension offices are trying to promote *benzoin* gardens by introducing programs in which *benzoin* is cultivated with more profitable crops like *gambir* (*Uncaria gambir* Roxb). The Forestry Research Institute in Pematang Siantar has devoted funds to the study of *benzoin* cultivation, exploitation and marketing techniques over the last few years. The research results dealing with planting materials and tapping techniques are to be published in a manual about *benzoin* cultivation (Rohadi 1999).

The future of *benzoin*

The market in *benzoin* for the production of perfumes and medicines is to some extent hindered by synthetic substitutes. It is a relatively small market, however, as most resin is used in the incense and traditional cigarette industries. Both of these uses are also facing challenges. With the modernisation of Indonesian society some of the rituals and ceremonies in which *benzoin* was burned are now considered old fashioned by the younger generation. Because most smokers of *Klembak menyan* cigarettes are old people and the younger generation prefers Western style cigarettes, this industry has suffered a major decrease from 70 cigarette factories in the 1950s and 1960s to just 14 at present. The future of *benzoin* depends on the maintenance of traditional ceremonies, where most of the resin is consumed, and on the modernisation of some end uses to enter niche markets for sustainable and organically produced commodities.

Conservation and development lessons

Benzoin gardens are established by local farmers who manage a diverse mosaic of forested and agricultural areas along a gradient of increasing human input. As *Benzoin* gardens are established under forest cover by eliminating competing species and favouring *benzoin* stands, the forest cover is progressively modified. Once management is abandoned, the resultant secondary forest reaches diversity levels close to primary forest. However, species typologies indicate a certain degree of degradation when compared to primary forests. Garden management does reduce biodiversity by decreasing species richness and/or by degrading species composition. But strict conservation that sacrifices basic human needs of the present for those of the future is essentially unfair (Gomez-Pompa and Kaus 1999). Fencing the forest to protect it is a short-sighted strategy to achieve biodiversity conservation in the long run.

The *benzoin* system could act as a complement, rather than an alternative, to protection areas, where local communities are counterparts of the environmental conservation process. This management system could maintain high diversity without compromising ecosystem resilience in the long run. Though farmers' prime objective is to maximise cash income, their management does not have a negative impact from the conservation point of view. In fact, within this regional context, gardens are a good conservation strategy to maintain forest cover, among other things.

At the landscape level, *benzoin* gardens cannot be considered a homogeneous land use, but rather as a range of small units defined by their intensity of use and integrated into a tessellated landscape, which includes primary and secondary forests and non-forested areas. It is within this context that intermediate management systems⁵ are particularly relevant as a conservation strategy to preserve biodiversity in the region, as happens with other systems elsewhere in the tropics (Padoch and Peters 1993; Lawrence and Mogeia 1996; Lawton *et al.* 1998).

The government has paid little attention to this management system, as non-timber forest products are normally given low priority on its agenda. This lack of strategy has neglected a product that offers a sustainable forest management system while providing communities with a source of income. There is scope for a *benzoin* system to be promoted. Recognising the importance of this product over the centuries and its present potential, interest from the research community has risen in the last decade. However, it is difficult to predict the result of interventions if they are not combined with stabilisation of *benzoin* prices, secure land rights and the improvement of the 'image' of forest related activities, which are nowadays perceived as backwards in the study area.

ENDNOTES

1. Departamento de Ecología, Facultad de Biología Universidad Complutense de Madrid. 28040 Madrid, Spain. And: CIFOR-Embrapa Oriental, Trav. Enéas Pinheiro S/N. 66.905-780, Belém, Pará, Brazil. E-mail: c.garcia@cgiar.org; mcferna@bio.ucm.es

2. Based on Lutnaes and Løken (1999) economic survey households were divided in three categories (low, middle and high) according to their income level, to explore the link between income and dependence on forest products and revenues from *benzoin* trade.

3. Calculated exchange rate (time of the fieldwork 1998-2000): US\$1 = Rp8,300.

4. Local governments do 'recognise' these traditional systems only informally as state law declares that forest areas belong to the state. The local government normally respects these traditional systems but in case of conflicting interests the state always wins.

5. 'Intermediate' refers to forest production systems between 'natural' forest management (basic resource collection in natural ecosystems) and 'plantation forestry' of specialised, intensively managed stands of trees.

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Chapter 11

The marketing of *tout tiang*,
a climber belonging to
the Urticaceae family, in Lao PDR

Joost Foppes¹, Vannalak Sengsavanh², Michael Victor³,
Viloune Soydara⁴ and Sounthone Ketphanh⁵

Common names	Part of the resource used	Management	Degree of transformation	Scale of trade	Geographic range
Shui-mao-pi, Tout tiang	Bark	Wild	Medium	International	Medium

OVERVIEW

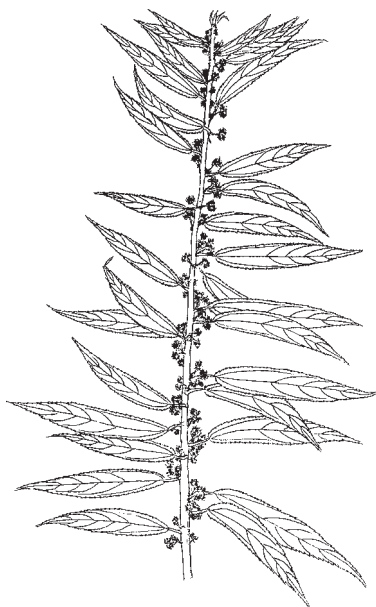
The people from Tat Mouan village in northern Lao People’s Democratic Republic (Lao PDR) collect the bark of the climbing shrub locally known as *tout tiang* (a member of the Urticaceae family) from the wild. Marketing started only 10 years ago. Locally established rules and regulations, which state that only the people from Tat Mouan may harvest from its surrounding forest, have not prevented the rapid depletion of *tout tiang* resources as a result of commercial demand. Harvest is driven by the demand from foreign companies that export the *tout tiang* bark to China, where it is used to make glue for incense sticks. Quantities harvested depend on the capacity of the export company rather than resource availability and regeneration capacity. As a response to the depletion of the resource, the farmers of Tat Mouan, in collaboration with a donor sponsored non-timber forest product project, started experimenting with domestication of the product. In this report the production, marketing and surrounding policy systems are described. The main finding is that these systems have failed to provide much incentive for sustainable production so far. The report concludes with several recommendations for sustainable use of *tout tiang* to improve the livelihoods of people in northern Lao PDR.

INTRODUCTION

Tout tiang is the local name for a previously little known climber found in northern Lao People’s Democratic Republic (Lao PDR). The species remains to be determined by international botanists. As a member of the Urticaceae

family, it is most likely *Boehmeria malabarica* Wedd, but it could also be *Debregesia longifolia* Wedd. Since the 1980s the bark of this climber has been exported to China, where it is known as *shui-mao-pi*, a traditional favourite for incense making. The Lao name *tout tiang* is derived from the Khamu language, a large ethnic group in northern Lao PDR. Other Lao names for the product are *nang tiang*, *peuak meua* and *sa phan*.

Non-timber forest products (NTFPs) are an important part of people's livelihood systems in Lao PDR. By documenting the case of *tout tiang*, the authors hope to contribute to the development of sustainable NTFP use systems. Finding an alternative source of income from forest resources, other than timber production, is essential for forest management in Lao PDR for the long term (Foppes and Ketphanh 2000).



(*Debregesia longifolia*)

Box 1. Trade of NTFPs between Lao PDR and countries in the region

Since the opening of trade with its neighbors, Lao PDR has exported several NTFPs to China, Vietnam and Thailand. Exported products include Chinese cardamom (*Amomum villosum*) and *she hu* (orchid stems) (*Dendrobium* sp.), both used to produce medicines; edible *nor khom* (bitter bamboo shoots) (*Indosasa sinica*); and handicraft products made from khem (broom grass) (*Thysanolaema maxima*) and rattans (*Calamus* spp.), among others.

IUCN-NTFP Project

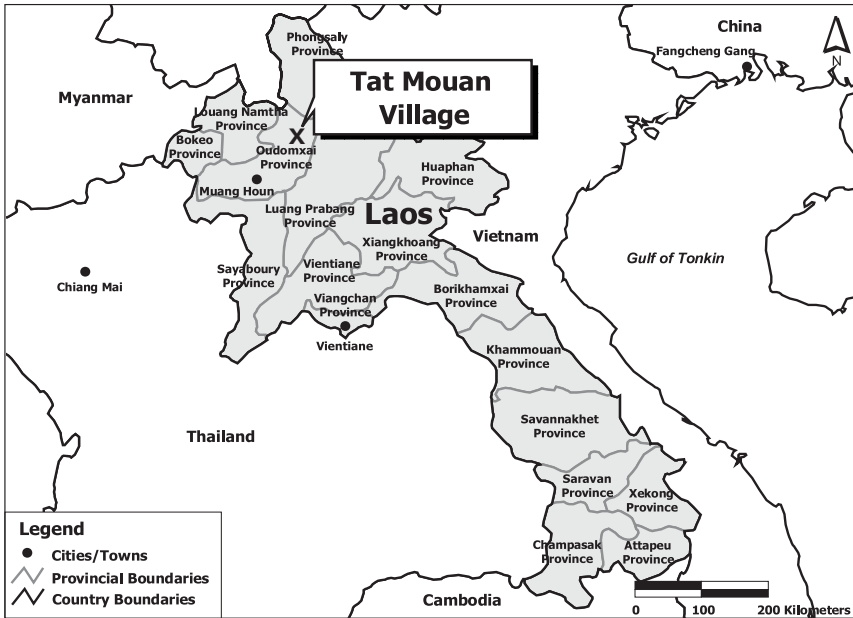
Information presented in this paper is the result of collaborative work between the International Union for Conservation of Nature and Natural Resources (IUCN) and the government of Lao PDR in supporting village communities in Oudomxai Province to improve their *tout tiang* production. The Department of Forestry implemented the NTFP project from 1995 to 2001, with technical assistance from IUCN and financial support from the Royal Netherlands Government (IUCN 2001). The IUCN-NTFP Project generated a number of valuable 'lessons learned' (Nurse and Soydara 2001) from its collaborative work with villagers and government organisations on methods of, and models for, the management of community forests, focusing on sustainable harvesting, domestication, marketing and processing of NTFP. The project operated through three field teams in the provinces of Oudomxai, Salavan and Champasak. These field teams are continuing to operate as permanent NTFP research and extension units of the Provincial Agriculture and Forestry Offices, with research support from the National Forest Research Centre.

Tat Mouan village and surrounding area

Northern Lao PDR is characterised by steep, mountainous terrain. Only 5% of the area has a slope of less than 20%, while 46% has a slope of more than 30%. Its remoteness sustains a diverse range of ethnic groups, biodiversity and ecosystems. With low population densities, the predominant traditional swidden upland agriculture has resulted in an ecologically diverse mosaic of forests and fallow lands. Over thousands of years, a cultural preference for glutinous rice as the staple food has made this area a unique genetic pool of global significance for glutinous, upland rice varieties (IRRI 1998). The main economic crop in northern Lao PDR is opium, cultivated at altitudes above 1000 m. The area bordering on Yunnan province of China, Myanmar and Vietnam shares a diverse fauna and flora, which remains remarkably little studied (Rundell 1999; IUCN 1999).

Tout tiang is thought to have originally occurred in all northern provinces of Lao PDR, but agricultural practices have caused a reduction in the resource in many provinces. The occurrence of *tout tiang* in Lao PDR now seems to be limited to five provinces: Luang Nam Tha, Bokeo, Oudomxay, Houaphan and Phongsaly. Together, these provinces stretch over 61,812 km² and sustain 897,700 inhabitants, 25% of whom are estimated to be actively collecting *tout tiang* bark. About half of the land (31,715 km²) is classified as 'non-stocked forest' (fallow lands, grasslands etc., where trees will emerge later) as a result of shifting cultivation, with (mostly secondary) forests covering about 40% of the area (25,455 km²). The climber *tout tiang* grows only in the immediate vicinity of mountain streams in mature forests. These forests are classified in Lao PDR as upper mixed deciduous forests, characterised by more than 50% deciduous trees and bamboo, an average tree diameter of 20 cm to 30 cm diameter at breast height and tree height of 15 m to 20 m (Manivong and Sandewall 1992). In adjacent northern Thailand, where similar forests occur at elevations of 1,000 m to 1,800 m, they are referred to as hill evergreen forests, characterised by a predominance of members of the *Fagaceae* family (Gardner *et al.* 2000).

Figure 1. Location of the study area



Source: ESRI Data and Maps 2002.

The study area is formed by Tat Mouan village, which is located at $102^{\circ}03'20''$ E longitude and $20^{\circ}54'05''$ N latitude (Figure 1). The village lies in the north-east of La district in Oudomxai province and its land covers 3,796 ha. Tat Mouan lies about 28 km from the provincial capital, Oudomxai, and about 140 km from the Chinese border. The village consists of 38 households with 250 individuals, 113 of whom are females. The population growth rate is about 3%. The villagers belong to the Khamu ethnic group, one of the oldest ethnic groups in northern Lao PDR, whose language belongs to the Austro-Asiatic Mon-Khmer language family. While an ethnic minority on the national scale, the Khamu are by far the largest ethnic group in Oudomxai province (Simana *et al.* 1994). The village is located in a narrow valley where some flat land has been converted to paddy fields. The houses are simple: made of wood and bamboo, with roofing made of fibre, cement, iron sheets, wood or bamboo. Most of the households have enough rice for their daily needs all year round, as only 20% have a shortage of rice for two months of the year—quite a good ratio for northern Lao PDR. Villagers make up the shortage with tubers, bamboo shoots and many other edible products. They also sell forest products to buy rice. Poor families may have to borrow money to buy rice, which often leads to long-term debt because of sky-high local interest rates. The main sources of cash income for villagers are livestock and NTFP.

Activities of the IUCN-NTFP Project in Tat Mouan village

Over the last six years, the IUCN-NTFP Project has been working with Tat Mouan villagers to learn how to improve their income generation and resource management systems. The village was chosen as one of the project's pilot sites because of the abundance of NTFP in the area, the economic importance of NTFP for the village and the interest and willingness of the villagers to work with the project. Besides working on *tout tiang*, the NTFP project also assisted the village with the production and marketing of brooms from *khem* grass (*Thysanolaema*), domestication trials of cardamom (*Amomum*) and the spice *mak khene* (*Zanthoxylum rhetsa*), the organisation of a village rice bank, credit for irrigation expansion etc. This combination of conservation and development activities has added to the body of lessons learned, which knowledge is being used by the provincial and district authorities for extension throughout Oudomxay province (Nurse and Soybara 2001).

THE PRODUCTION-TO-CONSUMPTION SYSTEM

Natural distribution and characteristics of the species

Most of the land surrounding Tat Mouan village is covered by hill evergreen forest. Typical tree species are *Mai deng nam* (*Xylia kerrii*), *Mai ten* (*Duabanga sonneratioides*), *Mai sa ko* (*Anthocephalus chinensis*), *Mai khouang* (*Zanthoxylum rhetsa*) and *Mai ko* (*Castanopsis* sp.). Typical bamboo species are *Mai houak* (*Thyrsostachys siamensis*) and *Mai nor khom* (*Indosasa sinensis*). Most of these forests are secondary. They consist of a mosaic of regenerating forests of ages varying between 1 and over 100 years, as they have all been used under extensive (long fallow) shifting cultivation for centuries. Some patches on steep slopes may never have been cultivated and could be considered as primary forest.

Tout tiang grows only in a narrow band of moist and fertile sandy loam soil around streams, about 50 m to each side of a stream, at elevations of 400 m to 800m above sea level. Knowing the length of the streams we can get a reliable area estimate of the actual production area. There are 18 streams that flow around the village, providing a total production area of 269 ha, or 7% of the total village area, i.e., the forests delineated by the government as belonging to Tat Mouan village. *Tout tiang* grows in clumps of 7 to 10 stems each. The stems can grow to a length of 20 m to 30 m. It needs 40% to 50% shade and will therefore grow under medium tree canopy cover. This plant loves wet places and cannot stand droughts very well. No fungus or insect seems to attack this species.

The villagers of Tat Mouan have observed that ants and birds eat the *tout tiang* seeds, which are very small, like grass seed. These animals may be the main seed dispersers, if propagation from seed takes place at all. According to villagers, the climber seems to multiply itself mainly in a vegetative way from rootstocks. Once established, *tout tiang* naturally grows fast and regenerates rapidly. The new stem emerges from the root of the parent clump underground. In one year a young stem can reach up to 10 m in length, depending on climate and location. It grows more rapidly in the rainy season.

Harvesting practices

Villagers harvest *tout tiang* by cutting the stems 5 cm to 10 cm above the ground. The stem is then pulled away from the supporting trees. Harvested stems are cut into sections of 1 m to 2 m to facilitate transportation. *Tout tiang* can be harvested when it reaches three years of age and its stems have a thickness of 0.5 cm to 1.0 cm. It will regenerate within a period of three years. After transport from the forest to the collector's home, the bark is removed from the sapwood, cut into sections and then spread out to dry in the open air for about a week. The bark is dried until the moisture content is as low as 12% to 15%. The dried bark is then broken into smaller pieces for the convenience of stocking and transporting.

In the harvesting period of 1998-99, around 5,700 kg of dried bark was extracted from the village production area, which averages to 21 kg of dried bark, or about 63 kg of fresh bark, per hectare. Harvesting can take place all year round, but villagers primarily harvest in the dry season from January to April (January and February are the most productive months). This allows the harvesters to sun-dry the *tout tiang*. Assuming that all 38 households participate in harvesting, the average household would harvest 150 kg of *tout tiang* per season from around 7 ha. One person can harvest four clumps per day. If one hectare contains 50 to 75 clumps, the labour needed to harvest one hectare is 12 to 19 person-days. To harvest all 269 ha would require 3,000 to 5,000 person-days, or at least 50 to 85 harvesters over a period of two months.

High levels of harvesting have caused rapid depletion. Villagers estimated that in their area only 50 to 75 clumps per ha remain as compared to 150 clumps in 1995-96, which would mean a reduction of more than 50% in just three years. From the forest survey it would seem that the density is only 18 clumps/ha within the area along the streams, which would indicate that depletion is even worse than villagers have estimated.

A lack of harvesting skills and knowledge of the plant leads to *tout tiang* sometimes being uprooted because the bark is thicker around the roots. This destroys the plant and makes further regeneration impossible. Villagers have also cut the surrounding trees, which has affected both the ecosystem and the regeneration of *tout tiang*. Ecological knowledge about the species is still very limited, and the amount harvested currently depends on the amount requested by local buyers, which results in overharvesting of the resource.

From harvester to consumer

Villagers harvest *tout tiang* only when there is clear demand from middlemen, who in turn get orders from export companies that export the bark to China. Once they receive an order, the villagers organise a village assembly meeting to discuss the amount to be harvested and the rules by which villagers should harvest. The villagers harvest the *tout tiang* and then sell the dried bark to middlemen, who sell it on to export companies. Harvesters normally form teams of two or three persons from different households to undertake the harvesting and processing. The replacement costs for labour involved in collection, drying and packing the raw product add up to about US\$0.11⁶

per kilogram. The product is sold at US\$0.17 per kilogram, which means that village collectors make a net profit of about US\$0.06 per kilogram, or 50% over their labour investment.

Photo 1. Drying of tout tiang bark (Photo by J. Foppes)



Oudomxai province borders China, Vietnam and Thailand. Both the Chinese border crossing at Boten and the Thai border checkpoint of Houay Xay are only 100 km away. For *tout tiang* the main export destination is China, but small quantities may be exported to Vietnam. Transport is by road, on trucks or small hand tractors (Table 1).

In line with the orders from foreign companies, export companies buy the product from local middlemen and sell to foreign buyers. The export company sets the local price and pays all provincial taxes (there are no national tariffs in the case of *tout tiang*), which are often referred to as border handling costs. The profit made from the export of *tout tiang* to China at this point in

the marketing chain, is quite considerable. The export price is US\$0.33 per kilogram, or twice the farm-gate price.

The export company gets a quota from the local government to operate the export of NTFPs. The quota is in essence an agreed target amount for extraction with an agreed tax percentage to be paid to the government institution issuing the quota. Based on the quota, companies set the amount of product they expect to extract and provide advance money to local

Table 1. Routes of transportation and distances from Oudomxai to major markets

Routes	Length of route (km)	Means of transport	Cost of transportation (kip*/km)
Pakbeng-Bokeo/Thailand	100	Boat	100
Oudomxai-China	100	Truck	100
Oudomxai-Vietnam	170	Truck	120

*Average exchange rate in 2001: US\$1 = 9,000 kip.

Photo 2. Collector selling tout tiang bark to a middleman (Photo by J. Foppes)



middlemen to buy the *tout tiang*. Middlemen sometimes deal through other buyers, e.g., a provincial level middleman, who may make similar advances and agreements to buy products from a district level buyer, who in turn may make similar arrangements with a village level buyer. No specific information on the role of such middlemen in the marketing chain was obtained. It is also not visible from Lao PDR how the marketing chain continues past the exporter to its final destination, i.e., the buyer of incense sticks.

Some government institutions that play a role in the marketing chain of *tout tiang* are (1) the Provincial Agriculture and Forestry Office, which is responsible for issuing quotas and has the mandate to manage and promote agriculture and forestry activities including NTFP management, control and monitoring; (2) the District Agriculture and Forestry Office, which implements the policy and strategy of the provincial office at the village level, approves harvesting documentation and collects a forest resource tax of 3% of the farm gate prices; and (3) the Provincial Commerce Office, which collects an export tax of 5% and finally approves the export.

Processing

The only processing steps carried out in Lao PDR are sun-drying and packing in bundles for transport. The processing of the bark into glue, which is used to make incense sticks, is carried out as a home industry in China. It was impossible for the Lao researchers to investigate this part of the production process further; more research is needed to get the full picture.

Local regulations

To encourage sustainable management Lao PDR forestry law mandates that each village establish its own local rules and regulations for NTFP harvesting, producing and marketing. The local people also set the rules and regulations pertaining to forest management, which the village administration authority then approves. The local rules in Tat Mouan prescribe that only the villagers themselves are allowed to harvest and collect NTFPs in the village forest. Whether this rule has prevented outsiders from taking *tout tiang* is unknown. In any case, the rules have not prevented the rapid depletion of *tout tiang* resources.

In Tat Mouan there is a self-imposed 1% local tax on the sale of NTFPs, proceeds of which go to the village development fund. The villagers have used these funds for rural development including construction of a schoolhouse, water pipes installation and purchase of a generator. Funds were not used to reinvest in the resource.

Land allocation

The allocation of land is an attempt by the Lao government to clarify land use tenure rights. This process has been beneficial in delineating permanent agricultural land to individual families, especially paddy fields. But in the context of non-permanent land use, as in the case of swidden agriculture,

the process has not worked so well (Raintree and Soydara 2001). Some of the key issues related to land allocation can be summarised as follows:

- 1) The way the land allocation process has been implemented has led villagers to adopt shorter fallow cycles on a limited area close to the village. This practice reduces the yield of upland rice. So, in a way, this forced move leads to more hardship and poverty as well as increased soil erosion and loss of soil fertility in the affected area (Rodenburg and Phengkay 2000), driving poor families to intensify their collection of NTFPs to sell for cash to buy rice. People are forced to adopt resource depleting survival strategies instead of being encouraged to develop sustainable strategies.
- 2) Being afraid of land taxes and knowing that there is little follow-up to land allocation, local people often do not report swidden fields used, but reserve large tracts of land actually used for this purpose under vague categories such as 'regeneration forest', 'use forest', 'reserve forest' or 'protected forest'. In practice this means shifting cultivation is proceeding covertly.
- 3) The land allocation process does not address NTFP use regulations or intravillage use conflicts on NTFP extraction from shared forestland.

This is not to say that land allocation should be abandoned, but the above issues should be addressed as shortcomings of a process that could be improved. There is much potential for NTFP based land allocation processes, but they require more testing.

Quota policies for NTFPs

All trade in large quantities of NTFPs in Lao PDR is governed by a quota system. Officially, the provincial authorities set quotas each year for all exports from their province, to be approved by the national assembly. Quotas are set on the basis of requests from export companies. The main criteria for assessing the size of a quota are (1) the financial and technical capacity of the company to realise the proposed extraction and (2) the ecological assessment of the amount of product available for harvesting in the province. In practice, provincial and district staff do not have the skills, means or knowledge available to make adequate estimates of the second criterion. Therefore the quotas are mostly based on an assessment of the ability of the company involved to get the proposed quantities out of the forest and out of the country. Similar to the timber quota system, the system of approving these quotas is not transparent and therefore open to corruption (Castren 1999). The situation has worsened since 1999, when the responsibility for checking quotas has been 'decentralised' from the provincial level to the districts. At the moment, no government organisation in Lao PDR is mandated, or able, to provide an accurate cumulative record of NTFP exports from year to year. This lack of record keeping makes it difficult for anyone, including the government, to monitor trends in the production and trade of NTFPs.

The case of *tout tiang* illustrates the confusion caused by the quota system. Because *tout tiang* is little known, there are no national quotas for the product. There are district quotas, but these have not been publicised. The nearness of the collection area to the Chinese border and the ethnic ties between local

residents on both sides of the border (Lao Lue ethnic group) make it easy for Chinese companies to get approval for a quota at the local level through informal contacts with local authorities.

The present marketing system encourages depletive extraction instead of sustainable harvesting, since it is implemented without taking into consideration regeneration capacity. Besides, the system focuses on quantities, not on quality of the product, which drives prices down. The present quota system is open to corruption, prices remain low and village collectors have little chance to get a better grip on the marketing system. The product may become depleted in a few years.

Box 2. Consequences of the quota system for NTFPs

The most important consequences of the present quota system for NTFP exploitation at the village level are:

- There is no incentive for any stakeholder to consider the sustainability of the harvest as an important factor, as quotas are issued on the basis of the potential of the exporting company rather than the availability of the resource.
- Village communities are highly dependent on the companies who obtain the quotas.
- Both companies and the government aim for quantity, not quality of the product. This keeps prices low and makes it all but impossible for village communities to get a better price for a better quality product.

Trade and taxation policies between countries

Another area where policy influences NTFP trade is that of trade and taxation policies between countries. Countries buying NTFPs from Lao PDR—such as Thailand and China—raise little to no taxes on the imports of raw materials. Processed products, however, are taxed in the area of 30% to 40%. These ‘tax walls’ encourage the export of low-cost raw materials from Lao PDR and make it highly difficult for Lao entrepreneurs to add value to products by local processing. Examples of such tax walls were found to exist in Thailand for brooms from *khem* grass (*Thysanolaema*) and for *mak tao*, or tinned sweet sugar palm fruits (*Arenga*). Few data are available on the taxation of incense produced from *tout tiang* bark. In China and Lao PDR incense making is usually a home industry, requiring little mechanisation. Local Lao villages could produce incense without much difficulty, but it is harder to export incense than the raw product to China because it is difficult to find a market and there are export restrictions, e.g., import taxes levied by the Chinese authorities. In practice, Lao villages find themselves limited to producing raw materials for the Chinese incense home industry.

TRENDS AND ISSUES—DEVELOPMENT AND CONSERVATION LESSONS

Trends in trade volumes

It remains all but impossible to obtain reliable data on the total national exports of *tout tiang* from Lao PDR. Until 1999, some export data were collected at the provincial level, but since then the task of keeping export records has been decentralised to the district level. As a consequence, it is impossible to get reliable estimates on NTFP exports from the Lao government for 1999 onwards. Overall there seems to have been a huge increase in the export of *tout tiang* over the last decade. Exports in 1999, however, were low—a probable explanation being that the 1999 exports were held up because of hidden trade conflicts and sold together with the next harvest in 2000. It is unlikely that high levels of exports can be sustained, as village surveys show a rapid depletion of available resources.

The role of *tout tiang* in the village economy

Whereas sales of *tout tiang* seem to have boomed on a national level in 2000, production in Tat Mouan dropped from five tonnes in 1999 to half a tonne in 2000 (Table 2). The reasons for this drop in production are reduced product availability in the forest and a landslide damaging the road to the village, which made it difficult for traders to visit as frequently as before. With the reduced availability, it is not surprising that *tout tiang* has lost importance for family cash income vis-à-vis other NTFPs.

Table 2. Production of *tout tiang* in Tat Mouan village, 1997-2001

	1997-98	1998-99	1999-2000	2000-01
Harvested amount (tonne)	5.9	5.7	0.6	0.6
Income (US\$)	2,135	2,063	253	190

From Rapid Rural Appraisal data collected in 1996, NTFPs seem to provide 80% or more of all cash income for the village of Tat Mouan. Cardamom was the most important NTFP at the village level in 1999-2000 (Table 3), but this may well have changed⁷. *Tout tiang* provided only 9% of the family cash income from NTFPs in 2001.

Project interventions in the production system

In 2000, as *tout tiang* supplies diminished rapidly, villagers in Tat Mouan requested support from the IUCN-NTFP Project in finding ways to improve the regeneration of *tout tiang*. Analysing the problems together, villagers and staff decided to experiment with methods to increase regeneration. Three methods were tried.

- *Seed propagation.* Seeds were sown, germinated, and then transplanted in plastic bags and kept for three to four months in the nursery before being planted in the field. Seed collection proved difficult because the seeds

Table 3. Income from NTFP for Tat Mouan (38 households), dry season 1999-2000

NTFP	Income (kip)	No. of households participating	Percentage of households participating	Income per participating household (kip)
Cardamom	14,013,000	38	100%	368,763
Brooms	1,876,500	24	63%	78,188
<i>Tout tiang</i>	1,714,200	27	71%	63,489
Handicrafts	919,000	7	18%	131,286
Paper mulberry bark	882,000	24	63%	36,750
Bitter bamboo shoots	764,000	9	24%	84,889
Galangal fruits, <i>makkha</i>	265,500	10	26%	26,550
Forest vegetables	260,000	9	24%	28,889
Grubs (insect larvae)	80,000	3	8%	26,667
Total	20,774,200	38	100%	546,689

Average exchange rate in 1999-2000: US\$1 = 7,624 kip.

are small and have to be collected before the pod dries and spreads its seeds. Germination rates were also low (60-70%). Because of the poor results, this method was discarded.

- *Cuttings.* Stems aged one to two years were cut into 20 cm lengths and put directly in plastic bags full of soil. They were then raised in the nursery for three to four months before being planted in the forest. Cuttings showed over 95% survival rate and grew fast. This method worked so well that it was chosen to establish new gardens and to increase the density of old natural stands. In two years more than 10,000 seedlings were produced. The villagers successfully replanted 2 ha of natural forest in 2000 and an additional 3 ha in 2001, resulting in a total of 5 ha of new plantations. They plan to continue replanting 2 ha to 3 ha each year in the wild and to establish home gardens for individual families.
- *Natural regeneration.* Remaining natural stands of *tout tiang* can be rehabilitated by selective harvesting. Sustainable harvesting means not uprooting any plants, harvesting only two or three stems and leaving at least one stem intact on each clump. This method will allow plants to regenerate quickly. Methods for sustainable harvesting are still being tested.

Both villagers and project staff feel excited about their collaborative research work. Neither the field workers nor the villagers had tried either method with *tout tiang* before, so the experiment was a collaborative learning process for all. It is expected that villagers will share *tout tiang* cultivated in the forest collectively, while individuals can grow it themselves in their home gardens and reap its benefits. Interestingly, two nearby villages have also started their own nurseries, following the success of the Tat Mouan experience.

Lessons

What lessons can be learned from the case of *tout tiang* for conservation and development?

- Uncontrolled market demand for the bark of *tout tiang* led to a rapid depletion of natural stands of this plant. Over three years, villagers observed a reduction of 75% to 90%.
- Participatory technological development is a useful technique to identify sustainable production systems. To be successful it is important that villagers and staff identify activities they can work on immediately and to show linkages between income generation and forest conservation. Activities should be based on local issues and problems, and experiments should be carried out in action research/learning mode. In the case of *tout tiang*, local people and project staff identified an effective and rapid method for establishing nurseries and plantations of *tout tiang* within one year. They also identified potentially effective sustainable harvesting systems and an accurate method for identifying suitable areas for enrichment planting and new plantations. Various criteria for monitoring the resource status were also identified: off-take per village and density of stands.
- Participatory technological development could be used to build a sustainable production system, with positive off-spins for forest conservation and the well being of the village community. Yet local communities need other incentives in the field of land tenure, market systems and capacity building to enable them to adopt truly sustainable production systems.
- Some issues of land access and tenure make it difficult for local communities to adopt sustainable management: (1) the present regulation leads to short-term rotating cycles on a limited amount of land, which reduces rice production, making local people poorer, not richer, by denying them the right to long-term rotating cycles; (2) fear of unfair taxation leads local people to hide land they use from the land allocation process; and (3) hardly any models exist to resolve conflicts on use of forest resources between neighbouring villages. These issues must be addressed to empower local communities to take responsibility for managing their forests.
- The current trade system has a number of flaws that work against sustainable production: (1) Chinese companies easily get approval for a quota at the local level through informal contacts with local authorities, but these quotas fail to take into account the availability and regeneration capacity of the natural resource; (2) without any records on trade volumes and prices it is almost impossible for the government or any other stakeholder to effectively monitor the trade, and (3) tax walls imposed by surrounding countries favour the export of raw materials from Lao PDR and discourage local processing. These issues need to be addressed to enable sustainable production for the long term.
- More capacity building and training is needed. Village communities need to learn how to produce in a sustainable manner. All stakeholders need more marketing and small business skills.

Possibilities for future development

Appropriate technologies for resource management and processing

The case of Tat Mouan shows that it is possible to improve natural stands and to plant new gardens of *tout tiang* rather easily using stem cuttings propagated in nurseries. It also shows that a sustainable harvesting system is possible, where about two thirds of the stems are harvested. Local villagers need to have knowledge of sustainable harvesting techniques and be prepared to apply them. The feasibility of processing *tout tiang* bark into incense locally in Lao PDR should be investigated further.

Box 3. Sustainable production of *tout tiang* in Lao PDR

How much *tout tiang* could be produced in a sustainable manner in Lao PDR? A rough estimate of the production potential of the five northern provinces can be calculated as follows. In the case study area, 7% of the forest was suitable for *tout tiang*. The average yield of dry bark under depletive harvesting was 21 kg/ha/year, which dropped to almost zero in two years. Based on the villagers' estimates, with optimal management, sustainable harvesting could perhaps be maintained at 7 kg/ha/year. The total forest area in the five provinces covers 2,545,500 ha. The optimal theoretical yield could then be $2,545,500 \times 0.07 \times 7 = 1,247,295$ kg, or about 1,200 tonnes per year. This figure is based on the assumption that all forests are similar to the forests in the pilot village of Tat Mouan. Based on casual observations, the forests of Tat Mouan seem to be of more than average quality. Waiting for more detailed examinations, the Lao government would perhaps be safe to assume a sustainable maximum yield of *tout tiang* of around 400 tonnes to 500 tonnes per year. This amount could be maintained only if all villages throughout the five provinces rehabilitated *tout tiang* stands along the banks of all streams and all villages applied sustainable harvesting systems. Obviously that situation is still a long way off, but it gives us a goal to strive for.

Marketing

To prevent foreign buyers from continuing to control the market, Lao stakeholders in the *tout tiang* trade need to improve their marketing and enterprise skills. It would be helpful to learn Chinese and go to China to learn how the market operates. Government and private trade agencies need to supply local villagers with improved information on the market chain, what the end products are and who the final buyers are.

Government policies

The present marketing system drives local collectors to exhaustive harvesting. To adopt sustainable harvesting methods, local collectors need strong incentives.

The government could develop a quota system based on indicators of sustainable harvesting, e.g., the number of seedlings in a nursery, number of hectare replanted, visual checks on stand quality etc. Quotas could then be linked to producers in villages rather than to export companies. Companies could be asked to provide extension services to spread the practice of sustainable harvesting among villages they buy from. The government needs to develop supportive legislation for such systems at all levels. Adequate systems for monitoring quantities and trade prices should be set up. Government staff need to be trained to work with these systems.

Social arrangements

To promote sustainable harvesting, village NTFP user groups or committees could be established. These associations should have the goal to improve village income from sustainable NTFP harvesting. They should be given the right to sell *tout tiang*, registered by district authorities.

Conclusions

The case of *tout tiang* is a good example of the effects of increased NTFP trade on rural livelihoods and the environment in northern Lao PDR. It points out many of the resource and marketing issues that are occurring in one of the last frontiers of Asia.

The case of *tout tiang* shows how increased market demand can quickly erase an NTFP from the forest. It also shows that local communities have the capacity to solve such problems by experimenting with domestication techniques. As *tout tiang* became quite difficult to find in its natural habitat, local collectors looked for assistance to experiment with domestication of the plant in gardens. Such gardens have a good potential to improve rural livelihoods and forest management, as this climber grows fast and there is a steady market. Furthermore, Lao PDR could develop a sustainable incense industry based on *tout tiang* with positive effects on forest conservation and local economic development.

The rural population in Lao PDR could benefit greatly from the large potential of this and hundreds of other NTFPs, but a number of policy changes and much capacity building need to take place.

ENDNOTES

1. Joost Foppes, SNV Lao PDR/Forest Research Center, National Agriculture and Forestry Research Institute (NAFRI), P.O. Box 345, Vientiane, Lao PDR. E-mail: jfoppes@loxinfo.co.th

2. Michael Victor, Lao-Swedish Upland Agriculture Research Programme, National Agriculture and Forestry Research Institute (NAFRI), P.O. Box 4298, Vientiane, Lao PDR. E-mail: omichael@loxinfo.co.th

3. Sounthone Ketphanh, NTFP Unit, Forest Research Center, National Agriculture and Forestry Research Institute (NAFRI) P.O.Box 7174, Ban Nong Vieng Kham, Xaythani Vientiane, Lao PDR. E-mail: sounthone53@yahoo.com

4. Viloune Soybara, Village Investment for the Poor, Agricultural

Development Project, Houay Yang Centre, National Agriculture and Forestry Extension Service (NAFES) Vientiane, Lao PDR.

5. Vannalak Sengsavanh, c.o. Forest Research Center, National Agriculture and Forestry Research Institute, P.O.Box 7174, Ban Nong Vieng Kham, Xaythani, Vientiane, Lao PDR.

6. Exchange rate 2001: US\$1 = LAK9,000.

7. For reasons yet to be understood, the price for cardamom dropped spectacularly from around US\$3.0 per kilogram to US\$1.1 per kilogram in 2001.

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Chapter 12

A case study of the production-to-consumption system of sandalwood (*Santalum album*) in South Central Timor, Indonesia

Dede Rohadi¹, Retno Maryani², Made Widyana³ and Irdez Azhar⁴

Common names	Part of the resource used	Management	Degree of transformation	Scale of trade	Geographic range
Cendana, Sandalwood, Hau meni	Resin and wood	Wild	High	International	Medium

OVERVIEW

In Nusa Tenggara Timur province, Indonesia, sandalwood (*Santalum album* L.) is harvested mainly from natural stands. Sought after for its pleasant odour, the wood is used for the production handicrafts, joss sticks and, the main sandalwood product from the region, sandalwood oil, which is exported to be used in perfume and cosmetics industries all over the world. The sandalwood production in Nusa Tenggara Timur province is threatened by an alarming rate of decline in the sandalwood population. Overcapacity of the sandalwood processing industries has stimulated overexploitation by illegal logging activities. In addition, some harvesting methods (e.g., digging up roots because of their oil content) and agricultural expansion have increased the pressure on the resource. There have been limited efforts to develop sandalwood plantations. Local government policies tend to neglect local people’s rights to the benefits of the valuable sandalwood and thus discourage them from participating in the maintenance of sandalwood natural regeneration. The local government should stimulate local participation in maintaining natural regeneration of sandalwood by offering more rational benefits to local communities as well as encourage intensive sandalwood plantations in the region.

INTRODUCTION

This case study discusses various aspects of sandalwood (*Santalum album* L.) in Timor Tengah Selatan (TTS) district of Nusa Tenggara Timur (NTT) province, Indonesia. The study is based on analytic reviews of the available references and unpublished reports, as well as field visits to some locations in the district during 1999/2000. The authors also visited various sandalwood oil processing and handicraft factories in Kupang, the provincial capital.

Brief description of the study area

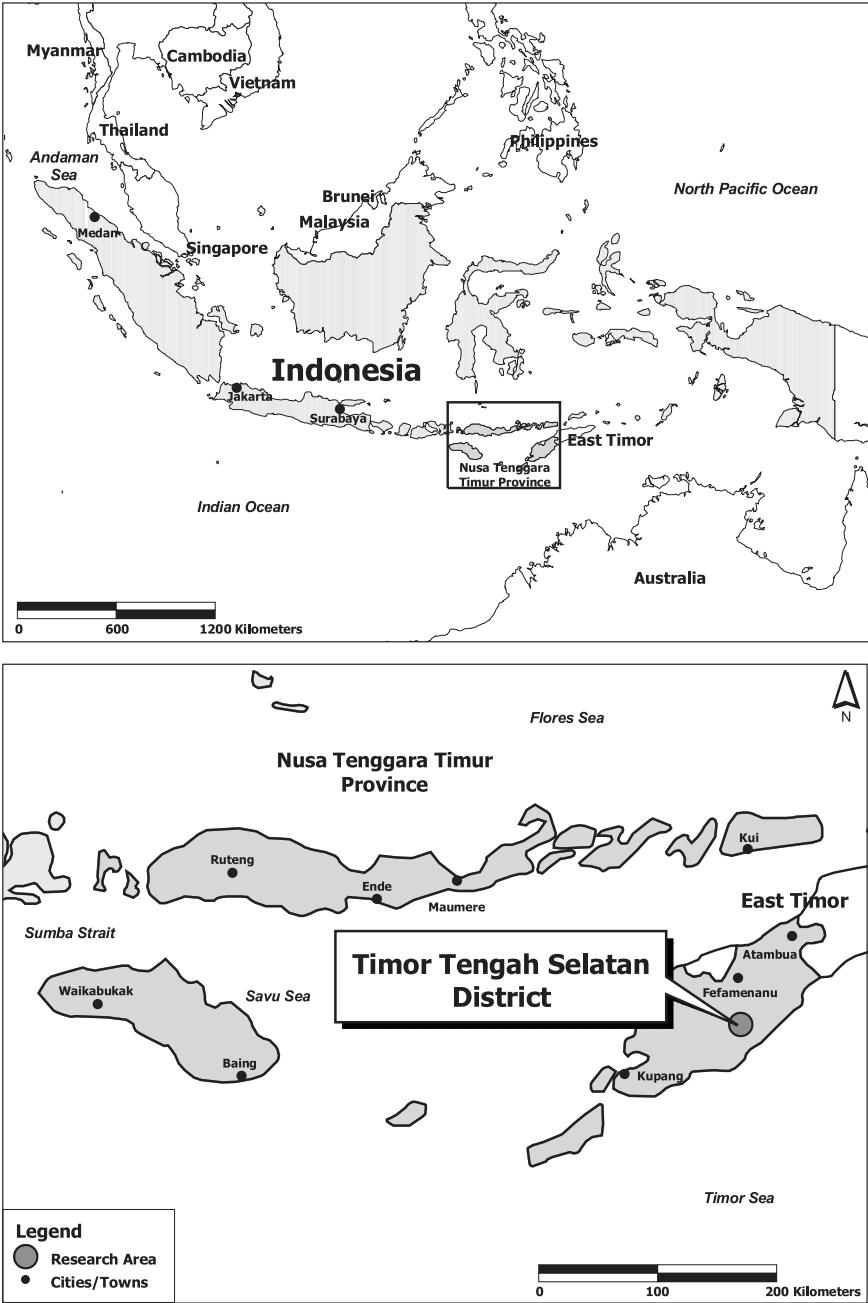
Timor Tengah Selatan is one of 14 districts in NTT Province. The district lies in the centre of Timor Island (see Figure 1). Its capital city, Soe, is located about 110 km from Kupang and is connected by asphalt road to other cities in Timor. The road system in the district is relatively good.

The district is dominated by mountainous topography with an altitude range of 500 m to 2,400 m above sea level (a.s.l.). In the northern area there are three mountains—Mollo, Kekneno and Mutis—ranging in altitude from 1,500 m to 2,400 m a.s.l. In the south, the topography is also hilly, but in general the altitude is lower, about 1,000 m a.s.l. The climate is cool with an average temperature of about 15°C in the evening and 20°C during the day, and the average rainfall is 1,372 mm per annum (Dinas Kehutanan Daerah Propinsi NTT 1974).

Because of the predominantly dry climate, the forests in Timor are dominated by short trees with less dense, curved trunks and relatively thick, low branches. Dominant species are *Acacia leucophloea*, *Eucalyptus* spp., *Cassia fistula*, *Zizyphus mauritana*, *Schleicera oleosa*, and *Albizia* spp. In areas higher than 1,000 m, on the slopes of the Mutis, Mollo and Miumafo mountains, there are stands of various evergreen non-fire-resistant *Podocarpus* species, among them *Podocarpus umbricatus*, known for its excellent carpentry wood. Below 1,000 m, isolated groups of non-fire-resistant trees are found, notably *Sterculia foetida* (nitas), *Callophyllum teysmanii* (camplong) and the candlenut *Aleurites moluccana* (kemiri). Sandalwood grows mainly in the transitional zone between deciduous monsoon forest and montane forest (600–1000 m). Other species growing within these regions are *kayu kuning* (*Cudranea javanensis*), *soga* tree (*Peltophorum pterocarpum*) and *tingi* (*Ceriops candolleana*), all of which are important sources of natural colouring for the batik industry in Java. Teak (*Tectona grandis*) plantations can also be found in many areas, particularly around Takari.

Agriculture is an important sector in the district. Rice fields are common and can be found along the way from Kupang to Soe, where plenty of water is available. Some other common agricultural products from the district are maize (as a staple food), cassava, sweet potatoes, oranges, mangos, *pinang* (*Areca catechu* L.), *sirih* (*Piper betle* L.) and vegetables such as tomatoes, green cabbage and spinach. *Pinang* (*Areca catechu* L.) and *sirih* (*Piper betle* L.) are used particularly for courtesy snacks to welcome guests.

Figure 1. Map of the study site



Source: ESRI Data and Maps 2002.



(*Santalum album*)

THE PRODUCTION-TO-CONSUMPTION SYSTEM

Plant and product characteristics

Sandalwood belongs to the family *Santalales*, subfamily *Santalineae*, order *Santalaceae* and genus *Santalum* (Sumarna 1985). There are various species of sandalwood, but the species *album* is believed to have originated from the Timor region, although it is also found in India. Two varieties of *S. album* are found in the Timor region, i.e., *S. album* L. var. *album*, which is characterised by small leaves, and *S. album* var. *largifolium*, which has larger leaves (Harisetijono and Suriamihardja 1992). Other sandalwood species are found in Western Australia (*Santalum sygrara*/*Eucaria spicata* SPRAG et SUMM), South Australia (*Santalum fresyssianum* MIQ), Eromanga and Hebrides islands (*Santalum homei* SEEM), Sandwich Island (*Santalum freveinetianum* GUND), Marquesas Islands (*Santalum austrocaledonium* VILLB) and Fiji (*Santalum yasi* SEEM) (Karminarsih 1997).

In Timor, the evergreen sandalwood tree (Photo 1) ranges in height from 12 m to 20 m and diameter from 25 cm to 40 cm (although they may reach 55 cm). Branches are usually numerous and irregular (Sipayung 1985; Sumarna 1985). They are rarely found as a single culture, but more often stand distributed in small groups of four to five trees (Sipayung 1985). This tree grows well in regions where the climate is dry. It tolerates 625 mm to 1,625 mm annual

rainfall and temperatures from 10°C to 35°C. The tree occurs at altitudes from 50 m to 1,200 m, but grows best in the higher elevations. Sandalwood prefers soil that has good drainage and it adapts easily to rocky or stony soil with low fertility (Sumarna 1985; Sinaga and Surata 1997).

Photo.1 Sandalwood trees (Photo by D. Rohadi)



Sandalwood is a semiparasitic species; the tree absorbs soil nutrients through *haustoria* roots that stick to other plants, which means that sandalwood trees require host plants from which to grow⁵. Various species reportedly are suitable host plants for sandalwood. During the seedling or sapling period (the first six months), some primary host plants include *Alternanthera* sp., *Desmanthes virgatus*, *Crotalaria juncea*, *Capsicum frutescens* and *Solanum* sp. The secondary host plants are mainly legume species, including *Acacia villosa*, *Sesbania grandiflora*, *Calliandra* sp. and *Leucaena leucocephala* (Surata 1994).

The tree either regenerates from seed or will shoot from roots or stumps after coppicing, the latter being more frequent although it may take one to three years from the time of cutting or damage to the emergence of new growth. Various bird species, and possibly rainwater, are the main seed dispersers in elevated areas (Sumarna 1985).

Sandalwood use

Sandalwood owes its popularity to its oil content. The oil is extracted from the heartwood of the stem, branches or roots of mature sandalwood trees and exported to the USA, Singapore and European countries, in particular

Switzerland, UK, France and the Netherlands, mainly for the perfume and cosmetics industries (BPEN 1993). The oil from *Santalum album* is in more demand than other *Santalum* species because of its high santalol content (around 80-90%). The mature tree is characterised by thin sapwood (the thickness is less than 2.5 cm) while the diameter of heartwood is more than 10 cm. The oil content varies from 2.5% to 6% depending on the age of the tree, the part of the tree from which the oil is drawn and the tree growth environment. The roots contain oil of higher quality, which has stimulated the current unecological harvesting practice of digging up sandalwood roots, eliminating the possibility of tree regeneration.

Sandalwood is also used, locally and neighbouring islands, for woodcarving and handicrafts such as fans, pens, beads, rosaries and handbags. Sandalwood is highly appreciated in the woodcarving industries in Bali and used for fine arts or sculptures. Some of the wood is exported to Taiwan and re-imported as sandalwood pens.

The sawdust from the handicraft and oil factories in Kupang is used to produce joss sticks, which are used in religious ceremonies, particularly by Hindus and Buddhist (Sumarna 1985). In Timor, sandalwood sawdust is processed into various forms of incense (spiral, prismatic and circular) and mosquito repellents.

Sandalwood has long been used for traditional medicines. Its paste is applied as a lotion to cure headaches. Drinking water in which sandalwood dust and wood have been soaked for a few days may cure *Gonorrhoea virulenta*, and sandalwood mixed with *Myristica argentea* may cure stomach illnesses. Mixed with coconut oil the sandalwood oil may be used as an antiseptic, and if mixed with benzoate acid or borate acid, it may reduce swelling caused by insect bites (Sumarna 1985).

Availability of sandalwood

Sandalwood is the only forest tree that has been completely inventoried in Indonesia. It was the high value of the wood that encouraged the government to carefully record all sandalwood trees. Ormeling (1955) reported that the first inventory of sandalwood was conducted in 1924. Two other inventories were undertaken during the Dutch colonial period in Indonesia but neither was completed, the first because of the outbreak of World War I and the second because of the end of Dutch colonial rule in 1947. The provincial government in NTT province (natural stands of sandalwood in Indonesia occur only in NTT) has since conducted sandalwood inventories approximately every five years. Trees less than 3 m in height are counted and trees with a girth of more than 30 cm and a height of more than 3 m are measured, marked, and observed for signs of attack by pests and diseases. In Table 1 the results of the sandalwood census conducted in Timor and surrounding islands are summarised. Though the accuracy of data resulting from the census is questionable, it is obvious that there has been a sharp decline in numbers over the last 10 years.

Table 1. Summary of sandalwood census in Timor and surrounding islands

Census year	Diameter > 30 cm (no. of trees)	Diameter < 30 cm (no. of trees)	Total (no. of trees)
Before 1966	109,000	150,000	340,000
1965-1968	131,687	375,065	506,752
1973-1976	200,575	325,106	525,681
1987-1988	188,389	395,041	583,430
1997-1998	41,427	209,513	250,940

Sources: Ormeling 1955; Kanwil Kehutanan Propinsi NTT 1989.

Harvesting quantities

The harvesting of sandalwood is conducted following guidelines set forth in an instruction letter issued by the Regional Forestry Office (Dinas Kehutanan Propinsi) to its branch offices (Cabang Dinas Kehutanan) at the district level. The letter states the target for total weight of heartwood to be collected, number of trees to be cut, and total weight of roots harvested. Technical guidance for wood administration, exploitation costs and revenue allocation are also stated in the letter. The instructions are further deliberated by both the district head (Bupati) and the branch office head and then disseminated to their subordinates, namely the subdistrict head (Camat), the head of forest rangers (Kepala Resort Pemangkuan Hutan), the village leader (Kepala Desa), the head of the village community (Ketua Rukun Kampung) and the head of the village neighbourhood (Ketua Rukun Tetangga).

The annual sandalwood production is calculated from the following formula:

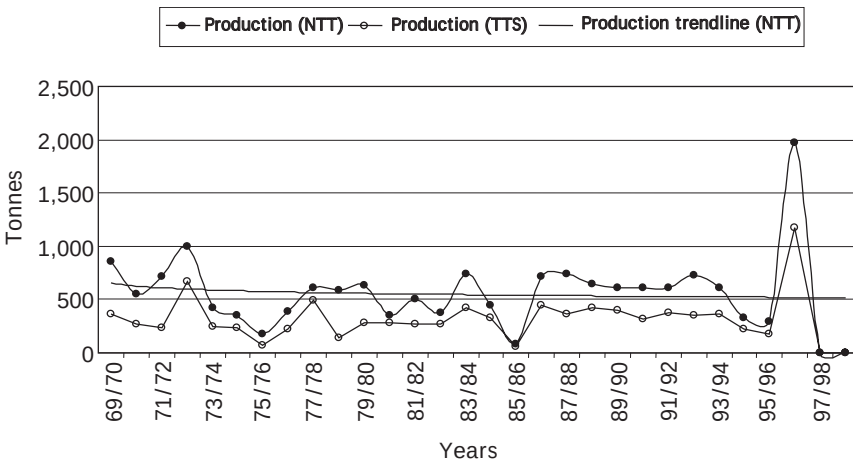
Annual allowable cutting =
$$\frac{\text{total mature trees} \times \text{average heartwood weight per tree}}{\text{cutting cycle}}$$

From the beginning of the 1970s till the late 1980s, when abundant mature trees were available, the predicted average heartwood weight per tree was 100 kg, and a cutting cycle of 50 years was recommended. The average weight was subsequently revised to 50 kg per tree in 1988 (BanoEt 2000). Research has shown, however, that the average heartwood green weight of stems and branches (excluding root) was only 39.47 kg per tree with a standard deviation of 7.57 kg, while the net dry weight was 29.82 ± 6.89 kg (Susila 1994). It has now become clear that the high estimation of heartwood content per tree has contributed to overexploitation and led to resource depletion, since fieldworkers have tended to fulfil the quota determined by the provincial government. In addition to previously too high annual allowable cutting ceilings, illegal logging practices clearly have also contributed to the overexploitation.

Legal sandalwood production in NTT province has fluctuated significantly, although now the trend is relatively stable at an average of almost 600 tonnes

per year (see Figure 2). There has been no legal cutting since the governor ordered a five-year moratorium from 1998 to 2002 to allow for regeneration and regrowth (Governor Order No. 12/1997). Despite the harvesting ban, the sandalwood oil and handicraft industries have continued to operate, and demand for sandalwood products remains high. To overcome resource scarcity, some factories have moved from producing sandalwood oil to eucalyptus oil, while others have turned to processing illegally cut wood.

Figure 2. Sandalwood production in East Nusa Tenggara province and South Central Timor district



The peak in sandalwood production during the period 1996/1997 (Figure 2) was caused by the government's launching of a 'special operation' preceding the suspension of sandalwood extraction. Called *Operasi Bersahabat*, it was a sweeping operation to collect illegally cut wood from communities. Instead of punishing illegal cutters, the regional government provided compensation for harvesting costs for any collected wood⁶. Once all available stock had been acquired, the provincial government declared the moratorium on sandalwood cutting. Though the operation was meant to collect only already cut wood which had presumably been stored, much of what was collected had been freshly cut. Figure 2 shows that the TTS district has shared, on average, more than 50% of the sandalwood production in NTT province.

Sandalwood plantations

Sandalwood production in Timor is derived mostly from natural regeneration. Efforts to plant the trees in the Timor islands started in the early part of the twentieth century, but have failed to produce successful plantations.

During the Dutch era, people were encouraged to plant and take care of sandalwood gardens for one or two years under the supervision of the Forestry Service. In return, permission was granted to cultivate food crops between the young sandalwood plants (Ormeling 1955). One of the reasons for the plantation failure is said to be a cancer that attacked sandalwood gardens. Husain (1983), however, argued that the disease was not the main cause of the plantation failure, but shifting cultivation with continuous burning, wild grazing and low incentives were. Conditions were even worse during the Japanese occupation, when the necessary maintenance was neglected. The majority of the 208 ha planted between the years 1923 and 1951 failed either partially or completely, and even successful trees were overgrown with *Lantana camara* (Ormeling 1955).

After independence, efforts to cultivate the species were mostly in the form of research trials, demonstration plots or within a framework of community forestry guided by either timber estate companies or the Regional Forestry Office. The total area planted with sandalwood on this island is still not clear. In the late 1980s the provincial government allocated a budget for establishing and maintaining plantations. However, these government initiatives have been limited in scope. The Regional Forestry Office has also established a tissue culture laboratory in collaboration with the Forestry Research Institute in Kupang, but it is still in its preliminary phase.

Processing and industries

Three types of sandalwood industry operate in and around Kupang. They are the processing of sandalwood oil, handicrafts and joss sticks. In 1998, the total wood intake of factories processing sandalwood, estimated from the conversion of total sandalwood products, was around 4,300 tonnes. Although this estimate may be a little bit too high, it is obvious that total sandalwood consumption by the industries was far above the formally reported production. As the total wood collected by Operasi Bersahabat was only around 2,000 tonnes, the gap between wood supply and consumption could only have been fulfilled with illegally cut wood.

The sandalwood oil industry is a major consumer of sandalwood raw material. It uses all wood parts of the tree. Three such factories are operating in Kupang, another in East Timor. The largest and oldest oil-distilling factory is located in Kupang. Established in 1974 this factory has a processing capacity (intake) of about 800 tonnes of wood per annum, but for lack of sufficient raw material it never fulfils that capacity. The average recovery of sandalwood oil in the processing factories is between 2.62% and 2.84%, that is, 1 kg of sandalwood yields 26.2 to 28.4 grams of oil. These numbers are far below those reported in India, where recovery is reported to be around 2.5% for mixed quality and sapwood, and 6% to 8% for the best root. One possible reason for the low recovery is the premature harvesting of the wood. Barret (1985) reported that the oil content (santalol) increases significantly with age. High santalol content also indicates a good quality of sandalwood oil.

The handicraft industry requires high quality wood but in practice also accepts low quality wood. There were 24 handicraft factories officially recorded in 1998, most of them located in Kupang. Only two factories are located in Soe and another two in Atambua. There are no data available on the total amount of raw material used in these factories.

Most of the joss stick factories were established in the last few years, and many of them also produce handicrafts. The 14 joss stick factories operating in 1998 had an annual capacity ranging from 75 tonnes to 900 tonnes per plant and a total capacity of 3,308 tonnes. The factories use sawdust from handicraft and oil processing to produce joss sticks in various forms—spiral, cone and stick—mainly for export to Taiwan, Hong Kong and Singapore. The factories usually mix the sandalwood dust with other wood dust, such as gaharu (*Aquilaria* spp.) and kayu pappi (*Acacia oraria*). During a field visit, it was found that factories use a mix of around 40% sandalwood sawdust to 60% of other wood sawdust.

Trade and marketing

Sandalwood has long been commercially traded, although it is not clear when exactly the practice started. Ormeling (1955) described sandalwood trade in Timor as early as 1400 A.D. It would seem that the first sandalwood traders were Javanese merchants, according to ancient Chinese and Portuguese sources of information. They acted as middlemen who transported the wood from Timor to the western part of the archipelago, to the collecting centres and the entry port of Sriwidjaja in Sumatra, and later to a Malayan harbour. From Malaya it was then shipped to India and China. Husain (1983) reported that the Chinese were trading sandalwood from the Timor islands to Malaya and India as early as the tenth century. They built trade relations with the ruling native chiefs (radjas) who controlled the cutting and sale of sandalwood in the Timor region and bartered the wood for silk, porcelain, beads and gold. Another writer, Widiyatmika (1986) suggests that sandalwood trading may have commenced as early as the third century, when the wood was used as a gift for kings.

During the Dutch colonial period the trade in sandalwood was controlled by the Dutch East Indies Company (Rahm 1957). Since independence, the government has continued to administer the sandalwood resource. The provincial government has established a sandalwood collecting system in the field and sets the selling price through an auction system. The Regional Forestry Office has been appointed the official collector of sandalwood raw material, from felling to the storage depot (Tempat Penumpukan Kayu) in Kupang.

At the lowest level of the chain, the wood administration is in the hands of a forestry field officer (Mandor Tebang), who organises the lumberjacks. The field officer records the specifications of each tree before cutting (height, diameter and estimated heartwood weight) as well as wood production data (stem/root number being cut, length, diameter, and heartwood weight) and exploitation expenses (including the wages paid to

the lumberjacks). The field officer reports to the subdistrict forestry officer (Kepala Rayon Pemangkuhan Hutan), who then issues a ‘wood transport’ document (Surat Angkutan Hasil Hutan Bukan Kayu) indicating the number of stems, quality classes, weight and other records concerning the harvested wood. The wood is then transported to the district storage depot in Soe and on to the depot in Kupang. From the main storage depot in Kupang, the wood is distributed to factories and traders through an auction system. Interisland traders sell the wood to other areas such as Bali and Surabaya. For transport to other islands, another document, called Surat Angkutan Kayu Olahan, is required. This letter, issued by the Regional Forestry Office, states the quantity of the product (pieces), class quality and total weight.

A team chaired by the Economy Bureau of the provincial government (Biro Ekonomi Pemda), determines the selling price for the sandalwood. The team consists of representatives of the Regional Forestry Office, Bureau of Finance, Bureau of Legal Aspects, Regional Office for Trade and Industries, Regional Bank, Regional Tax Office, and Regional Police Office. The price is subject to review every year. Table 2 shows the selling price for sandalwood based on its quality.

Several sandalwood oil, joss stick or handicraft factories are located outside NTT province. In Surabaya, for example, there is a factory that produces sandalwood oil with raw material derived from NTT. In Bali, there are many handicraft centres that sandalwood material from NTT. Factories located outside Indonesia that process sandalwood for various end products include handicraft factories in Taiwan that produce sandalwood pens and perfume industries in France that use sandalwood oil as one of their raw materials. The trade diagram is presented in Figure 3.

Figure 3. Sandalwood marketing chain

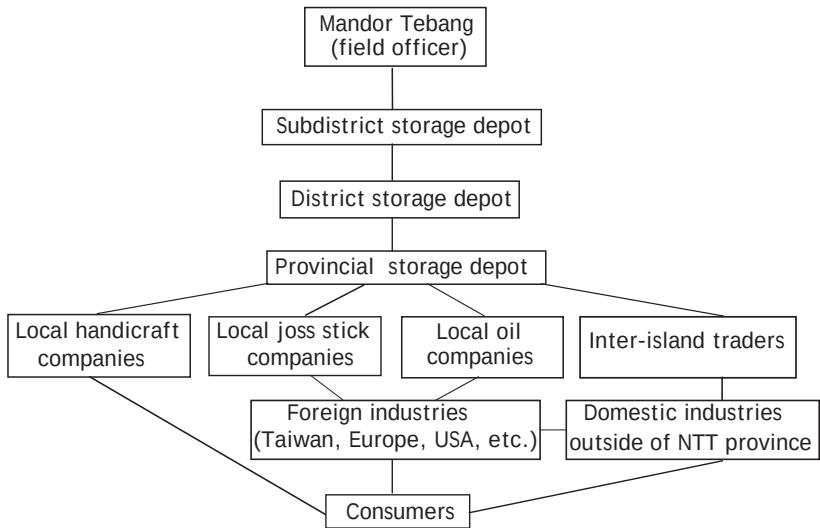


Table 2. Sale price of sandalwood based on quality

Quality Classes	Price (US\$/kg)							
	1984/85 (US\$1 = Rp1,136)	1985/86 (US\$1 = Rp1,136)	1986/87 (US\$1 = Rp1,648)	1987/88 (US\$1 = Rp1,688)	1988/89 (US\$1 = Rp1,773)	1989/90 (US\$1 = Rp1,847)	1990/91 (US\$1 = Rp1,957)	1995/96 (US\$1 = Rp2,347)
Special A (diameter > 19 cm)	1.76	2.86	2.06	2.49	3.38	3.90	4.34	7.67
Special B (diameter 8-9 cm)								6.52
Mixed	1.32	0.88	1.21	1.48	1.83	2.17	2.45	3.84
Sap wood								0.43
Twigs								0.21

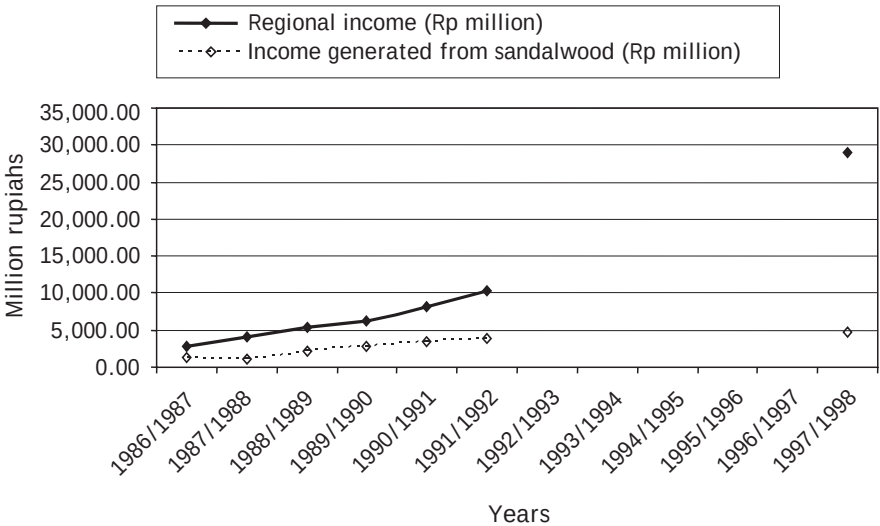
Sources: Ito 1993; Leki 1996.

As mentioned before, sandalwood oil is the main sandalwood product of the region and exports are mainly to the USA, Netherlands and Singapore. During the period 1983 to 1992 the average export volume of sandalwood oil from Indonesia was 12 tonnes per year. The price fluctuated from about US\$71 per kilogram to about US\$150 per kilogram, the average being about US\$114 per kilogram (BPEN 1993).

Contribution of sandalwood to regional income

The exploitation of sandalwood has contributed significantly to regional development (see Figure 4). During 1986 to 1991 sandalwood amounted to about 40% of the annual regional government income derived from economic activities in the region including tax, retribution and other government sources of income, or Pendapatan Asli Daerah (PAD) (Leki 1996). Until 1998 there were 3 sandalwood oil factories, 24 handicraft and 14 joss-stick factories registered in NTT province (Dinas Kehutanan Propinsi NTT, unpublished). The sandalwood industries provide direct employment for almost 1,000 local people and are a source of income generation for many more, particularly the handicraft suppliers.

Figure 4. Contribution of sandalwood to regional income



Policy context

Sandalwood exploitation in Timor has long been practised and used to be controlled by local rulers. As reported by Widiyatmika (1986), historically all sandalwood was owned by a king (*radja*), who would appoint a ‘landlord’ (*fetor* or *uis pah*) to control the sandalwood production in the region. The landlord then appointed an *adat* chief⁷ to maintain and secure the trees, as

well as to conduct ritual ceremonies whenever harvesting took place. The benefits from harvested sandalwood trees were shared as follows: the roots belonged to the *radja*, the stem went to the *fetor*, and the landowner received the branches (Ormeling 1955).

A wage system for sandalwood exploitation was introduced during the Dutch colonial era. Using the local ruler's power, the colonial government provided a certain amount of compensation for harvesting the sandalwood. It is unclear how much compensation the colonial government gave to the local ruler for the harvested wood or how much compensation the local ruler gave to the people who actually collected the wood. It seems, however, that the price was on a downwards spiral, which caused local people to protest and finally to refuse to collect sandalwood. In 1751 the system of compensation was replaced by a tax system. At that time one third of all harvested sandalwood had to be handed over to the local government ('*Swapradja*'). In a way this was just another type of monopoly as the government controlled the trade system and the huge price margin between local farm gate and the destination of trade, Jakarta (Rahm 1957).

After independence, the regional government assumed control of the wood through a series of regulations that controlled all aspects of its management. These regulations controlled sandalwood property rights, resource maintenance, harvesting, marketing and wood allocation. The main points of these regulations are as follows (Rohadi *et al.* 2000):

- All naturally regenerated sandalwood (trees, dead trees and wood) belongs to the regional government. Parties may plant sandalwood on their own land, but their income share from the harvested wood will be only 15%⁸ of the total value (Regional Government Regulation, or *Perda*, No. 16/1986 and the Ministry of Home Affairs Decree No. 522.63-433/1988). Landowners should have a land certificate to claim their income from cultivated sandalwood (Governor Decree No. 7/1993). This regulation has been replaced by *Perda* No. 2/1999, decentralising ownership of naturally regenerated sandalwood to the district government. The rules determining sandalwood rights are now unclear and can vary from district to district.
- The Regional Forestry Office will conduct a resource inventory every five years and determine the annual allowable cut for the following year. The allowable cut is determined every year based on inventory data and actual wood production (*Perda* No. 16/1986 and Governor Decree No. 7/1993)
- The local government conducts the harvesting activities, determines the harvesting costs and issues the documents required during harvesting and wood transportation (Governor Decree No. 7 and No. 8/1993). The local government has monopolised all matters regarding exploitation, transportation and marketing of sandalwood.
- The local government determines the wood price and allocates the wood to selected companies (Governor Decree No. 7/1993).
- Revenue from the sale of wood constitutes income for the provincial government. Half of the net revenue is allocated to the district that produced the sandalwood. Half of the district's revenue (or a quarter of the total wood sales) is allocated to the supervision, replanting, and maintenance of the trees (*Perda* No. 16/1986).

- All communities should care, maintain and work towards the sustainability of the resource. Illegal cutting, stockpiling or transportation of sandalwood, as well as intentional acts to damage the trees, are to be prosecuted. The governor has established the co-ordinating Sandalwood Board (Governor Decree No. 53/1992), which comprises a number of government representatives including the heads of district and subdistrict offices, the village head, an Indonesian Army representative and local community leaders.
- Because of the alarming rate of decline in sandalwood, the provincial government ordered a moratorium on the harvest of sandalwood from 1998 up to 2002. This regulation eliminated income contributions the PAD receives from the sale of sandalwood. Similarly, the ban on sandalwood harvesting will diminish export contributions from sandalwood products.

TRENDS AND ISSUES—DEVELOPMENT AND CONSERVATION LESSONS

Why is sandalwood becoming scarce?

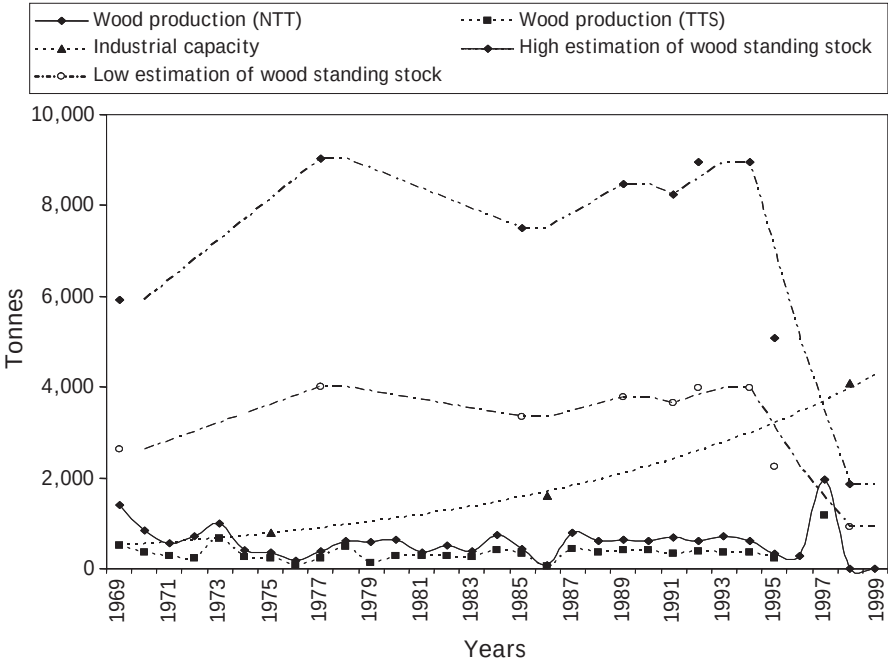
Since independence sandalwood has been controlled by the state. Economic benefits from the sale of the wood received by the local government have been significant. The regulations, however, tend to marginalize community rights to the resource. Because of low incentives for the local people, little effort has been put into sustaining the sandalwood resource. In some cases local people have purposely killed the seedlings so as not to be obliged to maintain the trees in their fields—a striking consequence of the lack of involvement of local people.

Standing stock⁹, supply and demand of raw sandalwood in the region as well as annual wood production (formally registered cut) and capacities of the sandalwood industry are presented in Figure 5. While in general wood production during the last three decades has been relatively stable or in a slight decline, the demand for sandalwood, as represented by industrial capacity, has continued to increase. The increasing demand, which far outweighs sustainable production, presumably has forced the overexploitation of sandalwood resources through illegal cutting, particularly so during the middle 1990s, when the remaining wood stock fell to the point that it could no longer fulfil industrial demand.

Clearly, illegal cutting endangers the sandalwood resource. Many opportunists, including local people, government officers and private companies, are involved in the practice, as often reported by local newspapers. The gap between supply and demand, as presented in Figure 5, may give an indication of the amount of illegal wood in the system. Shifting cultivation and wild grazing are other common practices with negative impacts on sandalwood regeneration.

Efforts to increase the sandalwood stock by developing plantations have not been fully implemented. As described previously, the efforts put into plantations were limited to government pilot projects with no significant effort from the local communities to plant trees or maintain seedlings.

Figure 5. Stock, supply and demand of sandalwood in East Nusa Tenggara



Conclusions and recommendations

Sandalwood is an important natural asset for the TTS district and has contributed significantly to the regional income for a long time. It has provided important employment opportunities as well as national export earnings through the sandalwood industries in the region. However, since the government halted further extraction in 1998 to protect the resource from overexploitation, this importance has started, and will continue, to decline. In Indonesia, sandalwood trees are specific to the Timor region, and globally they grow in a relatively limited area. Sandalwood trees could therefore provide a comparative advantage to the TTS district or NTT province if the resource were managed properly. However, current development shows that the sandalwood population in the region is decreasing at an alarming rate. Various factors including illegal cutting, shifting cultivation and grazing cause the current resource scarcity. The root of these problems is ineffective local government policies that tend to neglect community rights and thus discourage villagers from participating in the maintenance of sandalwood natural regeneration. The continued deterioration of the situation results, in the most part, from the imbalance between demand and supply and the limited efforts put into the development of sandalwood plantations.

To recover the sandalwood population in the region, local participation in maintaining the resource is required. More rational benefits should be offered to local communities to attract them to the cultivation and sustainable

Box 1. Harvesting of sandalwood roots

Sandalwood roots contain more oil than other parts of the tree. This phenomenon stimulates destructive harvesting of the roots and hence reduces the possibility of natural regeneration. According to harvesting procedures, only a part of the roots can be harvested two years or more after coppicing if regeneration is take place. The rule is often neglected during illegal harvesting or when it is difficult to fill a particular order.

Box 2. Substitution as a response to scarcity

To respond to the resource scarcity some sandalwood oil companies have had to diversify. They now produce eucalyptus oil, or *minyak kayu putih*, to keep their factories running. Outside Timor, such as in Bali, many handicraft companies use substitute wood species as the raw material and dip the products into a sandalwood oil solution to imitate sandalwood products.

harvesting of sandalwood. Intensive plantations should also be encouraged, particularly with a view to the industries that use sandalwood as a raw material. In a shift from previous practice, which focused on controlling the resource, new government policies should provide proper incentives to support sandalwood raw material production, policies that are more focused on investment in sandalwood plantations.

The sandalwood case is an interesting example of government intervention in resource management. Although regulations and mode of exploitation have changed from time to time, what has remained unchanged is that the people's rights to the resource are still marginalized. Local people receive little in the way of benefits from sandalwood under the existing system, which has consequently resulted in the local people's low level of participation in maintaining sandalwood resources.

ENDNOTES

1. Forestry Research Institute of Sumatra, Kampus Kehutanan Terpadu Aek Nauli, Jln. Raya Parapat Km. 10.5, Parapat, Sumatera Utara, Indonesia. E-mail: drohadi@indo.net.id
2. Center for Social and Economic Research on Forestry, Jln. Gunung Batu No. 5 - P.O. Box. 16610 - Bogor, Indonesia. E-mail: retnomaryani@hotmail.com
3. Forestry Research Institute of Bali and Nusa Tenggara, Jln. Untung Suropati No. 7 - P.O. Box 67 - Kupang, Indonesia
4. World Wildlife Fund, Wallacea - Bali Jalan Hayam Wuruk 179 - Denpasar 80235, Bali, Indonesia. At the time of study affiliated to the Center for

International Forestry Research (CIFOR). E-mail: iazhar@wallacea.wwf.or.id; irdez2001@yahoo.com

5. On field visits some trees were found to grow well without host plants.

6. Operasi Bersahabat may, in fact, well have been a pre-emptive strike by the provincial government against the new central government regulations, which stipulated that the collector or owner should receive up to 80% of the sandalwood value.

7. An *adat* chief is usually a senior village representative dealing with cultural affairs.

8. The income share was increased to 40% with the issue of *Perda* No. 2/1996.

9. See Rohadi *et al.* (2000) for more detailed information on the calculation of the estimated standing wood stock.

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Chapter 13

Damar agroforests in Sumatra,
Indonesia: domestication of a forest
ecosystem through domestication of
dipterocarps for resin production¹

*Hubert de Foresta², Geneviève Michon², Ahmad Kusworo³
and Patrice Levang²*

Common names	Part of the resource used	Management	Degree of transformation	Scale of trade	Geographic range
Damar kaca, White meranti	Resin	Cultivated	High	International	Medium

OVERVIEW

Farmers in the West Lampung Pesisir area in the south of Sumatra, Indonesia, have established forest gardens by introducing damar trees in upland rice swiddens plantations. These damar gardens were established as the wild resource itself was vanishing. While cultivating this forest resource, villagers have achieved the global restoration of a forest in the middle of agricultural lands. Harvest of resin from damar trees represents the main source of household cash income. Furthermore, Pesisir farmers managed to preserve a high level of biodiversity and a whole range of economic products and functions originally derived from the forest. Institutionally, appropriation of the forest resource has entailed a total reorganisation of the traditional tenure system for forest lands and goes along with the increasing importance of land as property and privatisation of this property. During the 1990s, the acceleration of regional development has threatened the agroforests of the area, as they were not recognised by the state and had no legal status. Damar gardens, as a successful forest management strategy developed by local communities, may represent an important support for the development of formal recognition of local people’s rights over forest resources.

INTRODUCTION

Driving westward from the peneplain along the Sumatra highway, a mosaic of dry fields and pepper plantations, through the Barisan range, a succession of reddish hills extensively degraded by pioneer coffee growing, one suddenly enters another country: a land of trees that stretches all along the quiet descent to the Indian Ocean. The human mark on this forest landscape is not immediately obvious: some clearings bearing hill rice, a few patches of fallow vegetation. Elsewhere stands a venerable jungle dominated by large trees. The area covers some 100,000 ha divided between a long coastal plain—130 km from the provincial border in the north to the southern Cape Cina in the Sunda Straits which widens from north to south—and a steep hilly and mountainous area rising to a height of over 2,000 m. It stretches over three administrative subdistricts (Pesisir Utara, Pesisir Tengah and Pesisir Selatan) referred to as the Pesisir (Figure 1).

Wherever possible, irrigated rice fields, and associated permanent villages, have been established along the coastal plain, but the rude topography and the relatively low quality of inland soils have limited the possibilities of further permanent agricultural food production. The hills have long remained the domain of a classic agroforestry rotation: mosaics of temporary rice fields and coffee plantations with secondary, fallow vegetation. But for about a century or so this traditional pattern of forest conversion to agriculture has evolved into a complex system of forest redevelopment. Planting valuable fruit- and resin-producing trees in their swiddens, Pesisir farmers have managed to create a new forest landscape entirely tailored to their needs. This forest made by humans, though forming an almost continuous massif, is made up of a mosaic of individually evolved gardens which the farmers have named after the dominant tree species, the damar⁴ (Torquebiau 1984; Michon and Bompard 1987; Michon and Jafarsidik 1989).

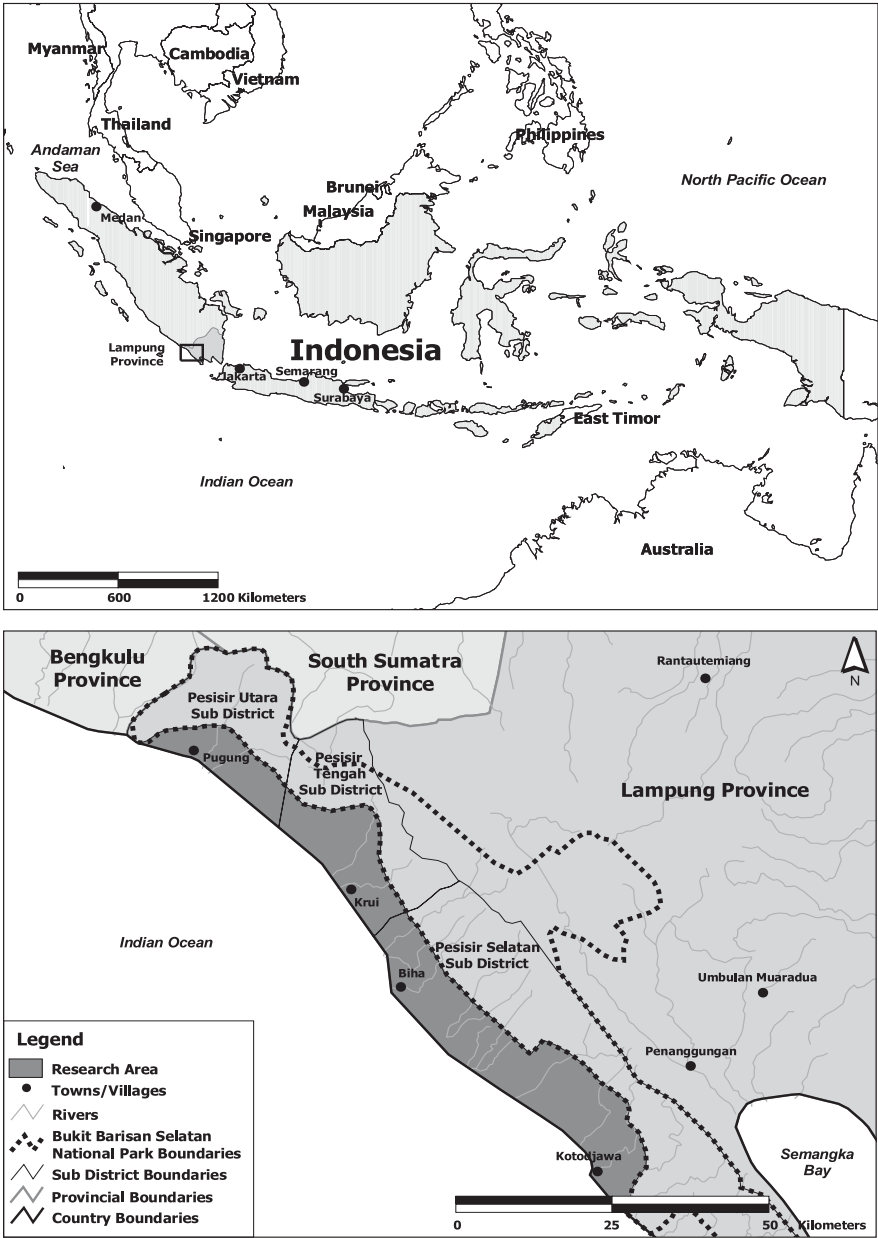
Damar gardens have gradually spread in the Pesisir, and productive gardens presently cover at least 50,000 ha, according to a December 1997 interpretation by the Department of Forestry and International Center for Research in Agroforestry of a Landsat image dated November 1994, completed by ground-checking. The main centre of cultivation is located around the city of Krui, where hills are almost totally covered with a mature damar forest. Yearly damar production was estimated around 8,000 tons in 1984 (Bourgeois 1984) and reached 10,000 tons in 1994 (Dupain 1994). New gardens are still being established in the northern and southern subdistricts. Today, more than 80 percent of the damar resins produced in Indonesia are provided not by natural forests, but by the Pesisir damar gardens. Among the 70 villages scattered along the coast, only 13 do not own damar gardens.

PRODUCTION-TO-CONSUMPTION SYSTEM

The damar garden

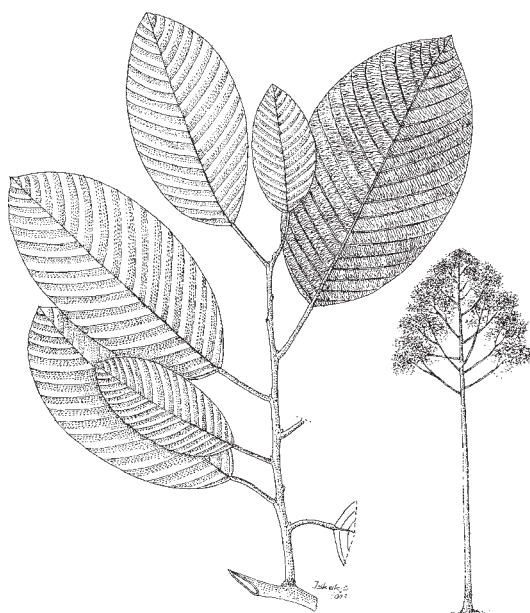
Damar gardens can be analysed as a forest, and indeed, biologically, they constitute a forest in their own right, a complex community of plants and

Figure 1. Location of the research area



Source: ESRI Data and Maps 2002.

animals and a balanced ensemble of biological processes reproducible in the long term through its own dynamics. However, the gardens have been established as agricultural production units on agricultural territory (Michon 1985; de Foresta and Michon 1993).



(*Shorea javanica*)

While damar trees (e.g., *Shorea javanica*) are clearly dominant in mature gardens, representing about 65% of the tree community and constituting the major canopy ensemble, damar gardens are not simple, homogeneous plantations. They exhibit diversity and heterogeneity typical of any natural forest ecosystem, with a high botanical richness and a multilayered vertical structure, as well as specific patterns of forest dynamics.

Plant inventories in mature damar agroforests have recorded around 40 common tree species, and several more tens of associated species, either large trees or treelets and shrubs, liana, herbs and epiphytes. Important economic species commonly associated with damar are mainly fruit trees, which represent 20% to 25% of the tree community. In the canopy, durian and the legume tree *Parkia speciosa* associate with damar trees. In the subcanopy ensembles, *Lansium domesticum* is the major species with, to a lesser extent, mangosteen, rambutan, jacktree, palms like the sugar-palm *Arenga pinnata* or the betel-palm *Areca catechu*, and several water apple species—*Eugenia* spp.—as well as trees producing spices and flavourings (*Garcinia* spp., the fruits of which are used as acid additives in curries, and *Eugenia polyantha*,

Photo 1. Old growth damar agroforests often present impressive tree stands in terms of biomass and volume of timber (Photo by G. Michon © IRD)



the local laurel tree). The last component, 10% to 15% of the tree community, is composed of wild trees of different sizes and types, which have been naturally established and are protected by farmers, either because they do not have adverse effects on planted trees or because of advantageous end uses. These species include valuable timber species (Apocynaceae, Lauraceae, etc). Non-tree species characteristic of a forest ecosystem (Zingiberaceae, Rubiaceae, Araceae, Urticaceae) have colonised the undergrowth of gardens, where they contribute to the maintenance of a favourable environment for the development of seedlings of the upper layer trees.

Management of the garden

Management of mature gardens is centred around the harvest of resin and fruits. Labour allocated to routine garden maintenance is mingled with labour devoted to resin harvest, and the tempo of harvests is determined by labour requirements for wet rice cultivation. Work in the gardens is postponed at the time of the rice harvest or of rice-field preparation, so that tree gardening never competes for labour with subsistence agriculture.

Once established, the damar plantation evolves with minimum human input. The silvicultural process in damar gardens is not conceived, as in conventional forest plantations, as a mass treatment applied to a homogeneous, even-aged population of trees, but aims at maintaining a system that produces and reproduces without disruption either in structural or functional patterns. The main task of the gardener is to regularly introduce young trees in the garden

plot in order to constitute and maintain an uneven-aged pool of replacement trees. In a well-managed garden, the size of the replacement pool ensures the sustainability of the productive stand.

Photo 2. Tapping the damar tree (*Shorea javanica*) in damar agroforest (Photo by H. de Foresta © IRD)



Integration of a forest tree in a farming system: the *ladang* way

Expansion and success of damar cultivation are closely related to swidden agricultural practices (Michon and Bompard 1987; de Foresta and Michon 1994b). It is through the *ladang* (swidden), and through its traditional crop succession structure, that damar trees have been restored to the landscape. In the former dry land cultivation system, *ladang* were opened primarily for rice production, but some did not directly return to fallow. Instead, they were further transformed to coffee and pepper plantations. The first damar trees were introduced in these successional *ladang* gardens, amidst coffee bushes and pepper vines, where they found a suitable environment to establish themselves and further develop. After abandonment of the coffee or/and pepper stand, damar trees were strong enough to grow along with secondary vegetation and to overcome competition from pioneers. The subsequent fallow was a mix of self-established successional vegetation and deliberately planted damar trees, which developed fully until reaching a tappable size some 20 to 25 years after plantation, but no more than 10 years after the last coffee or pepper harvest. Damar plantations soon became a success story. Everyone started to plant seedlings in his own swidden. Through this very simple cropping technique, after two decades, a traditional fallow land had changed into a managed tree

garden that included damar trees as well as other introduced fruit species and self-established trees, bushes and vines.

Economically, the vegetation succession process is of tremendous importance as it is the basis of a succession of harvestable commercial products, thus reducing the unproductive time span of the plantation to some 5 to 10 years. Costs of labour devoted to damar establishment are mingled with those devoted to rice and coffee/pepper cultivation on swidden fields. Cultivation of commercial tree crops does not compete for labour with subsistence agriculture. On the contrary, it allows the maximisation of returns on labour inherent to the swidden system—vegetation cutting and field maintenance—successively through coffee/pepper and trees.

Among the imperatives leading to the initiation of a generalised cultivation process, the main one was probably the growing difficulties encountered in the collection of wild damar, which could closely resemble the conflictual processes regarding access to common property resources encountered today for other forest products (Peluso 1983, 1992; Siebert 1989). In the late nineteenth century, the high increase in resin prices led to intensive and generalised tapping of trees in natural forests. Overcollection entailing the rarefaction of mother trees blocked natural regeneration, whereas the extension of the cultivated territory entailed the rarefaction of the forest itself. Damar trees were spared in the slash and burn process and could easily survive in the modified environment of *ladang* and secondary vegetation, but natural regeneration in these conditions appeared difficult. Some serious conflicts are reported to have occurred between villages as well as within villages concerning access to the remaining damar trees (Levang and Wiyono 1993).

Preserving biodiversity

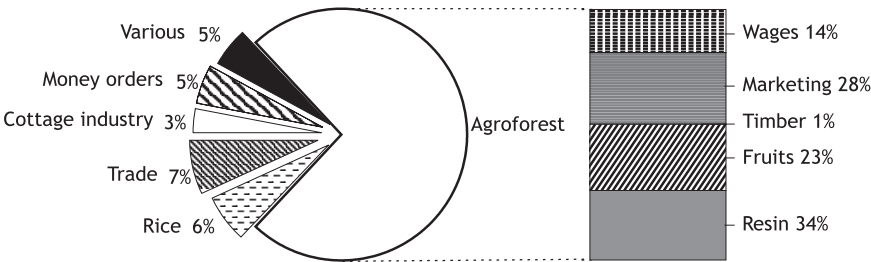
The real appropriation of forest richness and diversity is achieved through the free development of natural processes of diversification and niche colonisation. As in any secondary vegetation dominated by trees, the newly maturing damar plantation provides a suitable environment and convenient niches for the establishment of plant propagules from the neighbouring forests through natural dispersion. It also offers shelter and food to forest animals. In this natural enrichment process, farmers merely select among the possible options offered by the ecological processes: favouring resources, through introducing economical trees and protecting their development, or tolerating non-resources development and reproduction as long as they are not considered as 'weeds'. After several decades of such a balance between free functioning and integrated management, the global biodiversity levels are fairly high. As natural forests below 700 m to 800 m a.s.l. have almost disappeared in the Pesisir, damar gardens constitute the major habitat for many plant species characteristic of lowland and hill dipterocarp forests that would otherwise have disappeared (Michon and Bompard 1987; Michon and de Foresta 1992, 1995). The agroforest also shelters many animal species, including some highly endangered species like the Sumatran rhino and the Sumatran tiger.

Seen from the planter’s point of view, while the introduction of economic species in the damar agroforest is intentional, biodiversity reestablishment is ‘accidental’. These combined processes, the intentional and the accidental, are essential for several reasons. They restore resources that otherwise would not have been conserved purposefully because they do not appear as important economic resources. These noneconomic resources in turn help support viable populations of pollinators and dispersers that are essential for the long-term survival of commercial tree species, thus allowing the restoration of biological and ecological processes that are crucial for the functioning and reproduction of the agroforest as a commercially productive forest ecosystem.

The economic and social value of damar gardens

Damar trees represent the main source of household cash income (Figure 2), and damar collection is far more lucrative than other agricultural activities in the region (Mary 1987; Levang and Wiyono 1993). Resin is harvested on a regular basis: individual trees are usually tapped from once a month to once every two weeks. A single villager can harvest an average of 20 kg of resin a day. In the central subdistrict villages, average harvests are between 70 kg and 100 kg per family per month. Resin sale represents a regular income allocated to day-to-day expenses such as the purchase of additional foods or the weekly costs of children’s schooling. Five days of work in damar gardens are usually enough to ensure a month’s subsistence for the whole family (Levang 1989, Levang and Wiyono 1993). For those who do not own permanent rice fields, the damar income also allows for the purchase of some rice and thus complements dry rice culture where it still exists. However, the damar income is usually not sufficient for hoarding.

Figure 2. Origin of household cash income in a damar-based village, Pahlungan



Source: Levang and Wiyono 1993.

The damar activity also generates a series of associated activities: harvest, transportation from the field to the village, stocking, sorting, and transportation to wholesalers in Krui (see Table 1). Harvest, transportation, and sorting are carried out either by the growers themselves or by members of their families, or by specialized agents who are paid employees. Independent entrepreneurs ensure resin stocking in the village. These activities raise significant additional income for the village and allow those who do not own a damar garden to benefit from damar production (Bourgeois 1984; Mary 1987; Levang and Wiyono 1993; Nadapdap *et al.* 1995).

Damar gardens constitute one of the most profitable smallholder production systems in Sumatra (Table 2). They ensure reasonable quality-of-life levels including high school attendance for children, which is given top priority in most villages of the area. In addition, they can be managed—and used accordingly whenever needed—as a safety asset: a garden, or part of it consisting of several selected trees, can be ‘pawned’ through special agreements called *gadai* (Mary 1987; Lubis 1996) that allow any family to overcome difficult periods without resorting to selling trees or land, which is considered as one of the worse things that might happen to a family.

Indeed, in accordance with an agricultural conception of resource management, damar gardens also represent a patrimony. Arising from a strategy of land property creation, the fruit of labour invested for a distant term, which will mainly benefit future generations, the damar garden constitutes an inalienable lineage property (Mary 1987; Nadapdap *et al.* 1995). In the very particular social and institutional context of the Pesisir, where families are defined mainly by their land assets, this notion of lineage patrimony defines the agroforest not only as the source of living of a household, but also as the land foundation of a lineage.

Damar gardens as a useful forest

Damar gardens fulfil a role equivalent to that of natural forests in the economies of forest villages. Wild resources associated with damar trees support a whole range of gathering activities that are more typically linked with natural forest ecosystems—hunting, fishing, and harvesting of plant products—and provide important complementary subsistence resources for households. These include various noncommercial fruits, vegetables, spices and firewood, as well as other plant material and timber for housing purposes.

Damar gardens also represent, as does any natural forest, a source of products that are potentially marketable commodities at a larger scale: timber, rattan, medicinal and insecticide plants can be harvested for sale whenever needed or if market conditions are considered favourable.⁵ As new markets develop, some of the traditional subsistence products have actually emerged as new commodities. Timber presently stands as the major ‘new’ commodity that might even revolutionise the management of damar gardens (de Foresta and Michon 1992, 1994a; Michon *et al.* 1995a; Petit and de Foresta 1996).

Damar gardens have taken over the essential role traditionally devoted to natural forests in household economy: a place opened to subsistence gathering

Table 1. Main characteristics of the damar resin trade chain inside Indonesia

Agents	Relative profit margins ^a		Activities ^b					
	Trade chain 1 ^c	Trade chain 2 ^d	Harvest	Stocking	Drying	Sorting	Transport	Processing
Damar grower	70%	70%	xxxx	x	x	o	xxxx	o
Village traders	3%	6%	o	xxxx	xx	xx	xx	o
Krui dealers	1%	none	o	xxxx	xx	xx	xxxx	o
Direct traders	none	6%	o	xxxx	xx	xxxx	xxxx	o
Krui wholesalers	13%	none	o	xx	xx	xxxx	xxxx	xx
Expenses	10%	15%						
Losses	3%	3%						

^a Expressed in percentage of the resin price in Tanjung Karang or Jakarta.

^b xxxx = principal activity, xx = often, x = occasionally, o = never.

^c Trade chain 1: village traders → Krui entrepreneurs → outside trading.

^d Trade chain 2: village traders → outside trading.

Table 2. Average production per hectare per year in mature damar agroforest, Pahmungan village, Central Pesisir subdistrict, April 1995

Species	Density trees/ha > 20 cm DBH	Production	Traded	Labour family level	Yearly income (data: 1995)	
					Rp	US\$
<i>Shorea javanica</i> (resin)	145	1550 kg	1500 kg	50	1,500,000	682
<i>Durio zibethinus</i> *	25	625 fruits	600 fruits	10	420,000	191
<i>Lansium domesticum</i> °	15	600 kg	500 kg	10	250,000	114
<i>Parkia speciosa</i>	8	1200 pods	1000 pods	10	100,000	45
<i>Baccaurea racemosa</i> °	7	200 kg	50 kg	2	10,000	5
<i>Artocarpus cempedak</i> *	6	100 fruits	50 fruits	2	50,000	23
Other fruit trees (6 spp.)°	10	200 kg	50 kg	3	50,000	23
Timber (all species may be used)	250	5 m ³	2.5 m ³	0#	50,000	23
Total labour (man-days)				87		
Average yearly income					2,410,000	1106
Minimum income (no fruiting season)					1,650,000	750
Maximum income (fruit season)					3,570,000	1625

*: production every two years.
°: production every three years.
#: no family labour involved in timber harvesting.

and extractivism and used to fulfil the family's immediate needs. This forest function also appears in some of the social attributes of the gardens, i.e., product exchanges, sharing and donations and free harvesting rights (noncommercial garden products may be collected by anyone who needs and asks for them). This creates important networks of reciprocity that act as a counterpart to mercantile networks created through agricultural activities and helps maintain a social balance between well-endowed people and those without resources.

Damar trade

Resins, which are sticky plant exudates found in various families of forest trees, are among the oldest traded items from natural forests in Southeast Asia. They entered short-distance trade between Southeast Asian islands as far back as 3000 B.C. and were probably included in the first long-distance exchanges that developed with China from the third to fifth centuries (Dunn 1975). Locally, damar served for lighting purposes and for caulking boats. It was traditionally traded as incense, dyes, adhesives, and medicines (Burkill 1935) and acquired a new commercial value by the middle of the nineteenth century with the development of industrial varnish and paint factories. Collection intensified for export trade to Europe and the United States, and then to Japan and Hong Kong. After 1945, however, exports dropped rather sharply as a result of competition with petrochemical resins, which are preferred for most industrial uses.

Nowadays, Indonesia is the only damar-producing country in the world. Damar resins are marketed through both interinsular and export markets. Major end users are low quality paint factories in Indonesia, which use the lowest grades. The best quality damar is reserved for export, mainly to Singapore, where it is sorted and processed, and re-exported as incense or a base for paints, inks, and varnishes manufactured in industrial countries. Other destinations include handmade batik industries and the manufacture of low quality incense (Bourgeois 1984; Dupain 1994; Anonymous 1995).

In the glorious period of intensive harvesting for export, from the beginning of the twentieth century until World War II, the main damar producing areas were the natural forests of southern and western Sumatra, as well as West Kalimantan (van der Koppel 1932). Today, West Kalimantan and South Sumatra still produce some damar, but the main producing area is certainly Lampung, the southernmost province of Sumatra.

Access systems

According to the ancient customary tenure system, forest lands and resources were managed as common property by the local community, unlike irrigated lands for rice production, which were privately owned. Individual claims over economic resources in the communal land were acknowledged for certain species and through certain technical processes. Thus, a wild damar tree could be appropriated by those who first began tapping it; collecting damar from

that tree was then considered their own and exclusive right. However, nobody could claim rights over a piece of unmanaged, pristine forest. Access to land for subsistence and cash cropping was usually gained through clearing a piece of land in the communal forest and cultivating it. Distribution of access rights between the various families consisted of long-term individual usufruct rights. The land itself remained the property of the community. These individual usufruct rights were in fact tacitly maintained long after the crops were abandoned, and the same family could recultivate the land after a fallow period without asking permission. However, customary rights strictly forbade the planting of perennials on these communal forest lands, except for short-lived perennials like coffee or pepper.

As more people developed an interest in damar cultivation, the assembly of community heads, responsible for the customary law, formally accepted the removal of the prohibition against planting perennials in the communal lands, which boosted the spread of the plantation movement and led to drastic land appropriation activities by individuals in the former communal forest domain (Levang and Wiyono 1993). However, land property could only be claimed through tree plantation, and the old tenure system—communal property of the land and usufruct rights—prevailed for unplanted plots.

As the plantation process was conceived in a context of the relative failure of common property systems, its success required the assurance that the planter's children would effectively enjoy the right to harvest the trees, which implied that not only property rights are acknowledged and enforced, but that transmission rights are also secured. The consequence is that created land properties never returned to the community; the commons gradually disappeared. However, the privatisation process remained original as it did not entail promotion of individual control nor fragmentation of the agroforestry domain (Mary 1987; Levang and Wiyono 1993; Michon *et al.* 1995b).

Common property rights and values in the framework of private agroforests

As forest resources and structures have been re-established, common property traditions have been redefined and reinforced in the context of privatisation. Important economic resources such as resin and commercial fruits, as well as land, are effectively individually owned assets. However, on these private agroforest lands many resources are still considered as common property or open access resources. Noncommercial fruits, sap from the sugar palm, bamboos, and special thatching leaves provided by species commonly considered as 'planted' remain at the disposal of the community.

In the same way that the technical appropriation of the forest resource did not fundamentally change the Pesisir landscape, the institutional re-appropriation of the former forest commons through 'controlled privatisation' did not result in a total institutional revolution that erased old values. This maintenance of the communal philosophy in agroforest management is essential. In the way that former common property regulations controlled the permanence of the commons, the new property ethics in the Pesisir ensures that trees and land will be integrally transmitted to future generations.

For village communities the private property legal framework could secure a better bargaining position with external bodies than common property, which is still negatively perceived or easily denied by most state bodies as well as by private companies. The Indonesian administration more easily acknowledges, and compensates for, private claims over land. Privatisation could therefore be used as a political strategy for local communities to protect their resources.

TRENDS AND ISSUES—DEVELOPMENT AND CONSERVATION LESSONS

From extractivism to cultivation

Agroforest establishment in the Pesisir does constitute a true revolution in both the forestry and agriculture contexts. As a forest plantation strategy, the damar agroforest model runs counter to the conventional model of timber estates that are presently being developed. While favoring a selected resource, as estates do, the agroforest allows the maintenance of numerous other resources that otherwise would not have been conserved purposefully, and species that are not direct resources to be restored as well. Moreover, the establishment process allows the restoration of integral biological and ecological processes which are crucial to the overall survival and reproduction of the agroforest as an ecosystem. If encompassed in the framework of agricultural plantation strategies for the development of forest lands, extension of the damar agroforest represents a process of forest conversion that does not go along with economic reductionism. On the contrary, through the restoration of biodiversity in the agroforest, farmers have achieved the restitution of a whole range of economic choices for the present and the future, which appears indispensable in a sustainable development perspective. The agroforest development also represents a successful strategy for agricultural intensification that has helped to set farming system patterns without any disruption in food availability or living standards, while maintaining intact the productive potentialities of the land itself.

Agroforests are *not* natural forests that have been gradually modified through management. They represent an artificial area, which has been created by farmers' communities. They result from a voluntary decision of these communities to re-establish forest resources and to recreate forest structures. Natural forest management in Indonesia, including extractivism, is still a form of exploitation of nature's gift. Agroforest management is beyond that: it is the invention and the achievement of a new form of forest resource management on former natural forest lands.

The need for legal recognition

Damar farmers are caught between two mutually exclusive administrative mechanisms regarding their lands. Part of the damar gardens have been classified as state forest lands, as either Limited Production Forest or Protection Forest. The remaining areas of damar agroforests are 'unclassified' as far as the Forestry Service is concerned; they are not public land and are therefore

sometimes called 'private land'. However, private appropriation by local people is not formally acknowledged as farmers do not hold any official land certificate for either rice fields or damar gardens. In both cases, their legal position is dramatically weak. To forest authorities, they are undoubtedly outlaws. Conducting any agricultural or harvesting activities on forest lands without permission from the Department of Forestry is constitutionally illegal and implies a penalty. Under a 'private' regime, but with no land title, damar farmers may be considered as squatters on empty lands that are reserved for regional development. In both cases, they are highly subject to eviction in order to give way to 'projects'.

Forests, as well as non-forest lands in the Pesisir, represent the last 'wild frontier' in the already highly populated province of Lampung. Because of its proximity to Jakarta and ongoing road development, it is a tempting invitation for private speculators such as estate developers and agro-industries. For the regional authorities, these potential investors represent highly interesting parties. Besides being important taxpayers, which farmers are not, their investments would greatly increase the regional development index and supposedly increase the level of industrial activity in the area (Kusworo 1997).

Since the early 1990s, following completion of logging operations, the provincial authorities have started allocating 'private lands' as well as part of the logged-over forest lands in the three Pesisir subdistricts to two oil palm companies. Local farmers were not informed of these projects and started asking questions when they encountered field teams measuring land, including their damar gardens and even their rice fields. They not always received the correct answer.

Local authorities specified that oil palm would be planted only on 'empty' lands, though local farmers could also be invited to join with their own lands if they wished. They started campaigning to support the project, asking village heads to speak highly of the economic merits of oil palm planting and to ensure farmers' co-operation. But they also specified that no farmer should be compelled to give up his damar land for the company and that no damar tree should be felled without the consent of the owner. One of the companies soon applied its own conception of 'inviting' farmers to join. After a formal convocation conveyed through the subdistrict head, or *camat*, to village authorities, and given the subsequent lack of enthusiasm from damar farmers, it decided to use fake but positive agreements signed by farmers in lieu of true but negative ones, and started clear-felling damar gardens under moonlight!

The joint claims of farmers, nongovernmental organisations and international research institutions asserting that replacing farmers' damar gardens by oil palm estates was neither ecologically nor socially acceptable, and that the way this replacement was about to happen was clearly a classic case of power abuse by economic and political elites, finally succeeded. In December 1996, the Ministry of Forestry asked the first company to suspend its activities and solve the current conflicts with local damar farmers, while in March 1997, the provincial governor asked the second company to halt its activities.

Justice issues

The Pesisir case addresses many justice issues. The main one concerns civil justice. The basic property and use rights of local people over lands and resources they have not only managed, and sustainably managed, but also developed and enriched over centuries are not fully recognised by the state in spite of constitutional facilities that accommodate the acknowledgement and legalisation of such rights. This issue is not specific to the Pesisir; it constitutes the major confrontation area between the state and forest farmers' communities, while revealing the major impediment to the integration of local communities as groups of fully vested citizens into the Indonesian nation. Closure of the damar lands by the state would constitute not only a violation of basic rights but pure theft. Replacing damar gardens by estates, either forest or agricultural plantations, or reserving the damar gardens for any project of conservation or production forestry would obviously constitute a forceful appropriation not only of other people's lands, but also of the fruit of other people's labour.

The second issue is one of economic and social justice. Replacing damar gardens with specialised oil palm or acacia plantation might prove, in the short term and with a partial economic valuation, an economic gain for the region. However, it is uncertain whether this economic gain will be redistributed to the farmers who will, certainly, contribute to this gain through their—underpaid—labour. In terms of equity, the overall economic characteristic of the damar gardens is that the majority of the benefits they provide go to local people: farmers, wage labourers, local trade entrepreneurs. But the income officially derived from the damar activity by and for the district is almost nonexistent: taxes upon the damar resin represent less than 0.1% of the district budget. Industrial plantation estates provide much higher profits—but to a far lower number of people—whereas levies raised by the district through the estates and the related industrial processing units are numerous and substantial. Seen from the point of view of regional administrators, the choice is obvious.

The last issue concerns environmental justice. The damar garden system developed by Pesisir farmers has proven to be an almost perfect ecological substitute for natural forests, in fact probably the best possible one for a diversified production system. Destroying damar gardens to make room for specialised oil palm or acacia plantation would obviously constitute an ecological crime with, among other immediate consequences, the destruction of the specific habitat for many lowland plant species; a significant reduction in the feeding and breeding areas of many endangered mammal and bird species (Sumatran rhino, tiger, tapir, elephant, siamang, hornbills and rapaces); and a drastic increase in soil erosion with consecutive siltation of the Pesisir coast and of irrigation works in the lowlands, not to mention the increase in ecological risks for people as well as for the plantation. An additional consequence is the uncertain ecological sustainability of monocrop plantation over the long term, which has to be compared to the proven sustainability of the damar enterprise over the last 100 years. Crimes of this sort do not result in immediate punishment, but their long-term costs, for locals as well as for the nation itself, are potentially immense.

Which strategy for conflict resolution?

The damar success story has been strongly endangered. Pesisir farmers have been facing urgently threatening choices: either to become labourers on their land as their damar agroforests might be converted to oil palm estates, or to see their rights strongly restricted by zealous foresters who confound damar agroforest with natural forest and thus forget that there are no damar agroforests without damar farmers.

Indeed, culturally, biologically, economically and socially, damar farmers have succeeded in re-appropriating their forest resources. However, what the last few years of threats have shown is that the re-appropriation was obviously incomplete, enough to ensure the long-term sustainability of the system but not enough to protect its short-term survival. To be ensured against forceful conversion, a fifth element is needed that would translate into legal terms the formal and official recognition of the damar farmers' contribution to overall national and regional objectives.

The agroforest situation did not fit any of the existing legal forest categories. In response to this problem, the Minister of Forestry issued a decree in early 1998 that creates a new forest category in Krui. By this decree local communities are now legally and officially recognised as the sole users and sole managers of the state forest area covered with damar agroforests, as long as it stays as agroforest. The area remains state land, so farmers' ownership rights on the land itself are not recognised, but their usufructs rights on damar agroforest, including transmission rights, are now fully recognised (Fay *et al.* 1998; Fay and de Foresta 2001).

The 'agroforest framework' offers a good opportunity to escape the formal forestry context and to devise new forms of association between farmers, foresters, and regional authorities concerning forest resources. Ecologically, economically and socially the agroforest should not be identified with a natural forest, and indeed, as long as this confusion between forest and agroforest is maintained, as long as local practices for management of forest resources in farming systems are ignored, the chances of survival of agroforests as a unique model of integral forest management continue to decrease. Agroforests, once recognised, open a totally new field for negotiations between foresters and local communities, a field favourable to institutional innovations where ancient conflicts might be resolved without one or the other party losing face.

ENDNOTES

1. Modified after Michon, G., de Foresta, H., Kusworo, A., and Levang, P. 2000. The damar agroforest of Krui, Indonesia: Justice for forest farmers. *In*: Zerner, C. (ed.) *People plants, & justice: The politics of nature conservation*. Columbia University Press, New York.

2. Institut de Recherche pour le Développement (IRD). Current address: Centre ENGREF de Montpellier, 648, Rue Jean-François Breton, Domaine de Lavalette 34093, Montpellier, Cedex 5 France.

3. At the time of study affiliated with the International Center for Research in Agroforestry, Southeast Asia Regional Office, Jl. CIFOR, Sindang Barang Bogor 16680, Indonesia. At present: Department of Anthropology, Research School of Asia and Pacific Studies, the Australian National University

4. 'Damar' is a generic term used in Indonesia to designate resins produced by trees of the Dipterocarp family.

5. The most valuable but also less predictable extractive commodity in the damar gardens is rattan. Rattan cane harvest is subjected to the profit/failure dynamics of local buyers. This important economic unpredictability constitutes the main impediment to the development of rattan harvesting into a real garden production.

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Chapter 14

Paper Mulberry (*Broussonetia papyrifera*) in Lao PDR:
a successful example of forest
product domestication

Catherine Aubertin¹

Common names	Part of the resource used	Management	Degree of transformation	Scale of trade	Geographic range
Paper mulberry, Posa	Bark	Wild/ Cultivated	Medium	International	Large

OVERVIEW

Paper mulberry, *Broussonetia papyrifera*, is a pioneer species, commonly found in fallow after slash-and-burn cultivation. In Lao People’s Democratic Republic (Lao PDR), paper mulberry is cultivated in Sayaboury province as a cash crop, while in Luang Prabang province naturally occurring paper mulberry is harvested from fallow lands. Paper mulberry bark is usually integrated in a trade system of several cash crops, dominated by Thai buyers. It is processed into paper in Thailand and then exported to Japan and Korea. In Luang Prabang, the government’s attempt to stop shifting cultivation by allocating only three plots of land for cultivation to farmers has encouraged farmers to intensify exploitation of wild mulberry for extra cash income. This government policy has also stimulated the cultivation of paper mulberry in monocultures, at a cost to the existing agroforestry systems. Paper mulberry production could be improved, for example, by improving grading activities. However, the production in Lao PDR will remain vulnerable to fluctuations as it is controlled by Thai demand. The study of the paper mulberry network, like that of many other forest products, has enabled this research to touch on agricultural and environmental policies and the restrictions on land these policies have introduced for other activities, characterised as traditional. It has also enabled the following of regional and international marketing networks in the country. Paper mulberry provides a good example of successful domestication of a forest product.

INTRODUCTION

Paper mulberry, *Broussonetia papyrifera*, belonging to the *Moraceae* family, is widespread in Lao People's Democratic Republic (Lao PDR). Paper mulberry is a shrubby tree that sprouts spontaneously in swidden fields, after the harvesting of *ray²* rice. Paper mulberry is also common in degraded forests and is used more and more often as a plantation tree in forests and fields. Its branches supply the bark that is used in paper production.

Paper mulberry bark has long been used. The French explorer Auguste Pavie related that in 1887 he had attended a parade, in Luang Prabang, organised under a triumphal arch covered with 'cardboard made from mulberry pulp, from a pattern sent specially from Bangkok' (Pavie 1995: 37). Before the introduction of imported sisal and nylon ropes, farmers used to make string and rope from mulberry fibres. Paper production, however, is still limited in Lao PDR. It is the work of a small number of Yao people who draw Chinese characters, constituting the written form of their language, on mulberry paper, for use in religious rituals. Nowadays, paper production is promoted within the context of small development projects, intended to raise the standard of living of mountain people, and on the initiative of handicraft shops for tourists.

Large-scale export started only recently, after the economic opening of the country since 1989, when the communist government began to promote a market economy, and because of a growing demand from Thailand, where the bark is processed into paper pulp for further export to Japan and South Korea. In the latter countries, it is used to process special papers for banknotes, liturgical objects, lanterns, luxury stationery, etc.

The research area

This monograph is based on field studies carried out during the 'forest areas management' research project led by the Institute for Research and Development (IRD) and the Nabong Faculty of Agriculture of the National University of Lao PDR in Sayaboury and Luang Prabang provinces (Figure 1). Sayaboury is a dynamic area because of its commercial relationship with neighbouring Thailand. In Sayaboury province, data were collected in Kenthao and Paklay districts, where paper mulberry is grown as a cash crop. In Luang Prabang, which is a more traditional mountain area of northern Lao PDR, paper mulberry comes mainly from fallow land. The population densities in the two provinces are similar, at around 20 people/km².

THE PRODUCTION-TO-CONSUMPTION SYSTEM

Description

Paper mulberry, called *Posa* in Lao and *Salae* in Khamu (the second largest ethnic group in the Lao PDR), grows rapidly and reaches its full mature height at between six months and one year. The ordinary stature of the species is about 3 m and the stem diameter is about 5 cm. At first, the stems are

Figure 1. Map of the study area



Source: ESRI Data and Maps 2002.

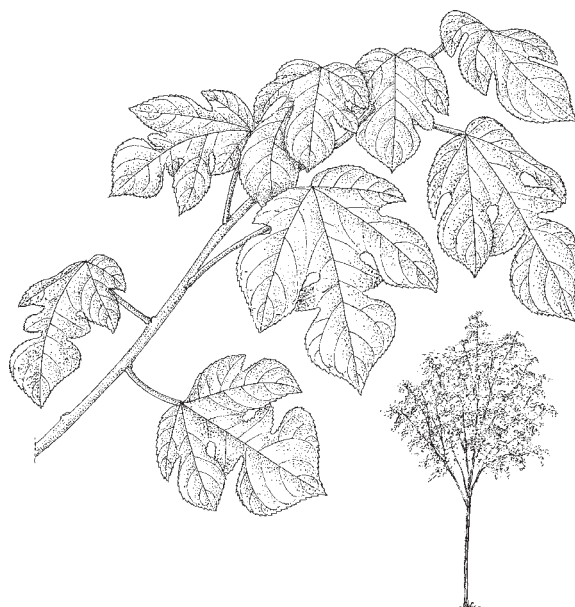
covered with down and then the bark turns smooth and grey. Its leaves are large, with several lobes, and measure more than 20 cm. The red fruits are small (3 cm in diameter) and though reportedly edible not much sought after.

Paper mulberry grows as a pioneer species all over the country. It grows at moderate elevations (500-800 m) in secondary forest and early fallow regrowth following slash-and-burn cultivation. It is traditionally a regeneration species under *ray* requiring a moist forest environment on flat or sloping land (Fahrney *et al.* 1997). Paper mulberry is especially common in northern Lao PDR, particularly in Luang Prabang, and also in the south-eastern province of Sayaboury, where it is now cultivated on a large scale. When domesticated, paper mulberry is grown in managed agro-ecosystems. In Sayaboury, it is cultivated with success as a flood crop along the Mekong riverbanks. Though it is adapted to all kinds of soil, paper mulberry grows particularly rapidly on moist alluvial soils.

The species sprouts spontaneously after burning and has long been considered a weed by foreign agricultural experts. However, paper mulberry trees are much appreciated by farmers because they accelerate the regeneration of soil fertility (thanks to their extensive carbon-fixing root system and their large leaves), along with their rapid growth, resulting in rapid canopy closure, which in turn reduces weeds.

It can be assumed that this is the same variety that grows all over Lao PDR. Male and female flower types occur on separate trees, which are

harvested in the same way. The species propagates through spontaneous germination and sprouts from the base when properly harvested. No serious diseases that affect the tree have been reported.



(*Broussonetia papyrifera*)

Harvesting

The more important part of the production is harvested in March and April, before the wet season. The quality in these months is higher with little moisture (less than 35%), which is reflected in the prices paid for the bark. The second and lesser part of the production (25%) is harvested between October and December, at the end of the wet season. This period is reported to be suitable because the inner bark is easy to strip, easily dried and therefore free of fungal problems when stored.

Paper mulberry can be harvested when the tree is just one year old and then every six to eight months thereafter. The theoretical yield increases until the sixth year and then begins to decrease. If the tree is harvested for commercial purposes, the harvest cycle will be short (six months). If the objective is to occupy an area for reasons of land speculation, the cycle can be very long, more than four years and even then the trees may not be harvested.

Quality paper mulberry must be young, from six months to one year. However, three to four year old paper mulberry bark can be sold at a price that may be 30% to 50% lower. The optimal stem diameter seems to be between 2 cm and 4 cm. Three to five branches are harvested on each tree.

Harvest from fallow lands

In active swidden *ray* fields, studied in Luang Prabang, the stocking density amounts to 300 plants/ha. Farmers do not let paper mulberry grow too long in fallow fields to prevent competition with other plants. It is generally harvested and removed from two to three year fallows after having fulfilled its function as a weed control. Harvesting in swidden *ray* fields is usually carried out in conjunction with other hunting or gathering activities. Farmers harvest from fallow fields belonging to their household or to other villagers. Traditionally, in Luang Prabang province, the harvest of paper mulberry from fields where rice had just been harvested was free for all the villagers. The freedom to harvest paper mulberry from old *ray* has tended to disappear with the reduction of forest areas and the increase in individually owned plots.

If properly harvested without damaging the tree (it is not necessary to cut the tree down completely), new shoots will sprout. Harvesting paper mulberry is not detrimental to plant or environment. Paper mulberry is one forest product for which there is no threat of extinction through overexploitation.

Cultivation of paper mulberry

Cultivation has developed following demand. It was implemented by the farmers themselves. They practise selective weeding in order to protect paper mulberry shoots. Then they plant root cuttings for propagation in their *ray*. Today, in Sayaboury province, paper mulberry is mostly planted in fields with significantly higher yields than those recorded in *ray*.

Paper mulberry is still a secondary crop for farmers, and is extensively produced by those who have enough land. It is generally intercropped with fruit trees and trees grown for their shade, like the kapok tree in Sayaboury and teak in Luang Prabang.

Farmers plant root cuttings, which they obtain either directly or through a tree nursery, in June, during the wet season. It is possible to plant seeds but the results are judged less reliable. The proper spacing to obtain longer fibrous fibre is reported to be about 1.5 m x 1.5 m, which represents a planting density of about 5,000 plants/ha. But the planting density depends on the objective of the farmer: weed control, limited competition with rice (3 m x 3 m) or with other trees (4 m x 4 m) or to show and mark ownership of a field (very wide spacing is then possible).

Paper mulberry cultivation requires several kinds of activities: fencing, first-year weeding and stripping. Then, the upkeep consists of weeding two or three times each year and cutting off any excess shoots, leaving only four to five on each tree. Weeding is the most restricting activity because it is labour intensive. In Sayaboury, the fields are weeded in January, May-June and September. A worker can cut and strip between 7 kg and 8 kg of dried bark per day. For one hectare yielding one ton of bark, the theoretical labour requirement amounts to 120 days. In Sayaboury province, each family harvests on average 100 kg of bark per year. Few families own large areas, most have less than 0.5 ha (Pelliard 2000).

Photo 1. Two year old paper mulberry tree in a mulberry paper plantation, Huaphan Province, Viengthong district (Photo by C. Aubertin)



As a rule, the areas under cultivation vary greatly according to market prospects. Farmers can easily change paper mulberry for another crop, and let it grow again spontaneously to harvest it the following year. They can also choose not to harvest if the price is too low. They either keep a standing stock of paper mulberry or give up the activity. The labour force is limited to family members. Both men and women plant, harvest and strip the outer bark from the mulberry trees. There are no particular rituals.

Production in Kenthao and Paklay districts, Sayaboury province

It is estimated that about one third of families in the southern districts of Sayaboury (7,000 families out of 20,500) harvest paper mulberry. The agricultural departments in Kenthao and Paklay districts in Sayaboury province, where we carried out a survey, only register the areas of paper mulberry that are either planted or looked after. It is therefore difficult to gain an understanding of the importance of 'wild' paper mulberry, forming scattered and temporary islands that are not registered. Yet this paper mulberry is also harvested and sold, and represents the main part of the production in other provinces.

In Kenthao district, the increase in cultivation of paper mulberry has followed the general agricultural growth in the area after the economic

opening up of Lao PDR. In 1997, there were 9,099 ha of cultivated lands in Kenthao district. Paper mulberry represented 4.7% of this area and 9% of the 4,718 hectares devoted to cash crops. Up until 1997 the land planted with paper mulberry in Kenthao district had been slowly increasing, but the area has since decreased again by 50% to 203 ha. This might be seen as a consequence of the economic crisis in Thailand in 1998-99, though it did not have any obvious effect in Paklay district, where the areas planted with paper mulberry have increased steadily since 1990. In 1999, the area planted with paper mulberry was twice as large in Paklay as in Kenthao (RDPL 1999).

The quantities reported by the trade department fit neither the areas reported to have been planted nor the yield assessed at the district level nor the statements of the actors who have undergone a downturn in their activities during the 1998 crisis. In Paklay there are huge gaps. In 1999, the quantity officially produced was 585 tons whereas exporters reported to have exported 500 tons and the trade department registered only 219 tons (Table 1).

Postharvest treatment and trade of paper mulberry

After cutting the branches, inner and outer barks are stripped from the woody stems. The inner bark is then separated from the outer bark, which is discarded. This is generally done in the field. The inner bark is hung out in the village to dry in the sun for a day. This step is important to limit mould. In Sayaboury (as in Luang Prabang), mulberry bark is sold in 1 kg bundles with most transactions being recorded in April.

The village first order traders are based in the villages and collect all kinds of products, according to the season. There is generally only one collector in a village, situated by the main road or riverside. These collectors store the paper mulberry in their homes on boards and protected by canvas covers. Once they have collected a given amount, generally more than 1 ton, they inform the exporter who comes to collect it. The farmers, who come from the most isolated villages, must deliver their harvest on foot, in carts or in cultivators. Each collector works principally for one specific merchant. The number of village collectors in Paklay and Kenthao districts is estimated at about 100.

There are no exclusive relations between collectors and traders, so the bark can be sold to the first trader who passes through the field or the village. Thirty percent of the production is directly collected at the central collection centre and 70% is collected in the villages. Farmers from villages close to the border sometimes transport and sell their products in Thailand, without going through a middleman.

Information on prices is circulated one to two weeks before the harvest. Kenthao authorities assert that prices are discussed between Lao traders and the trade department, after which the village leaders are officially notified. This was not the case in Paklay. A farmer sells about 100 kg per year. A trader may buy up to 20 tons and exporters from 10 tons to 1,000 tons. There is at present a concentration trend in the network that benefits the biggest traders, who sell directly to the Thai processors.

Table 1. Paper mulberry production in Kenthao and Paklay districts (Sayaboury province)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Kenthao District											
Area (ha)				118	118	128	384	427		203	300
Production (t)				117	117	128	460	513		243	360
Yield (t/ha)				1	1	1	1.2	1.2		1.2	1.2
Paklay District											
Area (ha)	10.35	40	124	244	357	360	240	300	450	450	600
Production (t)	7.24	31.5	85	95	324	324	312	390	585	585	780
Yield (t/ha)	0.7	0.82	0.68	0.66	0.9	0.9	1.3	1.3	1.3	1.3	1.3

Source: Statistics of the agricultural departments of Kenthao and Paklay Districts.

Paper mulberry is sent mostly to factories in Sukkothai (1,500 tons of bark was processed in 1997), Uttaradit and Konkhaen (Phoenix factory). Private wholesalers and purchasing companies share the Thai market among themselves according to defined geographic areas. The eastern area comprises Loei and Konkhaen, and the central area Bangkok and Sukkothai. They buy directly from big Lao exporters or from four to five Thai middlemen who control the products crossing the border in Kenthao (Pelliard 2000).

Photo 2. Bark stripping, Huaphan Province, Viengthong district (Photo by C. Aubertin)



Quality of the bark

The product collected in Lao PDR is of medium quality, and competition between first order traders leads to the purchase of bark that is not properly dried. The first trader who arrives in a village rushes to buy the bark. Bark grading requires much attention and is often done too fast by buyers. Thus quality is not properly accounted for in the price.

There are different grading categories. Top quality bark must be as white as possible and without knots or discoloration from fungi. Bark quality depends

mostly on the plantation age and is better when harvested from the secondary stems of young plants, less than three years old, with a diameter of 2 cm to 4 cm. It is essential to store bark in a dry place because mould appears quite rapidly in a moist environment. After one month in storage, about 20% of the bark quality may be lost.

In Thai processing factories, which buy the raw material, mulberry fibres are valued for their length and suppleness and resistance to tearing and creasing. The factories then grade the bark into four categories. 'Super A' grade is exported to Japan, and processed there. Grades 'A' and 'B' are processed either into paper or loose fibres that are compressed for further export to South Korea. Grade 'C' is sold to small Thai handicraft companies, where it is processed by hand.

Box 1. Export routes

There are two main export routes. Mulberry fibres may be sent from Luang Prabang by boat up the Mekong River to Bokeo province, reaching Houayxay and then on to Thailand. Or they may be sent down river to Sayaboury province in the south, down to Paklay harbour and then transferred by truck to the border town of Kenthao. The latter route is used for paper mulberry fibres produced in Kenthao and Paklay districts.

Processing paper mulberry

All Lao paper mulberry production is exported as raw material (in bundles) or as paper pulp. There is no paper processing in Sayaboury and only one paper mulberry processing factory in Luang Prabang, the Pethlama factory. This factory has been in operation since 1988. It buys paper mulberry bark locally and also from the northern provinces of Huaphan, Phongsly and Oudomxay. They semiprocess the bark using two grinders and then export the paper pulp to Thailand.

The most delicate stage is the final grading of the bark. After grading, the bark is cleaned and dried in the factory for the first time. The fibres are then soaked for one night, after which caustic soda or ashes are added and the mixture is stirred and boiled for 6 to 8 hours to bleach and thicken it. Between 50 g and 100 g of caustic soda are needed for each kilogram of paper mulberry bark. The resulting fibre slurry is cooled in cold water for a day. The lumps are then cut and ground. The pulp that is obtained is then dried in the Luang Prabang factory and exported to Thai factories where paper is produced. The Pethlama Company employs 80 workers. Fifty are employed to collect and buy the bark, while the others wash and defibre the pulp.

We did not observe paper processing in Thai factories, but at the head office of the Japanese FORCAP project, south of Luang Prabang on the road to Vangviene. To carry on with paper production, the damp pulp is poured into a fine sieve, often made of wire mesh in a simple frame the size of the sheet

that will be obtained. The standard size seems to be 60 cm x 80 cm. The thickness of the sheet depends on the sieving know-how. The more often the pulp is sifted, the better the quality. The frames are set in the sun to dry for a few hours, then the sheets are separated from the wire mesh and pressed. One kilogram of wet paper mulberry fibres yields 400 g of dried fibres. One kilogram of dried fibres yields 400 g of paper. At the FORCAP project headquarters, seven people can produce about 100 sheets of paper per day.

Prices and incomes

The economic profitability of the product can be assessed at US\$1.7 per working day per person with a price of US\$0.25 per kilogram in 1998 (Phongsavath 1998). Paper mulberry has a higher yield per hectare than rice but a lower yield than maize or kidney beans.

In July 2000, the average family income for two workers in the studied area in Sayaboury province amounted to US\$800³. More than 70% of the family income is monetary, which is exceptional in Lao PDR and is a result of closeness to the Thai market, which sustains the development of cash crops. With an average harvest of 100 kg of bark, sold at US\$0.35 per kilogram, paper mulberry can provide a family with an income of US\$35 per year, i.e., about 4.5% of total family income and 6% of their monetary income. The harvest of paper mulberry bark is a supplementary farm activity. Decision-making regarding this activity depends on the need for rice and the market evolution of a set of cash crops.

Mulberry bark processors insist on paper quality. For example, the Luang Prabang factory has instituted three markedly different prices according to raw material quality (US\$0.2, US\$0.4 and US\$0.5 per kilogram). A comparable price difference can be observed in Sayaboury. However, first order traders seem unconcerned about passing on this price difference to the households harvesting mulberry bark. Either they want to increase their margin or they refuse to take on additional selection and grading work. Farmers do not seem to be well informed of these various prices. According to official data, which do not account properly for inflation and exchange rates among the three currencies used (USD, Lao kip, Thai baht), during the years 1997, 1998 and 1999 the price paid to paper mulberry producers varied between US\$0.25 and US\$0.6 per kilogram. In kips, the price has increased evenly from 500 kips/kg up to 3000 kips/kg. (Pelliard 2000). It is therefore difficult to gain a clear understanding about the evolution of the product price.

In Sayaboury province, in Kenthao and Paklay districts, there is not a big difference between the price paid to the producer (US\$0.37) and the free on board (FOB) price at the frontier (US\$0.5) per kilogram. The collectors manage to retain a margin of US\$0.04 per kilogram of bark, whatever the export price. The adjustment cannot be such that the price paid to the producers is too low, or they are likely to give up harvesting. The adjustment is often to the detriment of the exporters' margins (Table 2).

Table 2. Breakdown of FOB prices in US\$ in different districts

Price per 100 kg of dried bark	Kenthao US\$	Paklay US\$
<i>Price paid to producers in the field</i>	37.50	34.50
Labour force: weighing, loading, grading (paid by exporter)	0.40	0.40
Transport to collection centre (district) (paid by exporter)	0.13	0.13
<i>Price paid to collectors (district)</i>	41.50	38.50
Collector's net profit	4.00	4.00
Transport to border	0.53	2.40
Tax on forest products (3% of price paid to producers in the field)	1.12	1.04
Customs dues (3% of price paid to producers in the field)	1.12	1.04
<i>FOB price</i>	47.00	47.00
Exporter's gross profit	2.20	3.49
Part levied by state company (30%)	0.66	1.05
Exporter's net profit	1.54	2.44

Exchange rate in July 2000: US\$1 = 7500 kips

Source: Pelliard 2000.

An export-oriented market

Since 1989, with the economic opening of the country and the promotion of a market economy, the demand has turned a product with local home use into a much sought-after export product. While the development of tourism in Luang Prabang supports the renewal of local consumption of handicraft objects (decorated papers and souvenirs), the traditional use of paper mulberry, the making of fetters for animals, has almost disappeared.

While local agricultural departments are interested in the development of paper mulberry, it is not really a matter of concern for the national agricultural department, perhaps because of the status of paper mulberry. As a forest plant it is close to being regarded as a weed. In Vientiane, paper mulberry has such a poor image that it did not even appear in the last agricultural census (1998/1999) questionnaire and is not included in the list of plants for which the Ministry of Agriculture has issued production forecasts for the 1999/2000 harvest. Only the forestry departments have data on this product. The figures they have are the result of an attempt to centralise the data of all the provinces. They are not made public so that we had to conduct a survey within the departments. The results are unconvincing. They indicate a national total quota of 1,740 tons (collection authorisations given to merchants) for an actual production of 735 tons at the end of 1999. The main producing provinces are those of Sayaboury (quota of 1,500 tons and 60 tons

of production registered) and Luang Prabang (quota of 100 tons and 591 tons of production registered) while, according to our estimates, the production would amount to 1,000 tons in Luang Prabang and 800 tons in Sayaboury.

Paper mulberry appears in the customs' export statistics, but only 508 tons were reported as exported to Thailand in 1998, representing a value of US\$150,000. The export price would then be US\$0.3/kg, without distinction between paper pulp and the various qualities of dried fibres of lesser value. The export data are therefore more likely to be an underestimate.

Thailand is the main buyer, Japan and Korea then buying high-quality paper from the former. Paper mulberry is no longer cultivated in Thailand, which is more developed than Lao PDR and offers better opportunities to increase the profitability of land and labour. Lao PDR appears as a buffer zone for Thailand and the Lao production is used as a marginal supply, enabling the adjustment of the Thai market to meet international demand.

TRENDS AND ISSUES—DEVELOPMENT AND CONSERVATION LESSONS

Demand for a panel of products

A product destined for export cannot be studied in isolation. Paper mulberry, being exported to Thailand, has always played a supporting role in exchanges and networks that were dominated by cotton some years ago and are now dominated by maize. However, its relative importance has tended to increase against that of other products, following demand.

All the merchants endeavour to meet the Thai demand for products from cotton, maize and peanuts to kidney beans, sesame seeds and Job's tears, among others. Consequently there is no merchant specialising in paper mulberry. As paper mulberry is an export product, it does not concern small retailers who intervene only at a local level.

The local production of paper mulberry in some other areas of Lao PDR is often insufficient or does not fit the demand from Thailand. Lao traders sometimes have to get supplies from the Luang Prabang area to honour their orders. However, paper mulberry depends on trade channels that also concern several other products. Thai traders who deliver products to Luang Prabang may take back a cargo of paper mulberry from Luang Prabang to cover transport costs. For example, a big merchant who supplies Thai products in Luang Prabang (e.g., cement) makes the return journey pay by taking back agricultural products. Likewise, the merchants of the Kenthao area who supply Luang Prabang processing factories with agricultural products look for freight for the return journey.

The demand for a group of products is determined by the Thai local market and above all by the international market, through the processing factories in Thailand. Peanuts and maize are processed for the Thai and international markets, beans are exported to Japan, and paper mulberry is exported to Japan and Korea. The demand is passed on to Thai wholesalers, to Thai retail dealers, and eventually to Lao exporters.

Because of its monopoly Thailand can control the trade in Lao agricultural and forest products, which includes prices and quantities. When prices drop on the Thai market, Lao producers and merchants have some difficulty selling their produce. In 2000, only half of the cotton production was sold in Thailand and the rest had to be stored or an outlet in Luang Prabang found.

A credit-sustained monopoly

Thai domination is all the more important as it controls demand but also supplies credit for all farming activities. The collection of products is often prepaid. This campaign credit is integrated into the production network of cash crops in Kenthao. These funds are used not only to prepare the soil or to buy seed but also for the purchase of building materials or rice for the poorest people. The interest rate, outwardly nonexistent, can then reach 10% per month.

Except two big, independent merchants who have their own capital, Lao exporters obtain credit for the campaign from Thai intermediary buyers. This credit can then be shared among village collectors and farmers. Each actor, from Thai merchant down to local farmer is therefore assured that he or she will be able to carry out commercial transactions (sale or purchase), which is a decisive asset given market instability, inflation and the fluctuations in exchange rates. These campaign credits account for one third to one half of merchants' working capital, the rest being made up from their own capital. It is an important asset for merchants to have this credit granted in Thai bahts, the currency commonly used.

The situation is noticeably different in Paklay, where commercial exchange between traders and collectors is based on trust. The merchants, who have less capital of their own and receive fewer credit facilities from Thai buyers, would rather borrow from the bank to finance the campaign. These merchants prefer to use the Lao kip as currency.

The Lao import-export company

The Thai economic crisis in 1998 unfortunately coincided with the attempt of the government of Lao PDR to win back economic control over profitable businesses. This policy was given up in 1983 when the Lao government stopped the co-operative system and set up a new market mechanism, a kind of transition from socialism to a market economy. But recently a state-controlled import-export society granting a monopoly on the trade of products was set up to master the market and to avoid the fraudulent export of agricultural and forest products. It must be mentioned that, unlike agricultural products, forest products are considered state property. A special tax is levied on their export, theoretically to compensate for the damage done to the national forests and heritage. This 3% tax is also levied on paper mulberry, even if it is produced in plantations and not harvested from the forest.

The State Company, present in Kenthao and Paklay districts, has signed contracts with private exporters for several reasons:

- To control exports: it grants exporters export licenses and buying quotas.
- To collect taxes: 3% of customs dues measured on the price paid to the exporter and 3% taxes on forest products.
- To be able to levy a considerable part of the profits of the traders (30%).

Merchants think of the company as a 'tiger that eats and sleeps'. Indeed it does not: a) grant support or credit, b) intervene in agricultural product networks, c) assist in the search for new markets, or d) help to establish contractual relations with the Thai market. Official agreements on the quantities and prices are, however, claimed for.

The two biggest merchants in Kenthao have not been obliged to sign contracts with the State Company. They are organised in family groups of three to four people who pool their capital and share the profits. However, they must show their accounts and theoretically they pay the same taxes as the other traders but directly to the Trade and Customs Department. Nine merchants in Kenthao and 11 in Paklay have signed agreements.

How to develop the product?

It appears that the paper mulberry network is such that it is near impossible to create a large income before the final processing stage. The margins are limited and marketing is above all favoured by the fact that paper mulberry is integrated into a panel of products that makes the trade structure possible. However, the State Company has found enough interest in the sector to levy taxes on its activities. It is also difficult to interpret the decrease in the number of exporters. Is the sector so profitable that it fosters competition, or, on the contrary, is it possible for only the biggest traders to bear the hazards of the activity, including taxes and the instability of demand? Despite the development of areas devoted to paper mulberry, cultivation and production could stop if Thai demand did not guarantee a minimal price. It is therefore necessary to take into account local dynamics when aiming to support or develop this product. There is a market for paper mulberry: it requires neither specific inputs nor technology and presents good adaptive, ecological qualities in monoculture as well as in silviculture.

The first step forward would be to improve the quality of production. It is possible to improve the sorting of the bark by quality grading through information and an incentive price system. It is essential that the drying process and storage facilities be improved so as to improve both quality and prices.

Another possibility would be to look for new markets. The development of a processing industry would require much investment and training for the workers while the market is questionable. Would it be feasible to bypass high-demand markets such as Japan, controlled for so long by Thailand, with the support of the authorities or of family networks in Lao PDR? How can new trade networks be created? The comparative advantage of Lao PDR, in terms of rural image and ecological production, could possibly open up the development of networks in fair trade and eco-products.

Finally, institutional reform is urgently needed. The State Company should supply actual services as a counterpart of taking in taxes. It could play the part of a professional organisation that would negotiate contracts with potential buyers to stabilise prices and quantities.

Spontaneous domestication

Although paper mulberry does not fit the traditional description of a non-timber forest product (for it is a wood product), it offers a good example of the domestication of a forest plant. This domestication has taken place in Sayaboury province under the influence of strong Thai market demand and as a result of the instability of the prices of the main products, e.g., cotton, which made it necessary to diversify production. Farmers have begun to cultivate paper mulberry in their fields and to encourage its growth in fallows. They have successfully used the banks of the Mekong River and they have turned this forest plant into a riverbank flood crop. The domestication has been carried out rapidly, without the intervention of the agricultural department.

Response to land restrictions

Agricultural and land policies have also exerted some influence on the change process. There is no longer any forest in the district of Sayaboury, and most farmers have turned to a farming system in which cash crops—among them paper mulberry—prevail. In Sayaboury paper mulberry is no longer a *ray* plant linked to shifting cultivation of rice.

The situation is different in the northern provinces of Lao PDR, e.g., Luang Prabang, where mulberry forms part of shifting cultivation systems and where presently land reforms related to shifting cultivation are implemented. The new land allocation regulation aims at abolishing slash-and-burn and at developing the private ownership of land, allocating three plots of land to farmer households (MAF 1999). This raises questions related to mulberry production: Should paper mulberry be planted only in the fields or in the so-called 'production forests'? Can it be exploited as well within agroforestry systems as in 'protected forests'? This is a highly debated issue because it refers to the impossibility imposed on mountain people to preserve their lifestyles (Aubertin 2001) and to the disappearance of paper mulberry as a 'wild' *ray* plant and even as a domesticated plant present in the forest.

Development and domestication of paper mulberry in forest areas, where the market is not widespread, show some similarities with cardamom production in Lao PDR⁴. The redistribution of three plots of land to each household for rice production (existing gardens and rice fields are not included in the lands subject to redistribution) implies a reduction in the land area devoted to rice and a reduction of fertility (due to a short fallow period), resulting in lower rice yields. As a result, harvesting of wild paper mulberry from natural forest has increased in order to obtain cash income to buy rice. Related to the farmers' increased need for cash, we observed in Luang Prabang

that the production of Job's tear, encouraged by the government, did not find a buyer. As a result, farmers have intensified their exploitation of forest products in reserved areas.

Since the harvest of mulberry paper is theoretically forbidden in protected areas, its plantation in the allocated land plots is presented as a means to bring additional income to farmers and to reduce the area under slash-and-burn used for subsistence production of rice. This is the viewpoint of the FORCAP project. The domestication of products comes within the context of the search for perennial species likely to replace rice. Since paper mulberry favours weed control and can be harvested after a few months, several projects suggest that it be planted in two-year fallow rotations, the only ones that are possible with the allocation of three plots to each household. However, intercropping paper mulberry with rice is probably not a real solution to ensure adequate soil fertility for rice each year.

As we have seen, the optimal age for harvesting depends on the objective sought: weed control, rice yield, quality fibre for paper production, or a strategy to obtain land ownership of squatter lands (declared as gardens to evade redistribution of the three plots). Reaching the latter aim implies playing with words. Gardens (*swan*) and rice fields (*na*), when recognised as such, remain the property of the user. If producers manage to convince the institution in charge of land allocation at the district level to recognise that the paper mulberry they grow in fallows or in forests is cultivated in a garden, they evade the condemnation incurred for *ray* and cultivation in protected forests. If the manoeuvre is carried off successfully, these gardens are actually privatised and are not included in the lands to be redistributed. They are added to the family's three plots of land.

Biodiversity and the market

There has been a boom in paper mulberry production in Lao PDR, but it could still disappear at any time. The harvest of wild paper mulberry from fallows is doomed in the very short term because of land policies. The low price, which can be partially explained by the fact that it does not depend on the quality of the product, is no incentive to continue growing paper mulberry or to upgrade its quality, especially since the farmer can very easily give up harvesting it by weeding it out and replacing it with another crop, or it can simply be kept standing. Paper mulberry is only one part of the household income in a very diversified farming economy.

Questions might arise as to the future of such a product, which is dependent on Thai demand and credit, while the government mostly endeavours to hinder the sector rather than to support it by imposing contractual agreements with Thailand.

It may well be delusive to look at paper mulberry from the viewpoint of biodiversity. The trend is towards planting in monoculture outside forests, and no longer associated with the practice of *ray*, paper mulberry does not have the ability to protect forests. By aiming to eliminate shifting cultivation, the government compromises farmers' agroforestry practices and is

encouraging monocultures of mulberry. Paper mulberry plantations do not require chemical inputs for the moment but the intensification process will probably continue.

It is difficult to assess the comparative advantages and specificities of paper mulberry in Lao PDR to explain its development. If there is a comparative advantage of mulberry production in Lao PDR, it is linked to the opportunity costs of land and labour in comparison with Thailand where paper mulberry production is no longer profitable. In Lao PDR, paper mulberry production is not supported by a market that acknowledges its ecological or genetic characteristics. It is supported because Lao PDR acts as a market regulator for Thailand, providing raw materials for use in Thai processing industries. Paper mulberry has become a cash crop like any other and is bearing less and less resemblance to a NTFP.

This case stresses that the development of paper mulberry production, probably like most NTFPs, implies the integration of a whole ecological and socio-economic system into a market economy. Consequently, the actors' interplay, the production conditions and even the botanical variety are no longer the same.

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ENDNOTES

1. Institut de Recherche pour le Développement. 5 rue du Carbone 45072 Orléans cédex 2, France. E-mail: Catherine.Aubertin@orleans.ird.fr
2. *Ray* is an area where the forest has been cut and burnt for temporary cultivation of rice and other crops. It is the cornerstone of shifting cultivation, a form of agriculture in which soil fertility is maintained by rotating fields rather than crops. New plots are usually cleared by slash-and-burn and cropped until soil exhaustion. The land is then left to regenerate naturally while cultivation is conducted elsewhere.
3. Exchange rate July 2000: US\$1 = 7500 kips.
4. See chapter 3 in this volume.

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Chapter 15

Moso bamboo (*Phyllostachys heterocycla* var. *pubescens*)
production and marketing in
Anji County, China

Fu Maoyi¹ and Yang Xiaosheng²

Common names	Part of the resource used	Management	Degree of transformation	Scale of trade	Geographic range
Moso, Bamboo, Mao zhu	Stem and shoot	Cultivated	Medium	International	Large

OVERVIEW

This chapter describes the significance, function, characteristics and trends of the bamboo production-to-consumption system in Anji County, China. Moso bamboo [*Phyllostachys heterocycla* var. *pubescens* (Mazel ex J. Houz.) Ohwi] contributes a great deal to the local economy and to farmers' income. With the change from collective to private management rights, the bamboo sector has increased considerably since the 1980s. The establishment of bamboo plantations also had positive ecological effects, as bamboo stands can be established on degraded lands. This has resulted in a decrease in the local people's dependency on natural forests (e.g., for firewood). However, the trend is towards intensification of production, which implies increased use of fertilizers and pesticides. Besides, bamboo plantations are usually monocultures and might compete with remaining natural forests in the area. The government needs to improve institutional support, for example by providing the right incentives to stimulate trade and the processing of higher value products.

INTRODUCTION

China is the richest bamboo producing country in the world, with over 500 bamboo species belonging to 39 genera and 4.21 million ha of bamboo plantations and improved natural bamboo stands (Shidong and Chuande 1998).

The history of bamboo utilisation in China can be traced back 7,000 years to the Neolithic Age, in both the primeval Hemudu Ruins and Liangzhu Ruins of Zhejiang Province where more than 200 woven bamboo articles demonstrating comparatively skilled weaving techniques have been unearthed (Qisheng and Weishan 1997). Anji County has a long-standing bamboo culture. An ancient Chinese work, called 'Shangshu Yugong', stated that, when Taihu Lake came into being, there were many different bamboos growing around it. Anji's bamboos were also recorded in the Tang and Song dynasties. According to a statement by the Ming Dynasty works, there were a lot of bamboos growing in Anji County at that time, stretching over hundreds of miles (Chengye 1993; Zhida 1998).

In modern times, bamboo plays an important role in the social and economic development of Anji. After the political reform of the People's Republic of China, the county government decided to forcefully develop the bamboo industry so as to make it a main source of income for the local economy. In November 1996, the former Chinese premier Li Peng visited the county and referred to it as 'China's bamboo hometown'.

Regional setting

Anji County is located between longitude 119°14' and 119°53' and latitude 30°23' and 30°53'. It comprises 1,886.34 km², which includes 44.21 km² of freshwater. The county boundary is 343.5 km long. Anji is a middle-income county located in the northwest of Zhejiang province, near the 'economic locomotive' of Shanghai (Figure 1). Having 22,600 ha above 500 m altitude and 9,600 ha of slopes greater than 25°, it can be considered a typical hilly county in eastern China. Its mean elevation is 125 m a.s.l. The highest peak, Longwang Mountain, reaches 1,587 m a.s.l. The average annual temperature is 15.6°C and the average annual rainfall is 1,485 mm, falling within the subtropical region of China. According to the forest inventory carried out in 1998, the forestland in Anji County covers 131,938 ha, of which the forested area amounts to 109,875 ha (69% of the whole county). In this, bamboo forests account for 63,338 ha, or 5 % of the total forested area and 33% of the total land area.

Anji is a beautiful resort with fresh air, green scenery and a lot of old architecture attracting many tourists from home and abroad. After 10 years of hard work, a national park with the Chinese Bamboo Museum has been established in Anji.

Cultural importance

Since the New Stone Age bamboo, above all other plants, has been rooted deeply in Chinese daily life and culture, colouring the lives of the Chinese. Some biological properties of bamboo have been thought of as the ideal embodiment of human characteristics, which have been praised in many Chinese songs, poems and traditional paintings since ancient times. Su Dongpo, the famous poet of the Song Dynasty, is reported to have said, 'There are

Figure 1. Map of the study area



Source: ESRI Data and Maps 2002.

bamboo tiles for shelter, bamboo hats for shading, bamboo paper for writing, bamboo rafts for carrying, bamboo skin for clothing, bamboo shoes for wearing, bamboo shoots for eating and bamboo fuel for fires. Indeed we can not live without bamboo for a single day' (Bamboo Information Centre 1994). Chinese literature, legends and epics also mention bamboo.

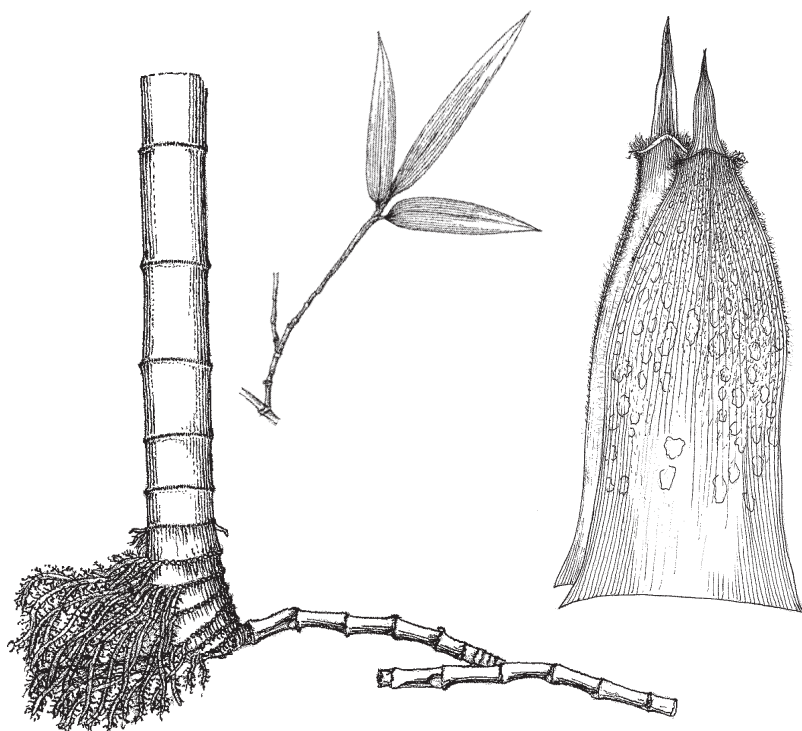
In modern times, the usefulness of bamboo in the daily lives of the Chinese people, especially in the rural areas, has been well eulogised in literature, both scientific and popular. The development of bamboo production has not only achieved extensive social benefits, but has also enriched people's culture, beautified the environment, and is thought to have moulded people's sentiments.

THE PRODUCTION-TO-CONSUMPTION SYSTEM

Resource base

The majority of bamboo stands in Anji County have been in existence for a long time. Bamboo plants are the most important element of the flora in Anji, occurring in many areas from sea level to some 1,500 meters on mountain slopes. The dominant species is *moso* bamboo [*Phyllostachys heterocycla* var. *pubescens* (Mazel ex J. Houz.) Ohwi], a monopodial bamboo, which has been cultivated in the region for centuries. The bamboo area is continuing to

increase. The expansion of the *moso* bamboo area is mainly a result of natural regeneration, whereas other bamboo species are specifically cultivated to meet increasing demands for fresh bamboo shoots on the domestic market.



(*Phyllostachys heterocycla* var. *pubescens*)

The trend in the study area has been one of intensification over the past 10 years. The intensively managed bamboo area increased from 1,000 ha in 1988 to 8,529 ha in 1998. (See Table 1 for characteristics of intensive management.) The management level in Anji County generally is higher than in other regions of China. As a fast growing plant, bamboo consumes substantial quantities of nutrients. It is estimated that, on average, farmers annually apply 200 kg of fertilisers (mainly nitrogen) per hectare to bamboo plantations. Based on data from Table 1 and Table 2 we can calculate that the average labour intensity, including growing and harvesting, was 106 days/year/ha in 1998 for Anji County. The total fertilised bamboo area in 1982 was 2,000 ha, while the high yielding bamboo stands for culms or shoots reached 1,000 ha in the county in 1988.

Table 1. Average yearly input for three types of management intensity

Inputs	Intensive	Normal	Extensive
Fertilizers (kg/ha)	450	225	0
Manure (tonnes/ha)	35	0	0
Labour (days/ha)	225	120	45

Source: Anji Forestry Bureau 1999.

Table 2. Bamboo areas at different management levels of bamboo stands in Anji in 1998

	Intensive management	Normal management	Extensive management
Moso bamboo (ha)	8,295 (16.6%)	20,768 (41.6%)	20,849 (41.8%)
Other bamboo (ha)	4,254 (31.7%)	3,515 (26.2%)	5,657 (42.1%)

Source: Anji Forestry Bureau 1999.

Moso bamboo culms can, in theory, be harvested throughout the year. However, cutting mature bamboo culms during the season of new bamboo growth, especially in April and May, affects the rhizomes, resulting in a loss of sap, which will in turn result in nutrient loss affecting new bamboo growth. If the culms are cut for storage during summer and autumn, they are likely to mould since bamboo culms are rich in sugars and starch during this period and are vulnerable to attack from insects and mildew (fungi). In winter most nutrients are stored in rhizomes rather than culms. In order to meet quality demands and minimize the impact of harvesting on new culm growth, harvest takes place during the following months³:

- Winter shoots: Two months, from the beginning of December to the end of January
- Spring shoots: Two months, from the beginning of March to the end of April
- Culms: Four months, from the beginning of October to the end of January.

If bamboo stands are properly managed the impact of the harvest on the bamboo ecosystem is limited. But if young bamboo culms are cut, bamboo stands will be greatly impaired. It is therefore important not to cut young culms. Preferably, one should harvest only the six-year-old culms, because, generally speaking, the rhizomes of six-year-old standing culms will have stopped producing shoots. Thus, if rhizomes are damaged from cutting the six-year-old culms, it will have little effect on the bamboo stands. In summertime the top parts of rhizomes can be used as a vegetable. If possible, the rhizomes of six-year-old bamboo plants, which are very long, are dug up and used as a raw material for arts and crafts (for example, flowerpot and handbag production).

Research has been conducted on factors influencing productivity (such as site conditions, cultivation measures, and the stand composition) and pest control technologies. The extension of these technologies has greatly promoted the cultivation and utilisation of bamboo resources (Maoyi and Jianghua 2000).

Photo 1. *Moso* bamboo culm (Photo by B. Belcher)

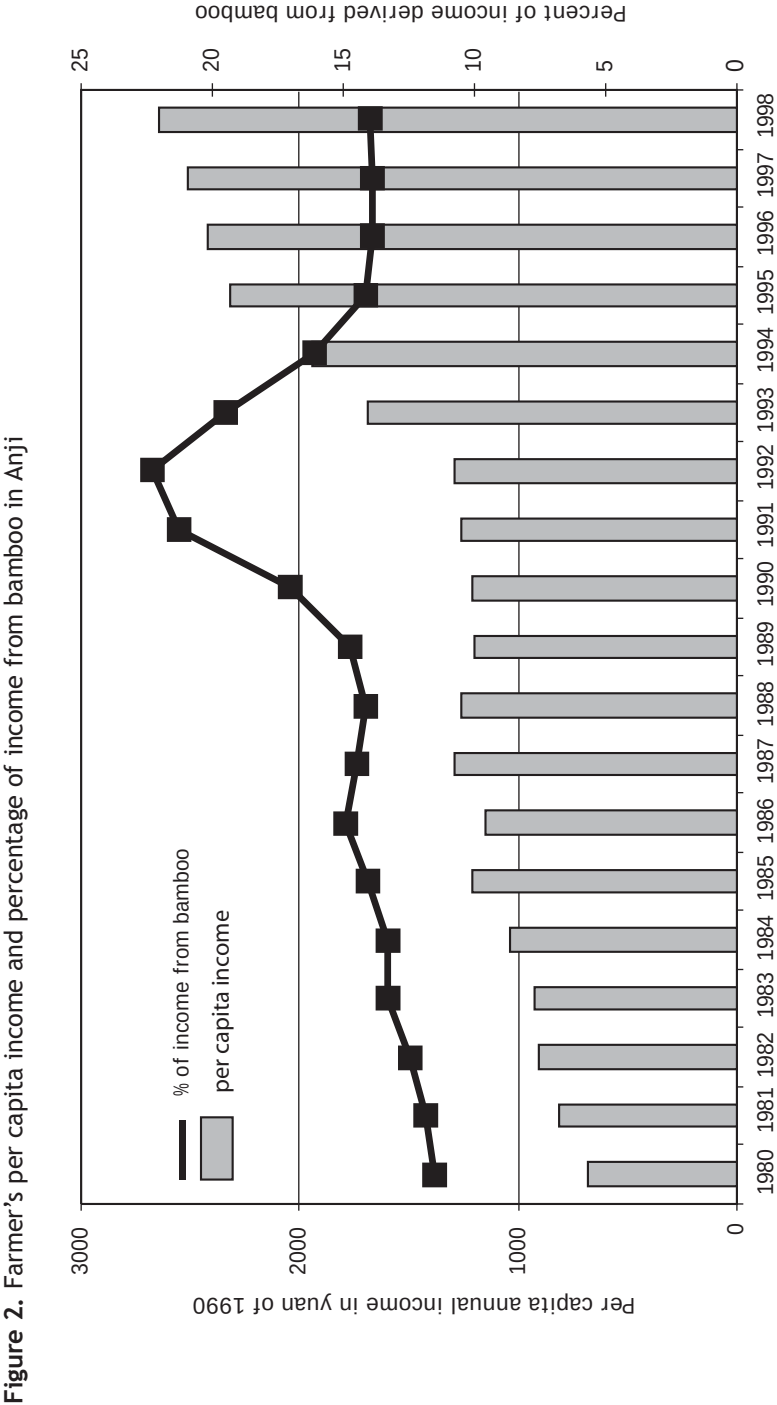


The socio-economic importance of Bamboo

The Anji County forest sector is dominated by bamboo, which represents about 70% of the total forestry output value. The economic importance of bamboo has been increasing steadily since the early 1980s. In 1980, only 8% of the bamboo produced in Anji was processed within the county, while in 1998 not less than 67% was. According to the Anji Forestry Bureau, in 1998 an estimated 64% of county farmers managed bamboo as part of their daily activities. The Anji Foreign Trade Bureau has stated that the total export of bamboo products from the county amounted to US\$56.3 million in 1998.

The average total annual household income from subsistence, barter and cash in Anji county in 1998 was US\$571. Income from bamboo represented 15% of farmers' average total income in Anji County (Figure 2). This percentage reflects the whole county, thus also those townships and households not involved in bamboo production. Studying a sample of 200 farming families from eight townships in bamboo growing areas, Ruiz Pérez *et al.* (2000) found that bamboo represents 25% of farmers' income (not including semiprocessing at the farm level).

According to a survey of 300 households involved in bamboo extraction, the average number of labourers involved in production per producer-household was 2.5. Farmers in the research area find bamboo to be an interesting option,



Note: Exchange rate in 1990: US\$1 = Yuan4.80

and they frequently participate in its processing either as part-time contracted labourers in factories or by doing some semiprocessing at home, thus adding value to the raw material. The combination of high demand for bamboo and an associated local industry has been one of the major success factors in Anji's rural development. In the last two decades, farmers' per capita net income has multiplied by 3.7 in real terms.

Box 1. Durability of bamboo culms

The high sugar and starch content in the bamboo culm, which is composed of about 50% parenchyma cells and 10% conducting tissues with large diameter vessels, has caused problems in bamboo utilisation because its natural durability is relatively low when untreated (Jiru *et al.* 1995). Although bamboo is one of the strongest structural materials available, it often succumbs prematurely to fungal and borer attacks resulting in heavy damage to structural units. Most of the durability estimates are based on the whole bamboo culm. There is not much systematic test data available on the natural durability of different bamboo species. The natural durability of raw bamboo is low and varies between 1 to 36 months depending on the species, age of culms and climatic conditions. Bamboo is generally destroyed in about one to two years when used in the open and in contact with the ground, while a service life of two to five years can be expected from bamboo under cover and out of direct contact with the ground.

Processing Industry

People have used bamboo for many years because of its excellent features. The strength of bamboo culms, their hardness, straightness, long fibres, light weight, hollowness, range in size, ease of splitting, cutting and working, and transportability make them suitable for multifarious traditional uses. The manufacture of mats and bamboo handcrafts is a cottage industry in Anji County, as well as in other parts of China. The traditional handcrafts industry used to be governed by certain social and cultural norms. Individual groups or castes of people had their own particular skills and thereby became associated with a particular type of handcraft.

At present, the utilisation of bamboo is no longer confined to private use; bamboo handcrafts and bamboo shoots are selling well on both the domestic and international markets. Industrial use of bamboo is also growing. Bamboo fibre is becoming a raw material for pulping, the culm is used in manufacturing high-grade ply-bamboo, bamboo flooring and particle board as well as chopsticks, mats, furniture, baskets, scaffolding and so on. As a food bamboo shoots are a healthy option because they contain 17 amino acids, cellulose and protein, trace elements and vitamins but are low in fat. Based on the consumption of raw materials and the total processing output value in Anji, the most important use is for home furnishings and accessories, followed by food and construction materials and tools.

Before the opening of China to the outside world, the majority of bamboo was used for construction, agriculture and utensils. The bamboo processing industry was outdated. In Anji the bamboo processing industry, which manufactures most of the main bamboo products with the exception of paper, has expanded enormously over the last 20 years, particularly since the reform of the rural industry and the establishment of private bamboo enterprises. The bamboo processing industry grew at an average annual rate of 34.5% for the period 1980-1998. According to the Anji Forestry Bureau (1999), there were 18,900 workers in the bamboo industry in 1998, creating a production value of US\$107 million (878 million yuan).⁴ Although collective enterprises still represent 33% of the total bamboo industrial output in Anji, most of this growth has come from private and joint-venture enterprises. Establishment of the latter began in the county in 1988. A total of 18 joint-venture enterprises employing 1,200 workers are currently operating, with a focus on production for export markets.

The proportion of raw material used in final products varies. Some of the products and the price component of raw material are listed in Table 3. The added value of the final bamboo products also varies from product to product. The value of one *moso* bamboo culm is about US\$0.9. The values of possible final goods of a selection of products are shown in Table 4. Handcrafts represent the highest added value; from one culm up to US\$13 worth of handcrafts can be produced. The prices shown will of course fluctuate with market conditions.

Table 3. The cost of raw material as a percentage of the price of end products

Product	Cost of raw material as a percentage of end product price
Chopsticks	44%
Mats	35%
Ply-bamboo and bamboo flooring	21%
Paper	42%
Furniture	25%
Joss sticks	28%
Handcrafts	8-13%

Table 4. Value of final products from one culm

Product	Value of product from one culm (US\$)
Chopsticks	2
Mats	2.5
Ply-bamboo and bamboo flooring	4.2
Paper	2.1
Furniture	3.5
Joss sticks	3.2
Handcrafts	7.5-13

The original technology and equipment for mat making and the processing of canned shoots were brought from Japan, Korea and Taiwan. The number of processing steps is no different from that in other areas of China or other countries. Most processing of manufactured bamboo goods is small-scale and labour intensive.

The Anji Bamboo Industrial Association and the *Ph. praecox* Association were established in 1986 and 1988, respectively. Some 125 members belong to the Anji Bamboo Industrial Association, including processors, trade firms, officers and bamboo producers. About 300 bamboo producers belong to the *Ph. praecox* Association. The purpose of the Anji Bamboo Industrial Association is to establish processing standards for bamboo products, release marketing information, stipulate price policies including the unified price of culms and shoots and so on. The *Ph. praecox* Association on the other hand holds training courses, exchanges information concerning markets and technology, provides nurseries from which bamboo seedlings can be purchased and stipulates the price policies for producers.

Photo 2. Selling salted dry bamboo shoots (Photo by M. Ruiz-Pérez)



Trade and Marketing

Bamboo products have been traded from the raw material production area for centuries. Before 1980, however, the main commercial bamboo products were culms and shoots for construction materials, handicrafts, woven products like baskets and food. Since 1980, processing has developed and bamboo mats, flooring and canned shoots have become the main commercial products.

Figure 3. The distribution line of bamboo products

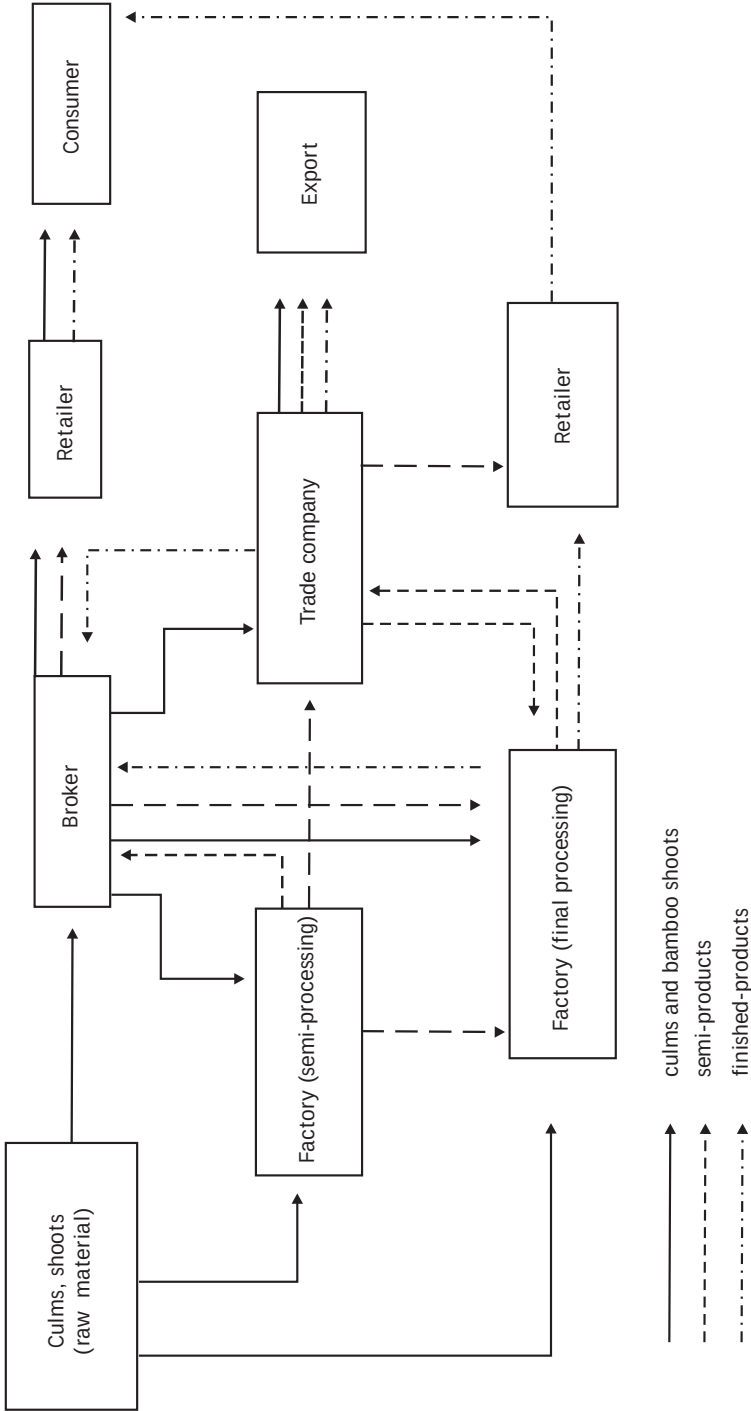
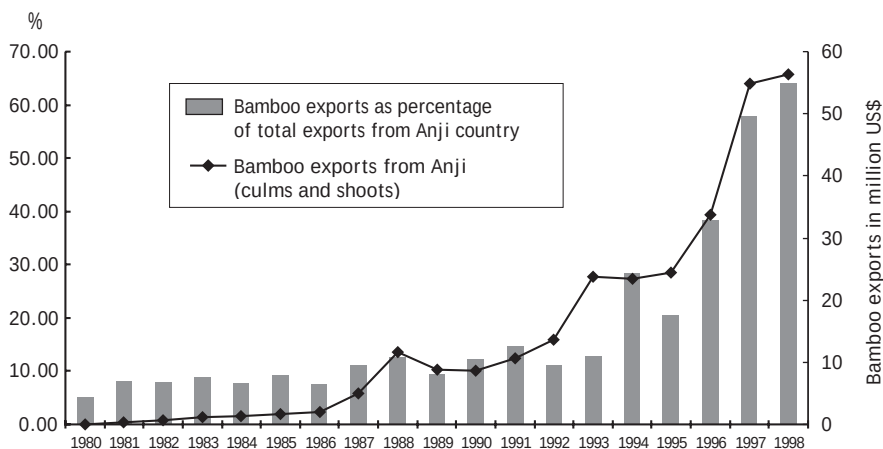


Figure 4. Anji bamboo and total exports

The production to consumption system includes producers, intermediates or traders of raw materials, processors and traders of finished products. Farmers harvest bamboo culms and shoots from bamboo stands, then bundle and skid them to the roadside, where traders and manufactures grade the culms and shoots before delivery to manufactures and markets. Traders may sell the culms or shoots to factories⁵. Bamboo products are then made in factories and finally sold to retail stores. The product flows are shown in Figure 3.

A significant component of Anji's bamboo production is exported to other countries. Bamboo exports have grown almost exponentially since 1980, and their contribution to total county exports has increased in parallel. Most exports are now undertaken through direct arrangements between the producing companies and customers in foreign countries. They amounted to US\$56.3 million in 1998, representing 64.2% of the county's total exports in that year, according to the Anji Foreign Trade Bureau. With the development of trade in bamboo products, the price of raw bamboo increased. However, partly because of the economic crisis that occurred in Asia in 1998 the price has begun to decline.

In Anji county more than 20 marketplaces for raw materials like culms and bamboo shoots and just under 100 trade centres for processed bamboo products have been set up. There are 4 special wholesale markets for bamboo products and 2,000 households who participate in trade and transportation of bamboo culms and shoots in Anji. Information gathered during the survey by Anji Forestry Bureau indicates that more than 500 trading places in over 100 cities around the country have been set up by the processing enterprises of Anji County.

Although Anji used to be the county with the highest production of raw materials in China, at present it cannot meet the increasing demands from the processing industry. Processors from the county now import about 5 million *moso* culms from other counties annually.

Policy Environment

In China's planned economy, characterised by generally low productivity, the bamboo sector developed slowly until the mid 1980s. Since then, the national reform has replaced the planned economy with a market-regulated economy. This has created more favourable circumstances for the industry's development, providing growers and enterprises with rights of production and trade, and resulting in increased competition in the bamboo market. In this system, various bamboo management systems such as a sharing system and leasehold system have been fully applied under the guidelines of the market. Transactions in the bamboo sector are now taking place according to market rules.

The government and related industrial societies practice macrocontrol on the bamboo sector, which means the use of financial policies and incentives to encourage the development of high-added-value products and limiting the production of 'outdated' products. The success of Anji County bamboo plantations is attributable to a combination of a tradition of planting bamboo, policy reforms, industrial development and geographical setting. The mountainous and hilly characteristics of Anji have helped to protect most of the land from intensive agricultural development. In 1983 the Household Responsibility System (HRS) was introduced, which changed commune-based management into individual-based management. After this shift many farmers started to get more intensively engaged in bamboo cultivation, based on the traditional experience of farmers in Anji. The original HRS contracts had terms of 30 years, but recently there has been a move to extend the terms to 50 years or more. Since 1983 the majority of bamboo cultivation has been contracted to individual farmers, who currently manage 96% of the total bamboo area.

The introduction of the HRS brought dynamism to a stagnant sector, greatly increasing culm and shoot production, which multiplied by 1.86 and 3.66, respectively, since 1980. Provisions to guarantee inheritance of the contract and to permit subletting were incorporated. Transferability of rights and use of other mechanisms such as the auctioning of allocated land (the collective land-use rights are transacted by auction) have started to be implemented recently.

In practice, bamboo legislation and regulations have yet to be enforced effectively. Moreover, the policy and institutional aspects of the legislation and regulations in relation to bamboo processing and marketing are not clearly defined. As a result, the government is losing revenue every year through uncollected taxes and fees on harvested bamboo. On the other hand, it would be worthwhile formulating a regime of fiscal incentives and tax exemptions for bamboo resource development with the aim of motivating rural people to include bamboo processing in their activities.

At the policy level, one category of issues that needs attention is the efficiency of policy measures such as subsidies intended to directly encourage bamboo cultivation. The evidence that farmers adopt bamboo growing because of its low capital costs and good benefits in the short term suggests the need to re-examine the rationale and effectiveness of the widespread practice of subsidising the cost of bamboo seedling supplies. These subsidies may be

unnecessary because bamboo producers will grow bamboo without subsidised seedlings. Interventions to ensure producers' access to the market may be more effective than subsidies.

Box 2. Bamboo-based tourism

Bamboo-based tourism and ecotourism have developed fast in recent years, with a campaign called 'visit the bamboo farmer's house' addressed to the large number of tourists that come to Anji to see its massive bamboo plantations. This effort is supported by the positive experience of the Anji Bamboo Botanical Gardens and China Bamboo Museum, the largest of its kind in China, established in 1989. The Great China Bamboo Sea, with a centre of 10,000 ha located in the eastern part of Anji County, is famous for its big bamboo culms. The number of tourists visiting Anji reached 1.1 million during the period 1996-97. Of these tourists, 70% visited bamboo related tourist objects. This travel is in addition to bamboo ecotours, which started in 1998.

Demonstration plots and environmental contracts

The local government has realised that it is essential to improve the exploitation and management of bamboo resources for ecological and economic benefits. In the context of the national logging ban following the disastrous floods of 1998, demonstration plots, where mixed plantations are managed, have been established to achieve the new multiple objectives and to study the effects of bamboo management practices on the environment. Some of these demonstration plots are managed by the local government, while others are supported by the national government.

Bamboo resources are managed based on the classification of two parts, i.e., ecological common weal forests and commercial forests. Based on the development plan, 26,600 ha of common weal bamboo forests will be established in the coming years. To implement this new policy, Anji Forestry authorities have signed environmental contracts with farmers for the allocation of new HRS forestland, as well as incorporating environmental clauses into the current forest management contracts. The environmental management contracts are being extended for a further period of 15 years. Farmers are eligible for subsidies of US\$9.1/ha/year to compensate for potential benefits they could have derived from the use of their contracted land. The county government set aside US\$303,000 to cover this program in 1999 (Anji Forestry Bureau 1999).

Efforts to promote the bamboo sector

Outside intervention from donors and non-governmental organisations has included financial, technical, organisational and political support and advocacy for the bamboo sector. Since the opening of China, institutions like the International Development Research Centre, the Center for International Forestry Research and the International Plant Genetic Resources Institute have co-operated with the Research Institute of Subtropical Forestry (RISF) to provide financial support for the Anji Bamboo Botanical Gardens, which were set up at the beginning of the 1980s. The RISF, as well as the Forestry Institute of Zhejiang, Zhejiang Forestry College and Nanjing Forestry University, has undertaken a number of projects from setting up bamboo management demonstrations and preparing technical manuals to train personnel and bamboo farmers to stipulating a standard for the products. The China Bamboo Society and Chinese Industrial Association have also held various academic workshops and meetings to exchange information and techniques. They have also prepared materials to be disseminated through the local media for propagating the bamboo sector, so as to promote the extension of technologies and to enhance the local communities' involvement in bamboo-based activities. The organisations mentioned above have emphasised the importance of bamboo in the local—and even the national—economy and in poverty alleviation, as well as its ecological functions and protection of biodiversity. In addition, the World Bank provided a financial loan for Anji to plant bamboo, which finished in 1999.

TRENDS AND ISSUES: DEVELOPMENT AND CONSERVATION LESSONS

Key issues and problems

The establishment of a market economy in China has been important for the development of the bamboo sector, but there are drawbacks. Farmers have been primarily interested in low technology processing activities that require low inputs (such as the production of mats). They seem reluctant to engage in 'high-tech' processing because it requires more input. This has resulted in an oversupply of 'low-tech' products. Therefore, the local government should try to control development in the processing sector by using a tax policy to limit the development of some products and incentives to encourage the development of high-tech products. Another drawback is the establishment of a market economy where competition between enterprises has resulted in low prices and low benefits or even in financial loss because of a lack of guidance and co-ordination concerning prices and markets. Heavy taxes and fees have also hampered manufacturers' efforts to further develop the bamboo sector. The taxes and fees in Anji County are higher than those of neighbouring counties such as Yuhang and Deqing. This situation has encouraged some processors to move their factories.

The current foreign trade system has contributed greatly to the export of bamboo products from processing factories. However, because the majority of bamboo-processing factories do not have licences for exporting to other

countries and regions, their products have to go through an export company. And Chinese export companies prefer to export cheap products to increase their profit margins.

Ecological drawbacks

The authorities are beginning to recognise that the success and tremendous growth of Anji County's bamboo sector has come at a cost to the forests. Natural forests in the vicinity of bamboo plantations have sometimes given way to bamboo as a result of conscious efforts to replace them or because of the vigorous natural expansion of bamboo in logged forests. This process has had a negative impact on biodiversity, affecting the few remnants of subtropical forests in the county.

At the same time, intensive management implies maintaining the plantation grounds clear of undergrowth, achieved through manual or chemical weeding and periodic tilling of the land. This increases erosion and results in a monoculture over vast areas, with all of the attendant biodiversity costs and economic and ecological risks. The intensive use of chemicals (pesticides, herbicides, fertilizers etc.) is also affecting the environment. The strong trend towards intensification of the bamboo sector makes it particularly important to study problems and alternatives for more environmentally sound practises.

Conservation and development lessons

With the development of the bamboo sector and the increasing economic importance of bamboo, this sector has received more attention from local communities and governments and investments in the bamboo sector have increased.

The bamboo sector has numerous economic and social benefits: Bamboo serves as a cheap and fast regenerating alternative to wood, its extraction increases the farmer's income, and the bamboo sector provides forest funds and revenue from taxes for the local government. In addition to the socio-economic importance of its multi-use culms and edible shoots, bamboo also has ecological benefits. Because of their evergreen characteristics, thick canopy, close and strong underground rhizome-root systems, bamboo stands perform an important function in soil and water conservation.⁶ In Anji County, excessive exploitation does not occur, in part because of the harvesting quota calculated by Anji Forestry Bureau based on the density of standing culms, age structures, area etc. However, some problems occur related to erosion and use of chemicals, as intensified management of bamboo stands can lead to a certain amount of soil degradation.

There is a shortage of agriculture lands but abundant hilly lands and labour resources in the mountainous areas. Further development of the bamboo sector in both forest management and product processing can generate income for local communities providing employment opportunities for the rural and suburban labour surplus. Future efforts to develop the sector should focus on the bamboo farmers, better protection for the forest ecosystem and the adding

of more value. Expansion of the bamboo stands could promote rural economic development, help farmers to fight poverty and further improve the people's living conditions. Meanwhile bamboo stands could increase land productivity per unit and promote sustainable utilisation of land resources. Bamboo plantations can be established on degraded land, which can improve soil characteristics and nutrient content, prevent the loss of soil and water, and stabilise the banks of rivers and lakes. The development of bamboo stands indirectly reduces the pressure on remaining wood resources for fuel wood as bamboo is used as an alternative fuel and also brings in cash earnings that enable farmers to purchase gas for energy.

In China, macroeconomic policies (such as tax and export policies) and sectoral policies affecting the bamboo sector could be improved. The government needs to pay more attention to strengthening institutional support for the bamboo sector and the government-private sector co-ordination, including financing schemes for small enterprises.

ENDNOTES

1. The Research Institute of Subtropical Forestry, Chinese Academy of Forestry, 73# Daqiao RD, Fuyang 311400, Zhejiang, P. R. China. E-mail: fmy@fy.hz.zj.cn E-mail Yang Xiaosheng: yxiaosheng@263.net

2. The Research Institute of Subtropical Forestry, Chinese Academy of Forestry, 73# Daqiao RD, Fuyang 311400, Zhejiang, P. R. China. E-mail: yxiaosheng@263.net

3. Other bamboo species, such as *Phyllostachys iridescens*, *Phyllostachys praecox* and *Phyllostachys meyeri*, may produce bamboo shoots at different times and their harvesting season may last eight months.

4. Exchange rate in 1998: US\$1 = Chinese Yuan 8.27.

5. Sometimes traders sell the bamboo directly to retailers or consumers.

6. It was reported that a bamboo stand's capacity for stabilising soil and sand is 1.5 times that of massons pine. Its ability to absorb water is 1.3 times that of the Chinese fir, while its water storage capacity is 30% to 45% higher than that of Chinese fir.

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Chapter 16

The development of the woodcarving industry and the cultivation of *Paraserianthes falcataria* in Bali, Indonesia

Dede Rohadi¹, Pipin Permadi² and Syarif Hidayat³

Common names	Part of the resource used	Management	Degree of transformation	Scale of trade	Geographic range
Sengon, Albizia, Belalu	Wood	Cultivated	Medium	International	Large

OVERVIEW

The woodcarving industry in Bali has changed from a traditional religious art into a modern industry with an economic orientation, which is reflected in the diversification of designs. The woodcarving industry involves various scales of business (wood suppliers, home based enterprises, collectors, large producers and exporters) and contributes significantly to regional as well as household income. The development of the woodcarving industry, to some extent, has caused the depletion of several preferred wood species in the area. Some substitute species, imported from other islands, are now being used. In Bali, *Paraserianthes falcataria*, a particularly fast growing species, is being planted in home gardens and plantations and increasingly being used for woodcarving. This species has become popular for the production of mass produced woodcarvings. Woodcarvings are both sold in Bali to tourists as well as exported. Government support has been beneficial, for example in art education, but efforts are needed to maintain the market and to sustain the raw material supply.

INTRODUCTION

Carving and Bali are two inseparable words. This becomes easily apparent when one enters Bali, a small island east of Java. Statues of varying shapes and sizes can be found everywhere in Bali, as gateways and building ornaments,

giving a strong indication of the importance of carving as part of the daily life of the Balinese. In terms of quality and economic importance, woodcarving is perhaps the most developed of all carvings in Bali. It has not only become the art of daily Balinese life, but has also developed into an important business. In terms of quality, Balinese woodcarving shows excellent styles, unique and full of imagination and creativity. In terms of quantity, the number of woodcarvers and the number of the products they are able to produce are high. Kanwil Deperindag Propinsi Bali (2000) recorded more than 6,000 woodcarving producer units employing more than 23,000 woodcarvers and consuming more than 60,000 m³ of wood in 1999. In 1998, the value of exported woodcarving products from Bali reached US\$99.5 million (Biro Pusat Statistik Propinsi Bali 2000).

This chapter is based on interviews in the field and a literature study conducted from May to November 2000. The documented materials (reports, theses, and regional statistics) were obtained from government offices (mainly the regional office of the Ministry of Industry and Trade and the regional office of the Ministry of Forestry) and other published materials. Interviews were conducted with wood suppliers, woodcarvers, traders and some well-known woodcarving artists.

The key informants for this case study

- I Wayan Rugeg. The current Secretary of DEKRANAS, or the National Handicraft Board of the province of Bali, he was hired as a local consultant for this study and recorded data about Tegallalang subdistrict from the subdistrict office.
- Sutrisno. A staff member of the regional office of the Ministry of Industry and Trade in the province of Bali, he was hired as a local consultant for this study and provided most of the data related to the woodcarving industry in Bali.
- I Nyoman Silanawa. A staff member of the regional office of the Ministry of Forestry in the province of Bali, he was hired as a local consultant for this study and provided most of the data related to wood supply and demand in Bali.
- I Ketut Sandiarsa. The director of Sekolah Menengah Industri Kerajinan (SMIK), an industrial craft high school in Sukawati, Gianyar.
- I Wayan Balik Riti. A religious leader (or *Mangku*) in Guwang village, Sukawati, Gianyar, he was the main informant for the story of woodcarving development in Bali.
- I Wayan Sugita. A woodcarver from Banjar Pakudui, Tegallalang village, specializing in carving *garudas*, he is also a producer and collector of 'pop art' woodcarving products.
- I Ketut Udu. A woodcarver from Banjar Pujung, Tegallalang village, he owns a small art shop producing mainly pop art woodcarvings and employing 10 daily workers.
- I Made Ada. A woodcarver from Banjar Pakudui, Tegallalang village, he is a well-known artist specializing in carving *garudas*.
- I Made Sutedja. One of the founders of the first carving school in Gianyar, he owns a gallery in Sukawati.

The study area

The province of Bali is well known for its tourist industry. Tourism currently ranks first in regional income, followed by agriculture and fisheries. Manufacturing, which includes woodcarving, is in fifth place. The district of Gianyar is the centre of the woodcarving industry in Bali. Around 90% of the woodcarving producers in Bali are located in this district. The many galleries and art shops in the district display fine quality woodcarving products and have become a popular tourist destination. The development of the woodcarving industry in the district has had a positive impact on adjacent districts such as Bangli, Klungkung and Tabanan, which now produce significant volumes of semifinished woodcarving products and send them to Gianyar for finishing and marketing. This study focuses on the subdistrict of Tegallalang, which is one of the centres for woodcarving producers in Gianyar (Figure 1). Tegallalang is well known as a producer of mass produced woodcarvings. Woodcarving products are made mainly from species of *Paraserianthes falcataria* and then finished with opaque paints. Most of the people living in this subdistrict are farmers and handicraft producers, including woodcarvers. From the total population of 39,874 people (in 1999) around 15%, or 6,020 individuals, are recorded as woodcarvers (I Wayan Rugeg personal communication).

Brief history of the woodcarving industry in Bali

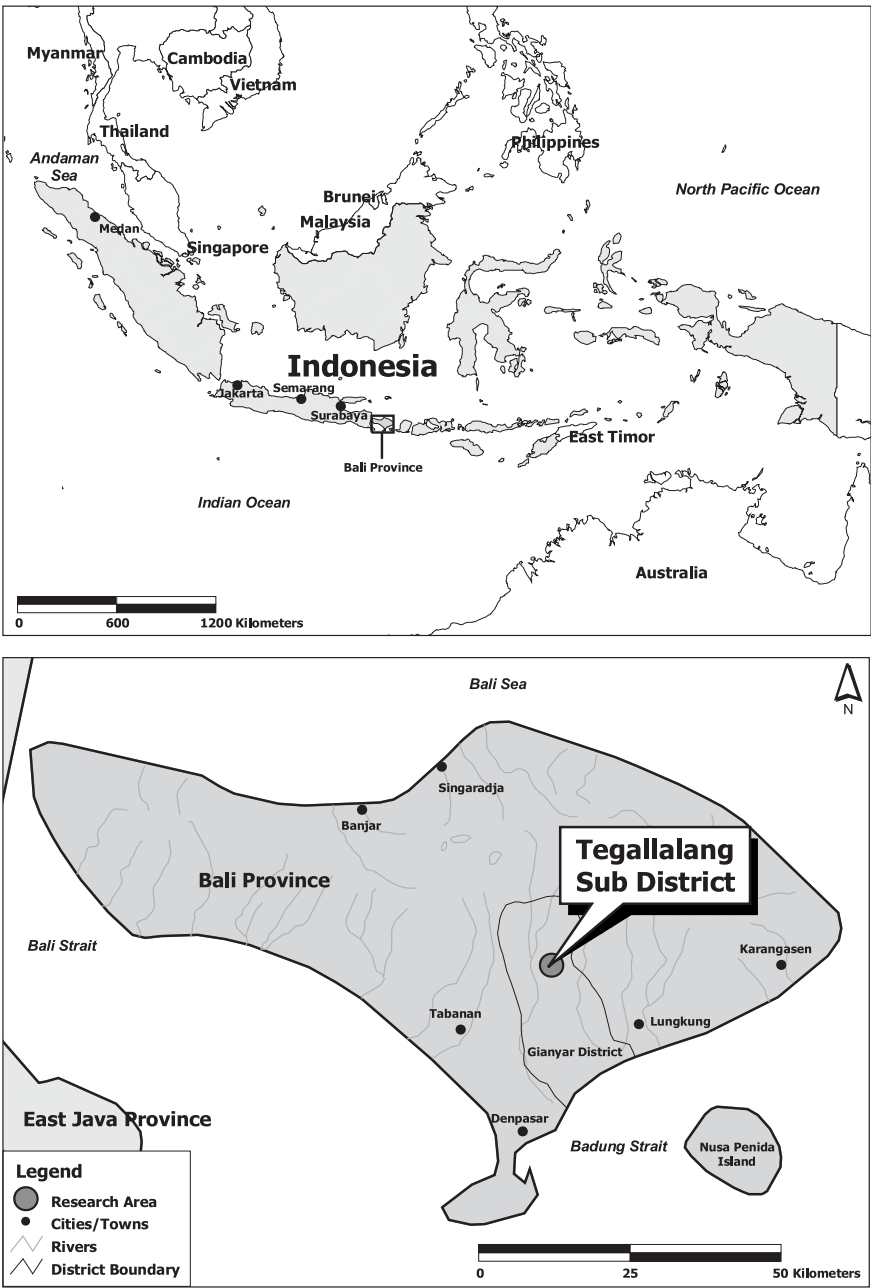
Carving has been a traditional Balinese art form for hundreds of years, practised as part of daily life particularly by those who live in and around Gianyar District. No one knows exactly when and how this carving tradition started, but there is evidence at one historical site, the Elephant Cave (*Goa Gajah*) near Bedulu, Gianyar, that carving has been practised there since at least the ninth century AD. Elaborate Buddhist style stone carvings adorn the entrance to the cave.

From various sources (Kandiyasa 1991; Sudarta 1991; I Wayan Balik Riti personal communication) it is clear that in the past the practice of carving was mostly related to religious traditions. This religious art is found not only in temples but also in Balinese homes in the form of *puras* (small private temples). Because of the traditional religious nature of the carvings and the related traditions that were commonly practised by the community, the old Balinese carving style was dominated by god and goddess figures, as shown nowadays by the collected ancient statues at Pura Beji in Medahan village.

Commercial woodcarving probably started around 1935 (Sudarta 1991). Initiated by the Dutch, Balinese woodcarving products were introduced to European markets. Later on as more European visitors came to Bali, the demand for Balinese woodcarving increased. This new market stimulated the woodcarving business and attracted many new woodcarvers.

The growing market and the influence of Western artists contributed to the development of the woodcarving style in Bali. In 1936, the art organization Pita Maha was established in Ubud, Gianyar, initiated by a prominent Balinese, Bapak Cokorda Sukawati, and supported by the Western artists R. Bonet and Walter Spies (Kandiyasa 1991). This organisation helped Balinese carvers to improve their carving techniques and styles. The group developed the technique

Figure 1. Location of the study area



Source: ESRI Data and Maps 2002.

for detailed anatomical structures and products became more expressive. Styles also developed from previously dominant religious themes into more varied objects related to daily Balinese life. This period was marked by the emergence of some creative and innovative carvers who developed their own individual styles. I Tegelan of Banjar village (Belaluan, Denpasar) was one such carver and the first to introduce the 'elongated style' of sculptures (Kandiyasa 1991). Another, I Tjokot, introduced a carving style that hollows out big tree stumps (which can be more than 1 m thick), including all root parts of the tree, to produce complex mythological characters. Some of the masterpieces of these well-known artists are now part of a collection in Ubud Museum.

Since 1940, woodcarving has become an important economic activity, particularly for the Balinese around Gianyar. Many woodcarving groups were first established here and it is likely that these formed the basis of the woodcarving industry in Bali today. In Kemenuh village, for example, a *sekehe*, or woodcarvers group, was established in 1940. This group, which became a legal co-operative in 1962, supplied its members with wood materials as well as providing assistance with carving techniques and product marketing. Unfortunately, because of political chaos in Indonesia during 1964-1965, the co-operative dissolved in 1964.

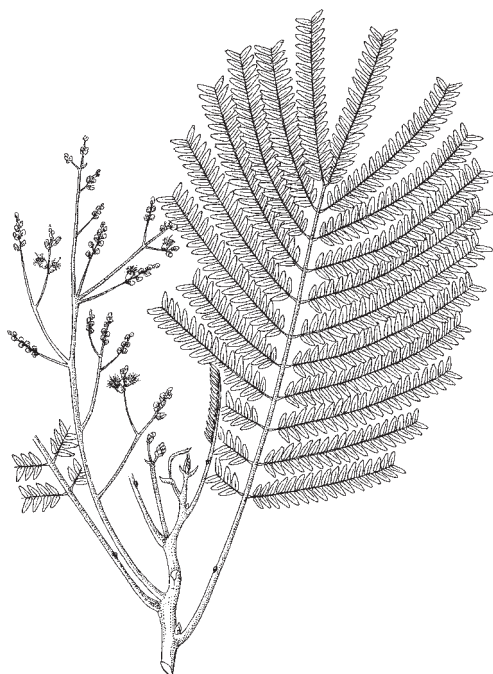
In 1969 a new opportunity arose for the woodcarving industry in Bali when the government of Indonesia declared Bali an Indonesian tourist area by opening Denpasar international airport. Bali was soon flooded with foreign tourists, a new prospective market for woodcarving products. Driven by increased demand from tourists, more woodcarving groups were established in the district of Gianyar. In Kemenuh village, for example, six carving groups sprang up in 1970, which later developed into the handicraft co-operative Dirga Yusa (Sudarta 1991). Similar to the previous pioneering co-operative, this co-operative also provided wood materials, technical and marketing assistance as well as providing its members with a small-loans credit system.

In 1974 the development of the woodcarving industry was noted by a new trend, i.e., mass-produced woodcarvings locally known as 'pop art'. The designs of, for example, animals or fruits are usually much simpler than traditional carvings. This kind of product has attracted many people to the industry, making it possible to produce thousands of woodcarvings per month. As little carving skill is required, mass production provides quick economic returns for carvers. Pop art became quite popular and triggered the development of woodcarving exports from Bali.

THE PRODUCTION-TO-CONSUMPTION SYSTEM

Wood species used

In the past, only a few tree species were used for woodcarving. For carved products related to traditional and religious purposes, *Manilkara kauki* (*Sawo Kecik*) and *Artocarpus heterophylla* (*Nangka* or jackfruit) were the most popular wood species used and are still today the preferred species for the production of ornaments in Pura (I Wayan Rugeg personal communication).



(*Paraserianthes falcataria*)

In 1972, the most popular species for woodcarving were *Manilkara kauki*, *Zhantoxylum rhetza* (Panggal buaya (crocodile wood)), *Santalum album* (Cendana (sandalwood)), *Diospyros celebica* (ebony), *Wrightia pubescens* R. Br. (bentawas), *Thespesia populnea* Soland (waru lot), *Dalbergia latifolia* Roxb (sonokeling), *Manglietia glauca* L. (manglid), *Michelia alba* DC and *Michelia champaca* L. (Cempaka) (Kanwil Kehutanan dan Perkebunan Propinsi Bali 2000b). Sandalwood and ebony are not grown on the island but are imported from places such as East Nusa Tenggara and Sulawesi.

Mandang (1982) recorded around 30 wood species used for carving in Bali in the early 1980s. Important characteristics of the wood that is preferred for carving are texture, colour, decorative grain and being easy to work. Changes in species used for woodcarving have been due mainly to the vigorous developments in the woodcarving industry. Bali is a small island with limited forest resources, and local wood production has simply not been able to keep up with the increasing demand. The island has also developed very fast because of tourism, and changes in the landscape have been considerable. The current forest cover in Bali is only around 25% of the total area (Table 1), some of which is in critical condition with poor vegetation. Most of the forest is in protected areas, while there is only around 8,600 ha of production forest, or 1.5% of the total land area of Bali (Table 2). With such a small area of production forest, wood production is low, and most of the wood used in Bali currently comes from other Indonesian islands, mainly Java.

Table 1. Land use in the province of Bali

Land use	Area (ha)	%
Irrigated crops	86,836	15.42
Estate crops	168,805	29.97
Forest (state owned)	127,271	22.59
Fields	86,711	15.39
Settlements	41,341	7.34
Private forest (plantation)	13,530	2.40
Other	38,798	6.89

Source: Kanwil Kehutanan dan Perkebunan Propinsi Bali 2000a.

Table 2. State owned forest in the province of Bali by function

Forest function	Area (ha)
Protection forest	95,776.06
Production forest	8,626.26
Nature conservation	1,762.80
National park	15,587.89
Recreation forest	5,527.90

Source: Kanwil Kehutanan dan Perkebunan Propinsi Bali 2000a.

The amount of wood consumed in Bali far exceeds production. The amount required for the woodcarving industry alone was more than 60,000 m³ in 1999 (Table 3). Since 1995, wood production from Balinese production forests has been practically zero. The small amount of wood recorded as coming from production forests between 1996 up and 1999 was derived from confiscated illegal logging. During that period, the amount of illegal logging accounted for around 230 m³ per year (Kanwil Kehutanan dan Perkebunan Propinsi Bali 2000c). Wood production from private/plantation forests (13,530 ha) is much higher, i.e., 4,451 m³ in 1999. The fast growing species *Paraserianthes falcataria* dominates private wood production, accounting for 30% of production. In 1999 locally produced wood accounted for around 5% of total wood consumption in Bali, the remainder being imported (Table 4).

The development of the woodcarving industry has triggered an increase in the planting of fast growing species, especially *Paraserianthes falcataria*. The species was first introduced through the land rehabilitation programme, carried out by the Ministry of Forestry in the early 1980s (I Nyoman Silanawa personal communication). At that time, the government distributed *P. falcataria* seedlings to local people for planting in their home gardens. Later on, this wood was found suitable for mass produced woodcarvings. The relatively cheap price as compared to other wood species and its advantageous properties (light, easy to work and takes paint well) has quickly made this species popular with woodcarvers. *Acacia mangium* is another fast growing species increasingly used for carving. This species is similar in appearance to *Tectona grandis* (teak wood).

Table 3. Distribution of woodcarving producers and volume of raw material used in the province of Bali in 1999

Districts	No. of enterprise units	No. of woodcarvers			Volume of raw material used (m ³)
		Men	Women	Total	
Tabanan	96	696	0	696	86
Badung	261	623	15	638	220
City of Denpasar	65	212	14	226	34
Gianyar	5,672	18,051	3,068	21,119	60,027
Klungkung	106	174	59	233	0
Bangli	192	465	142	607	0
Total Bali	6,392	20,221	3,298	23,519	60,366

Source: Kanwil Deperindag Propinsi Bali 2000.

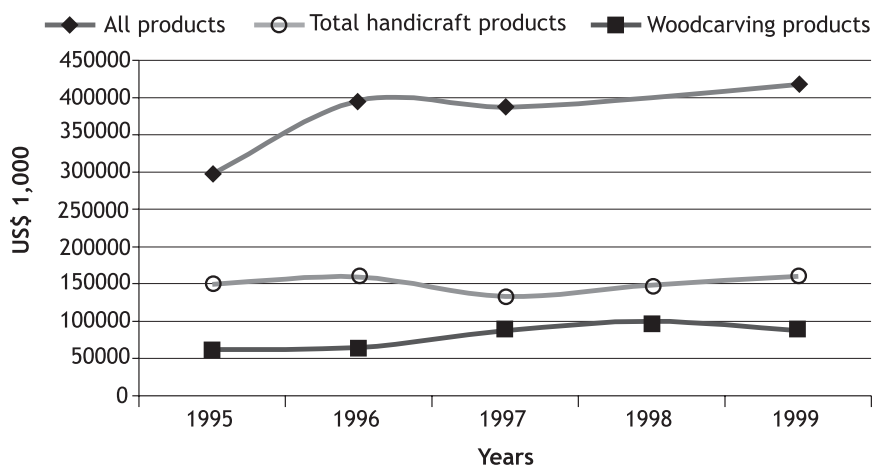
Table 4. Volume of wood supplied to Bali during 1997-1999

Port	Wood supplied to Bali (m ³)		
	1997	1998	1999
Gilimanuk	56,613	63,630	68,477
Celukan Bawang	34,088	21,428	24,387
Padang Bai	481	154	233
Total	91,182	85,212	93,097

Source: Kanwil Kehutanan dan Perkebunan Propinsi Bali 2000c.

Impacts on regional development and livelihoods

The woodcarving industry has played an important role in the economic development of the province of Bali, particularly the district of Gianyar. Between 1995 and 1999 the average export value of woodcarving products from Bali was around US\$79.95 million per year. The highest export value so far was reached in 1998 with around US\$99.5 million (Biro Pusat Statistik Propinsi Bali 2000). Over the period of 1995-1999, woodcarvings contributed more than half (53%) to the total value of handicraft exports and 21% to the total value of all exported goods from Bali. There was an increasing trend in woodcarving exports from 1995 up to 1998, from US\$61 million to US\$100 million. The drop in woodcarving exports after 1998 may well have been caused by the economic recession in Indonesia (Figure 2).

Figure 2. Export of woodcarvings and other products from Bali, 1995-1999

Source: Biro Pusat Statistik Propinsi Bali 2000.

The woodcarving industry provides employment for thousands of people, from wood farmers and traders to carvers, carving traders and exporters. The sector provides income to around 23,500 people in Bali. The Balinese woodcarving sector counts 6,000 units (from home-based enterprises to large carving and export companies) and most of these units are small-scale

Photo 1. Planted *Paraserianthes* (Photo by D. Rohadi)



enterprises engaged in actual woodcarving. There are only about 75 medium to large factories. The Biro Pusat Statistik Propinsi Bali (2000) recorded that these 75 units employed almost 4,000 people, or around 12% of the sector's total workforce.

At the household level, the woodcarving industry provides an important source of income. Farmers who grow trees for woodcarving, wood suppliers, carvers, woodcarving traders and the people who work in the woodcarving galleries or art shops are those who directly benefit from the industry. The income gained varies depending on the products or services they provide and the size of the enterprises.

For tree growers, woodcarving provides an attractive incentive through high prices on logs. A *Paraserianthes falcataria* tree with a diameter of 30 cm to 40 cm would be valued at between US\$10 and US\$ 20,⁴ depending on the distance of the farm to the nearest accessible road. Usually lumberjacks buy standing trees from a farmer. They will then harvest the tree and take it to the nearest sawmill or woodcarving centre. The distance from the stump to the nearest motorable road determines the log transportation cost. A longer distance increases transport costs and consequently reduces the value of the standing tree. Branches measuring 1cm x 1m, of the same species, can fetch US\$0.1 (I Wayan Sugita personal communication). This attractive price has encouraged farmers to plant *P. falcataria* on farms around Gianyar as well as in surrounding districts.

The prices of slow growing species are much higher, but not many farmers are interested in planting these species. The price of some wood species based on the field survey are presented in Table 5.

The income from woodcarving varies significantly. A carver who works in an art shop and makes semifinished pop art may make between US\$1.5 and US\$2.5 per day (I Ketut Udu personal communication), while a skilled woodcarver may get US\$7.5 per day (I Made Ada personal communication).

Table 5. Prices of some wood species often used for woodcarving

Wood species	Local name	Dimension (cm)	Price per unit (US\$)	Approx. log price per m ³ (US\$)
<i>Artocarpus heterophylla</i>	Nangka	35 x 35 x 200	230	470
<i>Michelia champaga</i>	Cempaka	35 x 35 x 200	250	510
<i>Paraserianthes falcataria</i>	Belalu, sengon	Ø 30 x 100	3	50

Assumed recovery factor from log to sawn timber = 50%.
Exchange rate used: US\$1 = Rp10,000 (year 2000).
Source: Interview with a wood supplier in Batu Bulan.

The income for a woodcarving artist is more difficult to quantify. I Wayan Sugita, a woodcarver from Pakudui village, Tegallalang, for example, needs three or four days to complete a small *garuda*⁵ carving made from *P. falcataria*. The carving then needs another two or three days to be painted by his wife and daughter. Once finished, the statue should sell at a price of US\$70. Further up the scale, a well-known artist like I Made Ada could take six months to complete one statue of a 1 m high *garuda*, made from *Swietenia macrophylla*, and priced at US\$7,500. Another artist interviewed, I Made Sutedja, never considers how much time he needs to finish his carvings, but he sets a price of between US\$8,000 and US\$15,000 for each of his pieces.

Photo 2. Women involved in woodcarving production (Photo by D. Rohadi)



Women and children are often involved in the production. They usually work in the finishing stages, such as sanding and painting. Their average income is around US\$0.8 to US\$1 per day. The wage is rather low compared to the normal daily wage in the area, but they are satisfied as they can work in their homes during what would otherwise be leisure time.

Trade and market

Except for *Paraserianthes falcata*, wood materials for woodcarving are obtained mostly from other Indonesian islands. There are 20 companies recorded as wood suppliers in Bali, located mostly around Denpasar and the District of Gianyar (Kanwil Kehutanan dan Perkebunan Propinsi Bali 2000c). These wood suppliers sell their wood to retailers located in villages. Sometimes carvers buy their materials directly from the suppliers, especially when they need a specific species or size for a specific piece or product.

P. falcata, an introduced fast growing species, is at present abundantly available in Bali. Carvers prefer to use this species newly cut, as fresh wood is easier to work with. Lumberjacks often buy the standing tree directly from farmers. A logging team may consist of fewer than five people, who cut and buck⁶ the tree and take the logs to small sawmills or directly to carvers.

The marketing channel for fine art woodcarving is usually simple. Skilled carvers sell their products directly in their galleries or art shops. Mass produced woodcarvings have longer trade channels. Carvers who own an art shop often buy semifinished carved products (*putihan*) and smooth, sand and paint the pieces in their shops. Many of these products are for export through cargo companies. There are no figures regarding the number of woodcarving products bought by tourists in Bali, but the volume is quite insignificant compared with exports. It is estimated that less than 5% of the carvings produced are sold locally to tourists.

The prices of products along the marketing chain from the log down to the final product ready for export are difficult to measure. Thousands of designs with high variability in both volume and value make it difficult to find a single, representative recovery factor for calculating the added value on the products.

Government support for the development of the woodcarving industry

The development of the woodcarving industry in Bali has shown remarkable growth from a previously traditional art into a commercial oriented industry. This development has partly depended on the creativity of the Balinese in improving their carving skills, as well as their open attitude toward a dynamic market. Government support, as well as consistent effort on the part of some Balinese entrepreneurs, has also played an important role in the development of the Balinese woodcarving industry. Below we describe some related activities, which originated from the regional government and local associations, that have contributed to the development of the woodcarving industry in Bali.

The carving school

The first recorded effort to formalise carving lessons or instruction took place in 1969 with the establishment of the Dwi Jendra carving school in Guwang village, in the district of Gianyar. I Wayan Balik Riti, one of the founders interviewed during the field survey, explained that the school provided carving lessons for children around 13 years old who had graduated from a six-year basic school. At the time, the lessons were given mainly based on the knowledge and experience of some of the artists. Many of the current well-known wood carvers went through this carving school.

In 1971 the Industrial Regional Office (Inspeksi Perindustrian Rakyat) provided the school with financial aid, buildings and some carving tools. Following the National Meeting of Technical Schools, Dwi Jendra was upgraded to a government owned school in 1974 and moved to Batu Bulan village, closer to Denpasar. In 1978 the level of the school was upgraded to a senior high school and it was renamed Sekolah Menengah Industri Kerajinan (SMIK), an industrial craft high school. In 1985, the school moved again to its current location in the art campus, or Kampus Kesenian Batu Bulan, in the subdistrict of Sukawati. The school has now been extended into three craft schools, consisting of the previous SMIK, the painting school (Sekolah Menengah Seni Rupa) and the dancing school (Sekolah Menengah Karawitan Indonesia). Each school has a director appointed by the Ministry of Education. The curricula of these craft schools are independently designed, although some general subjects such as mathematics, Indonesian, English, history etc. are mandated by the Ministry of Education. To maintain curriculum development, the schools set up an advisory board called the Majelis Sekolah, which consists of representatives from the Ministry of Industry and Trade, the handicraft association Dewan Kerajinan Nasional (DEKRANAS), the trader association Kantor Dagang Indonesia (KADIN) and well-known artists and art shop owners.

SMIK students follow a three-year education program, which is mostly practical (70% of the curriculum). In the first year, all students learn the basic concepts of handicraft making and are introduced to the three main carving materials, i.e., wood, stone and metal. In the second year, students are grouped into three divisions, i.e., woodcarving, stone carving and metalwork, based on their interest and talent. In the woodcarving division, studies are separated further into woodcarving, furniture making and woodturning. I Ketut Sandiarsa S.Pd., the current director of the SMIK, stated that the woodcarving division has always been popular with students. From the current 461 students at SMIK, 198 are studying woodcarving. Almost 90% of the students hail from the District of Gianyar. The director further stated that most of the graduated students have found jobs in art shops and galleries or are running their own woodcarving businesses. About 25% of the alumni went on to become well-known woodcarvers in Bali.

Handicraft board

DEKRANAS is an association of handicraft producers that promotes the development of handicraft industries through activities such as exhibitions and training (carving skills, wood treatment for improving wood durability,

export procedures, entrepreneurship etc.). At the national level the board is usually chaired by the vice president's wife, whereas at the provincial level it is chaired by the governor's wife. According to Bapak I Wayan Rugeg (see box 1), it could be said that DEKRANAS Bali is one of the most active sections in the nation. At least once a year this association holds a handicraft exhibition in Denpasar and always receives great attention from the public. These exhibitions often provide a market opportunity by creating a direct contact between woodcarving producers and domestic and foreign buyers. Financial support comes mainly from the local government (Pemerintah Daerah), the Ministry of Industry and Trade, and handicraft companies.

Small-scale credit

The Village Credit Institution, Lembaga Perkreditan Desa (LPD), offers credit to small businesses. This institution was initiated by the local government, but then managed by local people through the Village Cultural Board (Lembaga Adat Desa). The LPD provides small loans (a maximum of US\$3,000) for short periods of three to four months with an interest rate of about 3% per month. This institution runs well since it keeps traditional rules whereby religious ethics maintain the commitment of the debtor to repay the loan. The credit facility is quite helpful for small businesses as they can get financial support quickly and the procedures are easy to follow. The LPD in Tegalalang village for example was established in the mid 1980s with an initial capital of US\$200 (Bapak I Ketut Udu personal communication). Currently the LPD runs a total capital of about US\$200,000.

Research and development

Government agencies, universities and private companies have been contributing to the research and development of the woodcarving industry in Bali for some time. In the 1970s the Forest Products Research and Development Centre studied the characteristics of wood species used for carving in Bali. The main objective was to understand the preferred characteristics of the wood used and to search for alternative species to substitute for the preferred, but less available species (Mandang 1982). In collaboration with the Indonesian Wood Preservation Association (Asosiasi Pengawetan Kayu Indonesia) and the Bogor Agriculture University (Institut Pertanian Bogor), the institute also disseminated information concerning wood drying and preservation techniques to prevent woodcarvings from suffering drying defects and fungal attacks. The introduction of water repellent to improve dimensional stability of carvings has been embraced, particularly for natural finished woodcarving products.

In 1982, the Land Rehabilitation and Reforestation Institute of the Ministry of Forestry launched the Sengonisasi programme, which provided local people, mainly those living in villages or near forest areas, with seedlings of *Paraserianthes falcataria* to plant on their marginal lands. The species was chosen because of its superior properties: it is fast growing; able to improve soil fertility through its ability to fixate nitrogen; can provide fodder for animals;

can be used as fuel wood; and can be used for carving, mainly mass production. The species is particularly suited to the latter as it is easy to work, light and can be painted with relatively cheap paints. Currently, extensive local plantations of this species can be found in the District of Gianyar and the surrounding areas. The wood is now in high demand for carving, which has in turn encouraged local people to extensively plant this tree on their farms. During our field survey we saw many plantations of this species in Tegallalang and the surrounding areas.

The development of the woodcarving industry in Bali has resulted in the overexploitation of some species. While species such as *P. falcataria* are fast growing, some others are slow growing and therefore less attractive as a plantation species. *Zanthoxylum rhetza* and *Manilkara kauki* are two examples of the native slow-growth wood species that currently are becoming scarce because of high demand, particularly for high quality woodcarving products. The Forest Tree Seed Institute (Balai Perbenihan Tanaman Hutan), an institution under the Directorate General of Land Rehabilitation and Social Forestry, is now taking the lead in the cultivation of these two species. Supported by the Finnish agency Finnida, the institution is collecting and testing the seed qualities of the two species from various provenances in Bali and the surrounding islands. Once promising seeds have been selected, the institute will establish plantation trials involving community participation near West Bali National Park.

TRENDS AND ISSUES—DEVELOPMENT AND CONSERVATION LESSONS

The development of the woodcarving industry in Bali shows how market opportunities have changed the style of woodcarving from community carving mostly dedicated to traditional and religious objects to commercial production with an economic orientation. It also shows how wood as a raw material is used to produce goods (carved products), with the process of material transformation giving benefits to a large group of local people. Currently, the industry plays an important role as a source of regional as well as household income. It contributes to and is simultaneously supported by the development of the tourism industry in the area. The industry also has been encouraging local people to plant trees to supply wood.

Changing wood species and designs

The species used for carving have changed over time in response to market opportunities as well as the increasing scarcity of previously used species. Overexploitation of some preferred slow growing species such as *Manilkara kauki* and *Zanthoxylum rhetza* has resulted in a decline of these species. Slow growth and the availability of substitute species probably are the main reasons why plantation efforts for these species remain low. With other fast growing species such as *Paraserianthes falcataria*, however, market opportunities of mass produced carved products has stimulated local people to plant the trees in their home gardens.

Similar to wood species being used, the carving styles have changed significantly in response to the market. Pop art has been vigorously developed and is now the dominant woodcarving product exported from the region. Compared to the Balinese woodcarving tradition, pop art demands little skill, effort or time. It is, however, the craftsmanship of the traditional Balinese woodcarvers that distinguishes the Balinese woodcarving from that of other countries, giving it a special position on the international market. Young artists are encouraged by economic motivation and want products that will give quick economic return. If this development goes too far it could make Balinese woodcarving lose its identity and with that its good name and strong position in the woodcarving market. Thus, though the pop art designs and themes are very much market oriented, in the long term the trend to mass production could lessen the comparative advantage of woodcarvings from Bali. However, there are many woodcarvers in Bali who maintain the classic carving tradition, and it is expected that this adherence will have a positive impact in the long term on the market for Balinese woodcarvings.

Developing the woodcarving sector

The willingness of woodcarvers to work together through rural organisations and their open attitude towards market dynamics have contributed to the development of the woodcarving industry in Bali. There is also a positive impact from cultural (*adat*) traditions on running the rural organisations; there are, for example, traditional sanctions that would boycott an entire family business if a credit were not repaid. Government support in the form of financial aid through the Lembaga Perkreditan Desa, providing education for the younger generation, promotion through exhibitions and research and development have also contributed to the growth of the woodcarving industry in Bali.

In order to maintain the development of the woodcarving industry in Bali, as well as to reduce negative ecological impacts on the environment, consistent effort is required. Some proposed recommendations are:

- To maintain the market through promotional efforts such as making available more informational booklets and brochures and organising periodic woodcarving exhibitions.
- To support the Lembaga Perkreditan Desa in its efforts to be an effective village financial institution. The LPD could be extended to other districts.
- To maintain the quality of woodcarving designs and themes. Classic styles or fine art carving are important and should be maintained as a quality benchmark of Balinese woodcarving. Artists and educational institutions should be provided with incentives for maintaining or developing these woodcarving styles.
- To invest in plantations, particularly of slow-growth wood species. This could be implemented in areas where sufficient land is available, e.g., in the West Bali region. Collaboration between research institutes, Balai Perbenihan Tanaman Hutan and local organisations to establish plantation plots is recommended.

ENDNOTES

1. Forestry Research Institute of Sumatra, Kampus Kehutanan Terpadu Aek Nauli, Jln. Raya Parapat Km. 10.5, Parapat, Sumatera Utara, Indonesia. E-mail: drohadi@indo.net.id
2. Forestry Research and Development Agency, Ministry of Forestry, Manggala Wanabhakti Bld., Jakarta, Indonesia. E-mail: permadi@indo.net.id
3. Forestry and Nature Conservation Research and Development Center, Jln. Gunung Batu No. 5, Bogor, Indonesia. E-mail: syarif.hidayat@mailcity.com
4. Exchange rate used: US\$1 = Rp10,000.
5. *Garuda* carvings are the most popular type of woodcarving produced in Tegallalang. A carved *garuda* illustrates Prince Rama sitting on the *Jatayu* knight, a bird knight from the story of Ramayana. There are various sizes and carving qualities (detail and structure of the carving).
6. Bucking is cutting the tree stem into specific lengths. The stem may be cut into 1 m, 2 m or 3 m length depending on the market order.

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Chapter 17

Domestication of rattan (*Calamus tetradactylus*) in the buffer zone of Ke Go Natural Reserve Area, Cam Xuyen district, Vietnam

Vu Dinh Quang¹

Common names	Part of the resource used	Management	Degree of transformation	Scale of trade	Geographic range
May nep, Rattan	Stem	Wild/Cultivated	Medium	International	Small

OVERVIEW

Farmers living in the buffer zone of Ke Go Natural Reserve Area in Cam Xuyen district harvest a small-diameter rattan species, *Calamus tetradactylus* Hance (known locally as *may*), from both planted and wild resources. The availability of wild *may* has been decreasing owing to overharvesting. In 1998 a project was introduced promoting the cultivation of *may*, amongst others, by providing seedlings. The *may* from the study area feeds into a large pool of rattan used for the production of furniture and handicrafts near Hanoi. Most end products are produced for export. The demand from new international markets for rattan furniture and handicrafts is growing, partly as the result of political reforms aimed to open Vietnam to foreign markets. Households in the Ke Go buffer zone make baskets from *may* for domestic use, but there is hardly any local processing for the market. Local awareness of the possibilities of adding value is limited because of the complexity and length of the trade chain.

INTRODUCTION

Cam Xuyen district is located in Ha Tinh province in north-central Vietnam. It is one of the poorer districts in the country, mainly caused by a lack of rice fields and the prevalence of poor soils. Forests cover 29% of the district and have been heavily disturbed. The Ke Go Natural Reserve Area (NRA), established in 1996, is the only forest of any significance remaining in Cam Xuyen. The NRA

has a core area of 24,801 ha where no people are living and extraction of forest products is strictly prohibited (classified as Special Use Forest) and a buffer zone surrounding the strictly protected zone. Almost the entire reserve has been heavily logged and undisturbed primary forest is virtually absent. Most of the buffer zone area is barren or scrub, with only some forested parts.

This case study focuses on two communes² of Cam Xuyen district: Cam Son, consisting of 12 villages with 1,382 households; and Cam My, consisting of 10 villages with 1,131 households. Cam Son is located in the buffer zone of Ke Go NRA, while Cam My lies partly in the buffer zone and partly in the core area (Figure 1).

The non-timber forest product project

The non-timber forest product (NTFP) project, which started in 1998 with the objective of improving people's livelihoods and reducing the pressure on natural resources, has pilot sites in Ha Tinh and Bac Kan provinces. The pilot site in Ha Tinh province is formed by the communes Cam My, Cam Hung and Cam Son. The project³ in Ha Tinh is funded by the Royal Netherlands Embassy and implemented by the NTFP Research Centre (an agency of the Ministry of Agriculture and Development), the Centre for Natural Resources and Environmental Studies and the World Conservation Union. The main project activity is the promotion of rattan cultivation. Since 2000 more than half of the villagers in the communes located in the project area have received support in the form of *may* seedlings, fertilisers and technical training. Villagers themselves selected the households to receive support in participatory village meetings, based on the criteria of labour availability, land availability and labour skills. Among households meeting these criteria priority was given to the poorest households. The project activities have resulted in a substantial increase in the number of people with planted rattan on their lands.

THE PRODUCTION-TO-CONSUMPTION SYSTEM

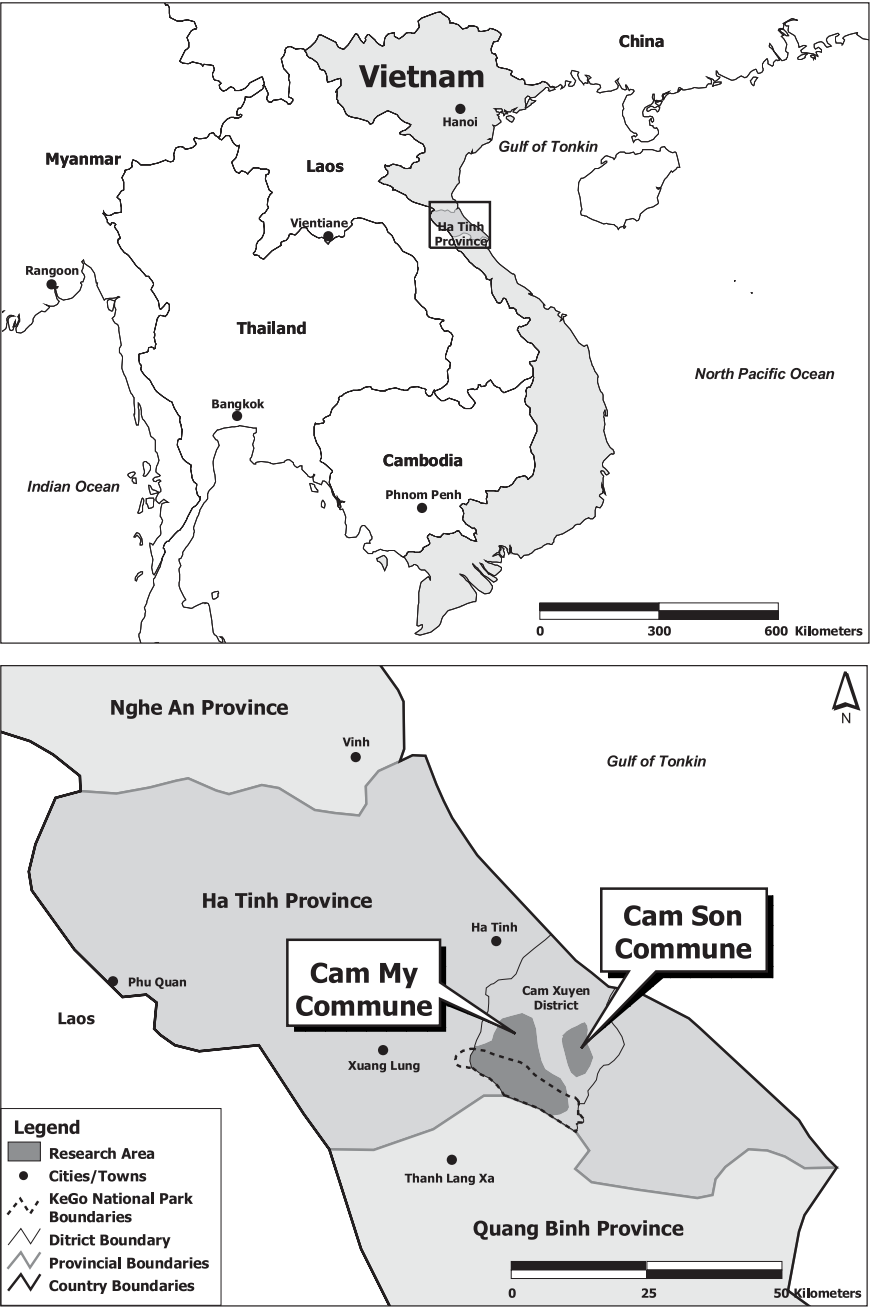
May, a small-diameter rattan

There are a number of rattan species used commercially in Vietnam (Table 1). All small-diameter rattan species are commercially known as *may* here, while large-diameter species are called *song*. The most important small-diameter rattan species in the research area, and the focus of this report, is *Calamus tetradactylus* Hance, locally known as *may tat*, *nep*, *may ruot ga*, or simply *may* (Vu van Dung and Le Huy Cuong 1996). *May* is commonly found in Cam Xuyen district, especially in Ke Go NRA.

Extraction of *may*

About 60% of the harvested *may* comes from home gardens, the rest from wild resources in the buffer zone and the protected area. It seems that the poorest households, with scarce labour and land, are the most dependent on rattan from the wild. Households may harvest *may* throughout the year, as a sideline

Figure 1. Location of study area



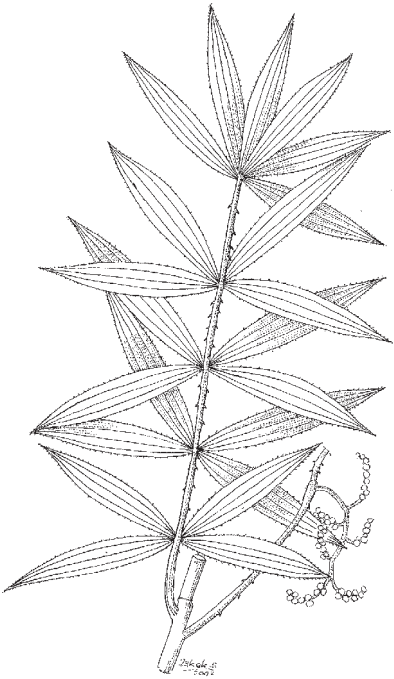
Source: ESRI Data and Maps 2002.

Table 1. Commercial rattan species in Vietnam

Local name	Scientific name	Commercial name
<i>May tat, nep, may ruot ga</i>	<i>C. tetradactylus</i>	<i>May</i>
<i>May dang</i>	<i>C. tonkinensis</i>	<i>May</i>
<i>May tau</i>	<i>C. dioicus</i>	<i>May</i>
<i>May cat</i>	<i>C. viminalis</i>	<i>May</i>
<i>Song bot</i>	<i>C. poilanei</i>	White <i>song</i>
<i>Song mat</i>	<i>C. platyacanthus</i>	<i>Song</i>
<i>Song la bac</i>	<i>C. Plectocomiopsis</i>	<i>Song</i>
<i>Heo</i>	<i>C. scutellaris</i>	<i>Song</i>

Source: Vu Van Dung and Le Huy Cuong 1996.

activity, but collection from the wild resource occurs mainly in the dry season from December to July, because access to the forested areas is limited during the rainy season. Most of the cultivated *may* is planted in fences bordering fields, since it serves as good protection against buffaloes and other animals. Bamboo is also considered good fencing material, but farmers prefer rattan because bamboo is said to compete with crops for soil nutrients. In fences the *may* is usually intercropped with tree species as it has a preference for partial shade and needs support to climb.



(*Calamus tetradactylus*)

May cultivation needs relatively little labour for maintenance and harvesting. Cultivated *may* requires four to five years before the first harvest (approximately 1–1.5 kg per bush). After 10 years, productivity will be in the range of 10 kg to 20 kg per bush per year, and about 15 to 20 years are required for the plants to reach full productivity of 80 kg to 120 kg per bush per year. Although a farmer may need to wait up to five years for the first harvest of cultivated *may*, it can be harvested approximately five years earlier than wild *may*. The difference between wild and cultivated rattan is caused by the beneficial effects of shade regulation when the rattan is planted and by occasional application of fertilisers.

In 2000 a total of 45,000 *may* seedlings were planted with the support of the NTFP project. The project provided on average 100 rattan seedlings to each supported household (NTFPRC 2000). As a result of the NTFP project activities, the supply of rattan should increase significantly from 2004 onwards.

The producer household

Most households in the study area are farmers with paddy fields and small home gardens. The most important cultivated products are rice, peanuts, fruit, vegetables, sweet potato, pepper, tea and rattan. Of these, rattan and peanuts are cultivated largely for cash income, while of the other products only the surplus is sold. One of the most important activities for cash income is animal husbandry. In addition to *may*, a number of other forest products are harvested including bamboo culms, bamboo shoots, palms, medicinal plants, fuel wood, wildlife and *song*. The average annual total household income in the research area is US\$570⁴, and households in the study area earn approximately 60% of their total income in cash. About 20% of the population in the research area extracts rattan for commercial purposes. *May* contributes about 15% to the total cash income of these households.

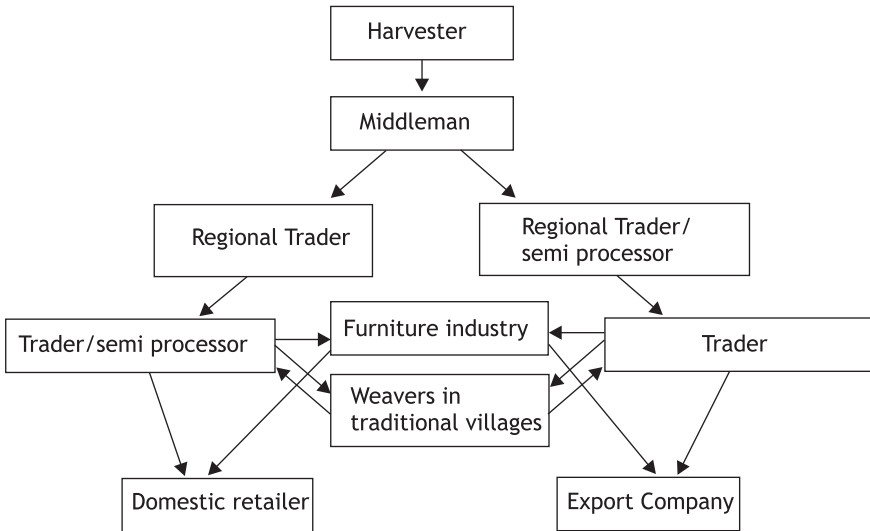
Trade and processing

Most of the *may* is used for the weaving of handicrafts such as baskets. Smaller quantities of *may* are used for furniture in combination with large diameter rattan and wood. The *may* trade system is complex and involves many steps. Figure 2 shows a simplified version of the trade flow in 1998.

In the communes in the buffer zone of Ke Go NRA, farmers collect rattan and sell it to middlemen or directly to one of the two big regional private traders in the neighbouring Thach Ha and Huong Khe districts⁵. Regional traders buy raw material from different parts of Ha Tinh province, either collecting the rattan by truck from the villages or having farmers and independent middlemen deliver it by bicycle or motorbike. Middlemen are usually farmers and work on an opportunistic basis, in their spare time. They collect rattan from farmers in their own and neighbouring villages. When a rattan owner has no time to harvest, the middleman may do the harvesting instead.

Regional traders treat the rattan with sulphur to protect it against fungi. The regional trader in Huong Khe has a semiprocessing factory 70 km from the study

Figure 2. Trade chain for rattan from Cam Son and Cam My



Note: The diagram presents a simplified version of the trade flow in 1998.

area, where the rattan is also cut, boiled and split before being resold. The regional trader in Thach Ha does not have semiprocessing facilities and sells the treated raw material to traders who arrange for the semiprocessing themselves⁶. The semiprocessed material is then sold to furniture factories or distributed to households in the weaving villages of Ha Tay, Thai Binh and Hung Yen province for handicrafts production. The raw material used for furniture and handicrafts comes from small farmers from all over Vietnam.

About 70% of the *may* processed into handicrafts and furniture is exported. Exports used to be dominated by state companies, but as a result of economic reforms in Vietnam state companies are now in strong competition with hundreds of private companies. The domestic trade in rattan handicrafts takes place mainly in the larger cities. Hanoi and Ho Chi Minh City have several 'rattan streets' packed with numerous outlets for rattan products. Demand is increasing from both the domestic and international markets.

For household purposes people in Cam Xuyen use split *may* as rope and to weave baskets, pillows and seat surfaces. This local processing is done mainly by older men and women. Hardly any commercial processing takes place in the research area, although it can be reasoned that more processing would increase local benefits from rattan. The lack of local processing activities is related to the nature of the trade chain, which is complex and long, with individual farmers contributing only small quantities of *may* into a relatively large processing system located far from the production area.

Photo 1. Furniture making (Photo by K. Kusters)



Photo 2. Rattan handicrafts (Photo by K. Kusters)



Land use rights

The core area of the reserve is managed by the Ke Go management board, which is directly accountable to the Ministry of Agriculture and Rural Development. Extraction and manipulation of resources of these lands is strictly prohibited. However, even though there are five inspection stations in the reserve, timber and NTFP are still illegally harvested from the protected area. Each year forest guards nab a few illegal harvesters, but they represent only a small proportion of the people entering the forest.

There are several types of land use rights in the buffer zone of the reserve, the most important ones being: (1) Agricultural lands (e.g. paddy fields and home gardens) for which villagers have long-term land use rights and which have been under the management of villagers for a long time. (2) Since 1995, as part of the government's land allocation program, households and organisations have been given conditional land use rights for barren scrub lands (most lands in the buffer zone are barren or degraded). These allocated lands are classified as 'production forest' and are to be used for agroforestry purposes. A certificate holder has the right to support from the state to encourage reforestation and agroforestry. The average size of allocated lands is 7 ha to 8 ha and special privileges are given to certain households (e.g., war veterans), who may have up to 30 ha. Seventy percent of all households in the study area have been allocated forestland located in the buffer zone of Ke Go NRA. (3) Forested lands in the buffer zone under the management of the Cam Xuyen State Forest Enterprise (SFE). The SFE has the formal land use certificate for these lands and can contract the land to households and organisations for protection, regeneration and planting. For example, the SFE has contracts with households for the management of pine plantations, which obliges the household to tap resin and sell it to the SFE. The SFE also has 'protection contracts' with villagers, which means the households receive US\$3.4 per ha per year for protecting a designated piece of forestland or plantation. The holders of such contracts do not receive full land use certificates and are obliged to follow the instructions of the SFE. Villagers are allowed to collect NTFP from SFE managed lands for domestic use (MARD 1996; Christ and Kloss 1998; McElwee 2001).

TRENDS AND ISSUES: DEVELOPMENT AND CONSERVATION LESSONS

The trend towards *may* cultivation

There has been a trend towards the cultivation of *may*, following the decline of wild resources in the 1980s. The decline of wild *may* was a result of overharvesting due to fierce competition amongst gatherers for the wild resources, the lack of regulations and management, a situation of *de facto* open access and the slow regeneration pace of wild *may*. The NTFP project—borne out of interest in the potential of NTFPs by the government and development and conservation organisations—followed up on the existing trend towards cultivation. The project activities have resulted in a sudden increase in planting from 2000 onwards.

While there has been an increase in *may* cultivation in the buffer zone area, in the plains of Cam Xuyen district people have been shifting away from rattan cultivation towards the cultivation of fruit trees. This shift seems to be related to the scarcity of land in the plains, which makes this area less suitable for extensive land uses such as rattan cultivation. The situation in the buffer zone of Ke Go NRA on the other hand is very different, since more land has become available to households as a result of the allocation of barren and scrub lands in the buffer zone to households.

A feasible sideline activity

The cultivation of rattan is a feasible option for households in the Ke Go buffer zone for several reasons. First, households have been allocated lands that are to be used for forestry activities. Second, the cultivation of rattan (stimulated by the government) fits into existing trends of intensifying cultivation. Third, the production of rattan demands little time, which suits the subsistence character of most household economies. Fourth, rattan has a dual purpose by serving as fencing while being commercially valuable. And fifth, rattan has good market prospects, with expanding export markets.

Box 1. Extraction of *song*

The production of the large diameter *song* still depends totally on wild resources. The availability of *song* has decreased considerably since the late 1970s as a result of increased harvesting activities. Prior to 1978, 80% of the rattan produced in the study area was *song*, while in 1998 it accounted for less than 30%. Because *song* takes 20 years before it is ready to be harvested, people are not interested in planting it.

Rattan exports

In the 1970s and 1980s, most rattan from Vietnam was exported as finished products to the former USSR. With the collapse of the USSR, this market was lost and the emphasis shifted to the export of raw and semiprocessed materials to neighbouring countries like Thailand, Taiwan, Hong Kong, Japan and China. From 1993 to 1995 raw rattan exports declined as a result of Decree 90, a government regulation forbidding the export of raw and semiprocessed materials in order to stimulate national processing industries. The regulation was proclaimed in 1992, but trade in these products continued until 1995. Following the ban, the rattan industry in Vietnam experienced numerous problems owing to a lack of processing technology and skilled craftspeople, but by 1996 the Vietnamese rattan-processing sector had become an advanced industry. Since 1996 the export of finished products has continued to increase partly as a result of Vietnam's economic reforms. The country is in the process of *doi moi*, or gradual economic liberalisation and opening to the West. As a result

new export markets such as Germany and the United States are gaining importance. In 1998, rattan handicrafts and furniture were important export products and the estimated export value of rattan products (including mixed rattan-bamboo products) was about US\$30 million. Demand for *may* is expected to continue to rise as a result of growing export markets. To keep addressing new markets, however, high-quality finished products are needed and the lack of skilled labour, up-to-date technology, modern designs and processing materials may be constraining factors. Shortage of capital is a big problem for both farmers and processors.

Future rattan supplies

Though trade and processing of *may* products is big business, traders and processors seem to pay little attention to the production side. Wild resources are overharvested because of a lack of regulations and management, and future supplies rely, to a large extent, on *may* cultivated in agroforestry systems. Land allocation by the government is considered an important incentive for the establishment of agroforestry systems, which could result in an increase in rattan production. However, the lack of resources (money and labour) to invest in allocated forestland is limiting the possibilities. This underlines the specificity of the study area, where *may* planting activities have relied to a large extent on external input provided by the NTFP project.

ENDNOTES

1. Non-Timber Forest Products Research Centre, 8 Chuong Duong Do, Hoan Kiem, Hanoi, Vietnam. E-mail: ntfp.project@hn.vnn.vn; Quang.vudinh@ntfp.org.vn
2. The 'commune' is the lowest administrative unit in Vietnam and is best described as a subdistrict.
3. Most of the data for this paper was collected during work for this project. The data in this report is from 1998 unless mentioned otherwise.
4. Exchange rate 1998: US\$1 = VND14,500
5. Since 2000 more big rattan traders have emerged. In 2002 one of the two regional traders dissolved his business.
6. This may involve contracting out the semiprocessing activities. Buyers may also work for weavers.

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Chapter 18

Case study of *tendu* leaves (*Diospyros melanoxylon*) in Harda district, Madhya Pradesh, India

Arvind A. Boaz¹

Common name	Part of the resource used	Management	Degree of transformation	Scale of trade	Geographic range
Tendu	Leaves	Wild/Managed	Medium	International	Large

OVERVIEW

The leaves of the *tendu* tree (*Diospyros melanoxylon* Roxb.) are an important non-timber forest product for the Indian state of Madhya Pradesh. They are used in the rolling of *beedis*, a local cigarette. After this product was commercialised in the early twentieth century, its economic importance for local communities has increased, particularly during the last four decades. The government established state control over the collection and trade of *tendu* leaves in 1964. In 1989 the government adjusted its regulations and established a co-operative structure for the collection and trade of *tendu* leaves. The majority of leaves collected in Harda district, located in the state of Madhya Pradesh, are harvested from disturbed primary forests and there is no cultivation of the tree. Some areas are pruned, to get a flush of fresh leaves. Sometimes fire is used to clear the undergrowth, which negatively affects other flora and fauna in the collection areas. The co-operative structure and additional government interventions have been successful in raising the wages of *tendu* leaf collectors. The author claims that investments in research are needed to explore marketing opportunities and sustainable harvesting methods. Furthermore, the author stresses the need of extension services focusing on improving pruning and harvesting practices.

INTRODUCTION

The leaves of the *tendu* tree (*Diopyros melanoxylon* Roxb.), collected from the forests of central India, are used in the rolling of cigarettes called *beedis*

because of their soft aroma and smooth, continuous burning characteristics (Tewari 1981). A *beedi* is a mixture of blended tobaccos, wrapped in *tendu* leaves. The state of Madhya Pradesh in central India is the largest producer of *tendu* leaves in India, with nearly 50% of the total production of the country, i.e., 4.5 million to 5 million bags (each bag being about 32 kg) annually. Harda district in the state of Madhya Pradesh is the research area (or 'raw material production area') for this case study. Most of the data for this case study are from 1998, except the population census data, which come from the 1991 census, as there is only one census every 10 years in India.

Harda district

Harda district (see Figure 1) is located between 21°53' and 22°36' latitude north and 76°47' and 77°20' longitude east. It is bounded in the north by the districts of Dewas and Sehore, in the east by Hoshangabad district, in the south by Betul and East Nimar (Khandwa) districts and in the west by East Nimar and Dewas districts. The total area of Harda district is 2,644 km² with a total forest area of 1,060 km² (40%). The mean elevation is 425 m a.s.l. (Jain 1999).

The study area can be divided into the following regions: (1) the Narmada Plains, (2) the Satpura Hill series and (3) the Budhimai Plateau. The area is partially flat in the Narmada river basin with small hills dotting the northern end. A portion of the Namada Plains will be submerged as a result of the Narmada Sagar Dam under construction near Punasa. The Satpura Hills are undulating and comprise several small hills and spurs protruding in different directions. The highest hilltop, known as Mirchibari (730 m), is situated in this hill series. An overview of the major agricultural land uses in the study area, recorded in terms of absolute area, is presented in Table 1.

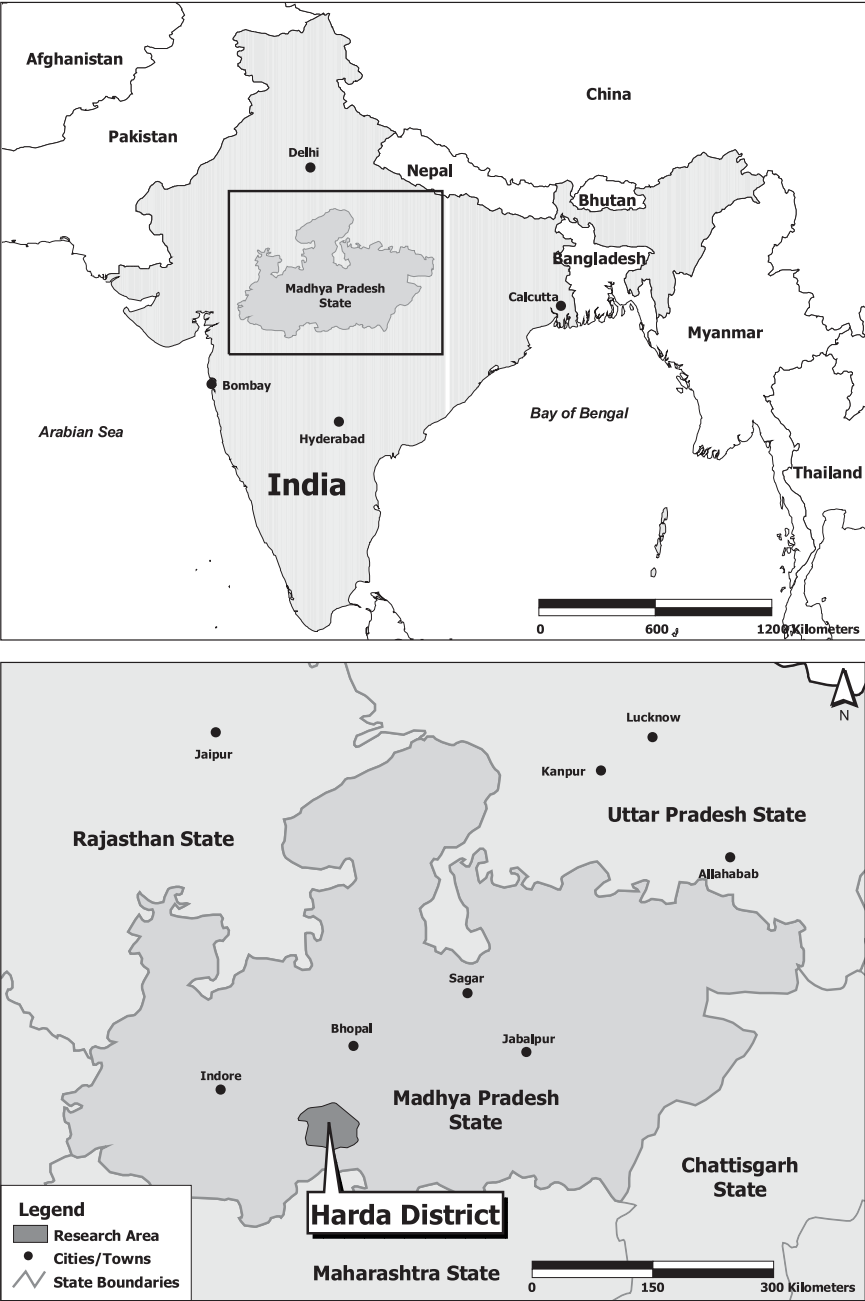
Table 1. Land use in the study area

Land use	Area
Rain fed/dry crop production	1,576.88 km ²
Irrigated crop production	1,272.38 km ²
Permanent crops	1,698.27 km ²
Pasture	215.44 km ²
Swidden fallow	40.36 km ²

Note: Some categories may overlap.

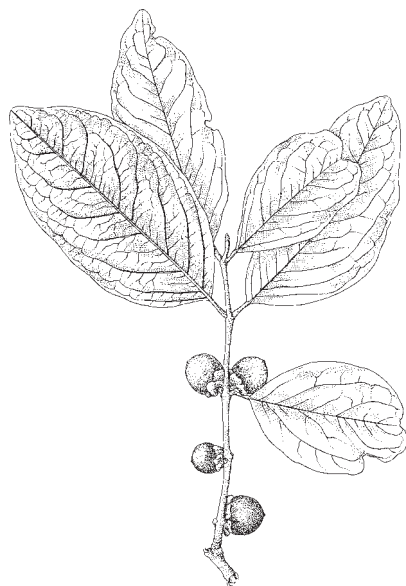
In the study area, the average annual temperature is 26°C (78°F) and the annual average rainfall is 1,210 mm (48 inches). The rainy season is from mid-June to mid-September, when 92% (1,115 mm) of the total annual rainfall is received. The winter rains (November to February) are meagre and the summer months of March to June are dry. According to the Holdridge

Figure 1. Map of the study site



Source: ESRI Data and Maps 2002.

classification system, the dominant forest types are tropical dry and tropical moist forests. The bulk of the study area contains teak forests in which the occurrence of teak (*Tectona grandis*) is more than 50%. The major associates of teak are *Saja* (*Terminalia tomentosa* W. ed. Am.), *Bija* (*Pterocarpus marsupium* Roxb.), *Dhoara* (*Anogeissus latifolia* Wall.) and *Tendu* (*Diospyros melanoxylon* Roxb.). *Dendrocalamus strictus* Nees is the only bamboo species found in the area.



(*Diospyros melanoxylon*)

The total population of the district as per the 1991 (latest) census was 380,762 people in 76,152 households. There are 3 towns and 497 villages. Of the total population, 80% lives in rural areas (Government of India 1991) and about 40% is literate. The scheduled castes are the people who are recognised by the Indian government as 'socially deprived', being descendants from former deprived castes. Scheduled tribes are the people belonging to different tribal groups of India.² The study area has a scheduled caste population of 64,104 (17%) and a scheduled tribe population of 92,064 (24%) (Government of Madhya Pradesh 1998), the main tribe being the Gonds. Harda district is quite well connected by road and has 1,566 km of motorable roads. The Bombay-Howrah railway line also passes through the district (Government of Madhya Pradesh 1999).

The average total annual household income from subsistence, barter and cash in the raw material production area is estimated at US\$147.31.³ The national annual total household income for 1998 was US\$199 (Economy Watch 2000). Seventy percent of the average total income of households in the raw material production area is earned in cash. Household earn cash

through the sale of agricultural and forest produce as well as through wage-labour in agricultural and forestry operations. In 1998, the average daily wage for a labourer in the study area was US\$1.13. In the same year 17,901 households, or 28% of the total population, were registered as *tendu* leaf collectors in the study area.

THE PRODUCTION-TO-CONSUMPTION SYSTEM

Tendu leaves

Tendu leaves are obtained from the *tendu* tree, which belongs to the family *Eberaceae* and is endemic to the Indian subcontinent. The total area (global) over which the species is distributed extends from the north Indian sub-Himalayan tracts to the Indus plains, Gangetic plains, Madhya Pradesh and eastern coast up to Coromandal in southern India. *Tendu* trees grow in both moist and dry deciduous forests. In the study area three types of forests occur: southern Indian deciduous slightly moist teak forests, southern tropical dry deciduous dry teak forest and southern tropical dry deciduous mixed forest (Champion and Seth 1968). The *tendu* tree is an under-story species in all three types of forest. It also occurs naturally on land that has become largely barren as a result of biotic interference such as firewood collection, logging, grazing and fires. *Tendu* manages to survive on these lands, because it is highly adaptive and responds to disturbance such as ground fires and root damage by sprouting new root suckers (Ghosh *et al.* 1976). It is a medium sized tree and bears leathery leaves and round fruits. The bark, fruits and leaves possess medicinal properties. Reproduction of the species is through seeds that are dispersed mostly by mammals (e.g., monkey and deer) and birds, as the fruit is sweet and edible. The time from germination to reproductive maturity is 10 to 15 years and the average life span of mature individuals is 60 to 80 years.

The author laid down several 0.25 ha plots in the study area in 2000 in a stratified random survey to count the average number of economically harvestable individuals per hectare in pruned areas. The results gave nearly 500 individuals per hectare, mostly root suckers. The survey showed that there were nearly 25 mature individuals per hectare in well-stocked areas but in some areas near habitation there was a preponderance of dense shrubby growth and hardly any mature trees.

Leaf collection in Harda district

Of the *tendu* leaf production in Harda, 95% comes from public forests. The remaining 5% comes from so-called 'revenue wasteland', public lands not classified as forest. *Tendu* trees occur naturally in the area and there is no trend towards cultivation of the product as it is abundantly available in the forest areas. Most leaves are collected from disturbed primary forest (see Table 2). About 70% of the annual production in the raw material production area is collected from the wild, naturally reproducing population in nonmanaged (nonpruned) disturbed primary forest, where the *tendu* is collected from

young trees and naturally occurring shrubs. The remaining 30% is collected from a managed population in a forest environment, where the plants are pruned for better leaf production.

Table 2. The percentage of annual production of *tendu* leaves in the raw material production area per forest type

Type of Forest	Percentage of Tendu leaves
Primary forest	10%
Disturbed primary forest	70%
Secondary forest (>10 years old; part of forest system)	10%
Savannah/woodland	10%

Roughly, there are two types of management: (1) maintaining the tree as a shrub by regularly pruning the branches; and (2) injuring the roots of the tree/shrub, which results in the sprouting of new root suckers; these shoots are maintained at ground level by regular pruning of the plant. The leaves from freshly pruned shrubs and shoots are of better quality as pruning gives rise to larger, papery thin leaves, which are preferred for *beedi* rolling and fetch a better price. They also are easier to collect than the leaves from mature trees. Pruning activities increase both quality and quantity of harvestable leaves. The increased production in Harda between 1997 and 2000 (Table 3) can be partly attributed to pruning activities.⁴ Ground fires improve the growth of harvestable leaves as well, since the fire burns the small shrubby growth and injures the root structure, giving rise to new root suckers. Sometimes, collectors deliberately start fires. The management practices do not allow trees to mature (e.g., grow tall and bear fruits) and have led to an increase in the shrubby form of the tree. Pruning activities are carried out from the end of February to the middle of March and it takes 45 to 50 days from the time of pruning to maturity of a fresh flush of harvestable leaves (Prasad and Bhatnagar 1991).

Table 3. *Tendu* leaf production in Harda district

Year	Number of Standard bags
1996	26,840
1997	23,838
1998	32,133
1999	33,379
2000	36,815

The collection of *tendu* leaves is seasonal work and lasts about six weeks. Collection in the study area starts in the middle of May and continues till the first week of June. The process of picking *tendu* leaves consists of five major closely related steps: (1) Collectors leave early in the morning to avoid the heat of summer (April to June) and walk to the forest; (2) they pick leaves

all day and (3) take the leaves to their homes; (4) at the collectors' homes the leaves are graded, whereby all infected, immature, torn and small leaves are rejected and the remainder tied in small standardised bundles of 50 leaves usually with a twine of *Dhak* (*Butea monosperma* Lank Taub); and (5) collectors then walk to the purchasing centre (*phad*) in the evening taking the bundles to the purchasing agent (*phad munshi*) (Gupta and Guleria 1982).

Tendu leaf collectors

The majority of *tendu* leaf collectors are the rural poor; marginal farmers (owners of less than 2 ha) or agricultural wage labourers, including tribal people and scheduled casts. In the study area, as in all production areas, women do most of the collection work though teenagers, small children and men may help as well. There are no costs involved other than labour. Collectors are job rate labourers, not earning a daily wage but a fixed amount for each bag delivered. During summertime (the time of *tendu* leaf collection) there is little agricultural activity in the study area and the collection of *tendu* leaves is particularly important as it contributes a major share to the income of many people in this lean agricultural season. Not all villages along the forest fringe have collectors. The activity depends on the presence of a collection centre, and the presence of a collection centre is dependent upon the amount of *tendu* in the locality, since *tendu* trees are not evenly distributed but occur in pockets. In villages in and near collection areas almost all the families participate in the collection work.

The number of households involved in raw material production in Harda district increased from 14,270 households in 1997 to 17,901 households in 1998. This increase followed a campaign by the Madhya Pradesh government to involve more people in collection, which led to the consequent increase in production (in Harda district) from 23,838 bags in 1997 to 32,133 bags in 1998. The average total annual household income of producer households is US\$103 (Jain 1999), 16% of which is derived from the product. Though most of the collectors are rural poor for whom *tendu* provides a relatively large contribution to their cash income, relatively rich farmers (with irrigation facilities and two crops per year) are involved in the collection of *tendu* as well.

Box 1. Collection of other NTFPs in Harda district

Many producer households are also involved in the commercial extraction of other nontimber forest products (NTFPs). Some of the important species are *Ocimum* species, *Azadirachta indica* seeds, *Maduca latifolia* flowers and seeds, *Cassia tora* seeds and *Phyllanthus officinalis* fruits. There has been a gradual increase in the relative household income from NTFPs in the study area over the past 10 years. This is mostly attributable to the increase in demand for medicinal plants and food plants in the herbal cosmetic and pharmaceutical industry, both nationally and internationally. Not only the quantities in demand have increased but also more species are being added to the herbal basket each year.

Primary processing of *tendu*

Primary processing takes place at the purchasing centre (*phad*), where men, mainly on a contract basis, do the work. At the purchasing centre the leaves are spread out in open fields for air-drying. The hot, scorching sun dries the leaves, which are turned over on the third day to ensure proper drying on both sides. In some areas, where there are termites, some insecticide is spread over the fields prior to the spreading of bundles for drying. After the sixth or seventh day, the leaves are collected together in heaps of 5,000 to 10,000 bundles. The packing of bundles is an art and is often done by 'packing parties', groups of five to six people who specialise in the packing of *tendu* leaves. These parties come mainly from Gondia, a district in the neighbouring state of Maharashtra and a centre for *beedi* manufacturing. People in the study area are also learning to pack. Packing is extremely important as the dry leaves become brittle and are easily damaged. On the packing day, the heaps are watered and covered with jute bags (*bhhakkus*, as they are locally called), and left to soften for three to four hours. The leaves soften in this period because of the moisture and the subsequent steam generated by the heat of the sun-dried leaves. In the evening, the softened leaves are counted and packed in thin jute bags of 90 cm x 125 cm. Each bag can hold around 500 to 800 bundles depending upon the size of the leaves. The bundles are packed layer upon layer. This avoids leaf breakage during the initial packing and at a later stage when the leaves dry out and are subject to rough handling during transportation to distant places. After the jute bags are filled, they are stitched up with twine and left to dry in the open for about two days. After drying, the bags are transported to a storage place (*godown*), where they are stored till their disposal (Boaz 1998-2002).

Photo 1. Bundle of dried leaves (Photo by K. Kusters)



Photo 2. Transportation of bags containing tendu leaves, with packed jute-gunny-bags in the foreground (Photo by A.A. Boaz)



***Beedi* rolling**

Beedi manufacturers, who usually have several small or medium scale factories for *beedi* processing, purchase *tendu* leaves, cotton thread and tobacco (grown mostly in the state of Andhra Pradesh), blend the tobacco and then let agents distribute the materials to *beedi* rollers. *Beedi* rolling is done by poor rural households at home, usually including the whole family, and goes on the whole year round. Not all of the *beedi* rolling is done in Harda. Some are rolled in the adjoining districts of Khandwa, Damoh and Jabalpur. *Beedis* are flat at the smoking end and round at the burning end. They are tied at the flat end with thread of a particular colour chosen to identify the manufacturer.

The rates paid to *beedi* rollers are low. The *Tendu* Leaves Regulation of the Trade Act contains a provision whereby villagers can keep a certain number of leaves for own consumption without registration. Sometimes, however, agents give fewer *tendu* leaves than they should to *beedi* rollers, which means that the rollers (who are gatherers themselves) have to make up the balance from their own collection. This is a form of illicit trade in leaves and it basically means that the manufacturer gets these *tendu* leaves for free. The *beedis* are collected from the rollers by manufacturer agents and taken to processing factories. These factories are all located outside of Harda and usually have fewer than 50 employees, mostly men. The *beedis* are roasted over a charcoal fire in a specially designed chamber to remove moisture and to give them a unique flavour. The *beedis* are tied in bundles of 20 or 25 with a thread and wrapped in labelled paper. Twenty packs are bundled in a particular coloured paper denoting the brand name. Ten such bundles are then tied with jute thread and put in a bag, sealed, stencilled and dispatched to the market.

There are barriers that make it difficult for new processing units to enter the industry. These are mostly economic barriers as the costs of entry (e.g., investment in a roasting chamber) are high. Other barriers are the skills in tobacco blending (a skill that identifies each brand), and the need to develop household processing and a marketing network. State intervention in processing of the product has increased in the past 10 years. In Madhya Pradesh, high taxes and regulations protecting the labour force make production expensive, and this is enticing manufacturers to move to other states. *Beedi* manufacturers have been spearheading a movement to pressurise the Madhya Pradesh state government to reduce taxes and change regulations.

Trade and marketing

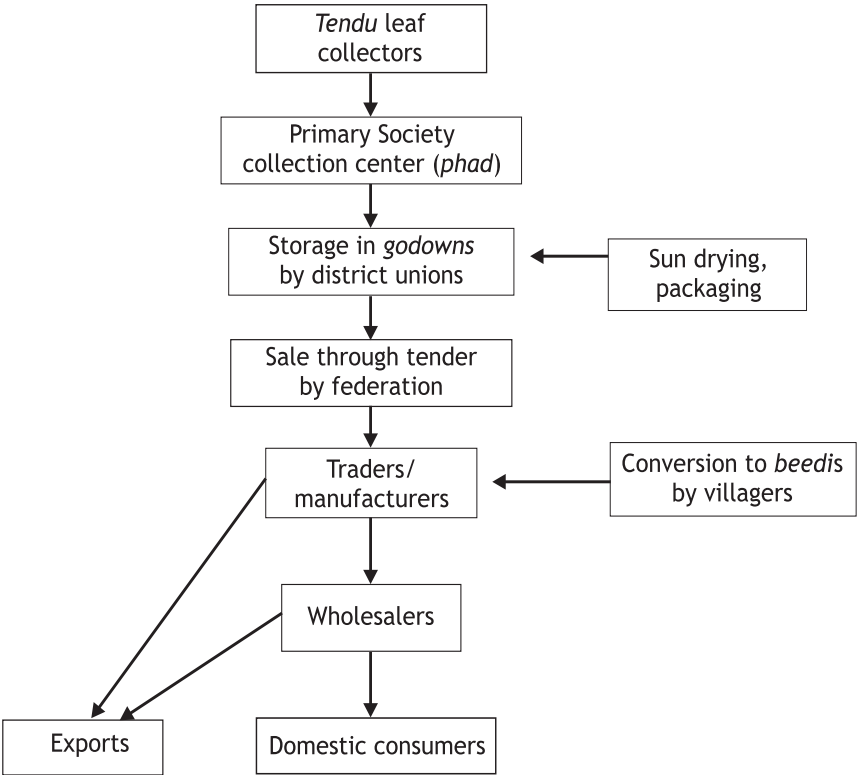
Tendu leaves are a nationalised product and only the Madhya Pradesh State Minor Forest Produce Cooperative Federation (the agent appointed by the state government) may buy leaves from collectors. Thus, raw material producers have no choice as to who they sell their produce to. Collectors take the bags to the local purchasing centres, after which the product is transported by truck or cart to storage centres.

Leaves are normally used within one year. Leaves aged more than one year lose their aromatic flavour and colour, consequently losing 50% of their value, and are then used for inferior quality *beedi* rolling. From the storage centre the federation sells the *beedis* to traders and manufacturers. There are six to eight traders in the raw material production area. Over the years, the number of traders has decreased and more and more manufacturers have started buying leaves directly from the federation (see trade diagram, Figure 2). Manufacturers pay *beedi* rollers by the number of *beedis* they roll and, after roasting and packing, usually sell the *beedis* to domestic wholesalers or retailers. *Beedis* are bought all over the country in packets of 20 or 25, for which the price varies from US\$0.049 to US\$0.12.

In 1998, the average price of the raw material was US\$26.05 per bag of about 32 kg leaves, which is equivalent to US\$0.81 per kilogram. The collection of *tendu* leaves in the study area in 1998 was 32,133 bags, and sold for US\$811,735. In 1998 the total national trade was estimated to be about 10 million standard bags with an annual value of US\$238 million. The value of the raw material is 20% of the value of the final product in the main market.

A relatively small proportion is sold for export. The value of the total national export of *tendu* leaves and *beedis* (sometimes further processed at the destination) is estimated at US\$2 million and US\$3 million, respectively. *Tendu* leaves are exported, for example, to Bangladesh and Pakistan, where they are used for rolling cigarettes. *Beedis* are exported to a variety of countries in the region and Arab countries. In the last decade exports to Europe and the United States have also increased, driven by the notion that *beedi* rollups are less harmful than normal cigarettes and by their novelty status in these countries.

Figure 2. The production-to-consumption chain



Policy environment

The collection of *tendu* leaves on a commercial scale started in the early twentieth century. Initially, even though most of the *tendu* trees were found on government lands, the government had no control over the picking. Collection from these lands was rampant, and traders exploited the forest dwellers who picked the leaves. Therefore, with a view to controlling the collection of *tendu* leaves from public forests and to ensure that pickers, mostly the rural poor, were paid a proper wage, the state government enacted the *Tendu Leaves Regulation of the Trade Act* in 1964 (*Madhya Pradesh Tendu Patta, Vyapar Viniyaman, Adhiniyam*). With this act the government took over the trade of *tendu* leaves through the establishment of a state monopoly ('nationalisation'). It is obligatory for collectors to sell their produce to the government appointed agent. The *tendu* leaves producing areas of Madhya Pradesh were divided into 1,826 units and the government appointed purchasing agents for each unit. The agent collects and delivers the leaves to the purchaser at the collection centre. The venue developed into a highly exploitative system in which middlemen and traders exploited collectors and ate away most of the profits.

In 1980 the state government, in a pilot program, appointed the Madhya Pradesh State Cooperative Marketing Federation as its agent in some units in order to protect the pickers from being exploited by private individuals and companies. In 1984 the Madhya Pradesh State Minor Forest Produce Cooperative Federation was formed to strengthen the position of collectors of minor forest products. However, during the period 1984 to 1988, the activities of that federation with regard to the *tendu* leaves trade were confined to a few districts. In 1989 a new scheme was introduced in the form of a three tier co-operative structure, which still exists today. At the primary level of the co-operative structure 1,947 Primary Forest Produce Co-operative Societies were constituted (Boaz, O. 1998). In the study area eight such societies were established, each comprising on average 30 small villages. Since it is the only option, all collectors are members of these primary forest co-operatives. The membership fee is only US\$0.25 (INR10) and is easily obtained by simply taking *tendu* leaves to the *phad* and getting oneself registered as a collector. There are no social, economic, technical or regulatory barriers that make it difficult for new producers to enter. At the secondary level, 86 District Forest Produce Cooperative Unions were formed. The study area has one such union. The Madhya Pradesh State Minor Forest Produce Cooperative Federation is at the apex level of the three-tier structure.

From 1989 to 1994, the primary societies were paid a commission of US\$0.21 (INR10) per standard bag of leaves collected. After 1994 the federation redistributed 20% of its profits to the societies. In 1996 all net income (profit) was distributed to the societies, who in turn redistributed 80% of the net income, after deduction of their expenses as deferred wages, to the collectors on top of their job rate. This was an important decision from the point of view of making these societies, and through them the actual collectors, owners of the product. Later, in the year 1998, the Madhya Pradesh government decided to transfer the entire net profit to the primary co-operatives, which were obligated by government order to redistribute 50% to collectors and utilise 20% for development of forests and 30% for village infrastructure development (MPMF 2000a). An amount of US\$0.16 million was distributed to collectors in the study area during 1998.

The restructuring of the new organisation into a co-operative system has been effective in curbing exploitative practices and organising the collectors. It has been beneficial to collectors, not only in ensuring due wages are paid, but also in obtaining higher bargaining power. It has also been successful in developing an effective mechanism for redistribution of profits amongst its members and to ensure a good flow of funds for village infrastructure development and resource (forest area) development.

Another important government intervention has been the establishment of the 73rd Panchayat Amendment Act 1996, which gave the local population user rights over NTFP in forest areas. Ownership of the land remains with the government and raw material producers therefore have no legal rights to change the land use to another production system. The raw material producers in the community are generally aware of the nature of their legal rights to harvest the product for commercial purposes.

Major emphasis on joint forest management came with the 1988 forest policy and the Joint Forest Management Resolution of the Madhya Pradesh State Government in 1991. Two types of Joint Forest Management (JFM) committees have been established—forest protection committees in well-forested areas and village forest committees in understocked forest areas. In the committees the forest department and people work together for protection, management and development of resources. In some cases (e.g., in the research area) the District Unions and societies are starting to collaborate more intensively with JFM committees. For example, in some cases the District Union has paid JFM committees for pruning activities. Another example would be the role of JFM committees to combat fires by taking action against any person setting fire to the forests. The forest department encourages the committees to get involved in combating fire.

Next to the existence of the co-operative structure and the growing importance of JFM committees, an important feature of the study area is the level of government control and enforcement, mainly through a network of forest guards, which has stopped encroachment and illegal logging to a large extent.

TRENDS AND ISSUES—DEVELOPMENT AND CONSERVATION LESSONS

Importance of *tendu* for the local population

The gathering of *tendu* leaves is an important economic activity in the production area. It provides a major share of collectors' income and gives them opportunities for wage earning during the peak summer months, when there is no other employment. The main beneficiaries are the landless and marginal farmers. Without the trade in *tendu* leaves, part of the population of the research area would most probably start migrating in search of alternative employment in the lean summer season.

Next to the commercial use of *tendu* leaves for *beedi* rolling, the *tendu* tree is also used for domestic purposes. Traditional medical practitioners use the dried flowers to treat urinary, skin and blood diseases, while the bark has astringent properties and its decoction has been used in the treatment of diarrhoea and dyspepsia. The bark also contains up to 19% tannin, which is used for curing leather. Ripe *tendu* fruits are very sweet and villagers eat them as a fruit. During the summer the fruits are sold in village markets (Boaz, A.A. 1998). Recent findings revealed that *tendu* seeds may have great medicinal use in the treatment of cancer. The seed is now starting to be traded by some pharmaceutical companies in north India, but its use is still in the experimental stage. In the near future this effort may have far reaching effects on the commercialisation and consequent conservation of *tendu* in the research area.

Dynamic changes

It is thought that the commercialisation of *tendu* leaves for *beedi* rolling started from Jabalpur in central India early in the twentieth century. In 1964

a state monopoly was established, but this could prevent exploitation of raw material gatherers only to a limited extent. Over the last few decades the government has been trying to empower the collectors, amongst others, by giving collectors the right to use NTFP. The government's interventions have also been successful in raising the wages of collectors and have brought about equitable sharing of benefits. Collection wages (excluding bonuses) rose from US\$3.68 (INR150) in 1989 to US\$9.82 (INR400) in 1998 (MPMFPP 2000b). Reinvestment of income in local community assets has improved village infrastructure and has helped build social security for the community. The decision of the state government to invest 20% of the income for the development of forest resources has stimulated several conservation efforts such as the creation of firebreaks. The collection of *tendu* leaves has also helped to prevent seasonal out-migration of labourers from the production area in search of work.

Several tax and wage reforms carried out by the government have led to an increase in production costs and as a result, the price of *beedis* has increased slightly. *Beedis* are, at present, suffering stiff competition from *Gutkas*, a form of chewing tobacco available in pouches, so the demand for *beedis* has not increased with the rising population. Ever since introduction of the co-operative, production has stabilised at around 4.5 million standard bags per year.

Customary regulations

There are local traditional and customary nonstatutory rules governing access to and management of the product. These rules are traditions that have developed over the years in the tribal communities in the study area. Some of these rules have to do with the collection of leaves by families from specific areas and respect for the territory of other families, collection of only mature leaves, picking of leaves one at a time and not stripping stems of all the leaves, pruning of only small branches, no cutting down of major branches, etc. The effect of traditional rules governing access and management of *tendu* leaves is generally positive in promoting sustainable exploitation and equitable access to the resource. The customary rules may even help to increase the total production and quality of *tendu* leaves because of better pruning habits. In tribal community managed areas, the raw material producers generally respect the traditional rules governing access to and management of the product. In other, more plural communities, customary rules are seldom respected and collectors tend to harvest as much as possible and as early as possible, because of fear that other collectors will harvest all the leaves if they leave any and so they will be deprived. Tribal villages are small and mostly inside the forest or on the fringe, while plural villages are larger and on the fringes, within 5 km of the boundaries.

Conservation issues

With regard to conservation, two major problems exist today. First, the setting of fires by villagers in early summer to encourage development of root suckers that give better quality leaves is harmful to the forest ecosystem

as it destroys the humus and ground flora. Furthermore, fires are detrimental to animals inhabiting and nesting in the area. The occurrence of human induced fires every year results in the forest floor being devoid of nutrients and consequently the growth of the forest is adversely affected. Government initiatives to stop human induced ground fires through involving Joint Forest Management Committees at the village level are reasonably successful. Second, pruning in order to enhance leaf production areas prevents trees from maturing. This practice decreases the availability of fruits (since shrubs do not produce fruits), negatively affecting the propagation through seeds, which is important in terms of genetic diversity. It also affects the food chain of animals that depend on the edible fruit during the summer months. Furthermore, preventing trees from maturing affects the breeding habitats of small animals (including reptiles) because the mature tree is a good shade bearer with a large, dense crown that can harbour small animals making use of the mature trees for nesting.

Though pruning has its negative effects on the local forest environment, it is recommended for quality enhancement of the leaves. The benefits and negative effects of pruning have to be viewed in light of the objectives—conservation of forest areas or enhancement of economic benefits for the local population. If the objective is to increase the economic benefits through opening new markets, better quality and a higher quantity of leaves, then pruning is necessary, even though it has certain negative effects on the ecology of the pruned area.

The forest environment is under some pressure from pruning, fires and fuel wood collection. The fringe of the forested area in the study area is, however, reasonably stable, and illegal logging of timber is limited, which can be attributed to a long standing system of forest guards and, more recently, the involvement of local communities in Joint Forest Management Committees. *Tendu* leaf collection itself does not seem to give direct incentives for forest conservation, since the shrubs do not need the forest cover; actually the quality of leaves for *beedi* rolling is even better from *tendu* that grows without forest cover.

Lessons for the future

Stern steps need to be taken to stop people from setting fire to the forests so as to encourage new growth of *tendu* leaves. The steps taken by the forest department towards encouraging the Joint Forest Management Committees to play their role in combating fire is a welcome start. Fierce competition between collectors, coupled with apathy of the regulation staff, leads to stripping of whole branches. This practice decreases quantities of useable leaves, leaves that could have been used if only individual mature leaves had been picked. It is important that an extension programme be launched to educate collectors about proper harvesting practices of *tendu* leaves and help them to understand that the proper picking of mature leaves will lead to better returns by allowing young leaves to mature. Furthermore, it is thought that considerable improvements can be made in pruning activities,

which is important for quality enhancement of the leaves. The author proposes a working plan adopting pruning cycles of five years. Such a working plan would ensure better utilisation of the money the federation sets aside for pruning, which was US\$0.21 per collected standard bag in 1998.

As well as the need to improve harvesting techniques, there is a need to implement better drying, grading and packaging techniques to reduce spoilage and breakage of leaves during packing. Up to now there has been little effort to improve harvesting, processing and marketing of the product on the part of the federation, which is only collecting and selling the product. With the present stable market, new markets should be explored to make increased quantity and quality of production worthwhile. At present a greater yield would influence the delicate supply-demand balance and lead to a crash in prices of the product. Export markets are available, and it is thought that *beedis* may be able to jump on to the 'herbal bandwagon' to ensure global acceptance and thereby increase international demand.

ENDNOTES

1. Chhattisgarh Forest Development Corporation, D-252-253, Devendra Nagar, Raipur, Chhattisgarh, India. E-mail: Draboaz@sancharnet.in
2. Scheduled castes and scheduled tribes are the people belonging to social classes as notified under the statutory lists in pursuance of articles 341 and 342 of the Constitution of India.
3. The exchange rate in January 1998 was INR38.99 = US\$1 and in December 1998 it was INR42.58 = US\$1. The average of 40.73 was used as conversion rate.
4. Fluctuations in production also depend to a large part on temperature, water availability and the occurrence of thunderstorms, hail, floods and insects attacking the leaves.

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Chapter 19

Rattan (*Calamus* spp.) extraction in the Philippines: the case of Manggapin and Kalakwasan watersheds, Palawan

Honorato G. Palis¹

Common names	Part of the resource used	Management	Degree of transformation	Scale of trade	Geographic range
Yantok, Rattan	Stem	Wild	Medium	International	Medium

OVERVIEW

This chapter is based on a study of rattan extraction from the Langogan and Kalakwasan watersheds in the eastern portion of the Philippine province of Palawan. Rattan is being extracted from the natural forest and traded in Manila and Cebu, where it is used in the production of rattan furniture. Laws and regulations meant to protect the resource have not yielded any significant positive results. The tribal communities in the research area have been granted user rights to their ‘ancestral domain’, but these are not exclusive, since the same area is being leased out to a concessionaire. The concessionaire has not complied with the regulations regarding allowable cut and the results of the study indicate that rattan gathering is exceeding the resource’s regeneration capacity. As a result harvesters have started extracting premature rattan canes, which are less valuable. Serious government implementation of policies could turn the tide in favour of the rattan industry.

INTRODUCTION

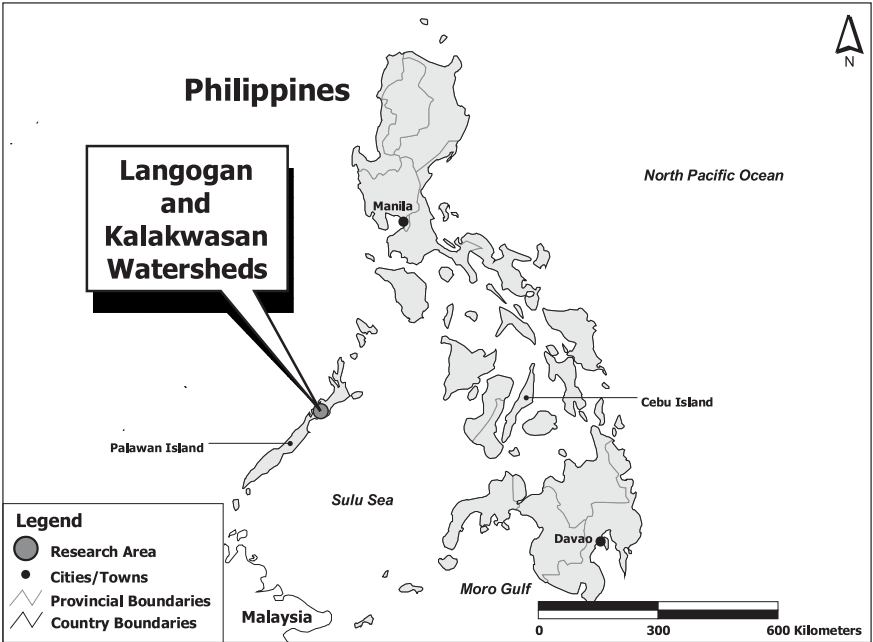
Rattan is one of many economically important plant species naturally growing in the old growth and residual forests of the Philippines. It is considered one of the most economically important non-timber forest products in the country and is used as raw material for various end products for the domestic as well as the international market. The most important among these end products is

rattan furniture (PCARRD 1991). The rattan sector is generating significant amounts of foreign exchange and rural employment. Among the tribal group known as the Batak, in the island-province of Palawan, rattan is an important source of income (Palis *et al.* 1998).

The case study area

The study site consists of two neighbouring *sitios*² located north of Puerto Princesa City on the island of Palawan (Figure 1). The two *sitios* are inhabited by the Batak and a few migrant lowlanders. The raw material production area is composed of two adjacent watersheds: the Langogan and Kalakwasan watersheds. The climate in the research area can be classified as climatic type III of the Corona’s classification, dry from November to April and wet during the rest of the year. Most of the area is covered with dense rainforest, with small amounts of tropical grass, coconut and orchards.

Figure 1. Location of the research area



Source: ESRI Data and Maps 2002.

Sitio Mangapin belongs to *barangay*³ Langogan and is located in the Langogan watershed, 84 km north-east of Puerto Princesa City. Mangapin has 58 households, 75 % of which belong to the Batak ethnic group. The Langogan watershed area, estimated at almost 22,000 hectares, is generally undulating to moderately steep with a maximum elevation of 1250 metres above sea level.

Sitio Kalakwasan in Barangay Tanabag is part of Kalakwasan watershed and is located 78 km north of Puerto Princesa City. Kalakwasan has 22 households, all of which are Batak. The watershed measures almost 6,000 hectares. There is a swamp just inside the watershed, near the mouth of the river. A large portion of the area is below 500 meters in elevation, while the highest elevation is 1500 meters above sea level. Almost 55% of the area is rolling to moderately steep with a small portion (0.11%) of very steep terrain.

The two watersheds are part of a rattan concession area instituted by the government. It is the only rattan extraction area of importance for the inhabitants of Kalakwasan and Mangapin.

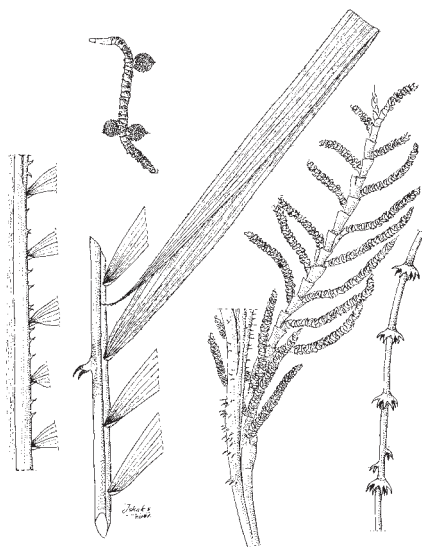
THE PRODUCTION-TO-CONSUMPTION SYSTEM

Resource base

Rattan, a member of the palm family, is a climbing plant. Its leaves and climbing organs are variously covered with thorns or spines, hairs and bristles. The climbing organs appear as long barbed whips with thorns. There are two major types of climbing organs, which anchor the plant to the supporting tree: Some species have climbing organs that are whiplike extensions at the apex of the midrib, called cirri or tendrils; and other species have climbing organs, known as flagella, which are filament-like appendages that originate from the leaf sheath in the same positions as the inflorescences. Flagella look like extensions of an infertile inflorescence. As rattan matures, its stem becomes relatively smooth with more or less regularly spaced scars left by the fallen leaves. These scars are called nodes. The dreaded thorns that characterise rattan are found only at its tip, where the leaf sheaths and the leaves with their climbing organs are located. The stem, without its young portion at the tip, is commonly called cane (PCARRD 1992).

In the case study area, only three rattan species (*Calamus merrilli*, *Calamus ornatus* and *Calamus mindorensis*) are extracted commercially. These species produce large-diameter canes (diameter of 2 cm or more), which is the most popular size on the rattan market, notably in the manufacture of furniture. Their canes are hard and durable, yet flexible, and fit the size requirements of most furniture shops (PCARRD 1991). These species occur naturally at a wide range of elevations (140-700 m a.s.l.) in the natural dipterocarp forests of the Langogan and Kalakwasan watersheds. Several tree species are found to be associated with these rattan species, e.g., *Pterocymbium tinctorium*, *Buchania nitida*, *Nephelium mutabile*, *Drypetes megacarpa*, *Gymnacranthera paniculata* and *Agathis philippinensis*.

These rattan species flower during the dry months from February to May and produce fruits from June to December. Flowering covers a period of two weeks to two months before pollination and eventual fertilisation. The flowers are fragrant, which attracts insects such as beetles, bees and flies. Insects, rather than wind, are the principal vectors of pollination. These species usually produce ripe fruits from August or September until November or December. Flowering in the genus *Calamus* is dioecious (PCARRD 1991).



(*Calamus merrillii*)

Calamus merrilli is the most common rattan species in the research area. It is estimated that Langogan watershed has a total of 468 lineal meters of *Calamus merrilli* per hectare. The Kalakwasan watershed has an estimated 161 lineal meters per hectare. Langogan watershed is near the research communities while Kalakwasan is near the lowland settlements. Because of its location, rattan gathering has been more intensive in Kalakwasan than in Langogan, which explains the lower number of lineal meters.

Extraction

In Mangapin 80% and in Kalakwasan 100% of the households are involved in rattan gathering on a regular basis for commercial purposes. Batak and non-Batak inhabitants of the area as well as non-Batak gatherers from outside the watersheds gather rattan from the research area. The area in which the rattan is being gathered is a rattan concession area, located in old growth forest, where the rattan occurs naturally. There has been little effort to plant rattan in the research area.

The canes are pulled down by hand and cut with a *bolo* (machete). It was observed that substantial merchantable lengths were wasted in the process of harvesting and cutting stems into standard sizes; wastage in the form of unutilised tops is prevalent. Size, specifically thickness, is important as this often determines the usefulness of canes for specific purposes. Strength, elasticity and lightness are critical cane attributes for the manufacture of furniture. These characteristics are primarily determined by the species harvested. Similarly, manufacturers demand consistent colour and shape. Few formal grades

or standards are recognised and local buyers typically provide delivery specifications when placing an order.

Vegetation data, from sampling done in the old-growth forest of Palawan by Palis *et al.* (1998), show a relatively low count of commercial rattan of merchantable length. This is attributed to too frequent and unregulated harvesting. The Batak blame lowlanders for the depletion of the resource. According to the Batak, the area has been subjected to rattan harvesting almost every month during the past three years. Harvesters have not respected a fallow period (at least five years after each cutting) necessary to enable the rattan to regenerate. In effect, the rattan species cannot grow to harvestable age and commercially acceptable size.

Raw material producers and socio-economic context

There are two groups that gather rattan in the research area: the Batak and the lowlanders. The Palawan Batak are a Negrito tribal group thought to be related to the Batak of Sumatra, indigenous peoples of the Andaman Islands, and a small group of Negrito hunter-gatherers in north-east India. The Batak tribe is one of four remaining indigenous tribes on Palawan Island. Its population was estimated at around 1,000 people in 1900. In 1990, the census revealed only 420 Batak. Most of their original territory has been lost as a result of logging activities and the settlement of migrants from the lowlands. The Batak have therefore been forced to move deeper into the forest, where they have become vulnerable to malaria.

The Batak were originally nomadic hunters and gatherers, but through their contacts with other indigenous tribes such as the Tagbanua and Kuyonon they adopted swidden cultivation practices in the late 1800s or early 1900s. Later, under the influence of a government programme promoting the cultivation of agricultural crops, they gradually became sedentary. At present, the gathering of non-timber forest products (e.g., rattan, resins and honey) is still their main activity and constitutes, for most of the families, their main source of income.

The average annual total household income (including subsistence value) in the research area is around US\$180⁴, approximately 40% of which is earned in cash. Rattan contributes up to 60% to a household's cash income. It was observed that rattan gathering households in the research area (e.g., households with one or two members working for the concessionaire) are generally richer than those not involved in rattan gathering.

The old growth forest located in the research area is a rattan concession area, issued by the government to a private individual. The rattan concessionaire hires men and women from the research villages as gatherers. During the gathering season they are given an advance (cash or in kind) for food and other provisions they need while in the field. This system is called *destino*, referring to the 'destination' in the forest. All these expenses are summed up and considered as advance payment: a credit, which is deducted from the total value of the harvest upon delivery to the dropping points. A foreman, locally called *kapatás*, and a trusted person of the concessionaire,

oversees the hired people at the gathering site and makes sure that all the harvested rattan is taken to the concessionaire. The concessionaire also hires people from the lowlands under a similar system of employment. Many of these lowlanders originate from the islands of Luzon, Visayas and Mindanao.

Most harvesters are hired under the *destino* system. A few, however, harvest rattan on an individual—and illegal—basis, usually outside of the concession area. Paid labourers cut an estimated 80% of the total amount of extracted rattan, and illegal cutters cut the remaining 20%. The illegally cut rattan is mostly sold to the concessionaire, who is the only big buyer in the area. There are a few smaller buyers (usually well-off individuals) of illegally cut rattan, but the quantities they buy are marginal compared to the concessionaire.

Trade and processing

Gatherers conduct the first stage of preprocessing still in the cutting areas. This involves scraping the canes with a machete and stacking them vertically for a short drying period. For durability, rattan should be thoroughly dried and scraped to remove the silica. The length of the drying period, which ranges from a few days to two weeks, is determined mostly by the market for canes and weather. After drying, the canes are cut into 6 m lengths and tied in bundles. From the extraction site, the rattan is taken to a dropping point in Sitio Manggapin or Sitio Kalakwasan either via waterways or by physically carrying the harvest. The canes are temporarily stored near the foreman's residence. When there are enough canes they are transported to a warehouse in a neighbouring *barangay*. The warehouse is owned by the concessionaire and is located near the main highway. The next stage of preprocessing involves straightening, grading according to diameter and rebundling at the warehouse. The canes are then transported to another warehouse in Puerto Princesa City, which is also owned by the concessionaire. Transactions between the concessionaire and buyers take place either in Puerto Princesa or Manila depending on the agreement concerning transport. After the necessary permits to transport the canes are complied with, the straightened canes are loaded into 20-foot container vans and transported to Manila or Cebu by ship. There the canes are processed into splits, wickers, and sanded canes, the size of which depends on the specifications of the furniture industry. Furniture manufacturers in Manila or Cebu purchase the semiprocessed rattan to produce furniture for the domestic and export markets.

The price the harvester receives depends on the size of the cane. Prices range from US\$0.01 for a 1 cm cane to US\$0.12 for a 2.5 cm cane. The price the concessionaire receives in Puerto Princesa may be double the price the harvester gets paid.

Some Batak households use split rattan as tying material and for weaving baskets and mats, which are then sold in neighbouring village markets. The local processing is a marginal activity, and the rattan used for it is usually gathered illegally from the concession area.

Photo 1. A small-scale enterprise in Palawan dries rattan splits for handicraft making (Photo by H.G. Palis)



Photo 2. Batak women clean rattan splits to be used as tying material for roofing (Photo by H.G. Palis)



Policy environment

The Department of Environment and Natural Resources (DENR) is the government agency in charge of managing the natural resources of the country. The rules and regulations governing the Philippine rattan subsector generally are found in DENR policies, memoranda and circulars. The DENR is responsible for the license agreements that set specific requirements for concessionaires in terms of cutting limits and replanting. The DENR is also responsible for monitoring concessionaires' compliance with regulations. The Board of Investments provides industry incentives and credit facility programmes, while the Bureau of Export Trade Promotions takes care of import and export policies and procedures.

The most important rules and regulations affecting rattan harvesting and trade are in DENR Administrative Order No. 4-1 of 1989, since it contains special provisions for the processing of rattan within areas occupied by cultural minorities and also provides a special permit for all tribal groups to utilise the rattan resource in their locality. In 1993 a new administrative order was issued to further empower local tribal groups by identifying, delineating and recognising ancestral land and domain claims, which established the rights to their occupied lands. This led to the birth of the Certificate of Ancestral Domains Claim (CADC) for indigenous peoples and tribal groups. Since its implementation in the mid 1990s, the arrangement seems to be working well, based on regular DENR monitoring.

Both research communities have this certificate, which means they are entitled to using the forest and non-forest resources within the boundary of their ancestral lands. The certificate gives them exclusive rights to utilise forest products in the CADC area. The situation in the research area is a special case, however, because of the existence of the concession area in the very same area as that of the CADC. The CADC is not officially related to the extraction rights of the concessionaire, but ever since the CADC was issued, the concessionaire is obliged to first hire inhabitants from the communities for extraction activities. Only if there are too few CADC workers may the concessionaire hire labour from the lowlands. The concessionaire is also supposed to consult the leaders of the communities regarding the extraction activities. The practice shows that this has not prevented the rattan resources from being overexploited.

The Philippine government issues extraction permits for lands that are classified as forest production areas (which may include CADC areas). The concession in the research region is renewed every three to five years. Before issuing a permit, the government determines an annual allowable cut which the concessionaire is not allowed to exceed. The permit for a concession shows how many lineal metres may be harvested and the concessionaire must pay the regional office in the concession area for every lineal meter of rattan harvested. Also, as per the approval permit, the concessionaire is supposed to follow the guidelines concerning regulations and harvesting methods of rattan canes, i.e., leaving two or three immature canes per clump. There is no requirement for the concessionaire to plant or conduct enrichment planting but simply to follow the fallow period until such time as young canes left have reached maturity. The DENR is supposed to monitor the cutting practices regularly but in reality this is not being done, hence there is no control of harvesting

practices. Because of the lack of control and competition between gatherers, young canes are cut and the allowable cut is usually exceeded.

TRENDS AND ISSUES—DEVELOPMENT AND CONSERVATION LESSONS

Declining resources

In traditional Batak culture the ‘ancestral lands’ and all living entities occupying these lands are considered sacred and to be respected. The Batak’s traditional beliefs and culture, in combination with low population densities and a subsistence economy, prevented the rattan resource from being overexploited. As rattan became economically popular and valuable, and demand increased on both the local and international markets, non-Batak gatherers invaded the rattan areas and the Batak themselves started to get involved in commercial gathering as well. In particular the entry of the legal concessionaire has intensified extraction. The concessionaire often exceeds the allowable cut, since control is lacking, and also buys illegally cut rattan. As a result of increasing scarcity of good rattan in the concession area, gatherers are starting to cut rattan from forestlands outside the concession boundary.

On a national scale, rattan exports—which became one of the country’s export winners during the 1970s and 1980s—was in decline in terms of volume and value from 1989 to 1993. The share of rattan furniture of total furniture exports fell from 68% in 1989 to 56% in 1993. In 1993, the total volume of furniture exports was only 3,013 tonnes, valued at US\$114.21 million FOB, about 20% lower than the peak value of US\$137.75 million in 1989. The export of rattan baskets and wicker ware showed a 31% decline from US\$106.3 million in 1988 to US\$73 million in 1993 (Pabuayon and Espanto 1995). The decrease in furniture exports was mainly due to a low supply of raw materials as a result of overexploitation, the precarious dollar-peso exchange rate, and the shift of foreign buyers to other supplying countries.

There is no evidence to suggest a reversal in the declining trend of exports in rattan furniture from the Philippines in the near future, even though total world demand for rattan continues to increase (Kilmer 1994). Unsustainable harvesting of the resource further contributes to the sad state of the resource in the country, specifically in the forests of the island-province of Palawan.

Economic importance for producer households

In this case, the concessionaire and traders take most of the profits from the commercialisation of rattan, not the gatherers (Batak or non-Batak). Being at the higher level of the market hierarchy, traders and concessionaires are more knowledgeable of the trading system and capable of taking advantage of the ‘ignorance’ and ‘no choice’ condition of the gatherers. Still, rattan gatherers earn 25% of their total income, which is 60% of their cash income, from rattan extraction. The latter is thus a very important source of income.

Socio-economic and ecological consequences of commercialisation

The growing rattan market, since the 1970s, has opened the door for commercial exploitation in the research area. For the Batak, commercialisation of rattan and influx of lowland gatherers have had important consequences in terms of socio-economic development as well as sustainability of extraction practices. It can be argued that the Batak have been positively influenced by their contacts with lowland rattan gatherers, who have introduced them to 'modern' perceptions on health and education issues. At the same time it can be argued that the contacts with lowland gatherers, and the introduction of the Batak to the market economy, has resulted in a loss of the Batak's traditional culture and practices, including sustainable methods of rattan gathering. Efforts to achieve a 'modern' lifestyle have led to the search for short-term monetary gains, which—in combination with competition for the resource with lowland gatherers—has resulted in overharvesting of the rattan resources.

Though policies have been introduced in order to prevent overexploitation of the Philippine rattan resources, uncontrolled harvesting is rampant because of loopholes in the policies. Batak and non-Batak rattan gatherers also cut immature canes into wrong lengths, for which only low prices are paid. In effect, rattan canes available in the market are of a low quality, negatively affecting the position of Philippine rattan products on the international market. Regulations set by DENR to insure the sustainability of the rattan resources have so far not resulted in sustainable harvesting of rattan in the study area. It was observed that laxity on the part of the government to monitor is often the very reason why resource sustainability is not achieved.

The Batak communities in the research area have been granted official land use rights in the form of CADC and this could be a good avenue with which to effect the conservation and development of the rattan resource. In the research area these use rights are not exclusive, however, since a cutting permit has been granted to an outsider. The concessionaire exceeds the maximum allowable cut and buys illegally cut rattan, resulting in a depleting resource. To reduce the pressure on the remaining resources, outsiders should not be entitled to cut in the CADC areas.

ENDNOTES

1. Ecosystem Research Development Bureau (ERDB), Laguna 4031, The Philippines. E-mail: hgpalis@laguna.net
2. *Sitio* is the Philippine term for village or settlement.
3. The *barangay* is the lowest administrative unit in the Philippines.
4. Exchange rate 1998: US\$1 = PhP40.

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Chapter 20

The kitchen utensils home industry in Sukaraja subdistrict, Java, Indonesia: wood (*Agathis borneensis*) from a state owned plantation used by local enterprises

Pipin Permadi¹, Syarif Hidayat² and Dede Rohadi³

Common names	Part of the resource used	Management	Degree of transformation	Scale of trade	Geographic range
Damar, Agathis, Damar pulau	Wood	Cultivated	Medium	National	Medium

OVERVIEW

The forested areas in the subdistrict of Sukaraja, West Java, are plantations managed by the state owned company Perum Perhutani. The company hires local people for planting, maintenance and logging activities. *Damar* (*Agathis borneensis*) is one of the species grown and is the main wood species for the production of kitchen utensils in the area. There are four kitchen utensil enterprises, each employing 10 to 15 workers. Often the production of kitchen utensils takes place in a worker’s home, usually as piecework paid as per the amount produced. Workers are farmers, for whom the work provides an important part of their cash income (about 45%). Most products are sold to traders, who then sell them on to large department stores in Java. In the 1970s there were more enterprises in the area producing kitchen utensils, but with the economic crisis of 1998, many lost their businesses because of a decline in demand and rising wood prices. Those that survived the crisis have received support from Perum Perhutani in the form of soft loans and assistance on marketing and management issues. This assistance falls under a government programme obliging the company to use 5% of its profits to support small, home enterprises. The author argues that such aid schemes improve the local economic situation and as such reduce illegal logging activities.

INTRODUCTION

Wooden kitchen utensils such as pestle and mortars, spoons, spatulas and forks are common in Indonesia. The production of these handicrafts has long been a cottage industry in many parts of the country, using traditional, manual tools. Now, however, some enterprises employ modern machines. Some of the wood species commonly used are *damar* (*Agathis borneensis* Warb.), pine (*Pinus merkusii*) and mahogany (*Swietenia macrophylla* King).

The wooden kitchen utensil home industry in Sukaraja subdistrict of West Java is an interesting case study, particularly from the point of view of the *anak-bapak angkat*, or son-father relationship, between the home enterprises and the state owned company, Perum Perhutani, in which the latter gives assistance to the kitchen utensil cottage industry. The cottage industry came into being in the 1970s and initially involved many households, but because of the economic crisis of the late 1990s only a few enterprises remain. The main handicaps are lack of capital and a limited market. Moreover, the relatively small quantities of wood required by these enterprises are of little interest to the state company, which usually does business with larger companies requiring larger amounts of timber.

The study area: Sukaraja subdistrict

Sukaraja subdistrict is one among 30 subdistricts within the district of Sukabumi in the province of West Java (Figure 1). To the north the area (6°50' to 7° south, 106°50' to 107°5' east) borders Gede-Pangrango National Park, to the south the city of Sukabumi and the Geger Bitung subdistrict and to the east the district of Cianjur. The altitude ranges between 550 and 1,300 m a.s.l. Based on the Schmidt and Ferguson climatic system, the subdistrict area falls within type B with temperatures ranging between 10°C and 30°C and an average relative humidity of 40%. The annual rainfall is high, i.e., between 3,000 mm and 5,500 mm. The soil type is dominated by andosol and brown latosol, which make the area fertile.

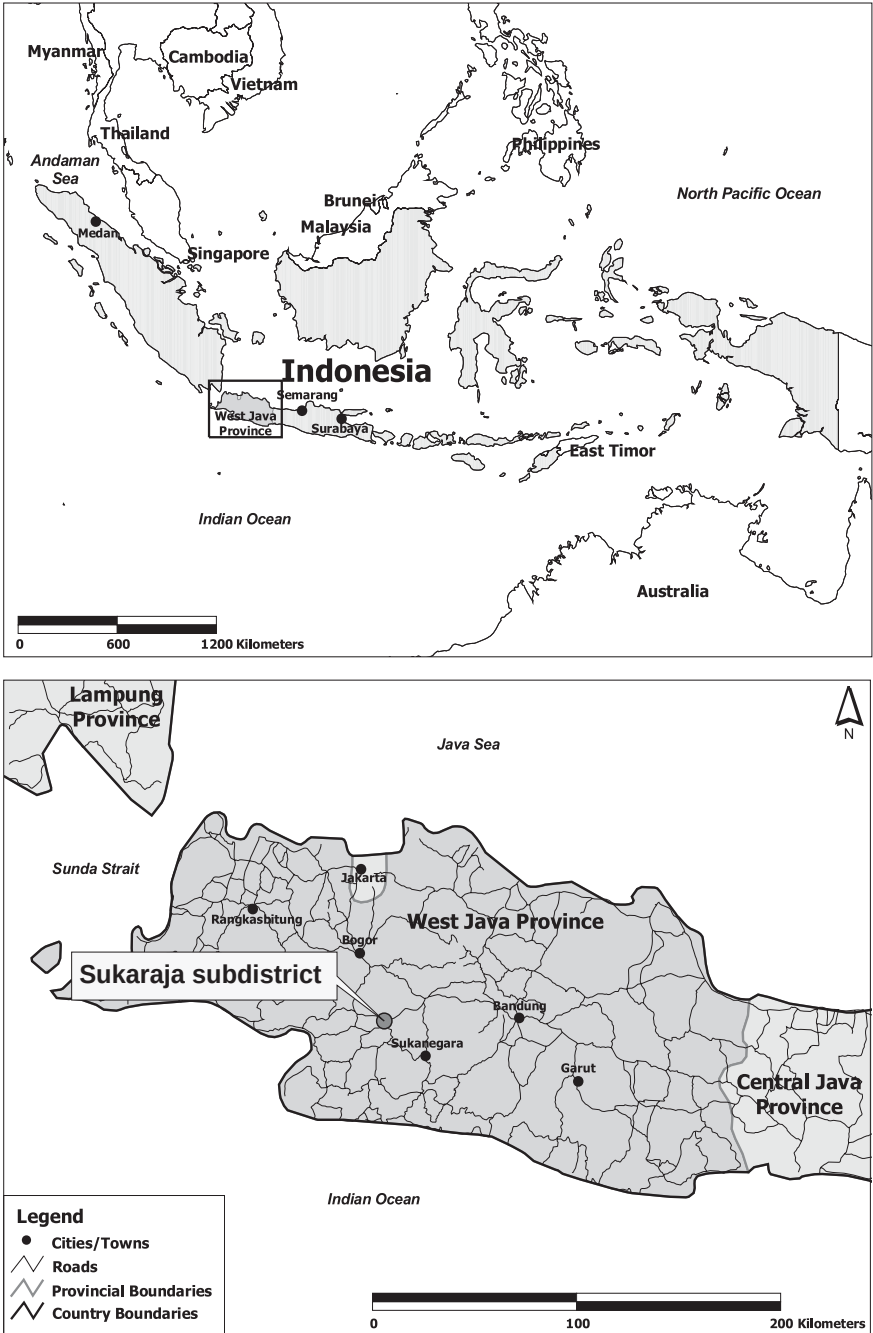
The total area of the subdistrict is 9,900 ha. It comprises 650 ha of forest, 3,900 ha of *sawah* (wet paddy fields) and 1,175 ha of residential area (Anonymous 1999a). Details of the land use system are presented in Table 1. Sukaraja has 25 villages with a total population of 195,265 individuals. The area has good access and a good road system. The provincial highway, Bogor-Sukabumi-Cianjur, goes through the subdistrict.

Table 1. Land use system in Sukaraja subdistrict, Sukabumi district

Land uses	Area (ha)	Percentage
<i>Sawah</i>	3,981,463	40.0
Dry land	4,131,805	41.7
Residential and home gardens	1,172,649	11.8
State forest	650,322	6.5
Total	9,936,239	100.0

Source: Anonymous 1999a.

Figure 1. Location of the study area



Source: ESRI Data and Maps 2002.

All the forest area has been planted and is managed by the state owned company Perum Perhutani. Around 113 ha of this forest have been planted with *damar* (*Agathis borneensis*), whereas the remaining area is mixed species such as mahogany (*Swietenia macrophylla*), pine (*Pinus merkusii*), teak (*Tectona grandis*) and others (Anonymous 2000).

THE PRODUCTION-TO-CONSUMPTION SYSTEM

The raw material

Damar is the main wood species used for the production of kitchen utensils in the area. Other species used are mahogany, pine and *sengon* (*Paraserianthes falcataria*). Most of the wood (89%) is derived from Perum Perhutani plantation forests and the remainder is from private gardens. Perum Perhutani manages the plantations on the basis of a continuous rotational system.

The quantity of *damar* wood used for kitchen utensils is considered small, i.e., only around 600 m³ per annum. It is large factories in Jakarta that use the most *damar* for construction purposes (about 1,100 m³ per annum) and for furniture (about 550 m³ per annum).

The plantation forests in the study area that supply wood to home enterprises are administered by Perum Perhutani, West Gede region. The company has received the government mandate to manage state production forests, including planting and extraction. Perum Perhutani hires local people as either workers (*buruh*) or partners (*pesanggem*) for all its activities, from planting to logging. Hired locals usually work in groups. For example, there are separate groups for felling, skidding and transporting.

Workers are hired as either company staff (*buruh tetap*) or contract workers (*buruh borongan*). The latter usually do piecework, which is paid according to the quantity produced. For example, for logging activities, the wage paid is based on the cubic measure of the log felled, skidded or transported to the timber yard. Even for contracted workers, there are strong linkages between the workers and the company. In fact, almost all of the contracted workers are maintained in the company's activities; newcomers do not find it easy to join these groups. Women make up around 20% of the total workforce.

In the partnership model, the locals are given access to land for agricultural activities through an intercropping (*Tumpang Sari*) system. Each person (or household) is permitted to use 0.2 ha of forestland a year for intercropping activities. The contract may be extended for up to five years. The locals grow rice or other crops on the land for their own consumption and maintain the timber seedlings in return. There are currently 2.8 ha of forestland under this system in the study area (Anonymous 1999b).

As mentioned earlier, most work in the *damar* plantations in the region is done by contracted workers who receive an average income of about US\$1 to US\$2.5 per day depending on how much work they finish that day.⁴ This amount is comparable with the average wage of the area, which is US\$1.25 per day.

Box 1. Long term contracts

A partnership model called *Pengusahaan Hutan Bersama Masyarakat* is similar to the *Tumpang Sari* model, except that the contract is given for the whole timber cutting cycle (usually 40 years). Local people receive fertiliser, pesticides and other materials and tools to maintain the timber seedlings. They also receive approximately US\$5.20 per hectare per year for timber maintenance. Under this system, local people also have a permit to grow perennial trees (e.g., fruit trees) on the forestland for their own consumption. This system benefits both sides: for the company it reduces the production costs of timber plantations, secures timber maintenance and reduces conflict between it and the local people; for the local people it provides them with land for agriculture as well as with input such as fertilisers, pesticides etc. The main difference between this model and the partnership model applied in the research area is the duration of the partnership contract. The *Pengusahaan Hutan Bersama Masyarakat* model is not currently practised in the study area.

The kitchen utensil industry

There are 90 wood based enterprises registered with the District Industrial Office (*Dinas Perindustrian*) in Sukabumi district, although there may be more than 100 such enterprises currently operating in the district as many small home enterprises are not registered. In Sukaraja, 15 small wood based enterprises are now operating, four of which are small kitchen utensil enterprises and the rest furniture factories and sawmills. The number of workers in the kitchen utensil industry ranges between 10 and 15 per unit, most of them being family related. The number of workers in the kitchen utensil home industry in Sukaraja is about 60 persons, mostly family members working from their homes on piecework. Most of the workers are farmers living near the production unit, who work part time to supplement their income. Although the contribution of this home industry to the national economy is small, woodcarving does play an important role in increasing local income. Compared with households engaged only in farming, those that undertake woodcarving may well have twice their cash income. In general woodcarving households have higher incomes than those employed in other activities in the area. Around 30% of the workers are women. The owners of the kitchen utensil enterprises are relatively rich and own large houses and cars.

The four kitchen utensil enterprises mentioned above are the only surviving enterprises from about 10 enterprises that existed previously in Sukaraja. Perum Perhutani provides the surviving enterprises with assistance in the form of investment capital, management, marketing and promotion of the products. Above all, kitchen utensil enterprises may buy small quantities of wood from Perum Perhutani.

Photo 1. Wood being cut into rough forms (Photo by P. Permadi)



The wood extractor, the state company Perum Perhutani, sells the wood as sawn timber to the kitchen utensil enterprises at US\$0.4 per kilogram. The timber is cut into various rough forms (see Photo 1) and then shaped into final products either manually or by using machines such as a lathe or an electric saw. Finally the products are sanded, sun- or oven-dried, resanded and packaged. The finishing and packing is often done by women (see Photo 2). Around 40 different types of kitchen utensils are produced in the production area.

Production fluctuates according to demand. Because of limited capital, enterprises rarely keep surplus stock and generally only produce to order. Wood consumption ranges between 10 m³ and 15 m³ per month per enterprise. Labour costs vary by product (Table 2). Workers are paid according to the quantity of items they produce. Average daily income ranges between US\$1.5 and US\$2. Although the number of people working in the enterprise unit may be limited to only two to four people, the number of people involved in kitchen utensil production is much larger, because many woodcarvers take the material provided by the enterprise to their homes. They return with finished items, which are paid as piecework.

The marketing chain is depicted in Figure 2. The biggest buyers are usually the larger department stores in Java. Enterprises seldom sell directly to department stores. Instead they go through agents or traders from whom they can expect quick cash for their products. Approximately 5% of all kitchen utensils produced are sold in the local market or in the nearby cities of Sukabumi and Bogor.

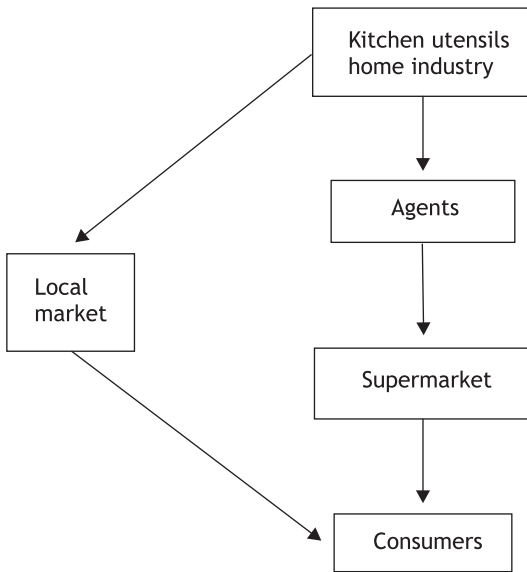
Photo 2. Women working in a small kitchen utensil enterprise in Sukaraja, Sukabumi (Photo by P. Permadi)



Table 2. Production costs of various kitchen utensils and profits derived

Items	Quantity produced from 1 m ³ of wood	Labour cost per unit (Rp)	Selling price per unit (Rp)	Selling price per m ³ of raw material (Rp)	Profit* per m ³ of raw material (Rp)
Bowl (cowet)	330	225	3,500	1,155,000	580,750
Spoon (sendok)	1,000	150	1,500	1,500,000	850,000
Dish (talenan)	500	175	2,500	1,250,000	662,500
Turner (cukil)	1,000	150	1,500	1,500,000	850,000
Sawn timber	0.5 m ³	20,000/m ³	1,200,000/m ³	600,000	80,000

* Profit = selling price minus costs of raw material (Rp500,000/m³) minus labour costs. Exchange rate (2001): US\$1 = Rp10,000.

Figure 2. The kitchen utensil trade diagram

Policy environment

The kitchen utensil enterprises in Sukaraja are considered small home enterprises and therefore are not subject to taxation. Registered enterprises can apply for financial aid from Perum Perhutani, which, like other state owned companies in Indonesia, is obliged to give 5% of its revenue to help small enterprises⁵. Perum Perhutani aids about 150 small enterprises around Sukabumi. It need not necessarily be a kitchen utensil enterprise to be considered for the aid programme so long the enterprise can convince Perum Perhutani that it is small. Perum Perhutani makes the selection based on the 'suitability' of the applicant, that is, the feasibility of the applicant's business proposal. Besides financial aid in the form of soft loans the state company also helps with promotional and management issues.

This system is locally called *anak-bapak angkat*, referring to the role the state owned company plays as a foster father for small enterprises. The objective of this policy is to develop small enterprises and to strengthen a number of different industries. All four kitchen utensil enterprises in Sukaraja receive such aid.

TRENDS AND ISSUES—DEVELOPMENT AND CONSERVATION LESSONS

The kitchen utensil industry started in Sukabumi in the 1970s. At that time around 10 enterprises were operating in the area, employing more than 200 people. Increasing demand caused the enterprises to expand and they reached

a peak in 1995, when at least 12 enterprises were operating in the area. The enterprises provided significant income opportunities for local people. The average annual income of producer households from the production of wooden kitchen utensils was around US\$650, which was higher than the average income from other activities in the research area, including farming.

The availability of wood has not been a constraint for the enterprises as Perum Perhutani provides wood from its plantation forests in the area. However, with the economic crisis of 1998, the market declined. Several enterprises lost their businesses because of declining demand and an increase in the price of wood. The few enterprises that survived did so because of assistance from Perum Perhutani. The company started in 1998 to provide soft loans for enterprises to buy wood and other production tools. Most loans run three years (but some carry longer terms) and provide a maximum of US\$1,000 per enterprise at only 3% interest per year.

Lessons from the case

The case of kitchen utensils in Sukaraja provides an interesting lesson on how a big company may play a significant role in developing a local community's economy. The investment need not be high, as Perum Perhutani sets aside only 5% of its profits for this aid programme. This small aid in the form of soft loans and managerial, marketing and promotion assistance has had some positive impacts on the development of the kitchen utensil enterprises in the area. The provision of soft loans has been helpful since one of the major constraints the kitchen utensil enterprises had to face was a lack of capital to invest in expansion, while getting credit from commercial banks is difficult and not preferred. The assistance in marketing is valuable for the kitchen utensil industry because these are usually small-scale enterprises with limited possibilities and skills to market their product on their own. The assistance the state company has given has benefited not only the small-scale enterprises but may well have benefited Perum Perhutani by improving the economic situation of the local people and thus reducing the occurrence of illegal logging in the company's plantation forests.

ENDNOTES

1. Forestry Research and Development Agency, Ministry of Forestry, Manggala Wanabhakti Bld., Jakarta, Indonesia. E-mail: permadi@indo.net.id
2. Forestry and Nature Conservation Research and Development Center, Jln. Gunung Batu No. 5, Bogor, Indonesia. E-mail: syarif.hidayat@mailcity.com
3. Forestry Research Institute of Sumatra, Kampus Kehutanan Terpadu Aek Nauli, Jln. Raya Parapat Km. 10.5, Parapat, Sumatera Utara, Indonesia. E-mail: drohadi@indo.net.id
4. Exchange rate (2001): US\$1 = Rp10,000.
5. Other state owned companies, such as Perusahaan Listrik Negara or the National Electricity Company, provide programmes similar to the aid programme run by Perum Perhutani to develop various other home handicraft enterprises in the district.

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Chapter 21

Bamboo (*Neohouzeaua dullooa*) production and trade in Cho Don, Vietnam: NTFP extraction from allocated forest lands

An Van Bay¹

Common names	Part of the resource used	Management	Degree of transformation	Scale of trade	Geographic range
Nua, Bamboo	Stem and Shoot	Wild	Medium	International	Large

OVERVIEW

The culms and shoots of the bamboo species *Nua* (*Neohouzeaua dullooa* (Gamble) A. Camus) are harvested by farmers in the district of Cho Don, Vietnam. The shoots are sold as food and the culms are sold for paper processing and the production of handicrafts, largely for export. Households may earn more than half of their cash income from the sale of *Nua*. The annual cut of mature *Nua* culms does not threaten the resource base since the culms regenerate quickly. The harvesting of shoots is an important source of income for farmers in need of cash, but limits the availability of mature culms, which are much more valuable. Farmers harvest *Nua* from forested lands for which they have been granted a use permit by the government as part of a large-scale land allocation programme. The Cho Don State Forest Enterprise and the local government co-operate to control harvesting practices (e.g., by issuing harvesting permits) and trade. The Cho Don State Forest Enterprise itself is the most important buyer and is in control of all *Nua* trade in the district, since private traders may buy *Nua* only with permission from the state enterprise. The allocation of forest lands in combination with strong and committed local government institutions has stimulated forestry activities such as the harvest of *Nua*. At the same time it can be argued that the high level of state control may limit possibilities for farmers and removes incentives for more active management activities.

INTRODUCTION

In Vietnam bamboo is found throughout the whole of the country. It has many domestic uses: the seeds are eaten as grain, the cooked young shoots of some bamboo species are eaten as a vegetable, and bamboo stems have numerous purposes from buckets to scaffolding. Next to the extraction of bamboo for domestic purposes, several species are being extracted for commercial purposes and as such are of economic importance for many rural households.

Cho Don District

The focus of this study is on Cho Don District in the northern part of Bac Kan province (Figure 1). Cho Don district, comprising 90,770 ha, is located 150 km from Hanoi and is the largest bamboo raw material production area in the province. The area has a monsoon tropical climate with two seasons (a hot and humid season and a dry and cold season) and a mean annual rainfall of 2,000 mm. The total population of Cho Don is 46,000 and human settlements account for only 4% of the total land area, while the forested area (including fallow lands) accounts for about 70% of the total area. Population growth is 3% annually and there is substantial in-migration from the lowlands and from the Vietnam-Chinese border area (Pham Thanh Tinh 1997).

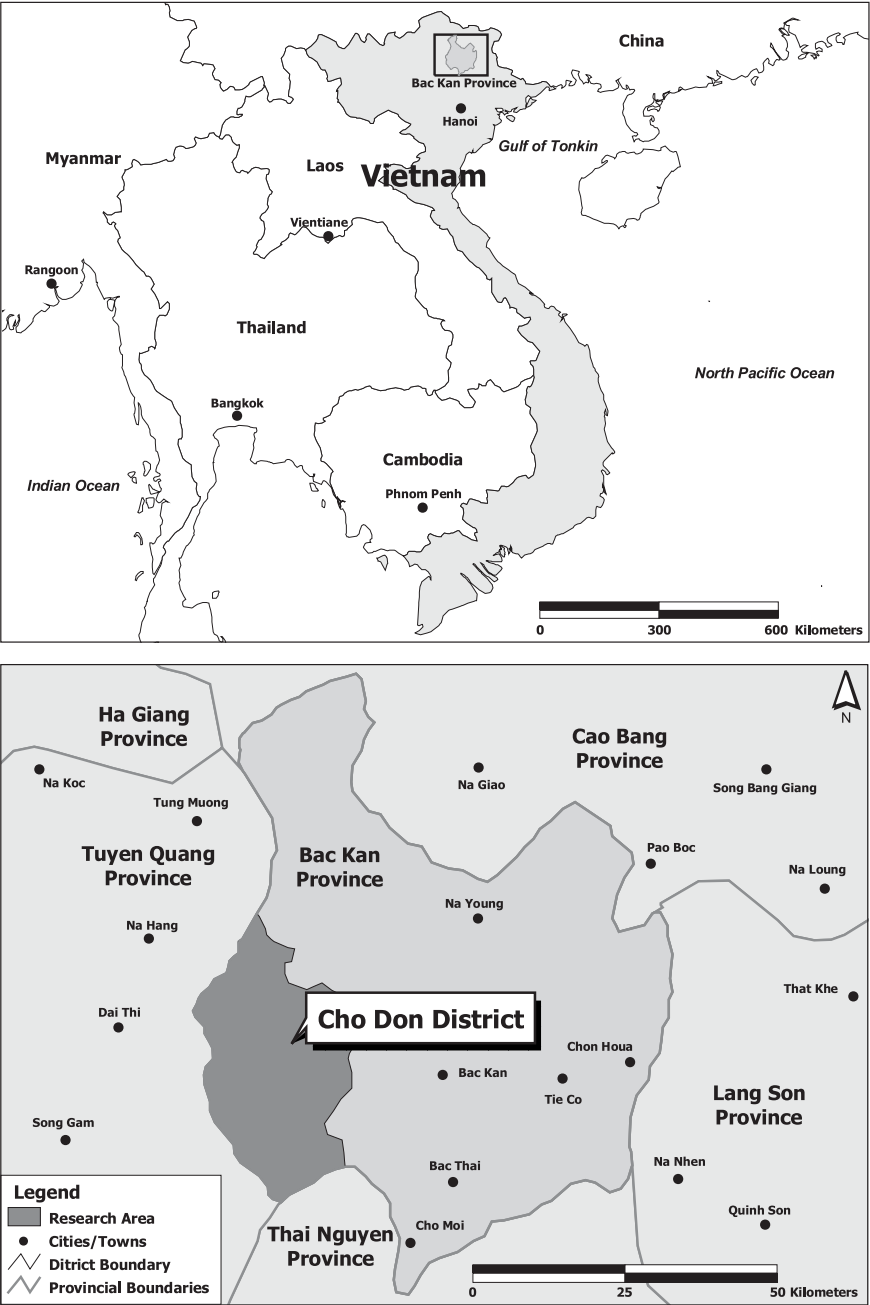
THE PRODUCTION-TO-CONSUMPTION SYSTEM

Nua bamboo

There are many species of bamboo growing in Bac Kan province (Table 1). The most dominant species are *Truc* (*Phyllostachys pubescens*), *Vao* (*Arundinaria spathiflora*) and *Nua* (*Neohouzeaua dullooa*). *Nua* accounts for more than 60% of all bamboo extracted in the province and this case study focuses exclusively on this species. *Nua* is abundant in the forested area of Cho Don and thrives in disturbed and secondary forest because it prefers an open canopy. The time from germination to reproductive maturity of *Nua* is about 7 to 10 years. *Nua* regenerates quickly, growing to its full height within one year after cutting. The cutting of mature culms does not affect the clump's capacity to regenerate.

The flowering of *Nua* is locally known as the *Khuy* phenomenon and happens once every 30 to 35 years, after which the bamboo dies en mass. In the years after flowering, young plants start to appear from the seeds dispersed following the flowering (Nguyen Tu Uong 2000). In Vietnam there has been limited research on the flowering of *Nua* and on the impact of this phenomenon on *Nua* extraction and the forest ecology. It is only since the late 1980s that *Nua* extraction has become an important source of income for households in the research area and so far there is no recorded experience of the socio-economic impact of *Nua* flowering.

Figure 1. Location of the research area



Source: ESRI Data and Maps 2002.

Table 1. Common species of bamboo in Bac Kan Province, Vietnam

Local Name	Species	Characteristics	Typical uses
<i>Nua</i>	<i>Neohouzeaua dullooa</i> (Gamble) A. Camus	Medium sized bamboo, straight culm	Paper pulp, baskets, handicrafts, light construction, mats, beds, shoots for food
<i>Truc</i>	<i>Phyllostachys pubescens</i> Mazel ex H. de Lehaie	Medium sized bamboo, straight culm	Baskets, handicrafts, light construction, mats, beds, shoots for food, chopsticks, mats, paper, fishing rods
<i>Vau</i>	<i>Arundinaria spathiflora</i> Trin	Large straight culms that are pliable	Baskets, handicrafts, fishing rods, shoots for food
<i>Mai</i>	<i>Dendrocalamus latifollus</i> Munro	Long straight culm that are very strong; shoots highly valued for food	Construction, paper, baskets, composite boards, handicrafts, shoots for food, ladders, chopsticks, mats

***Nua* harvesting**

Nua production (extraction for commercial purposes) is concentrated in the south of the district. *Nua* is harvested either by the Cho Don State Forest Enterprise (SFE) from forested lands that are managed by the SFE or by farmers who have land use rights to pieces of forestland.

***Nua* harvesting by individual farmers**

It is estimated that about half of the households in the southern part of Cho Don (the communes Bang Lang and Phong Huan) are involved in *Nua* production. Collection takes place throughout the whole year, depending on the available time of household members and demand. The preferred harvesting season is the dry season (from August to February), since high humidity during the rainy season increases the chance of cut culms being damaged by insects. For the making of handicrafts *Nua* needs to be at least two years old, while for papermaking one-year old culms can be sold as well.

Farmers usually cut culms aged one year or older, which in practice means about 50% of the standing culms per clump. The collection of bamboo shoots takes place during the wet season and is mainly done by women. Ideally, only those shoots that grow close to mature culms –and are therefore unlikely to grow out to straight, mature culms– are harvested. However, households in need of cash in the wet season rarely take the future availability of valuable culms into consideration and harvest to meet their needs. Some *Nua* extractors try to manage the *Nua* on their lands, for example by removing unwanted nonvaluable vegetation to give *Nua* room to grow.

***Nua* harvesting by the SFE**

The Cho Don SFE harvests *Nua* from an area of 4,700 ha that it manages exclusively. The annual production from this area is estimated at 1,000 tonnes to 1,500 tonnes of mature culms. SFE staff as well as hired labourers are involved in the cutting of culms from the SFE area. The cost of labour for harvesting is estimated at US\$13 per tonne of culms.² Each year about 25% of the standing culms are cut selectively. *Nua* shoots are not harvested by the SFE and extraction of shoots from the SFE area is prohibited.

Photo 1. Farmer harvesting *Nua* (Photo by K. Kusters)



The importance of *Nua* for producer households

Households harvest *Nua* as part of a range of activities, such as the cultivation of rice, maize and cassava. Most farmers in Cho Don are subsistence oriented, with half of their total income earned in cash. They usually have a small area (<1 ha) of agricultural lands and an allocated piece of forested land for utilisation. For households that have substantial amounts of *Nua* on their allocated land *Nua* is the most important part of cash income, contributing up to 80% of the household's cash income. The rest may come from selling agricultural surplus, fuel-wood, sugarcane, fruit, fish, *Vao* and livestock.

Box 1. Domestic uses of *Nua*

In the research area *Nua* is used domestically in many different ways. The culms of this bamboo species are, for example, used for housing, telephone and clothes-drying poles, animal shelters, fencing, baskets, bird cages, damming paddy fields, ladders, tobacco pipes, lighting sticks, picture frames, kitchen utensils and fuel.

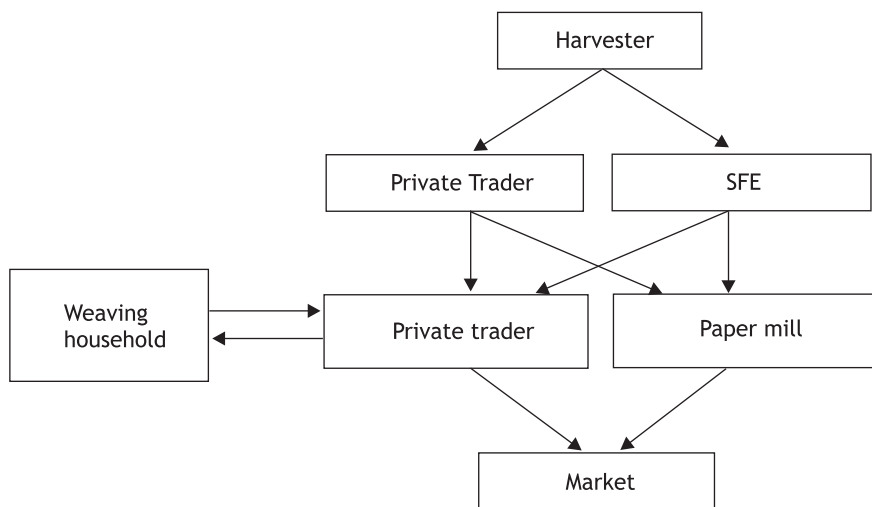
Trade and processing of *Nua*

Nua culms are used in the production of handicrafts and paper. Less *Nua* from Cho Don is sold for paper processing than for handicrafts. There are mainly two types of traders in the district; the SFE on the one hand and private traders on the other. It is estimated that 70% of the culms collected by farmers are sold to the SFE, while the remaining 30% goes to private traders. Private traders active in the area need to have official permission from the SFE to buy *Nua* in Cho Don, and in this way the SFE is in control of all trade within the district.

Photo 2. Trader loading truck with *Nua* (Photo by K. Kusters)



Individual farmers receive an order from the buyer (SFE or private trader) and arrangements are made regarding the number of culms and place of transaction. The buyer usually buys from several households over a period of some weeks, after which the *Nua* is collected from a central storage area near a roadside or river by truck (see Photo 2). There is continuous demand for *Nua* for the processing of paper and handicrafts; however, since farmers have variable amounts of time available throughout the year, the price may rise in periods when labour demand for farming is high. Private traders sometimes pay farmers in advance, when placing their order. This prepaid arrangement, even though it often yields a lower price for the bamboo, is an attractive option for farmers who need cash immediately. The average farm gate prices for bamboo are shown in Table 2. Bamboo chips (split culms) provide the best price, this being marginally more than large diameter culms. Figure 2 presents a simplified trade diagram for *Nua* culms harvested in Cho Don.

Figure 2. Trade diagram for *Nua* culms harvested in Cho Don**Table 2.** Prices of raw material at the farm gate

Product		Price per kilogram, 1999 (US\$)
<i>Nua</i> culm	Diameter >10 cm; length 5-7 m	0.02
	Diameter >5-7 cm; length 3-5 m	0.02
	Diameter > 3-4 cm; length 4-5 m	0.01
Split <i>Nua</i> culm for handicrafts		0.03
Boiled <i>Nua</i> shoot (five shoots per kilogram)		0.003

Sources: NTFP-RC 1999; field research 2003.

Paper industry

Nua from Cho Don (in combination with other bamboo species) is used for the production of paper by the Hoang Van Thu paper mill in Thai Nguyen province. The SFE has a contract with the paper company and supplies approximately 2,000 tonnes of *Nua* per year. The role of private traders selling *Nua* from Cho Don to the paper industry is small. Only 'lower quality' *Nua* (small-diameter culms with nodes less than 50 cm apart) is used for papermaking. Farmers sort the *Nua* before selling it to the SFE as the latter culms are less valuable than the culms used for the handicrafts.

The SFE processes the culms into bamboo chips using simple chipping machines, which are moved around the district. The harvester brings the culms to the nearest chipping machine where the transaction takes place between the harvester and an SFE employee. A chipping machine nearby is an incentive for farmers to cut *Nua*. Thus, by moving the chipping machines around, the SFE controls, to a certain extent, where and when *Nua* is being harvested. After chipping, the SFE takes care of the transport to the paper mill in Thai Nguyen.

Handicrafts

Split *Nua* is used for the weaving of handicrafts. After harvesting the farmer selects the 'high quality' culms, which are sold in their full length or first split by the harvester. Splitting is relatively simple: the culm is cut at the nodes (0.5-1 m) and split with a knife into four pieces (Tran Tuan Nghia 1999). The decision to split the bamboo—often done by women—depends largely on time and labour availability within the household. It is an attractive activity for harvesters since the selling price per kilogram of split *Nua* can be up to three times higher than the selling price of culms per kilogram (see Table 2).

Traders who come to Cho Don buy the bamboo either from individual farmers or from the SFE. The trader will then transport the material to another province (usually Ha Tay) and contract individual households in the so-called traditional weaving villages, providing them with the semiprocessed material. The trader buying *Nua* in Cho Don may also sell the material to another trader in Ha Tay province who takes care of distributing the material to weaving households.

The actual processing of the handicrafts (e.g., the weaving of *Nua* baskets) takes place in individual households in the weaving villages of Ha Tay province. Most of the handicrafts are produced for the export market (e.g., Japan, Hong Kong, Taiwan, USA and the EU). In Bac Kan province no processing of handicrafts for the international market takes place, which can be attributed to a lack of skills and understanding of international consumers and their tastes.

Shoots

Women collect bamboo shoots, which are a particularly important source of additional income during the rainy season. After collection, the shoots are boiled, dried and packed in baskets. They are then sold to travelling merchants who sell the shoots in city markets. The middlemen may also sell the shoots to other traders from cities such as Bac Kan and Ha Noi. There used to be a state factory where shoots were sealed in cans after blanching at high temperatures to kill bacteria and preserve colour. The factory closed in the early 1990s, however, as a result of poor management, even though the international market for bamboo shoots was growing.

Box 2. The processing of *Vao* (*Arundinaria spathiflora*) and *Truc* (*Phyllostachys pubescens*).

In Bac Kan (the capital of Bac Kan province) there is a bamboo processing plant run by the Bac Kan Forest Processing Enterprise. Here *Vao* is used to make chopsticks (600-700 tonnes per year) and the waste of this product is used to produce paper (2,000 tonnes per year). Papermaking involves chopping the raw material into small pieces and boiling the material to soften the fibres. The pulp is then dried to the required thickness and texture of the paper. The paper is of low quality and is exported to Taiwan, where it is used to print 'fake money' to be burned while praying. The Bac Kan Forest Processing Enterprise is also involved in the semiprocessing of *Truc*; the poles are cut in pieces of approximately 2 m, dried and straightened before being exported. The poles are used to make fishing rods, amongst other uses. The Cho Don SFE faces a number of constraints; it is unable to respond to changing demands from the market and there are limited incentives within SFE to improve the processing.

Government regulation

Since the 1990s Vietnam's forestry legislation and administration system has been rapidly evolving. Various incentives to rehabilitate and develop forest resources and increase forest production have been introduced. The most striking example is the Prime Minister's Decision No. 661/QĐ-TTg (29 July 1998) on the Five Million-Hectare Reforestation Programme, which intends to increase forest cover to 43% of the national territory by 2010. The aim of the programme is to protect the environment, decrease the severity of natural disasters, increase water availability, protect biodiversity and strengthen the forestry sector (Vo Nguyen Huan *et al.* 2001). Tighter controls on forest destruction and the illegal trafficking of forest products have also been introduced.

Land allocation policies

For the bamboo collecting households in Cho Don, the government's land allocation programme is of particular importance. According to Decision No. 02/CP (15 January 1994), the state will allocate forestland to organisations, households and individuals for stable and long term use according to specific conditions in each category of forest. The programme was first implemented in 1995. (Before 2000, the Forest Protection Department (FPD) was responsible for the allocation programme. Since 2000, land allocations have been conducted by the Land Department.) Land allocation means that a household, individual or organisation is granted a long term, exclusive user rights certificate (referred to as a 'red book') for a certain area of forestland. The allocation contracts are for periods of 50 years, after which the state will determine, for each case, whether the holder of the certificate (i) has used it for suitable purposes and (ii) still needs the land (MARD 1996). The certificate holder must comply

with a particular set of rules regarding use and management of the land. Contracts, in which the rights and obligations are laid out, are signed for the management of the allocated area. The rules depend on the category within which the allocated land falls: production forest, protection forest or special use forest. Production forest is allocated for the production of forest products. Protection forest has a specific function for watershed protection, soil erosion control and regeneration and is largely located on steep slopes. Special use forest is forestland for environmental conservation, tourism, educational purposes, and other special uses (VFFSCP 1997; Tordoff *et al.* 2000).

The forested area of Cho Don (76,089 ha) is classified as protection forest (23,098 ha) and production forest (52,991 ha). There is no special use forest in the district. Most of the production forest, which is the most important source of *Nua*, is allocated to households. About half of the protection forest in the district is allocated to households with strict regulations with regard to utilisation, aimed to maintain or restore the function of the forest. To harvest *Nua* from allocated protection forests, the household needs to apply to the commune and the SFE for permission. The procedure on average takes two weeks, but sometimes it may take as long as two months. Most households in the southern part of Cho Don have land use certificates for between 2.5 ha and 5 ha of forestlands (protection or production forest) per household. Households that do not have *Nua* on their allocated lands are usually involved in plantation programmes, planting acacia, pine and eucalyptus.

TRENDS AND ISSUES—DEVELOPMENT AND CONSERVATION LESSONS

Increasing importance of *Nua* production

The commercial production of *Nua* started in the late 1980s and has continued to increase over the last decade. This increase can be attributed to several factors: First, the increase is a direct result of increasing demand from the paper and handicrafts industries. The increase in demand from the handicraft sector is partly a result of the introduction of political reforms ('*Doi moi*') in 1986, which meant the start of a gradual transition from central planning to a market economy in Vietnam and has opened the country to new foreign markets. Second, the increase in the commercial production of *Nua* cannot be seen separately from the overall government efforts to halt deforestation and to stimulate sustainable forestry practices, reforestation and rehabilitation of forestlands. As a result of these efforts forest cover in Vietnam increased from 26% in 1993 to 33.2% of the land area in 2001 (FSIV 2001). In particular the allocation of long term and exclusive land use rights for forestlands has facilitated the increase in the commercial extraction of *Nua*. Third, due to the division of the province in 1998, Cho Don district received more money to spend on infrastructure development. The improvement of infrastructure in the district has made the transport of *Nua* by truck much more attractive and as such has stimulated trading activities. Lastly, the SFE has played an important role by functioning as the most important trader with contacts with a paper mill and traders from other provinces.

The role of the SFE

As well as being the most important trader for *Nua* in Cho Don, the SFE also (i) issues permits and so controls the private trade, (ii) semiprocesses large amounts of *Nua* into bamboo chips, (iii) issues permits to collectors to harvest from protection forests, (iv) operates chipping machines that move around the district and so influences where and when harvesting takes place, and (v) plays a role in implementing government policies aimed at stimulating forestry by providing practical support for *Nua* harvesters (for example, the provision of 'harvesting schedules' to advise farmers where and when to harvest). Though SFE activities have contributed to the growing importance of *Nua* production in the study area, at the same time it can be argued that the dominance of the SFE, as described above, leaves little room and gives little incentive for individual farmers to become more involved in the management of *Nua*.

Sustainability of *Nua* production

The regular harvesting of *Nua* does not severely threaten the resource base since *Nua* has strong regeneration capabilities. However, some practices are detrimental: while cutting 30% of the culms (only those aged two years or older) is recommended to maintain full productivity of the plant, farmers are in fact usually harvesting about 50% of the culms (including the one year old culms) and some farmers even cut up to 80% of the standing culms; young culms are often damaged when mature culms are cut, which decreases the number of harvestable culms in the following years; and the harvesting of shoots limits the availability of future mature culms, which are much more profitable than shoots. Where 10 shoots (most of which would have grown out to be good culms) fetch about US\$0.007 (VND100), the price of one culm is at least US\$0.03 (VND500). There is a need to further study the trade-offs between the harvesting of shoots and the harvesting of culms.

Unique characteristics of the system

The *Nua* case has some unique features, which may be characteristic of the present situation in Vietnam: The combination of a large-scale land allocation programme, a reforestation programme, a strong and committed local government apparatus and the dominant role of the State Forest Enterprise has resulted in a production system that is subject to strict government rules and regulation, top-down oriented and at the same time very well-organised. The production system is further characterised by individual harvesters who behave more as employees than managers, and by the reasonably effective enforcement of regulations. The latter seems largely the result of the co-ordination between local governments and the SFE, controlling both harvesters and traders.

ENDNOTES

1. Non-Timber Forest Products Research Centre, 8 Chuong Duong Do, Hoan Kiem, Hanoi, Vietnam. E-mail: bay11352@hn.vnn.vn
2. Exchange rate (1998): US\$1= VND14,500.

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Chapter 22

Rattan (*Calamus* spp.) gardens of Kalimantan: resilience and evolution in a managed non-timber forest product system¹

Fadjar Pambudhi², Brian Belcher³, Patrice Levang³ and Sonya Dewi³

Common names	Part of the resource used	Management	Degree of transformation	Scale of trade	Geographic range
Rotan, Rattan	Stem	Cultivated	Medium	International	Large

OVERVIEW

Rattan cultivated as part of the traditional swidden agricultural system has been a major source of internationally traded rattan raw material and, more recently, the basis of a strong domestic furniture and handicrafts industry. The rattan gardens of Kalimantan provide an example of an intermediate non-timber forest product management system that is well adapted to the local economy and ecology. Over the past two decades, however, important changes have taken place, changes that tested the resilience of the system. Government policies designed to encourage the domestic processing industry and monopsonistic manufacturing association have sharply depressed demand and prices. New developments in the region, in the form of roads, industrial plantations, mining, and other new economic activities, have both actively displaced existing rattan gardens and offered attractive alternatives which have led some rattan farmers to shift to new activities. Recent widespread forest fires have destroyed large areas of rattan gardens, effectively forcing some rattan farmers out of business. Under current conditions, with low prevailing demand and prices, rattan gardens are a marginal activity in purely financial terms. They remain important, however, where competition for land is low because they fit well with the swidden cultivation system that is the economic mainstay in the region. Moreover, rattan gardens provide valuable ecological services, in terms of biodiversity conservation and other forest functions. As rattan remains an important commodity in Indonesia and internationally, the rattan garden system may remain viable, at least in the medium term.

INTRODUCTION

When travelling through rural areas of East Kalimantan, in the Indonesian part of Borneo, a visitor soon becomes aware of the importance of rattan, the spiny climbing palms. From baskets to mats to ropes or even as a side dish in meals, to mention just some of the multiple uses, rattan has played a fundamental role in Borneo since ancient times. It is ever-present in daily life, in the mats one sits on, the baskets carrying produce, the binding holding together houses and tools. Bundles of rattan stems can be seen drying, moving down river in small boats and being stacked in the warehouses of towns. Most rattans grow wild in the forest, but in this part of Indonesia several species are cultivated as part of the traditional swidden agricultural system. The rattan trade has long played an important part in the local and national economy, and the system itself provides a very interesting model of an intermediate management system for forest product production.

Here we will examine the system and its evolution, to understand better the factors that promote such an intermediate management system, the factors that may undermine such a system, and the reasons for the apparent resilience of this system in some places. This chapter provides a synthesis of recent research, drawing on several component studies with the aim of understanding more about the role and potential of this particular management system. The primary analytical approach is a comparison of intertemporal and interspatial differences in the importance of rattan in household economic strategies. We test the hypothesis that changing social and economic conditions are making rattan gardens relatively uneconomic, ultimately leading to abandonment of the system. The main questions we seek to answer are: (1) Are rattan gardens a viable economic option now and in the future? And (2) what are the general lessons about intermediate management systems for non-timber forest products?

Research area

The Center for International Forestry Research (CIFOR) and the Center for Social Forestry, University of Mulawarman have been involved in a collaborative research activity designed to investigate the changing role and potential of forest products in household livelihood strategies under rapidly changing socio-economic conditions. Research has taken place in villages in Pasir and Kutai districts, including Besiq village (see Box 1).

Box 1. Besiq village

Besiq village, Damai subdistrict, in Kutai district was one of the research villages and served as the study area for the Case Comparison Project. The Damai subdistrict covers an area of 343,870 ha and consists of 19 villages, mostly occupied by Dayak Benuaq people. The distance between Samarinda (the capital of East Kalimantan) and Damai village (the subdistrict principal) is approximately 357 km. Besiq village is located about 33 km upstream from Damai village. In Besiq the average population density is 2 persons/km² and the village covers an area of 585 km²; it is the largest village in this subdistrict.

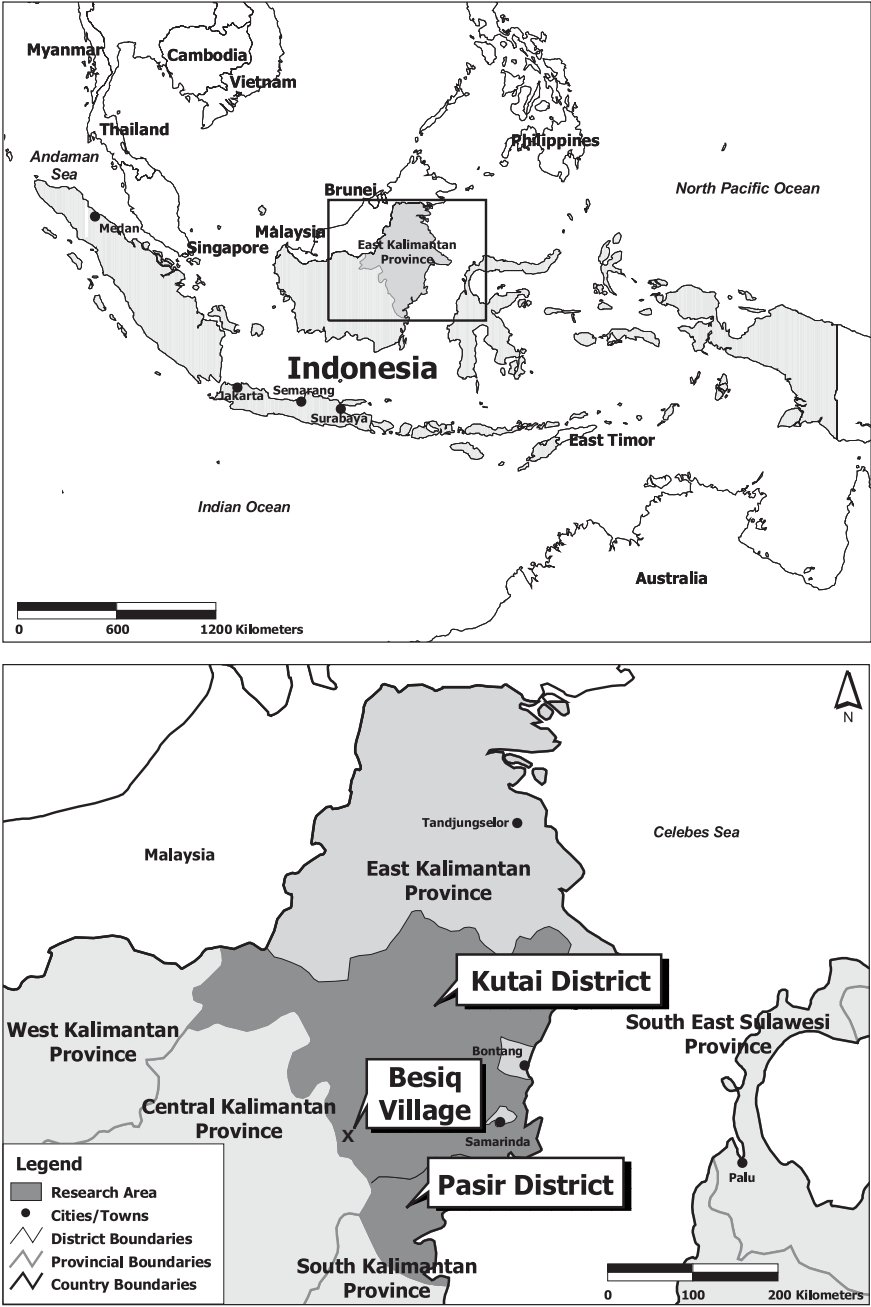
In Pasir and Kutai districts in the Indonesian province of East Kalimantan (see Figure 1) people are mainly indigenes (Dayak tribes) who live in scattered villages and practise swidden agriculture. Rice is the mainstay, but they grow several other field crops and supplement by hunting, fishing and collecting from the forest and increasing integration in the cash economy. The study area was selected because there is a high level of traditional forest use by people living in the area; the traditional rattan gardens of the area represent an interesting and important intermediate-intensity forest product production system; and the area is currently undergoing rapid externally generated changes such as building of new roads and large-scale establishment of oil palm and pulp plantations, which lead to new pressures and opportunities for people living in the area. This combination of factors makes the area interesting for a study of the changing role and importance of forest products.

The development of rattan cultivation

The origins of the rattan cultivation system in use in Kalimantan are not well documented. It probably dates back to the mid-nineteenth century (Van Tuil 1929). The evidence suggests that rattan gardens originated in the areas around Barito, Kapuas and Kahayan rivers in Central Kalimantan (Van Tuil 1929). From there the system spread to other areas in South and East Kalimantan. Most authors agree that in East Kalimantan rattan gardens were introduced first in the Pasir region in the late nineteenth century, when the Sultans granted land to promote its cultivation, and later expanded to the middle Mahakam area, favoured by the Sultan of Kutai (Weinstock 1983; Mayer 1989; Fried and Mustofa 1992). Village elders in the survey area recounted similar stories. They mentioned that it was the Sultan of Kutai who encouraged rattan cultivation, but they did not know when or how this occurred. However, most village elders reported that rattan was only a secondary forest product during the colonial period. Rattan was collected in the wild and occasionally traded. Other forest products, such as resins and gums, were the main sources of cash income for local people before independence in 1945. Rattan was sometimes planted in *ladang* (swidden fields) close to dwelling places, mainly to meet subsistence needs. During the colonial period, and even until the 1960s, iron was scarce in Kalimantan and nails were a luxury item. Rattan was indispensable as a binding material to tie up poles and beams in traditional construction and in the manufacture of many utility items.

We can only speculate about the domestication process. It is a relatively small step from wild gathering to planting within a *ladang*. The rice-swidden system and the main cultivated rattan species have coexisted in the area over millennia. These rattans produce a large amount of fruit and the seeds germinate easily. They are multistemmed varieties, so repeated harvesting is possible. The rattan cultivation system fits extremely well with the current agricultural system, based on swidden farming with rice as the main staple crop. Rattan seeds or seedlings can be established simultaneously with the rice crop at very low extra cost. Our studies show that it requires an extra 7 or

Figure 1. Location of the study area



Source: ESRI Data and Maps 2002.

8 man-days in the first year, and small inputs for weeding and protecting the young rattan plants afterwards. Once established, rattan plants can be harvested periodically, with simple technology, over a long period of time for just the cost of harvesting labour (cutting and carrying). Most likely an intensification of the system to the current situation occurred with the entrance of rattan in the international trade in mid-nineteenth century.



(*Calamus caesius*)

PRODUCTION TO CONSUMPTION SYSTEM

The cultivation of rattan in a shifting cultivation system

The details of the current rattan planting practices vary from farmer to farmer and place to place, but the basic elements are consistent. The rattan cultivation system in Kalimantan has been described frequently in the literature (Weinstock 1983; Mayer 1989; Godoy 1990; Fried and Mustofa 1992; Peluso 1992; Boen *et al.* 1996; Belcher 1997; Eghenter and Sellato 1999). Farmers start the swidden cycle in May by slashing undergrowth vegetation, followed by felling the trees in a selected area of primary or secondary forest. In August, after a drying period of a month or so, the field is burned, and by September farmers start planting the hill rice that will be harvested in February. The main agricultural crop is upland rice, along with maize, cassava and banana among other food crops. Farmers plant rattan seeds, wildings or seedlings in a newly created agricultural field (or *ladang*) as part of this shifting cultivation system.

The main rattan species used is *Calamus caesius*, known locally as *rotan sega*. Several other species are also grown, including *Calamus trachycoleus*, or *jahab*; *Daemonorops crinita*, or *pulut merah*; and *Calamus pinisillatus*, or *pulut putih*. The young rattan plants are protected in the *ladang* and, when the farmer shifts to a new swidden plot one to two years later, the rattan is left to grow with the secondary forest vegetation to create a *kebun rotan*, or rattan garden. The average size of such rattan gardens is 1.4 ha and the density of rattan clumps ranges from about 50 per hectare up to 350 per hectare, with a mean of around 170 per hectare (García-Fernández 2001).

Harvesting of *C. caesius* typically commences 8 to 10 years after planting. *Daemonorops crinita* and *C. pinisillatus* mature more quickly. *C. caesius*, and most of the other cultivated species, have multiple stems and can sustain repeated harvests. Thus, the rattan gardens can be harvested periodically over time. Farmers report that production peaks between 24 and 30 years after planting and begins to decline between age 37 and 43 (García-Fernández 2001).

Photo 1. Collecting rattan from a garden (Photo by B. Belcher)



Socio-economic context

Based on a regional survey, the 53 villages in Kutai and Pasir districts were classified into three groups according to the economic importance of rattan at the village level as well as in terms of land use cover. The three groups are: (1) 'active rattan villages'—those which maintain a high level of activity in rattan growing, where the majority of households depend on rattan as the main income source and where rattan gardens are a major land use (see Box 2 for an example);

(2) 'stand-by rattan villages'—those which retain existing rattan gardens but have a lower level of economic activity in rattan, where rattan income does not play a major role in overall income but it is still important in terms of land use cover; and (3) 'ex-rattan villages'—where rattan is unimportant as a source of income and not a major land use, where people have shifted to other activities. A general description of the main differences among these groups is presented in Table 1, which summarises data from an extensive, detailed database built with the information collected in a regional survey.

Box 2. Besiq, an active rattan village

Besiq village can be classified as an 'active rattan village'. Out of little more than 350 households, 334 are commercial raw material producers. Based on a household survey more than 85% of the annual cash income per capita comes from rattan. There are nine first order traders (traders who buy from raw material producers) involved in trading raw material, who sometimes receive advance money from processing firms in Samarinda. Most of the raw rattan producers know accurately what the rattan is used for, but few know the price paid for raw material by second order traders. The co-operative agency Koperasi Sokaq Maju is concerned with rattan production in Besiq, but fewer than 40% of the producers participate, since many villagers find the agency unreliable. Ownership of rattan gardens is arranged according to traditional Dayak law, and all villagers are aware of and respect the traditional rules governing ownership. However, some of the traditional regulations on land ownership are in conflict with the state law.

Stand-by villages represent an intermediate stage between active and ex-rattan villages. On the one hand, active rattan villages show a more subsistence dependant strategy with less integration in the cash economy. They have lower monthly expenses and own fewer consumer goods (indicated by number of television sets). As well, people in these villages tend to have higher interest in trading other forest products, including timber, honey, *gaharu* and damar (unpublished data collected by the authors). On the other hand, in ex-rattan villages income tends to be more heavily based on cash crops and gold; rattan has been displaced by new, more profitable activities.

A spatial analysis showed clear patterns. Generally speaking, villages in Kutai were more likely to be active in rattan growing, while villages in Pasir were more likely to have abandoned rattan farming. The economic importance of rattan is correlated with variables such as the importance of rattan in the neighbouring village, ethnic make-up of the village, district, distance to the subdistrict capital by river, and distance to the nearest main town (trading centre) by river.

Table 1. Description of village groups (average values)

Groups	Number of villages	Number of households	Monthly expenses per household (US\$*)	Percentage of households with TV	Number of students		Products that contribute to household income (in order of importance)
					Primary school	High school	
Active rattan	28	113	34.13	6	9	6	Rattan, fruit
Stand-by	15	124	37.50	13	10	7	Rattan, rubber, fruit
Ex-rattan	10	171	40.63	15	72	22	Gold, coffee, rattan, rubber

*Exchange rate used: US\$1 = Rp8,000.
Source: Village survey 1999/2000.

Developments in trade and processing

The rattan stems are cut, cleaned and dried for sale through a network of traders. The main market for the primary cultivated species used to be the *lampit* (rattan mat) industry in South Kalimantan, which has since largely collapsed (as discussed below). Now the furniture and handicrafts industries, primarily located in Java, are important buyers. A substantial portion has also been smuggled to Malaysia (Haury and Saragih 1996, 1997) and on to other countries with large rattan furniture manufacturing industries (especially the Philippines and China).

Photo 2. Making lampit (Photo by B. Belcher)



Village elders report that rattan cultivation gained importance after independence, when rattan prices reached high levels. Rattan became a major economic crop at the end of the 1960s with the growing motorization of river transportation and an increasing number of traders and exporters. The main driving force were regular increases in rattan prices. At the same time, other sources of income were lost as forest products that had been important, such as resins and gums, became less valuable. The rapid development in Malaysia and Indonesia of *hevea* rubber plantations in the 1920s and 1930s meant reduced importance for the gums. Resins followed the same path with the development of synthetic substitutes around the time of World War II. Locally, village elders lay the blame on logging companies, who removed the big resin producing dipterocarps. By the end of the 1970s, rattan became the main source of income in most villages, as many farmers concentrated on rattan cultivation and purchased rice to meet their requirements.

The economic role of rattan was exaggerated in the 1980s with the rapid development of the *lampit* industry in South Kalimantan. In 1984 there were just 21 *lampit* manufacturing enterprises in Amuntai, the centre of the industry, producing 64,000 m² of *lampit*, valued at US\$366. By 1987 the industry was at its peak, having swollen to 435 units producing over 1 million m² of rattan mats worth US\$4,612 (see Figure 2).⁴ The industry used cultivated *Calamus caesius*, and demand and prices reached unprecedented highs (see Figure 3). Farmers report that competition among buyers was fierce. Traders would come to the villages, offering advances of cash and consumer goods to secure rattan supplies. But good things don't last, and this boom was short-lived.

Government involvement and its implications

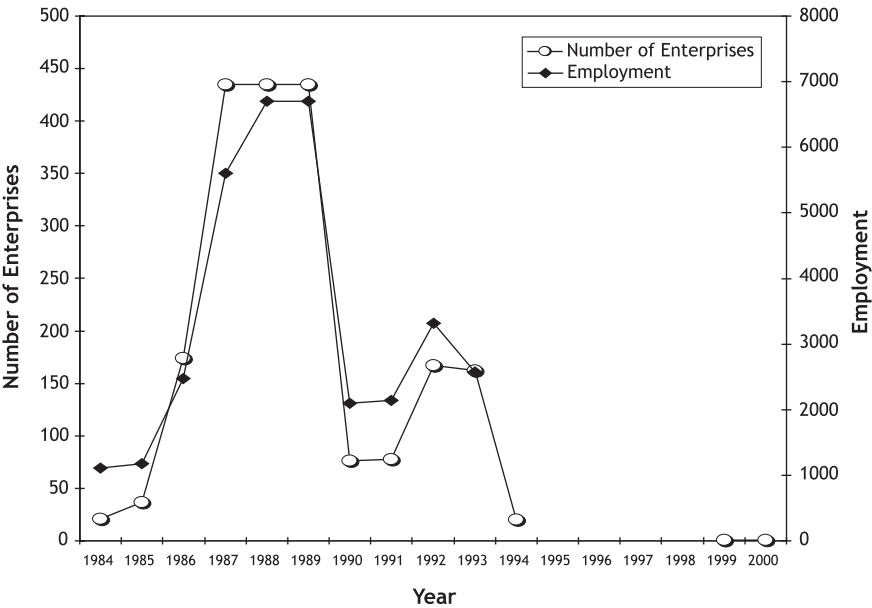
There has been a tradition in Indonesia of heavy government intervention in resource industries, often in collusion with powerful private interests (de Jong *et al.* 2003). The boom in the rattan sector in the 1980s attracted the attention of some of these people, and a series of regulations were swiftly put in place to try to capture some of the profits being generated. Some of these policy instruments affecting rattan in Indonesia were:

- a ban on the export of unprocessed (raw) rattan in October 1986
- a ban on the export of semifinished rattan in January 1989, replaced in 1992 with a prohibitive export tax
- the reclassification of rattan webbing as a semifinished product (from finished product) in 1992
- establishment of the joint marketing board Asosiasi Industri Permebelan dan Kerajinan Indonesia (ASMINDO), an approved exporters system and an export quota system for *lampit*, by a Ministry of Trade decree.

These measures were ostensibly aimed at protecting the resource and encouraging the domestic processing industry. The ban on the export of unprocessed and semiprocessed rattan artificially reduced the demand for raw material, causing prices to drop, which acted as a subsidy for domestic processors. In this respect the policy was successful; the rattan processing industry in Indonesia has grown substantially. However, the depressing effect on raw material prices came at great cost to the people involved in raw material cultivation and extraction. The reclassification of rattan webbing as a semifinished product further reduced demand for cultivated rattan species used for this product.

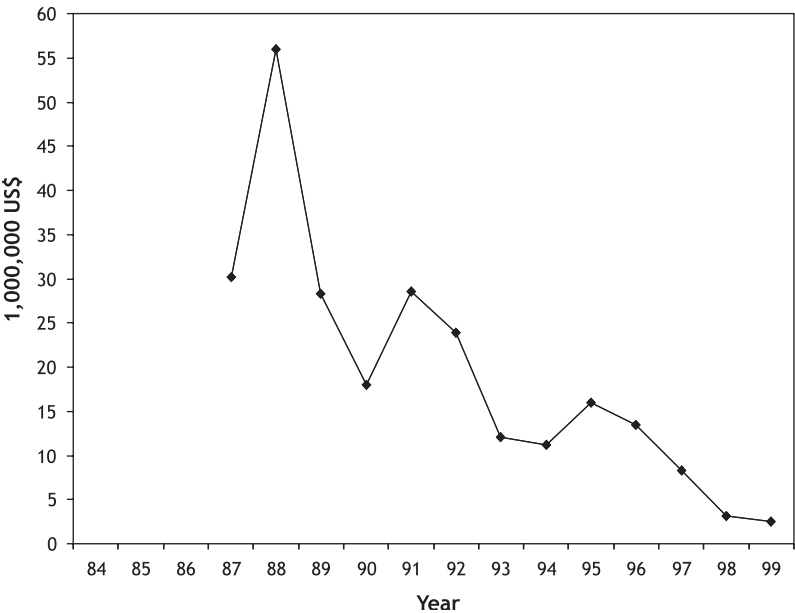
One of the most important changes for the rattan growers of Kalimantan was the establishment of ASMINDO, ostensibly to 'prevent unhealthy competition' among *lampit* exporters, following the same approach used by Asosiasi Panel Kayu Indonesia (APKINDO) to control the plywood industry (Barr 1998). Indeed, both associations were effectively controlled by the same person. ASMINDO imposed export restrictions on its membership in order to manage supply, in an effort to control quality and to increase unit prices. This strategy was based on the reasoning that, as the main supplier of *lampit*, Indonesia could control the market. Individual manufacturers reported that the quota was assigned based on political connections and payments.

Figure 2. Rattan lampit industry in Amuntai, South Kalimantan, 1984-2000



Source: Indonesia Central Bureau of Statistics.

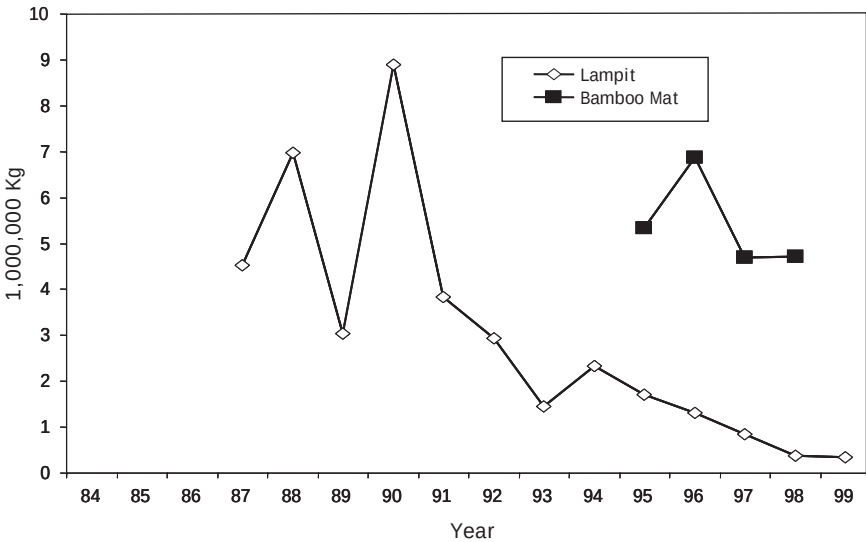
Figure 3. Lampit exports, 1984-1999 (US\$, free on board)



Source: Indonesia Central Bureau of Statistics.

These measures led to severe reductions in manufacture and export of *lampit* (see Figure 4). There were also big fluctuations in value-added, as the unit price changed (in nominal terms) from US\$6.38 in 1987 to as low as US\$1.22 in 1990 and back up to US\$8.39 in 1995. The number of enterprises had dropped to 20, and now, according to anecdotal evidence, the industry is almost completely destroyed, with only one *lampit* factory and a number of home-based manufacturers producing for the domestic market. ASMINDO officials lay the blame for this situation on changing tastes and decreased demand in the main importing country, Japan. In fact, Chinese manufacturers developed a bamboo based substitute for rattan *lampit*. This product was exported to Japan beginning in the early 1980s, but exports expanded dramatically to fill the gap created when the Indonesian prices increased and quantities decreased (see Figure 4).

Figure 4. Lampit exports from Indonesia and bamboo mats sales from China to Japan, 1984-1999 (kg net weight)



Sources:
Indonesia Central Bureau of Statistics.
Yearly Book of China Customs.

The drastic reduction in output has likewise reduced demand, and prices, for raw material. Raw material prices have changed little in nominal terms since 1987, and have decreased in real terms. Researchers in other rattan farming areas in Kalimantan report similar, though more pronounced, trends. In more remote areas, with higher transport and other transactions costs, there have been no buyers for several years.

The price slump following the introduction of restrictions on exports was a hard blow to all rattan farmers. Most farmers were unaware of the reasons for the price slump. They had already experienced ups and downs in prices of rattan, so they were waiting for the good times to come back. As the situation did not improve over time, more and more farmers have begun to seek alternative sources of cash income. Villages with better access to alternative opportunities started to set themselves apart from the dominant rattan based model. These villages were mainly located in the eastern part of our survey area in Kutai and in Pasir as a whole. The biggest change in activities occurred in Pasir along the trans-Kalimantan road, where numerous immigrants from South Kalimantan started panning for gold on a large scale with motorised equipment. Though not directly linked to the slump in rattan prices, the development of gold panning, with very high returns to labour, quickly changed opportunity costs.

Oil palm plantations and pulp plantations

Another major change that has affected rattan growers is the rapid expansion of oil palm plantations in the province. These plantations typically cover several thousand hectares, often in rattan growing areas. In many cases there is direct competition for land, with oil palm concessions given on land that has been used and managed by indigenous people for swidden agriculture, including rattan gardens. In the village Modang the establishment of a large oil palm plantation in the early 1980s resulted in many people being displaced and large areas of productive rattan gardens being destroyed. More recent attempts to establish oil palm plantations have led to bitter, sometimes armed, conflict between villagers and company employees. For example, a severe conflict between the company P.T. London Sumatra and Lempunah villagers involved malicious destruction of rattan gardens and forest on the one side, and burning of vehicles and buildings and uprooting of newly planted oil palm plants on the other (C. Gönner personal communication).

But oil palm plantations also have a 'pull effect'. Oil palm growing is seen as an interesting new opportunity by local people who appreciate benefits such as regular cash income (oil palm fruits can be harvested every week), guaranteed market, and a more 'modern' lifestyle. Indeed, the main reasons for people's resistance seem to be the lack of adequate compensation for land they consider to belong to them and the wish to maintain a broad portfolio of economic activities. People do not want to limit their options. The oil palm companies, in contrast, want to encourage (or force) people to concentrate their efforts on oil palm growing, partly to ensure more efficient production and sufficient raw material to run their processing factories at capacity and partly, no doubt, to foster a dependence among growers. These issues notwithstanding, there is a strong desire among people in the area to get involved in oil palm growing.

The other big land use change has been large-scale planting of pulp plantations (HTI), oftentimes on 'degraded lands'. Under the Indonesian government's definition of degraded lands, the term applies to rattan gardens, which are seen as degraded forests. Indeed, our spatial analysis showed a strong correlation of rattan growing areas with HTI.

The fires of 1997

Another major impact on rattan gardens was the fires of 1997. During a period of prolonged drought associated with an *el niño* event, several million hectares of Kalimantan were burned by wildfires. The hardest hit areas were logged over forests and areas of new oil palm and HTI plantation establishment, which often coincide. In many places, fire was used as a weapon in land conflicts. For example, in the aforementioned village of Lempunah large areas of rattan gardens were burned (C. Gönner personal communication).

The fires did not affect all the villages of the area with the same intensity. The easternmost villages of Kutai and all of Pasir were the hardest hit. As these villages were also the ones with the best access to other opportunities, the trend towards change was reinforced.

In some villages, fires destroyed up to 90% of the rattan gardens. Beyond the physical damage, this event had a traumatic effect on local people. Rattan gardens had been seen as a source of security. While prices might fluctuate, the rattan could always be sold for cash when needed. The rattan kept growing, and in many ways people used their rattan gardens like a savings account. Many respondents use the analogy themselves, saying that a rattan garden is like having money in the bank. All of a sudden, with the widespread burning of rattan gardens, the sense of security was replaced by the recognition that rattan gardens too are vulnerable. This new reality, combined with the low prevailing prices, had a determining effect in many villages to abandon rattan cultivation.

In other areas the response was different. In the west part of Kutai some villages were spared the fires, while others were as severely hit as Pasir villages. People from villages in both categories seem to retain a high interest in rattan growing. Some have decided to convert from *sega* cultivation to *pulut merah* cultivation. This small-diameter species is relatively fast growing (compared to *sega*) and current prices are high. Farmers are able to harvest quicker, reducing the risk of total loss by fire. Furthermore *pulut merah* thrives in wetter areas along rivers, which are less prone to fires. The shift to this new species is so popular that *pulut merah* seeds are in high demand all over the area.

Other villages, especially those dominated by Benuaq and Bentian ethnic groups, still maintain their interest in rattan gardens, even after the price slump and the destructive fires. They still hope that prices will soar again. But this may be due to their limited choice. In these remote villages the only source of cash is rattan. No other commodity is traded in the area. They need to sell rattan, even at very low prices, if they are lucky enough to have a buyer. But they no longer invest in establishing large rattan gardens. They cut only small amounts on a regular basis in order to meet their basic subsistence needs. In villages closer to the primary forest, farmers look for wild rattans (*Calamus manan*, *Calamus scipionum*) still in higher demand by traders for the furniture industry. Provided that there are traders willing to buy timber, illegal logging is a favourite occupation for local people in need of cash all over the area.

Krismon

Another important factor came into play with the monetary crisis, or *krismon* (from *krisis moneter*), associated with the Asian financial collapse. With the massive devaluation of the local currency the relative value of export commodities soared. In Indonesia agricultural commodities—such as coffee, cocoa, pepper, rubber and palm oil—and mineral resources from oil to coal and gold appreciated in value, as did any labour-intensive industry. In our study area the impact was seen in Pasir with the rise of gold panning operations and in a trend towards increased coffee growing. There was also a short-lived boom in the rattan furniture industry, but the raw material demands did not result in much price increase for the small diameter canes grown in the study area.

TRENDS AND ISSUES—DEVELOPMENT AND CONSERVATION LESSONS

The occurrence of an intermediate management system

The rattan gardens of Kalimantan provide an excellent example of an intermediate management system for forest products. Tracing their development is difficult, as the historical records are sparse, but the evidence fits together well. Essentially, the rattan cultivation system was developed to fit with the traditional *ladang* (swidden) system. It offers the advantage of low cost establishment and maintenance with relatively high yields. The traditional system is highly diversified, and the rattan element fits well. Harvesting is highly flexible—the rattan continues to grow for years, so there is no penalty for delaying harvesting to coincide with labour availability or higher prices. Many villagers mentioned that it functions like a bank account, in that rattan can be harvested to respond to urgent needs for cash—to respond to medical emergencies, for example, or for ceremonial requirements.

The resilience of the rattan cultivation system

It is important to know whether such an intermediate management system is robust if we are going to recommend and support such systems. This case is interesting because it has been ‘stressed’ by several factors, including the low prices, in this case driven by the policy environment; fires and competing land uses leading to reduced rattan garden area; and the occurrence of new, financially superior alternative opportunities for land use (oil palm) and labour (wage jobs, gold panning).

In fact, the rattan gardens in East Kalimantan tend to be resilient, especially in areas where there are limited other opportunities. While this may seem obvious, there are some important lessons in the reasons for their resilience. These systems:

- Offer a valuable risk management tool in which the rattan is available as long-lived, low-maintenance source of savings or income. This is especially important in systems without other, well-developed risk management institutions (not everybody has a bank account, let alone insurance policies)

- Play an important 'marker' function for property 'ownership'. Within the traditional system, rattan gardens are respected as a sign of occupation. Under the present circumstances, with large-scale state-sanctioned land appropriation by oil palm, HTI and mining companies, rattan gardens have been used successfully to demonstrate ownership and claim financial compensation from the company (however meagre)
- Provide a source of cash income in areas where there are few other opportunities to earn cash
- Provide other valuable forest products and services as the rattan gardens function as secondary forests, giving habitat for medicinal plants, ritual plants, and plants and animals valued for food
- Retain important cultural values. Rattan gardens, many of which have been inherited from fathers and grandfathers, represent important traditions and provide links to ancestors
- Live long, with little input required. Thus they have a high degree of inertia.

Reasons to support the system

The question arises as to whether this system should be subsidised or otherwise supported, and if so, how? Clearly, as discussed above, rattan gardens are very important to a significant number of people and form an integral part of their livelihood systems. The stresses placed on the system have been, for the most part, generated from outside. Rattan trade policies have been designed to keep raw material prices low. Large-scale plantation agriculture has been pursued at the expense of people already living in the area. And the fires were largely human induced, many deliberately targeted to rattan gardens, even if they were facilitated by a natural period of drought. On this count, it seems that the system could be economically competitive if provided with a level playing field.

There are other benefits to be considered. The rattan garden system offers important ecological benefits in terms of biodiversity, forest cover, carbon sink and climate. Essentially, the financial value of rattan makes a long fallow period feasible. During the long fallow, the forest can regenerate and increasingly provide these ecological services.

From a national perspective, the strongest argument for removing barriers, and even for actively supporting the rattan cultivation system, is that it supplies a valuable export industry.

Policy measures needed

There are several policy options that could be pursued simultaneously. Simple measures include reducing trade barriers that depress domestic raw material prices (including internal barriers, such as the ubiquitous illegal fees charged to traders, and official export taxes). Industry has resisted this, fearing that higher raw material prices would threaten its competitiveness. Additional measures then would be needed to assist industry to become more competitive. This could be achieved through more efficient raw material production (through

research and extension to improve the cultivation system) and trade (especially through improved market information) and through improved design, quality, efficiency and marketing of manufactured products. Combined with these measures, there is a strong case in favour of more careful land use planning to ensure that important rattan growing areas are not displaced by industrial estate crops.

The future of the system

Under the current conditions of low demand and prices rattan gardens are a marginal activity in financial terms. New roads in the region, industrial plantations, mining and other new economic activities have displaced existing rattan gardens (push factors) and offered alternatives which attracted some rattan farmers to new activities (pull factors). However, rattan gardens remain important where competition for land is low because they fit well with the swidden cultivation system that is the economic mainstay in the region, because they have low establishment and maintenance costs, because they provide a mark of land 'ownership' and because they still serve an important purpose in economic risk management as a source of 'savings'. Moreover, rattan gardens provide valuable ecological services, in terms of biodiversity conservation and other forest functions. As rattan remains an important commodity in Indonesia and internationally, and as the current farm gate price for rattan appears to be artificially low—in large part because of the prevailing policy environment—the rattan garden system may remain viable, at least in the medium term.

Under the current circumstances, the young people interviewed in our surveys place their hopes on plantation crops. They acknowledge that their low level of education and know-how prevents them from being hired as salaried workers by large companies and even from migrating. Condemned to stay in the village, they long for the regular incomes from plantation crops: oil palm or rubber. Rattan is seen as a thing from the past, something rather backwards, inherited from their forefathers. But such negative perception may easily be overridden if prices go up and if returns to labour become favourable again.

ENDNOTES

1. Derived from Belcher, B., Levang, P., García Fernández, C., Dewi, S., Achdiawan, R., Tarigan, J., Riva, W.F., Kurniawan, I., Sitorus, S. and Mustikasari, R. (2000) Rattan (*Calamus* spp.) gardens of Kalimantan: Resilience and evolution in a managed non-timber forest product system. FPP team paper presented at Lofoten workshop, June 2000, Lofoten, Norway.

2. Center for Social Forestry, Universitas Mulawarman, Gd. Pasca Sarjana Magister Kehutanan-Kampus Gn. Kelua, Jl. Ki Hajar Deantara 7 Samarinda, Kalimantan Timur 75123, Indonesia. E-mail: csf@samarinda.org

3. Center for International Forestry Research, P.O. Box 6596, JKPWB Jakarta 10065, Indonesia. E-mail: cifor@cgiar.org

4. Exchange rate 1984: US\$1 = Rp1,136; exchange rate 1987: US\$1 = Rp1,648.

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Sources used for illustrations

- Chapter 2: *Garcinia gummi-gutta*, based on a photo by Nitin D. Rai
- Chapter 3: *Amomum villosum*, based on photos by Catherine Aubertin and Joost Foppes
- Chapter 4: *Oecophylla smaragdina*, based on photos by Nicolas Césard
- Chapter 5: *Tricholoma matsutake*, based on photos by Ying Long Chen
- Chapter 6: *Lentinula edodes*, based on a Hidden Forest Designs photo from the Hidden Forest (Forest Fungi) website (<http://www.hiddenforest.co.nz/fungi/index.htm>)
- Chapter 7: *Amomum villosum*, based on photos by Catherine Aubertin and Joost Foppes
- Chapter 8: *Choerospondias axillaris*, drawn from a botanical specimen, Bogor Herbarium
- Chapter 9: *Elettaria cardamomum*, drawn from a botanical specimen, Bogor Herbarium
- Chapter 10: *Styrax paralleloneurum*, drawn from a botanical specimen, Bogor Herbarium
- Chapter 11: *Debregesia longifolia*, drawn from a botanical specimen, Bogor Herbarium
- Chapter 12: *Santalum album*, drawn from a botanical specimen, Bogor Herbarium
- Chapter 13: *Shorea javanica*, drawn from a botanical specimen, Bogor Herbarium
- Chapter 14: *Broussonetia papyrifera*, based on a photo by Catherine Aubertin
- Chapter 15: *Phyllostachys heterocycla*, based on a botanical illustration in *Reforestation technology of main Chinese tree species* published by the Chinese Forestry Publishing House in Beijing, Jan. 1981
- Chapter 16: *Paraserianthes falcataria*, drawn from a botanical specimen, Bogor Herbarium
- Chapter 17: *Calamus tetradactylus*, drawn from a botanical specimen, Bogor Herbarium
- Chapter 18: *Diospyros melanoxylon*, drawn from a botanical specimen, Bogor Herbarium
- Chapter 19: *Calamus merrillii*, drawn from a botanical specimen, Bogor Herbarium
- Chapter: 22: *Calamus caesius*, drawn from a botanical specimen, Bogor Herbarium

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Forest Products, Livelihoods and Conservation

Case Studies of Non-Timber Forest Product Systems

VOLUME 1 - ASIA

Non-timber forest products (NTFPs) provide important sources of subsistence, income and employment everywhere there are forests (and sometimes even where there are none). With new emphasis on poverty alleviation and livelihood improvement in national and international development agendas, this group of products seems to offer means to increasing welfare in an environmentally sound way. And yet, despite more than a decade of research and targeted development projects, systematic understanding of the economic behaviour of NTFPs, and their role and potential in conservation and development, remains weak.

To help fill this gap, a large group of researchers combined efforts to compare and contrast individual cases of commercial NTFP production, processing and trade from throughout Asia, Africa and Latin America. The cases represent a range of product kinds, geographic, biophysical, social, and economic conditions. As a part of the research process, the cases were described in narrative reports.

This book, along with the companion volumes, presents the full set of 61 cases from Asia (Vol. 1: 21 cases), Africa (Vol. 2: 17 cases) and Latin America (Vol. 3: 23 cases). The reports are organized to present a standard set of information to support comparative analysis, but the authors also included rich detail, idiosyncrasies and analyses of issues and opportunities in their own cases. Individually, the cases provide a wealth of interesting and useful information. Collectively, they offer an invaluable resource for researchers, development practitioners and conservation workers interested in understanding the links between commercialisation, livelihoods and forest conservation.



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