Domesticating forests

How farmers manage forest resources

Geneviève Michon

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• **FORRESASIA**. Alternative Strategies for Forest Resources Development in Southeast Asia is a programme funded by the European Community, associating NGOs and scientists from the social and biological sciences for the documentation and evaluation of various models of forest management.

• **IRD** is a French public science and technology research institute under the joint authority of the French ministries in charge of research and overseas development. It performs research and manages scientific programmes contributing to the sustainable development of the countries of the South, with an emphasis on the relationship between humans and the environment.

• **The Center for International Forestry Research** (CIFOR) was established in 1993 as part of the Consultative Group on International Agricultural Research (CGIAR) in response to global concerns about the social, environmental and economic consequences of forest loss and degradation. CIFOR research produces knowledge and methods needed to improve the well-being of forest-dependent people and to help tropical countries manage their forests wisely for sustained benefits. This research is done in more than two dozen countries, in partnership with numerous partners. Since it was founded, CIFOR has also played a central role in influencing global and national forestry policies.

• **The World Agroforestry Centre** (ICRAF) is an international institution devoted to agroforestry research and development. It is comitted to the improvement of rural livelihoods through good governance for multifunctional landscapes supporting healthy farms with useful trees.

To . . .

. . .the families of Hyderus and Ashabi in Krui
Pak Sultan Said Jama'a in Maninjau
Pak Kusnadi in Kecupak . . .

. . . And all the generations,
past and still to come,
of forest cultivators in South-east Asia and
in the world.

Here and there, with words, acts or just smiles.
Thanks for having been with us along our travels in these cultivated forests.
May your efforts be acknowledged and supported.

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Data, analyses and recommendations presented in this book have been principally derived from the Forresasiaproject, 'Alternative strategies for forest resources management: extractivism, agroforestry or plantations?', a research project on local forest management in island South-east Asia funded by the European Community within the IVth Framework Programme of DG XII between December 1996 and March 2001. The author compiled the information from the various reports and scientific papers the project generated. The final report to the European Union (EU), synthesized from individual reports by Arild Angelsen, Carmen Garcia-Fernandez, Tristan Le Cotty, Geneviève Michon, Rachmat Muhtaman, Honorato Palis and Achmad Purwanto, has been used as the major basis for this book.

The Forresasia project was conducted in Indonesia and the Philippines, with additional material from Europe. It has involved eight partner institutions in Europe (France, Spain, Norway) and South-east Asia (Indonesia and the Philippines), including universities, research institutes and non-governmental organizations with altogether 20 permanent or part-time scientists and nine research assistants, three Ph.D. students and five master students, as well as eight consultants.

The Forresasia project conducted detailed analysis of several management systems in the region, ranging from extraction in natural forests (logging and local systems of forest gathering, or extractivism), various examples of local forest culture by smallholder farmers and intensive forest plantation systems, including pulpwood estates (Eucalyptus), estate crops (oil palm and rubber) as well as smallholder specialized plantations (of cinnamon, coffee and clonal rubber). Parallel to detailed studies on local management systems including ecological, economic and socio-anthropological aspects, the project has developed two other fields of analysis: one concerning the influence of local, national and international markets of selected forest products on the profitability and evolution of local forest management systems, and the other on the impact of international instruments like the Convention on Biodiversity or Intellectual Property Rights on the dynamics of these systems. Results of the latter two studies are not necessarily included in the present book, but reference is made to relevant results whenever appropriate. (Full details on these two analyses appear in the final report of Forresasia to the EU as well as in annual scientific reports.)

The present book concentrates on forest management by local people. After delineating the study itself and introducing the forest people studied in chapters I and II, respectively, chapter III gives a global analysis of local systems of resource extraction from natural forests. The book's main substance, however, consists of detailed reports and analysis of forest culture by smallholder farmers (chapters IV, V, VI and VII). Examples of specialized logging, industrial tree plantations and specialized woodlots on farmlands are not detailed here, but have been extensively used for the comparative analysis in chapter V. Comprehensive data on these systems appears in the annual and final scientific reports.

The material presented here on local forest culture in South-east Asia has been used as a major basis for the International Workshop on Cultivating (in) Tropical Forests? The Evolution and Sustainability of Intermediate Systems between Extractivism and Plantations held in Lofoten, Norway, in July 2000, after being organized jointly by Forresasia and the Center for International Forest Research (CIFOR). Proceedings of the workshop, as well as a book collecting contrasted examples of intermediate systems of forest management around the world, are being finalized.

In addition to the Forresasia results, which form the main body of this book, we have included relevant material derived from related projects on local forest management and forest culture, carried out by several FORRESASIA members before or outside the EU-funded project. These include several research programmes on complex agroforestry systems in Indonesia, carried out between 1992 and 1996 by scientists from Institut de Recherche pour le Développement seconded to International Center for Research in Agroforestry (ICRAF, presently the World Agroforestry Center), from which are drawn the examples of damar agroforests in the Pesisir, rubber agroforests in Sumatra (also analysed by Arild Angelsen in Riau from 1993 to 1995), and the Maninjau fruit forest in West Sumatra. The FORRESASIA study on cultivated rattan forests in East Kalimantan–Pasir has been carried out jointly with a CIFOR team working on a world comparison of various non-timber forest products management systems, details of which are presently in press.

We have chosen to designate the cultivated forests we present in this book under the term 'forest', with the adjunction of the main cultivated production. We will talk of 'benzoin forests', 'damar forests', 'rubber forests', etc. In other publications, we may have used different terms. The damar forest for example has been abundantly described under the term 'damar agroforest', the rubber forest under the terms 'rubber agroforest', 'rubber gardens' or 'jungle rubber'. 'Agroforest' was created in 1982 to emphasise the fact that these forests are *cultivated* and *located on farmlands*. 'Garden' is used to render the connotation of the local terms used to designate these systems. This diversity shows at least that, in spite of our previous efforts to promote the unifying concept of 'agroforest', there is not yet a commonly accepted term for these original systems that are neither like a natural forest nor like a garden. Elements of semantic discussion will occur in chapter VII, Extrapolation.

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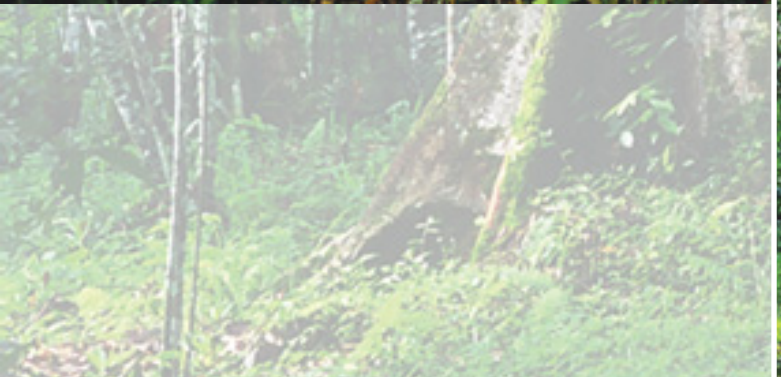
Introduction:

Managing natural forests . . .



. . . or cultivating forests on farmlands?

This book concentrates on the cultivation of forests on farmlands by smallholder farmers, not only because the practice constitutes altogether the most original and lesser known aspect of local forest management in the region, but also because, in our opinion, it represents the most promising field for the design of alternative strategies for the management of forest resources and forest lands.

Since the 1970s, the importance of indigenous communities' utilisation of forest resources in tropical countries and the relevance of local management systems for forest science, conservation and development have become well-recognized facts. Studies on local forest management have multiplied. Few of them, however, recognize the significance of the difference between 'natural forest management' and forest culture. If farmers in South-east Asia are often cited as skilled forest managers, it is barely acknowledged that an essential part of this forest management does not concern natural forests, but forests that have been planted on farmlands after the removal of pre-existing natural forests.

Why do people cut natural forests to replant the same kind of trees they have just chopped down? This book gives many elements of the answer to this question. Conclusions from 10 years of analysis of forests cultivated by smallholder farmers on farmlands do show that the management of self-established forest resources in natural forests and forest culture should not be confused any longer. Despite obvious biological and ecological similarities between cultivated forests and natural forests, their historical, socio-cultural, institutional and economic foundations as well as their social and political dimensions are totally different, if not divergent. Beyond the various examples given in this book, the underlying strategy of forest culture on farmlands bears a universal dimension, which justifies its separation from the common domain of 'natural forest management'. This separation is not only conceptual, but bears important practical as well as social, legal and political dimensions, as we will try to illustrate here.

Most examples of forest culture on farmlands given in this book are derived from Indonesia. This happenstance is more a consequence of the historical development of the research projects from which the book is derived—in particular the importance of FORRESASIA and former Institut de Recherche pour le Développement (IRD) research on such systems in Indonesia and the concentration of our Philippine study on critical examples of forest extraction by remote forest communities—than a reflection of any inexistence of such systems outside of Indonesia. The Lofoten Workshop has shown that other forms of cultivated forests exist in other parts of the world. The International Council for Research in Agroforestry (ICRAF) is presently documenting examples of traditional and modern forest culture from Thailand and the Philippines.

These cultivated forests are not home gardens. They usually form large blocks of several tens of thousands of hectares extending between open farmlands and natural forests. In Indonesia, they cover altogether an estimated 6 million to 8 million hectares. They are not, as commonly reported in most professional forestry circles, anecdotal components of backwards, traditional agriculture. Most of them assume a determining role in the farm economy, both through the provision of regular cash flow from traded commodities and for their risk-buffering function. They also constitute a major element of

smallholder agriculture at the scale of the country. In Indonesia, they provide 80% of the processed and exported rubber latex, 80% of the dipterocarp resin and 95% of the benzoin resin traded in and outside the country, between 60% and 75% of the main tree spices (clove, cinnamon, nutmeg) produced for national and international markets, roughly 95% of the various fruits and nuts marketed in the country, as well as a significant part of bamboos, small cane rattan, fuel wood, handicraft material and medicinal plants traded or used in the country.

These cultivated forests should not be integrated in the global category of 'secondary forests'. The term 'secondary forests' and the related concept of 'primary forest' (this latter concept being derived from the former through durable perturbation), though scientifically defined, do not constitute the only true representation of reality. On the contrary, they embody a specific vision of tropical forest. These two related concepts refer to a presently criticised representation of 'nature' by the ecological sciences, in which humans are not constitutive elements of the 'ecosystem', but do perturb the 'ecological balance'. It concentrates on a definition of forest that is uniquely physiognomic and silvigenetic. This representation denies the reality of millennia of co-evolution between human societies and forests, and it sends the economic, social, symbolic and political dimensions of forest history back to a secondary position. Even though cultivated forests are not 'primary forests' (and therefore should fall in the category of 'secondary forests'), even though some of them have the physiognomic characteristics of secondary vegetations, there are more dangers than clear advantages to classifying them as such. By assimilating them to any type of vegetation evolved from 'primary forest' through 'perturbation', it dilutes their specificity and obscures their originality. It finally justifies the lack of official acknowledgement (either political or scientific) of these cultivated forests.

Unlike conventional forest plantations, which are physiognomically and ecologically quite distinct from natural forests, these forests cultivated by smallholder farmers in the tropics do look like natural forests. But they are more than just managed forests. They are not the result of any integration of economic tree species in natural forests through gradual planting. They have evolved from the total clearing of the natural forest vegetation, usually through slash-and-burn agriculture, and the planting of selected tree species on the cleared plot. They are socially defined by bundles of rights that clearly differ from those concerning natural forests. As natural forests, they have clear economic functions, but they also serve as the material and symbolic foundation of particular social status or local identities, a role that is usually not assumed by natural forests. Locally, they never bear the name of 'forest', but are designated by terms closely related to the English term of 'garden'. The historical process of their establishment shows how they have often been erected against the natural forest itself, as a strategy to allow the continuation or the development of a forest-related economy in a context where this economy was threatened by the imposition of colonial or national forestry regulations on customary forest lands.

Cultivation and domestication of plant species represent a well-defined domain in the range of resource management possibilities. Technically, fruit culture for example is quite distinct from the collection and management of wild fruits in the forest. The same holds true for forest culture, even when practiced in a mode quite different from the canons of professional

Cultivated forests are often ‘invisible’

A natural dipterocarp forest in Kalimantan

'Forest management' includes the management of both naturally regenerated forests and that of cultivated forests. Professional forest culture in the tropics occurs through the specialized plantation of homogenous stands of timber species. Local forest culture is quite different, as it reconstitutes diversified forest ecosystems adjoining farmlands.

An Agathis plantation established by the public forestry services in Java for the production of damar resin

A dipterocarp forest planted for damar resin production in southern Sumatra farmlands

forest plantations. The specificity of the models that can be derived from existing examples of forest culture on farmlands is defined by qualities that extend far beyond pure technical or economic considerations. In areas where natural forests are still present and actively managed, the development of forest culture by smallholder farmers on farmlands is not neutral or accidental. It necessarily constitutes a strategy that questions the practical, conceptual and legal aspects of conventional forest management.

Our book tries to capture the multiple dimensions of this strategy and analyzes its comparative advantages. We speak for more attention and support for these systems. This book is not an ideological plea, but is built on the conclusions of a multidisciplinary analysis of scientifically collected facts and observations. We aim at attracting scientific and political attention to these systems, because they are altogether neglected, endangered and full of potential.

Professional foresters or the decision-making elite in forest management have never seriously considered indigenous forest culture, however sustainable and profitable it may be. Why has it been neglected? Probably because the existing systems are 'invisible'. Their physiognomy is so close to an old-growth or a secondary forest that they are easily confused with a natural forest. They have been invented by politically 'invisible people': swidden farmers, who are generally considered bad managers of the forest. Their patterns are so different from those attributed to a 'cultivated system' that it might be difficult to admit that they result from active planting and planning. They globally do not 'fit' the conventional separation between forest and agriculture. Even though resulting from planting on farmlands, and acknowledged as specific tenurial properties in customary systems, they are usually classified as 'natural forests' in official land-use categories and therefore fall under the forestry regulatory framework. In most tropical countries, the ideology and the political considerations that found the regulatory framework of forestry tend to exclude smallholder farmers (and moreover swidden farmers) from the management of forestlands and resources. The public status of 'forestlands', the concessionary mode of forest exploitation and the legal restrictions on the trade of forest products represent measures that globally do not favour the sustainable management of forest resources by local communities. By not recognizing customary property rights on planted forests, by forbidding the local trade of cultivated timber and by not allowing management and harvesting activities in cultivated forests established on 'conservation forest lands', forest regulations also represent a major threat to the future of forest culture on farmlands. The ecological, economic and social success of the existing examples of the forest culture of smallholder farmers allows us to question the legitimacy and the efficiency of maintaining these particular forests under the common forestry regulatory framework.

Our argument in this book extends far beyond a recommendation for more support for existing systems. Our main objective is to define what benefits the concept of 'forest culture on farmlands', derived from the existing examples of cultivated forests in South-east Asia, can bring to forest management and development. In this book, we try to analyze which among its specific qualities can make it an interesting alternative to either forest extraction or specialized forest plantations.

On the island of Java, lands not under forestry regulations often bear more trees than 'forest lands'. These trees are

This picture (left) from West Java shows the boundary between ‘state forestlands’ on the upper, heavily deforested part of the slope and ‘private lands’ downhill, which are covered by forests cultivated by local farmers for multiple uses.

Forest conversion in Kalimantan

On the island of Java, lands that are not under forestry regulations often bear more trees than ‘forestlands’. These trees are managed in forests that have been planted by farmers.

In many areas of Sumatra and Kalimantan, whereas natural forests are being overlogged or converted, the last patches of dense forest are located on farmlands and are in fact cultivated by local farmers and swiddeners.

A cultivated forests with fruit trees and timber species in West Java

Cultivated dipterocarp forest in southern Sumatra

managed in forests planted by farmers. In many areas of Sumatra and Borneo the last patches of dense forest are located on farmlands and constitute cultivated forest and agroforests, whereas natural forests are being overlogged or converted. In the eastern lowlands of Sumatra, rubber forests planted during the twentieth century by swidden farmers constitute the last large reservoir of forest biodiversity. All of Indonesia's exported damar resin (an important 'non-timber forest product' from Dipterocarps, the major constituents of South-east Asian forests) comes from cultivated dipterocarp forests. In many areas, most of the sustainable relations between local people and forest resources no longer occur in the natural forest but through one or another type of planted forest. These are important facts to consider, especially in the present context of depletion of natural forests all over the planet.

Grouped under the evil term of 'deforestation', the global dynamics of forest conversion nurture worries about the unavoidable demise of all old-growth forests on the planet, and about the environmental consequences of this forest conversion. As a reaction, many conservationists, after having defended the idea of 'integrated conservation and development', presently plead for enforced conservation, arguing that people and forests are incompatible on the same unit of land.

Primary, old growth forests of the humid tropics constitute irreplaceable ecosystems harbouring the highest known concentration of terrestrial biodiversity. True efforts have to be made to conserve significant examples of these unique systems. Most primary forests, however, are not exactly 'virgin', and the conversion of primary forests does not necessarily mean the end of forests. Primary forests are necessarily replaced by 'something else'. The examples detailed in this book show that this 'something else' can still be related to a real forest and does allow for the preservation of many true forest functions: soil protection and the regulation of water flows; production of forest resources like timber, fibres, exudates, game and fish; chemicals or plant foods; habitats for forest species; and a good proportion of the original forest biodiversity.

Can the transfer of these original examples to other parts of the world be achieved? How can it be successful? We do hope this book will help to answer these important questions.

I – The framework of Forresasia:

Specialized plantations?

sustainable development of forest resources, which alternatives?

Extractivism?

Agroforestry?

1. Objectives

In the context of growing dissatisfaction with the dominant models of forest development promoted by professional forestry —namely, timber extraction from natural forests as presently practiced, specialized plantations of forest crops over huge areas and rigid social forestry— the overall objective of the Forresasia project was to evaluate how alternative solutions for a 'better' management of forest resources could be inspired by local forest management systems. For the project, the concept of 'better' management included values related to management practices: eco-friendly and able to conserve biodiversity; economic development —income enhancement at the local level through sustainable development of commercial forest resources— and social development. In particular the latter should include welfare improvement, as well as the development of social and environmental justice, for local populations.

2. Activities

Our activities included scientific investigation and analysis, technical expertise, and policy recommendations.

Expertise aimed at elaborating on the synthesis of existing examples, economically efficient, ecologically sustainable and socially acceptable models for forest resource management.

Policy-related activities included the transfer of the scientific results into policies and action-guiding instruments adapted to the regional scale in order to improve current forest management

Consolidation work with NGOs was developed in order to facilitate

- communication between the project and local communities during the research phase
- The follow-up of the project.

This work was carried-out through

- An involvement of local NGOs in research and discussion activities
- The involvement of national NGOs in Indonesia (LATIN) and the Philippines in all activities
- The involvement of a France-based NGO working at the international level on the elaboration of conventions, policies and markets (SOLAGRAL) linked to the environment

Scientific research was carried out at local (forest management systems) and international (conventions, policies, trade chains and organizations) levels in order to understand:

- The conditions, evolutionary trends, comparative advantages, potential and limitations of a continuum of management models ranging from product collection in natural ecosystems to active production of forest commodities in specialized fields
- The influence of policies and markets on local forest management, and the extent of the gap between the official objectives and the actual effects of policies and markets on the evolution of forest management systems.

The scientific objectives were achieved through detailed comparisons between several types of forest management situations in Indonesia and the Philippines.

3. The general framework of forest management in South-east Asia

Island South-east Asia was selected as an interesting area for the project for both the originality and the diversity of local forms of forest management, which includes many active examples of the forest culture of swidden farmers, and the growing constraints burdening local farmer forest management.

- The dominant modes of forest management in the region concern timber extraction from natural forests through the concession system, and forest conversion to large-scale plantations of fast-growing tree species for the pulp and paper industry. Large private or corporate firms, able to invest heavily and having close connections to policy-makers and political circles, dominate these two modes. Besides these systems, a whole range of local forest management systems can be encountered, with (1) various types of extractivism from the traditional extraction models of forest nomads or semi-nomads, or those of settled farmers, to emerging extraction activities developed by unemployed urban dwellers, (2) a burgeoning sector for small-scale timber extraction driven by local entrepreneurs, and (3) discrete, but fully developed and diverse models of local forest culture, ranging from complex agroforests (forests integrated into farmlands) to specialized woodlots.

  Local farmers, especially in Indonesia, have developed original models of forest plantations that do not follow conventional models of industrial silviculture, but usually exhibit an interesting diversity of cultivated tree crops, management intensities, and collected products. FORRESASIA, together with former and ongoing IRD/ICRAF projects, has devoted a large part of its resources to the documentation and understanding of these systems.
- For the last 20 years, forest logging, migration, the development of small-scale sawmills (especially in the Philippines) and large-scale industrial plantations (oil palm, fast growing trees) on forest lands have led to a critical loss of the original forest cover and to an intense erosion of biodiversity, especially in lowland forests.
- Forest management in the South-east Asian region is dominated largely by strong, public policies and forest regulations, and is greatly influenced by the political, economic and military elites. From a legal point of view, most areas considered as 'forest' in Indonesia[1] and the Philippines[2] are under state jurisdiction and control. In the sphere of forest management, the national constitutions, though acknowledging the existence of customary systems, give preference to government-approved institutions and projects. Local communities keep their customary rights on

1. Lynch & Talbott 1995; Lynch & Harwell 2002.
2. Colfer & Resosudarmo 2001.

forestlands and resources only as long as the government has no other projects for the land. Forest policies in both Indonesia and the Philippines demonstrate a negative perception of forest dwellers and swidden farmers. For policy-makers and forest administrators at all levels, local farmers are mainly forest destroyers who need to be taught how to manage forests in a rational way, how to restore degraded lands and how to plant trees. Therefore, policies, regulations and development plans for forestlands give preference to contracted firms (for logging and estate plantations). Some policy instruments directly target the forced conversion of local agricultural and forest-related practices into more 'modern' forms of intensive field management.

As a consequence, local systems of forest management, and particularly the cultivation of forests on farmlands, are not supported, and often not even accepted, by the state in both Indonesia and the Philippines. For the last 20 years, this has entailed

- the multiplication and intensification of conflicts between local people and outsiders over access to forestlands and resources and over the sharing of forest-related benefits;
- a strong destabilization of customary systems for forest management;
- a forced transformation of many local systems and practices, and the related erosion of local practices and knowledge.

This translates into a dilapidation of essential forest resources, the disruption of traditional lifestyles and a correlated degradation of local welfare, as well as the loss of local control over lands and resources.

The situation has drastically deteriorated since 1998 with the eruption of the economic and political crises in Indonesia and, to a lesser extent, the Philippines. Recent development in Indonesia gives some hope, however, for more local control of forest resources. But will it translate into a reinforcement of local systems of forest management and forest culture?

4. The study sites

The study sites were selected to include a range of forest management systems, from pure extractive systems to various degrees of forest resource domestication and plantation through either diversified forest culture, agroforestry or conventional plantation models. The study sites are located on the large, forested islands of the Indonesian and Philippine archipelagos.

The main interests in the Talang Mamak and Melayu areas in the Bukit Tigapuluh area, in Riau province are traditional extractivism, the expansion of smallholder rubber production and conflicts with a large-scale commercial project.

The main interest in the western Toba highlands in North Sumatra is benzoin domestication in cultivated forests.

The main interest in the Maninjau area in West Sumatra is the cultivation of fruit and timber forests in the context of permanent rice farming.

The main interest in the rubber-growing Muara Bungo area in Jambi is the intensive forest use aided by exceptional economic and climatic conditions.

The main interest in the Krui area in Lampung is the domestication of a resin-producing tree and the conversion of natural forest into a human-made dipterocarp forest in the context of swidden rice farming.

The Bulungan district in East Kalimantan features traditional and modern multiproduct extractivism.

The main interest in the Kutai district in East Kalimantan is the evolution of bird's nest management in a context of increased market demand.

The main interests in the Pasir district in East Kalimantan are the management of rattan cultivated forests in the context of swidden farming and conflicts between oil palm and pulp plantations and rattan farmers.

Sources:

- Elevation data from The GTOPO30 Global 30 Arc Second Elevation Data Set (http://edcwww.cr.usgs.gov/landdaac/gtopo30/gtopo30.html)
- Administrative unit boundaries from Uwe Deichmann and the Center for International Earth Science Information Network (CIESIN), Columbia University and World Resources Institute

Indonesia

Blue boxes indicate the sites where complete surveys were conducted. Orange boxes indicate the sites where only supplementary information was collected, basic information being available through previous projects of FORRESASIA scientists.

Sources:

- Elevation data from The GTOPO30 Global 30 Arc Second Elevation Data Set (http://edcwww.cr.usgs.gov/landdaac/gtopo30/gtopo30.html)
- Administrative unit boundaries from Uwe Deichmann and the Center for International Earth Science Information Network (CIESIN), Columbia University and World Resources Institute

The main interests in El Nido Province are its famous caves and associated bird's nest production.

The still densely forested Puerto Princesa Province is the setting for many extractive activities and part of the Certificate of Ancestral Domain Claim awarded by the government to Batak tribes.

The Philippines

II – Forest people?

Against the myths

Indonesia has around 80 million to 95 million forest-dependent people, and the Philippines 20 million to 30 million. Some 40 million to 65 million people live on lands classified as public forestlands in Indonesia and 24 million in the Philippines.

We have worked for some time among these millions of people who manage forest resources and forest lands. They were swidden farmers (practicing slash-and-burn agriculture), permanent farmers, former forest nomads, small-scale entrepreneurs looking for profit in the forest, jobless urban dwellers chased by the economic crisis from the urban centres. Can all these different people then be called 'forest people'?

How far are they from the mythical image of 'indigenous forest people' carried from the Amazon? Are they wise managers of forest riches, living in harmony with an undisturbed nature, as many nongovernmental organizations (NGOs) claim? Or are they destroyers of old-growth forests because of their endemic poverty and rudimentary agricultural practices, as commonly thought in professional forestry circles? How many of them are nomadic and live isolated in empty old-growth forest in temporary huts made of palm leaves? How many live in autarky, from hunting and gathering, far from the turmoil of international markets and politics? What is their connection to the outer world?

These questions need to be answered. The dominant perception of 'indigenous forest people' in forestry administrations and among policy-makers and development agencies, national or international, deeply affects the ideology and practice of forest management as well as the way these people are 'treated' in forest policies and projects. It also allows people-related forest policies or projects to concentrate on a few groups of true forest dwellers and to completely avoid addressing the fate of the hundreds of thousands of farmers living on official 'forestlands'. For example, in Indonesia, the strong belief that forestlands are empty or inhabited by, at most, a few scattered groups of semi-nomads helps to justify the government's allocation of large tracks of the supposedly uninhabited State Forest Domain to timber and plantation companies. In 1996, 600 logging companies were holding official 25- to 50-year concessionary rights to 62 million hectares of the production forest domain. Tens of pulpwood and oil palm estates were holding either long-term tenure rights or full property rights on 10 million to 15 million hectares of the forest domain. In contrast, until now, none of the 40 million to 65 million people living in the forest domain have been able to get any official tenure rights to the lands they manage or to the forest resources from which they make their living.

People in the study areas, like most forest people in South-east Asia, are obviously far from the folkloric image that urban dwellers have of 'forest dwellers'. No half-naked and tattooed bodies, no communal 'longhouses'. These people live in settled villages, sometimes away from forest margins, and always rather easily connected to the city centres (the most isolated village in East Kalimantan was located two days upriver by motorboat). All of them are aware of the changes currently happening in the world, in national policies and in the global and national economic environments. All of them are farming lands for rice production. Most of them extensively use manufactured goods: outboard motors in the case of those living upriver, motorcycles in the case of those connected to road systems, iron tiles for roofing, radios and tape recorders. Most of the villages have satellite television. All people wear modern, though often quite extensively worn, clothes like T-shirts, jeans, caps etc.

1. 'Indigenous', in the context of island South-east Asia

Contrary to the American continent, where 'indigenous' people (Amerindians) obviously contrast with European and African migrants, and survive with a heavy historical heritage of ethnocide, the concept of indigenous people in the context of Indonesia and, to a lesser extent, the Philippines is not fully relevant, neither historically nor politically.

Indonesia has well-defined ethnic groups, with singular traditions and institutions. Most of the ethnic groups have well-defined territories, like the dominant Batak and Minangkabau in Sumatra. Some, like the Talang Mamak of eastern Sumatra, have seen their forested homeland shrink during the last decades because of the encroachment of more spatially aggressive groups like the Melayu. Others, like many of the ethnic groups in Kalimantan, have been migrating extensively along and across river basins, and it is therefore more difficult to define their homeland.

Some ethnic groups have been historically dominant in terms of political power, demographic extension or land colonization. Most of the ethnic groups of the Outer Islands legitimately perceive the Javanese as politically dominant. Present forest conversion patterns linked to agricultural development and resettlement policies that clearly favour outsiders (poor transmigrants from Java as well as powerful financial groups) over local groups are perceived as political, socio-economic and cultural 'colonisation' by the Javanese and their relatives. This colonisation is expressed by, among others, a physical occupation of customary ethnic lands by smallholder migrants and government-sponsored estates, which causes the number of conflicts over lands and resources confronting local ethnic groups and outsiders to escalate. In this context, local groups use the concept of 'indigenous people' in order to claim their anteriority and their greater legitimacy in regard to customary lands. It is, however, far less relevant in present land disputes regarding 'original land rights' and anteriority of land occupation pitting two related subgroups against each other. (The Punan in the Bulungan regency are an example.)[1]

The Indonesian constitution does not use the concept of 'indigenous people', but that of 'isolated tribe' (*suku terasing*), which permits policies to be formulated for the removal of such peoples from isolation (including resettlement programmes that displace forest villages from their resources).

The Philippines also have numerous ethnic groups, but they have been more subjected to inter-island migrations, especially from the north towards the two large forested islands of Mindanao and Palawan. Small ethnic groups belonging to the

1. Kaskija 2000.

larger Negrito group are truly 'indigenous', like the Batak of Palawan, who represent the original group there. Philippine law has recently integrated the concept of 'ancestral domain', acknowledging the prevailing rights of original ethnic groups in forestlands.

Local people involved in the project belong exclusively to local ethic groups (we have not included any inter-island migrants). They include

- *in Sumatra*: the Melayu of Jambi and Riau; the Talang Mamak of Riau; the Lampung Pesisir of Krui in Lampung Province; the Maninjau Minangkabau in Maninjau, West Sumatra; the Batak Toba and Batak Pak-Pak in North Sumatra
- *in East Kalimantan*: in Bulungan regency, various Kenyah groups in the Bahau valley and the Punan of the Malinau and Tubu rivers; in Pasir regency, the Pasir (formerly known as Melayu)
- *in the Philippines*: the *Batak* of Palawan.

Some of these ethnic groups, such as the Pesisir Krui of Lampung and the Maninjau of West Sumatra, are symbolically as well as socially and politically well grounded in their territory. Others have migrated locally, sometimes repeatedly, from a mythical place of origin: the Bungo-Melayu in the Bungo valley trace their origins back to the Minangkabau highlands, and the Toba Batak in the highlands claim they all came from one village on Samosir island in Lake Toba and founded the present villages two or three generations ago. The Punan keep migrating along the Tubu River and its tributaries, and some claim they came from across the mountains. Some of the Pasir have been relocated (others relocated spontaneously) along the road leading from East Kalimantan to South Kalimantan. All surveyed groups, however, have strong connections with surrounding ethnic groups, migrants and urban dwellers, through temporary migrations of their members, as well as through family, labour or trade exchange links.

2. Nomadic forest tribes or permanent and swidden farmers?

The old myths associated with indigenous forest people are still strong (see the critical report of Bahuchet *et al*. 2001), particularly the image of nomadic bands of a few individuals living in a hunting-gathering economy. In spite of numerous scientific reports showing the importance of historical relations between local people and forests in the shaping of the present forest facies, the tropical rainforest is often perceived as 'virgin nature' and described as largely uninhabited, with only scattered groups of 'indigenous forest people'.

Forest people are usually considered as nomadic hunters and gatherers or primitive horticulturalists.

But

The vast majority of people managing forests are farmers practising either swidden farming or permanent agriculture.

Traditional hut in West Timor

Village in East Kalimantan

The wooden huts of the Punan people in the Tubu valley of East Kalimantan bear solar panels for electricity supply.

Large wooden houses in the Toba Batak highlands of North Sumatra

Few forest people still live in temporary huts.

But

Most of the people managing forests live in long-standing houses and sedentary villages.

Forest people are perceived as living in harmony with nature in the heart of the forest. They are presented as the stewards of the forest riches. Their forest management practices and 'traditional shifting cultivation systems' are considered to be in balance with the natural.

?

Farmers on forest margins are designated as the main destroyers of the forest, through 'pioneer' shifting cultivation and rampant poverty.

Forest areas in the region are considerably more densely populated than the forests of the Amazon and the Congo basin. Truly nomadic people are few and scattered in small, disjointed groups: altogether only about 1,000 Kubus in Sumatra, Batak in Palawan and Punan in Kalimantan. Not all Kubu, Batak and Punan are nomadic. Most of them live in semi-permanent or permanent dwellings and practice at least rudimentary forms of agriculture.

The vast majority of the forested lands is inhabited by large groups of smallholder farmers, living in permanent villages and practicing either swidden (slash and burn) agriculture or some form of permanent farming, in addition to off-farm activities. Temporary migration towards urban centres and exchanges with neighbouring regions are common habits in most of the surveyed areas. It is precisely these large groups of smallholder farmers who have been, for centuries, the main managers of forest resources and lands in our study areas. They are still the most prominent and knowledgeable among present forest managers. (In this book, the term 'smallholder farmer' refers to swidden cultivators and farmers practicing agriculture on permanent fields.)

In addition to farming communities belonging to local ethnic groups, migrant settlers, transmigrants and other types of displaced populations—usually from overpopulated areas of rural Java, Bali, Madura or South Sulawesi in Indonesia or from the northern islands of the Philippines—have invaded accessible forestlands during the last decades. These migrants practice permanent or semi-permanent forms of rice culture and usually do not have a strong tradition of forest management. They do, however, also manage forest resources as part of their livelihood strategies, for both subsistence and cash needs. The recent political and economic turmoil in the region has brought urban dwellers back to their original farmlands and forestlands, where they try to make a living with hardly any tradition. Unlike rural migrants, who more or less follow local patterns of forest management, these neo-rural people tend to be quite destructive to natural resources, which they mine until exhausted.

3. 'Good forest people' and 'bad shifting cultivators'?

A small fraction of all these local and migrant forest dwellers are 'integral shifting cultivators': the Batak of Palawan, some Talang Mamak of Riau in Sumatra and some Kenyah groups in Bulungan, East Kalimantan, farm their lands exclusively through slash and burn agriculture. However, the vast majority of present forest dwellers in our study areas (Pesisir Krui, Talang Mamak, Pasir, Jambi and most migrants) practice mixed agriculture combining permanent rice farming and one of numerous forms of swidden farming. Some (Batak, Minangkabau) live predominantly, but never exclusively, from sedentary

rice farming. All of them rely on the forest for subsistence and cash.

A common image in conservation circles, blended from a re-interpretation of scientific studies[2] and former colonial perceptions of shifting cultivation, tends to differentiate 'good' forest stewards from 'bad' shifting cultivators. The first group supposedly consists of wise 'indigenous communities' living 'in harmony with nature' in the heart of the forest, practicing forest collection and rotational agriculture ('traditionally shifting cultivation'). The second group consists of poor and often displaced farmers ('pioneers'), who destroy the forest to establish their fields, produce until soil fertility is exhausted and then move forwards.

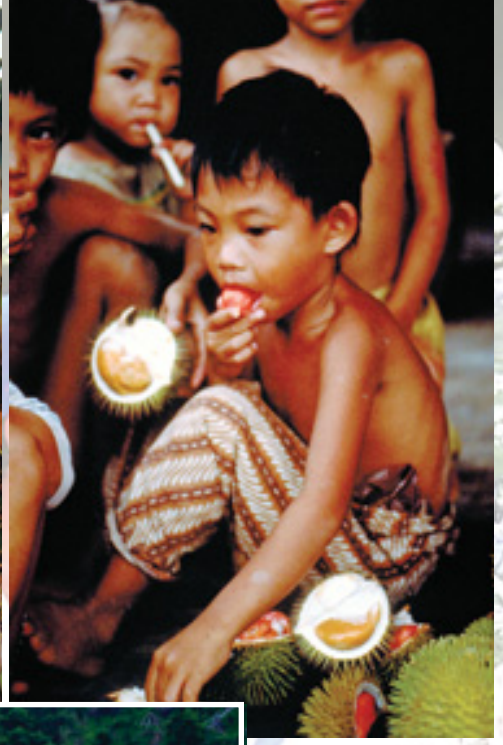
This caricatured misperception of shifting cultivation and the related partition of shifting cultivators in 'good guys' and 'bad guys' is echoed by a large part of the scientific and donor communities (see the first rationale of the Consultative Group on International Agricultural Research–based Alternative to Slash and Burn (ASB) initiative)[3], as well as by NGOs working for sustainable development. In Indonesia and the Philippines, for the combined sake of social development and forest conservation, it serves as a justification for national policies that promote the conversion of 'traditional farming' to intensive sedentary farming, the resettlement of small groups living in the forest to large villages on forest margins or the establishment of development projects based on large-scale industrial agriculture. It also supports policies and projects that promote 'good forest managers' (a few groups of emblematic 'forest people' like the 'Dayak'—which is not an ethnic group, but a common appellation for 'people of the interior'—in Kalimantan) through participatory forest management and devolution processes, while trying to find alternative resource management models for the bad 'pioneers' (most swidden farmers).

One of our major conclusions is that swidden farmers (shifting cultivators), who constitute the bulk of actual day-to-day forest users, are also the most imaginative and the most innovative forest managers and cultivators, and that their forest management systems should inspire more widely the theory and practice of forest management in general. These points are discussed in more detail in a later chapter.

2. Clarte 1966; Spencer1966; Pelzer 1978; Dove 1983.
3. Sanchez *et al*. 1993.

4. The forest is not only for subsistence

NGOs advocating for the rights of forest communities often claim that forest resources are essential for the subsistence of local people. This emphasis on the subsistence function of the forest conceals the facts that local communities, as any other economic actor on the forest scene, often manage forest resources for commercial purposes and that the sale of forest products constitutes a substantial share of their cash income.



Emphasis is regularly put on the importance of forest resources for the subsistence of forest people. Forest foods in particular are thought to be essential to balancing the local diet.

But

Local people also manage forests in order to get income. For example, they organize expeditions to collect eaglewood, a forest product that provides important, though quite irregular and unpredictable, amounts of cash income. Cash from forest products is used to purchase manufactured goods.

Forest people are thought to follow traditional lifestyles and live deep in the forest, having limited contact with the outside world.

But

Most people managing forests are connected to the modern world through their economy and culture. They use manufactured products, are connected to large media communication networks, and have lifestyle aspirations influenced by the outside world.influenced by the outside world.

In Indonesia and the Philippines, the cash benefits obtained from 'forest collection' and 'forest culture' largely exceed the value of locally consumed forest products. In some of the surveyed villages, they may represent the only source of cash income (for the Batak in the Philippines or the Talang Mamak in Riau). Among important commercial products, rattan, which is second only to timber in terms of traded volume and national income in Indonesia, represents the most 'universal' forest product collected for trade (rattan collection was present, though sometimes sporadically, in all the surveyed villages). In all surveyed villages it constitutes a relatively stable source of cash income. Honey represents a good commercial product, which constantly gains in value (five of nine sites). In many of the surveyed villages, timber, though its access is often legally restricted for smallholder farmers, presently represents the main source of cash. Timber extraction or production was developing in all the surveyed sites. In addition to these regular products, Indonesia and the Philippines harbour some of the most valuable forest products in the world, prices of which reach several thousand dollars per kilogramme of product: sandalwood in eastern Indonesia, eaglewood in Sumatra and Borneo, and animal products such as birds' nests in Sumatra, Borneo and Palawan. These high-value products occasionally provide large amounts of money to villages. (We have documented the sandalwood decline in western Timor, eaglewood dynamics in East Kalimantan, and birds' nest business in Palawan, Kalimantan, Java and Sumatra.)

The misperception of subsistence versus commercial use of the forest in local communities is used to justify the allocation of concessionary rights to timber and other valuable forest products to outsiders, which tends either to lead local people to engage in illegal harvesting or to lock them in the management of marginal non-timber forest products. Integrated conservation and development projects, as well as community forestry projects, most often remain focused on the development of subsistence or low-value products (among them the universal 'weaving mats and baskets' projects), excluding those that could represent a real economic challenge for local people.

5. Forest communities and the global world economy

The myth of social and economic isolation of forest communities is still strong in spite of mounting evidence showing that almost all forest people have developed close connections with the outside world through trade and migration[4].

In island South-east Asia, the involvement of forest people in long-distance trade networks (mainly to China) is mentioned from the third century B.C.[5]. During the ninth century A.D., the trade in forest products gained in importance with the development of

4. Dunn 1975; Hutterer 1988.
5. Dunn 1975.

the Indian maritime kingdoms (the Srividjaya Empire) and the spread of Islam, which opened new trade roads to Arabia and Yemen. European colonisers arrived in the region during the sixteenth century in search of spices (cinnamon, clove, nutmeg, pepper), which were, at that time, collected from natural forests. Through the colonial empires, forest people's links to the occident increased. Throughout the nineteenth century forest people found themselves linked to the early development of the Western industrial revolution through products like latex and oleoresins[6]. They have since been affected by the replacement of many of these products by chemical substitutes, starting shortly after World War II. Most of the forest products being extracted and traded in the early twenty-first century are still traded on the international market. Birds' nests and bezoar stones, eaglewood, rattan and resins, as well as gold or plant chemicals, and now 'indigenous knowledge', directly link forest dwellers to the global economy and to the fluctuations of the U.S. dollar, to the conversion of China to economic liberalism, to financial operations of corporation fusion or national economic bankruptcies, and to the Rio Convention and the Kyoto Protocol.

Nevertheless the myth of isolation persists among national policy makers and international donors. It supports all the official enterprises of 'human welfare development', which often become enterprises of cultural homogenization.

6. Sellato 2001.

6. Forest people are more interested in non-timber forest products than in timber

Considering the abuses and damages linked to timber extraction, non-timber forest products (NTFP) have been promoted during the last 15 years from the status of 'minor forest products' to that of 'good forest products', whereas timber has been somehow considered an evil commodity, management of which is incompatible with sustainable forest management[7].Forest management based on NTFP development is now commonly supposed to be the best strategy to solve, altogether, the problems related to profitability and sustainability of natural resource management, poverty alleviation and biodiversity conservation[8]. NTFP development presently dominates small-scale projects for sustainable local forest management, including most social forestry projects, and all integrated conservation and development projects (ICDP)[9].

The reality shows that forest people do manage timber, either through extraction or cultivation. They need timber for their own use, but they also need it as the potentially best source of cash income obtainable through forest management.

Is the distinction between NTFP and timber a productive one? What are its positive or perverse consequences? Why should not farmers engage in timber management in parallel to professional foresters?

7. CFAN 1993.
8. Shanley *et al*. 2002.
9. Panayotou & Ashton 1992.

We have carefully studied local forest management activities linked to both timber and non-timber products and illustrated the fact that current local forest management indistinctly concerns NTFP and timber. As timber from natural forests is being exhausted, timber management by local people is gaining in importance all over the region. Our studies have shown that, if local dynamics of timber extraction from the last forest patches are highly unsustainable, timber management in cultivated forests is always conducted in a sustainable way and therefore bears high prospects for further development of local forest culture.

Whereas timber, as a category of products of different qualities, is quite uniform from both a management and a policy point of view, NTFP do not constitute a homogenous category either from a biological point of view or from management, economic or institutional considerations. They range from quickly renewable resources to almost non-renewable ones. Harvest of NTFP may entail very little damage to the plant from which it is collected, as in the cases of leaves, latex and fallen fruits, or will kill it, as in the case of essential oils from wood like sandalwood and rosewood. They include products without market value, such as vegetable leaves locally used as greens, as well as highly coveted and priced items, such as fragrant sandalwood and eaglewood, birds' nests and bezoar stones. These differences are directly expressed in local management practices, public policies and regulations on collection and marketing and are as significant as the ones that can exist between a given NTFP and timber.

In the practice of forest development in South-east Asia, forestry policies, regulations and practices totally exclude local people from the commercial management of timber, and from the benefits of timber exploitation, which appears to be highly detrimental to local development. Our studies have shown that local people cannot accumulate much capital if they stick to the collection of NTFP in purely extractive systems, even for high-value NTFP where most of the benefits accrue to either external collectors or traders. However, they have recently reaped quite substantial benefits from the collection and local sale of logs. Unfortunately, timber extraction from natural forests is illegal and is therefore conducted as a mining and totally unsustainable activity.

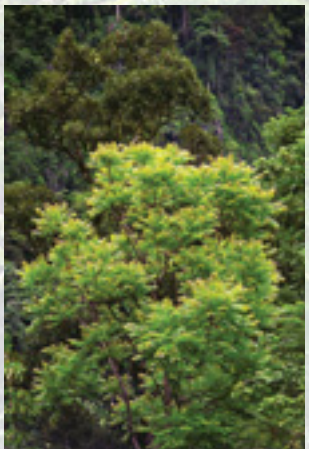
Present examples of smallholder-cultivated forests in the region are founded on the cultivation of specific NTFP (benzoin, cinnamon, damar, fruits, rattan, rubber etc.). For decades, timber from either cultivated or self-established trees was locally used as a by-product. As its economic importance on local and regional markets has considerably increased during the last decade (a consequence of timber from local forests being exhausted), timber has become an important product of local forest culture. In most of the existing examples, timber production is increasing through the utilization of over-aged NTFP species, the fostering and harvesting of self-established forest trees or actual cultivation of timber species. Because the marketing of timber outside district boundaries is forbidden, the price local farmers get for their timber is far below national market prices. But even with these adverse policy conditions, in all documented cases, the marketing of timber can easily double farmers' income.

Local people do not restrict their forest management activities to the exploitation of non-timber forest products, but exploit and manage timber for their own needs as well as for income generation. Because regional policies disfavour timber exploitation by local communities, most local exploitation is illegal.

The damar cultivated forest is rich in naturally regenerated timber species.

Cultivated forests provide a large part of the locally exploited timber. Timber management in these forests has proven to be quite sustainable over decades.

Naturally regenerated *Peronema* trees in local oil palm gardens.



Timber from overaged rubber cultivated forests, sold to furniture industries in the West.

The common distinction between timber and NTFP prevents the development of discourse on timber management by smallholder farmers or forest collectors. As a consequence, the likelihood that timber may well be the number one crop for farmers in the twenty-first century is totally concealed. The prospects for developing sustainable farm cultivation and marketing of timber through multipurpose cultivated forests, which has proven not only possible but also positive, are blurred.

Dissociating timber from NTFP in scientific forest research, in international discussions on forest management and in development projects indirectly contributes to reinforce policies that deprive local communities from the large benefits of timber management. It brings a fresh and 'scientifically neutral' justification of the historical evolution, which has locked local people into the management of NTFP, whereas timber harvesting, trade and utilization were the privilege of professional foresters.

We have accumulated enough evidence from the field to conclude that policy and technical support of forest development at a local level will be more sustainable if they are based on a close integration of NTFP and timber in the same management units. This is particularly true for the success of forest culture on farmlands.

III – Managing wild resources:

Hunting, gathering, and extractivism in natural forests and on farmlands

1. How does indigenous forest management integrate extraction activities?

Extraction concerns the collection and utilization of natural stocks of forest resources. Extraction per se does not constitute a management system, but, embedded in local frameworks of representations and beliefs, knowledge and practices, customs and institutions, it refers to three broad categories of forest management: timber extraction by logging firms, hunting and gathering by local communities, and 'extractivism', or the extraction of NTFP by individuals or small-scale entrepreneurs for trade[1].

For centuries, people of tropical rainforests have been collecting wild forest resources for their subsistence. In South-east Asia, subsistence gathering is still important. Hunting, fishing and the gathering of plant foods and medicines still provide an important part of the diet and health system of rural people in the region, and the forest still provides essential plant material for household use—leaves, lianas, resins and latexes, bark and palm fibres as well as timber and firewood. Besides collecting forest resources for subsistence, rural people also visit the forest to get cash. In South-east Asia, collection for trade (extractivism) represents an important branch of forest gathering. Extractivism is not a new practice in South-east Asia, as it emerged as far back as the prehistoric period with the development of inter-island exchanges based on animal products and resins[2]. It slowly flourished and became the main economic activity in the region with the development of first Chinese, then Hindu and Arab trade routes. Products traded ranged from parts of animals (bezoar stones, birds' nests, rhino horn) to spices and resins for medicinal and ritual purposes (benzoin, camphor, eagle wood). Colonial trade with Europe gave a new dimension to extractivism, first with spices (cinnamon, cloves, nutmeg, pepper), then with raw material for industries, especially resins (copal, damar, turpentine) and latexes (gutta percha, rubbers)[3]. Since World War II, many of these products have lost their economic importance, and the present extractive economy in the region has developed around two important poles: rattan, which represents the largest forest activity, in volume and benefits, after timber; and luxury products like birds' nests and dragon's blood (eaglewood)[4]. Collection of natural chemicals for the pharmaceutical or insecticide industries is emerging as a promising industry.

We have encountered extractive activities for either subsistence or trade in all the study sites of the project. ***Extraction is not a uniform strategy throughout the study areas, but is adapted to the structure of the local farming system, to market and policy imperatives and to the individual and collective strategies of local communities***. Various

1. Fearnside 1989, Allegretti 1990, Salafsky *et al.* 1993.
2. Dunn 1975.
3. Michon & de Foresta 1997.
4. Sellato 2004.

categories of people engage in extraction for a variety of reasons and in various ways. The impact on the ecosystem or on particular resources is also highly varied, as are the social and economic consequences. However, in all cases, ***these activities are not exclusive, but are integrated into agricultural and other activities***. In many cases, ***these activities are not carried out exclusively in natural forests, but also (sometimes almost exclusively) on agricultural territory, in predominantly anthropogenic or cultivated vegetations***. How does this integration occur, especially within household and village economies? How do forest activities and agriculture relate? What are the important points of these complementarities between forest collection and collection on farmlands? How far do rural people of the twenty-first century still depend on 'wild' resources?

Various ways: Even if it is impossible to draw a single general model of forest extraction for the region, some general tendencies have been analysed:

- There is a *continuum of activities* between a 'generalist model', implying regular and diversified, multipurpose activities, and a 'single-focus model', where the forest is exploited for a particular product or to meet a particular need. The generalist model is now uncommon as a dominant mode of production and mainly concerns people living in deep forests with rudimentary swidden cultivation systems (Punan in East Kalimantan and Talang Mamak in Sumatra, as exposed further in this chapter). Traces of it can still be found in most rural areas, however, where collection of wild plants, hunting and fishing are still practiced either regularly or seasonally as a complement to regular agricultural activities. Single-focus extraction is more frequent, either regularly or sporadically, and often co-exists in a given society with the generalist model. For example, nomadic Punan in East Kalimantan combine generalist harvesting for sago, game and fruits and specialized extraction of commercial products as a source of cash income.
- There is a general, and ancient, tendency to *cultivate and domesticate* interesting products (on this particular point, see Michon *et al.* 1998). Domestication has been achieved in a long process over the last centuries for most of the local fruit species, for sago and sugar palms as well as for internationally traded spices (cinnamon, clove, nutmeg, pepper). More recently, the cultivation of key commercial forest products such as small cane rattan, benzoin, damar and rubber in restored forestlike gardens has fostered a semidomestication process (as we will abundantly detail in this volume). New attempts for local domestication are being developed nowadays with birds' nests (see this volume), large cane rattan, and timber (see this volume).

A variety of reasons: From an economic point of view, forest extraction can be characterised as follows:

- Local people usually maintain forest harvesting, especially commercial extraction, by choice rather than by necessity. Even for poor and isolated forest dwellers the practice is considered an alternative or complementary option in the economic portfolio, and it is developed in different types of livelihood strategies. Forest extraction is usually opportunistic (i.e., practiced when it is considered more profitable than other options). The importance

The meadow of the sagu palm provides starches.

The forest is often the main provider of protein foods like game and fish.

Forest fruits in South-east Asia exhibit an astonishing variety.

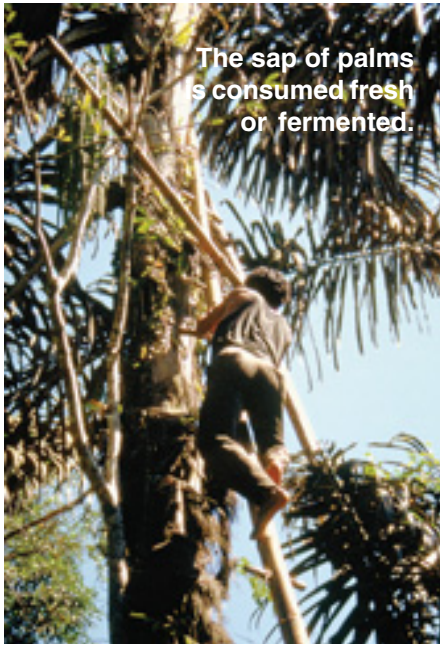
Durio kutejensis

Wild honey is an important traditional forest food.

Mangifera sp.

Dialium sp.

The forest provides vegetables, here bamboo shoot.



The sap of palms is consumed fresh or fermented.

The forest provides material for building . . .

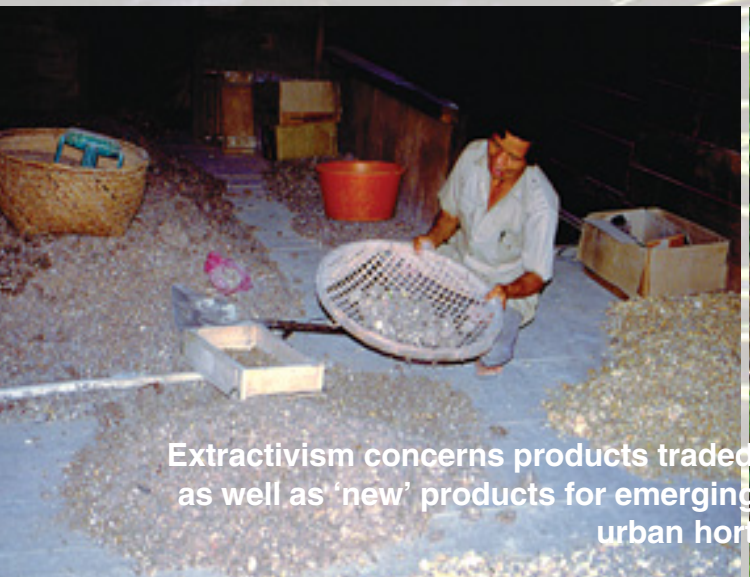
Harvesting for subsistence

. . . and for daily-use handicraft, here rattan

Extractivism is indifferently practised in the forest (rattan palms, left) and in open vegetations (alang-alang grass, right).

Forest extraction for trade

Extractivism concerns low value species (leaves for mat weaving, above) as well as high value products (sandalwood, middle, and gold, below).



Extractivism concerns products traded for centuries (like damar resins, left) as well as 'new' products for emerging markets, like the tree fern (right) for urban horticulture.

given to forest extraction usually varies along the life cycle and the social category of the household.

- In shifting cultivation areas, subsistence harvesting represents the main source of food (except for staples) during the swidden season, providing protein (fish, game) and vitamins (fruits, vegetables). It also represents an important source of building materials and materials for productive activities and home handicraft.
- Forest extraction for commercial purposes represents an important starter or transitional activity for bachelors or newly established households with little patrimony. In areas where the management of a cultivated forest represents the main activity, extractivism brings cash income during the few years between the plantation of the forest plot and the first harvest.
- Extractivism is used by some farmers as a strategy for capital accumulation, especially with high-value products such as eaglewood, logs and large cane rattan.
- For the majority of farmers, commercial extraction represents either an additional or a seasonal source of income, which is particularly useful in times of agricultural recession. Social and economic welfare is not usually achieved through forest collection, but mainly through forest cultivation. In other words, the majority of people do not get rich if they stick exclusively to extractivism.
- The importance of forest products in the economic life of households has in most areas declined during the last 20 years, reflecting new economic opportunities (better market access, temporary migration, wage labour, commercial agriculture or forest product cultivation) and farmers' negative perception of forest-related activities.
- Nevertheless, forest extraction and cultivation still represent a major source of livelihood and survival in times of crisis, as illustrated by farmers surviving the 1997–1998 drought and associated economic crisis thanks to the forest (as illustrated in chap. II section 6 for Muara Bungo; see Clément *et al*. 1998; Clément 2000).

Various categories of people: The degree of involvement in forest collection varies among social groups.

- It is mostly women who carry out the collection of subsistence products. Men preferably engage in hunting, wood cutting and commercial collection.
- Commercial collection involving long expeditions deep into the forest is preferentially practiced by

  —strong bachelors who prefer forest collection over migration or wage labour in order to obtain sufficient capital to start their own enterprise or establish their own household

  —specialized or professional collectors, who permanently or temporarily set aside their agricultural activity. They usually collect illegal products (e.g., timber or tiger skins) or products that require a certain knowledge or *savoir faire* such as dragon's blood, eaglewood or fish.
- There is strong competition between local collectors and outsiders, especially for high-value products such as birds' nests, eaglewood and timber. Nontraditional products are usually collected by outsiders, as local people ignore or

are unaware of the market niche. (In Riau, nontraditional products targeted by outsiders include turtles and singing birds.) Local farmers may join in the collection of these nontraditional products, but when they do so, the resource is already declining. This kind of nonlocal extractivism is almost always unsustainable and conducted in a 'collect and run' style.

Various dynamics and various impacts: The evaluation of the impact of subsistence gathering and extractivism on the ecosystem depends on the type of activity considered and on the scale (in space and time) at which the analysis is carried out. Broad conclusions can be drawn, however, on global dynamics of forest extraction in the region.

- Extraction for subsistence purposes is usually quite sustainable, having little negative impact on individual resources and the ecosystem because demand for subsistence products is relatively low compared with the availability of the targeted resources. In times of crisis, however, the impact may become temporarily negative as pressure on wild foods and materials increases. As long as crises occur far enough apart in time, individual resources generally have time to regenerate.
- Extraction dynamics linked to extractivism are often destructive for the targeted resource (as illustrated further for the Toba Batak highlands). In boom periods, incentives for harvesting as much as possible (immediate profit, competition with outsiders, abuse of power by external authorities towards local collectors and related fears of being evicted) are obviously higher than incentives for sustainable management. This pattern is strongly correlated to the highly fluctuating and fleeting nature of external demand for forest products conveyed by outside traders, e.g., a given product may be in high demand one day, having not been a few days earlier, and then a few months later is reduced to its valueless state once again. Uncertainties introduced by abrupt changes in policies, such as the imposition of concessionary or auction systems for, say, the exploitation of edible birds' nests, or the creation of a unique buying body (as the buying system established for rattan in the late 1980s) often appear when a product gains in value. They may deeply affect prices paid to producers and lead to the collapse of the collection, as we will illustrate for birds' nests. Farmers react to this uncertainty by maximising the profitability of extraction, setting aside any long-term concern for sustainability, as there is no related intrinsic sustainability in the market.
- Nevertheless extractivism, considered an economic activity made of a succession of collecting booms targeted at individual resources that change in time, appears to be quite sustainable over long periods of time. From the times of early trade in forest products until now, extraction for trade has persisted as a profitable economic activity with the permanence of a large stock of forest resources.
- The main threat to the future of extractivism is not the rate at which the activity is carried out, but the present forest conversion to non-forest uses.
- Timber extraction (usually illegal) for local sawmills has boomed since 1996 (as observed at all Indonesian locations). It tends to replace all the other extractive activities where it develops. The observed rates of log extraction lead us

to conclude that this activity is highly unsustainable. All the valuable species are collected, independently of their diameter, and the most valuable have already gone.

- Extraction dynamics are mainly determined by traders' strategies and by government policies.

Conclusions

1. In any support programme, forest extraction as a management system should be considered for the long term and in a global environment relating local dynamics to national and international market and policy trends. The global tendency of present extraction habits for trade is to be nonsustainable in the short term, but to remain globally sustainable in the long term. As an economic strategy, 'extractivism' is maintained as long as the forest itself exists. It is therefore more important to foster the maintenance of a diverse forest that can be used in a flexible way than to base a project on the extraction of a unique product, and to work on a policy environment that would give more incentives for sustainable management of individual resources.

2. The complementarity between forest and agriculture is still essential in all rural areas where farmers do not have enough capacity for income accumulation and are still quite exposed to risk. To retain this forest–agriculture complementariness, it is essential to maintain patches of natural forests or enough 'wild' or forestlike spaces on farmlands (i.e., niches for wild plants in cultivated spaces), especially until other strategies can be used on farmlands.

2. Is the concept of extractive reserves as developed in the Amazon region useful in the South-east Asian context?

Extractive reserves are large areas of undisturbed forest given in long-term concession to indigenous communities for the exclusive practice of extractivism and forest collection for subsistence[5]. Conversion to agriculture is strictly controlled. It is usually forbidden, or at best restricted to the development of small home gardens around dwellings. The benefits of extractive reserves are twofold: they serve as conservation areas, while allowing local communities to retain their authority over the protected forest and to draw their subsistence and cash from it.

Can conservation areas of this type be conceived in the South-east Asian context?

Our conclusion is that several factors linked to the reality of forest extraction in the area render the Amazon model quite undesirable from the point of view of local communities.

- Unlike that reported from the Amazon region, and in contrast to large-scale timber harvesting, forest harvesting practiced by local people in the region is not a standalone activity. It is always associated with one form or another

5. Allegretti 1990

of farming (sedentary or shifting cultivation) and cannot be dissociated from the management of tree gardens and planted forest resources. Complementarity between extraction and farming concerns economic as well as social and cultural fields.

- Collection of wild products is not restricted to areas of primary forest, as already mentioned. A large part of the activity, and especially generalist harvesting for subsistence, is practiced close to the villages, in secondary forests, fallows, field borders and roadsides or in plantation forests established by the farmers themselves. Extraction patterns and purposes vary with each vegetation type. Primary forests are mainly visited for the collection of commercial products, and extraction practices tend to be quite unsustainable because of a combination of economic reasons (quick market and traders dynamic) and policy factors (conflicts in the public forest domain between locals and outsiders). Forest gardens and fallow vegetation are the main providers of plant material for domestic uses and of plant foods. Collection is more careful and therefore more sustainable.

For these first two sets of reasons, extractive reserves in the region should accommodate large areas 'disturbed' by local farming activities and allow the evolution of these farming areas.

- The management of forest resources in the wild is governed by the superimposition of national forest regulations over local customary systems. The establishment of logging concessions, conservation areas and, more recently, large-scale industrial plantations has displaced 'traditional' extraction dynamics. Industrial projects do affect farmers' access to the wild resources, and farmers perceive the restrictions imposed upon their forest collection activities in a highly negative way, which has a direct negative impact on their respect for customary as well as national rules.
- The growing importance of outsiders in the collection of valuable forest products increases this perception. The main consequence is that most of the commercial collection is not governed by any regulation —or by any ethics. More recently, the fear that most of the forest will be either converted to non-forest uses or set aside for strict conservation, with the probable exclusion of local people in either case, or that outsiders will anyhow capture most of the benefits of forest resource exploitation, combined with current economic and political uncertainty, has led local people to either plunder their resources or sell them at the best price to outsiders.

For the last two sets of reasons, local customary systems concerning forest management, including the strict control of outsiders, should be acknowledged and enforced.

Conclusions

Under these conditions, it seems unlikely that the much discussed concept of 'extractive reserve' can be of any relevance in the region, whether in Indonesia or the Philippines. Compared to the Amazon, the remaining large tracks of forested areas in the region are much coveted by all kinds of actors who interact with different types of management practices and purposes to the detriment of sustainability. We do think that hopes for sustainable forest management can come from the local models of forest domestication and cultivation rather than from extraction systems.

3. The history of forest extraction dynamics in the Bulungan regency, East Kalimantan: from the unsustainable extraction of individual resources to the sustainability of extractivism as a whole

Bulungan is the main NTFP producing district in East Kalimantan Province. (For a history of NTFP trade in East Kalimantan, see Peluso 1983; for a critical analysis of NTFP extraction in Bulungan, see Sellato 2001.) Extractivism in Bulungan is characterised by a superimposition of various dynamics related to individual products. The sustainability of these dynamics depends primarily on the biological characteristics of the resource as well as on market constraints. According to our analysis[6], extraction dynamics are determined by two combined sets of criteria, defined as follows.

1. Criteria related to fluctuations of external demand over time, defining the degree of permanency of the practice, fall into three broad categories:
   - activities that have steadily survived over the last decades
   - activities that appeared (or boomed) recently
   - activities that did not survive or hardly survived because of market displacement for the product
2. Criteria related to the intensity of the collection practice and its impact on the renewal of the resource, fall into three broad categories:
   - activities leading to the (local) exhaustion of the resource or even the extinction of the species
   - activities leading to cyclical reduction in resource availability
   - activities allowing the conservation of the resource

The combination of these two sets of criteria allows for the definition of several striking extractive dynamics.

1. Extraction driven by constant demand and resulting in species extinction

The best example of collection for trade that led to extinction of the species is that of the ***rhinoceros horn***. Rhino (*Rhinoceros sumatrana*) horn for the Chinese market was, for centuries, one of the most valuable forest products in Bulungan as well as all over Java, Borneo and Sumatra. Increasing rates of extraction compounded by the slow reproduction dynamics of the animal has made the species reportedly extinct in Borneo over 40 years ago.

6. Katz *et al*. 2002.

The other highly valued animal product traditionally traded with China for which the constant increase in demand is threatening species survival is ***bezoar stones***, collected in the bladders of monkeys (*Presbytis hosei*) and porcupines (*Hystrix brachyura*).

2. Extraction stopped by lack of market

Many of the traditional products of extractivism in Borneo are not collected anymore, not because they are rare or scarce, but because their market has failed.

Camphor is an oleoresin from the tree *Dryobalanops aromatica*. It used to be a luxury product exported to China, India and the Middle East since the sixth century[7] and harvested in a sustained way for at least 10 centuries, in spite of drastic collection methods (the tree must be felled). International demand increased during the course of the nineteenth century, threatening the very existence of the species in Borneo, but before any solution was found, Bornean camphor was partly replaced by Chinese camphor (*Cinnamomum camphora* and *Blumea balsamifera*, produced in a more sustainable way through cultivation in China). But by the end of the 1930s, *Dryobalanops* had already become more important for timber than for camphor. (Camphor wood is one of the three major timbers in Kalimantan.) Some camphor was still exported from the area until 1980, but quite likely it came from loggers, not local collectors.

The collection of ***gutta perch***a (the latex from *Palaquium* spp. and *Payena leeri*) stopped not because of the replacement of the wild species in Borneo by trees cultivated elsewhere, but because of the displacement of the market by a substitute resource. *Gutta percha* used to be an essential coating for European submarine cables. Between 1840 and 1915, it was the main product extracted in the Bulungan area, as in the whole of Borneo. The high demand from European industries and the common harvesting practices that entailed the death of the collected individuals (most trees were cut and then tapped) almost drove the species to extinction before World War II. But the market was suddenly displaced by the increasing importance of Para rubber from Indonesia, and *gutta percha* collection stopped. *Palaquium* trees are now common again in the area and sometimes tapped for local purposes.

The collection of ***damar*** (*Shorea* and *Agathis* resins) stopped because of the generalised use of chemical substitutes. Damar was the most important forest product in the area from World War II until the 1960s. Collection entailed the rarefaction of the product but never threatened the species itself as the resin is collected from either the base of the tree or the trunk itself, but not through tapping or felling of the tree. After 1960, the price for damar suddenly decreased because of the increasing use of petrochemical resins. Though still abundant, damar is no longer collected in the Bulungan region.

3. Extraction that recently boomed and might lead to exhaustion of the resource

Two products that have recently acquired an important market value and are heavily sought after are eaglewood and birds' nests. Having been managed and traded for centuries, both products are presently threatened by exhaustion as prices are starting to skyrocket.

7. Burkill 1935.

The ***edible nest*** of the cave swiftlet *(Collocalia* spp.*)* is a common ingredient in Chinese medicine. It is an item of longstanding trade with China, but its price boomed in the mid 1980s, probably because of the opening of the market with continental China. Traditional cave management systems have since been replaced by short-term (maximum one year) concession rights bought through auction. This measure, which was meant to protect the resource, is in fact causing its depletion as it pushes concession holders to harvest as much as they can and provides no incentive for sustainable practices.

Like camphor, ***gaharu*** or eagle wood, also used for medicine, has been exported for many centuries. The demand increased significantly at the end of the 1970s, when the supply of high quality *gaharu* from Vietnam and Cambodia was cut because of the political situation[8], while demand from Saudi Arabia and the Gulf Emirates increased after the oil boom. In Bulungan, it seems that *gaharu* has always been collected, but its importance first slightly increased in the mid 1960s, and more seriously in the early 1990s. The *gaharu* boom attracted many outsiders to the area, who participated in large expeditions to the interior forests. As a result of the '*gaharu* rush', the product became much harder to find after only two or three years, and by 1995 traders had stopped funding high cost expeditions. Looking for *gaharu* now belongs to the past.

4. Stable, though cyclic extraction

Rattan extraction dynamics follow cycles by which intensive periods of harvesting alternate with periods of low levels of collection. Rattan has always been traded in the area, but it gained importance in the late 1970s. When rattan started fetching a higher price, many outsiders also went into the forests to collect it. Just like *gaharu* it became more and more difficult to find. Since the price collapsed in 1989 as the result of an export ban, rattan collection declined, and it is now growing abundantly in the region again.

8. Peluso 1983; Jessup & Peluso 1986.

Conclusion: unsustainable extraction but sustainable extractivism?

The history of extractivism in Bulungan shows that, except for rattan, extraction of individual products appears to have been, for either biological or market reasons, quite unsustainable over time, going through boom periods and through recessions or exhaustion. The historical evidence questions the supposed intrinsic 'sustainability' of extractivism carried out by local people in the whole of Borneo as well as all over Indonesia. Apart from a mythical 'environmental wisdom' of indigenous people, there is no obvious reason why extraction for trade should be sustainable rather than practiced in a mining mode. In normal periods, sustainability usually happens by accident, as demand-driven collection pressure does not exceed the renewal rate of the resource. But in boom periods, incentives for harvesting as much as possible obviously run contrary to any potential arguments for sustainable management. These incentives include hopes for immediate gains, of course, but increasing competition with outsiders also eradicates any concerns for sound management. The obvious abuse of power by local or regional authorities over local collectors, and the collectors' related fears of spoliation or eviction, also plays against sustainability. Past experience of collectors, based on the marked instability of demand for forest products, has shown the relevance of opportunistic habits like switching from one product to another for income generation. Disincentives for sustainable management have increased with the recent fears that the forest will be logged or converted and that sustainability of forest management as a whole is not a relevant concern anymore.

As an integral economic and social activity, however, extractivism appears to be highly sustainable over a long time span and over a large geographical area. From the early times of trade in forest products until now, local people in Bulungan have managed to get what they need from the forest, in terms of both products and income. People of the interior of Bulungan district are quite well off, and this clearly is so because of extractivism: some forest products are more valuable than gold. With successive booms in *Gutta percha* and

camphor, then damar, *gaharu* and birds' nests, collectors have managed to stay active and productive for the last 150 to 200 years, relying on more or less constant products like rattan and fruits in times of scarcity. This situation gives interesting insights for further assessment of extractive strategies in our study fields. What should sustainability aim at, sustainable management of individual forest resources or sustainable management of the forest resource as a whole?

4. Extraction of forest products in the Gangsal valley, Siberida, Riau: the permanence of forest extraction as foundation of the economic system

The people of the Gangsal valley belong to the Talang Mamak group, which is usually considered an isolated ethnic group (*suku terasing*). The Talang Mamak used to be forest collectors, but in many areas they have become more or less settled and now engage in rice cultivation through slash and burn systems. The Talang Mamak in the Gangsal valley, which still contains large tracks of good forest, live in settled villages, grow some rice in swidden and have started to grow rubber, but they still rely upon the collection of forest products. This forest dependence is nevertheless evolving quite rapidly, in close correlation with the growing importance of rubber cultivation.

Subsistence harvesting targets fish, game, fruits and staples for the daily diet. Though they grow rice in swidden fields, the Talang Mamak still rely on the starchy grains of the sago palm, which provides half of their annual needs in staples. This dependence on wild staples seems to be a choice dictated by taste and work efficiency, rather than a necessity. Subsistence harvesting also includes benzoin, locally mixed with tobacco, and building materials, as well as light materials for agricultural and forest collection activities or for home handicrafts.

Extractivism is an age-old practice, and the Talang Mamak are known to be the specialist collectors of one of the oldest traded forest products from Sumatra, dragon's blood, or *jernang*, a red wax covering the scales of the *Daemonorops draco* rattan fruits. They also collect *jelutung,* a wild latex produced by *Dyera costulata*, which was extensively traded in the eighteenth and nineteenth centuries. Extraction used to be the only income-generating activity in the valley. However, the importance of extractivism in the economic life of households has considerably decreased during the last 20 years. This decrease is strongly correlated to the increasing importance of rubber growing. Villages still actively collecting forest products are those that are just starting to grow rubber, whereas the less involved are those where rubber gardens are already extensive. There is a clear transition from the collection of *jelutung* in the forest, which is still important in the first set of villages, to the cultivation of Para rubber.

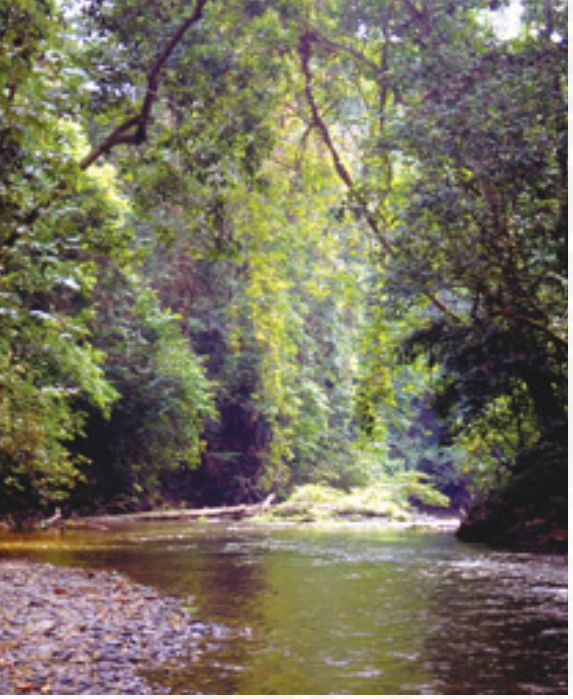
Extractivism is generally used as a complementary strategy in a system dominated, or starting to be dominated, by rubber production. It compensates for regular seasonal decreases in rubber production as well as for unexpected price drops, and it provides a regular additional source of cash income in the economic portfolio of households. There are obvious differences in the management of the different forest products. Whereas *jelutung* tapping appears to be a relic activity present only in villages with young rubber gardens, rattan collection is more adaptive and flexible. Dragon's blood collection is a more specialised activity that keeps a relatively constant importance, probably because of its high value per unit of weight and historical affinity of the Talang Mamak for the product. The Talang Mamak tend to stick to 'traditional' forest products (rattan, dragon's blood, *jelutung*), and collect them in a sustainable way, in contrast to extractivism carried out by outsiders, who plunder fancy and high-value products such as *gaharu* a few years ago, and more recently turtles, songbirds and timber. The Talang Mamak are slow to understand the profits obtainable from aggressive extractivism, and when they finally decide to join in, the resource is already declining, and the profits they make are meagre.

Extractivism is important as a starter activity for newly established households. It brings income during the few years between the establishment of a rubber garden and its full production. The social and economic welfare of established households, however, is usually not achieved through extractivism, but mainly through rubber cultivation. In other words and as stated earlier, people do not get rich if they stick exclusively to extractivism, which probably explains why extractivism is perceived as a backwards activity in comparison with rubber growing.

Conclusion: Is the extraction of forest products a declining base for household economy and a devaluated mode of subsistence?

Even though it represents the main, if not the sole, economic activity in the valley, the extraction of forest products, and in particular commercial extraction, is rapidly declining. This decline stems from the negative perception of the activity among the practitioners themselves and among the surrounding social groups of Melayu farmers and village traders. This negative perception concerns the economy of forest subsistence and extractivism, as benefits of extraction are perceived to be less important than those that can be obtained from rubber cultivation and more difficult to get in terms of labour and physical effort involved. The low economic profitability includes collectors' perceived lack of bargaining power when facing organised traders and fluctuating international markets, even though most villages have refused to accept any credit from local traders in order to keep some 'freedom'. But the negative perception also concerns the social and cultural value of the activity, which is considered 'backwards'.

As for all isolated forest tribes in Indonesia and the Philippines, the gradual abandonment of the collection of forest products epitomises the current economic, socio-cultural and political transition of the last true 'forest people' in the region as they witness the perceived benefits linked to the 'development' of their neighbour farmers. The collection of forest products might be important for identity claims, but it is undesirable as an integral economic activity.



The Gangsal valley is still forested.

Acess to villages is by river.

Fruit trees surround villages.

A recent activity, the cultivation of swidden rice provides for half of the annual starch needs.

Benzoin is a culturally important forest product in the Gangsal valley. Besides being used in religious ceremonies, it is mixed with locally grown tobacco and smoked.

Wild fruits (here *Baccaurea* sp.) represent an important part of the diet.

Forest foods are essential for the Talang Mamak.

Starch extracted from wild sagu palm provides half the annual need of staples.

Hunting is a major activity and provides the totality of the proteins.

Extractivism in the Gangsal Valley.

Rattan is still an important income-generating forest product.

Outsiders are initiating the Talang Mamak to the collection of new products, like these turtoises to be sold in Jakarta and Singapore markets.

Extractivism is the major cash-generating activity among the Talang Mamak. It mainly concerns traditional forest products, traded for centuries from the eastern Sumatra lowlands.

Benzoin is also traded locally.

Dragon's blood is among the oldest products traded from Sumatra by forest people. The red resin covering the fruits of rattan Daemonorops draco is processed into a deep-red wax in China.

The Talang Mamak are still collecting the latex of Jelutung, which was the main product traded from the Sumatra lowlands during the eighteenth and nineteenth centuries, but now has a very limited market.

5. Extractivism as an integral system: the Batak in Palawan

In less than a century, the Batak community of Tanabag, Palawan Island, Philippines, has evolved from nomadic hunting and gathering to sedentary systems. They have engaged in swidden rice production and in trading NTFP formerly collected for subsistence purposes. Almaciga, the resin of *Agathis*, and rattan used to represent the major trade products until the early 1990s, but presently they constitute only 37% of village income. This decrease is a consequence, in particular, of (i) forest resource decrease; (ii) price drop, and the related reluctance to engage in a strenuous activity for a decreasing return; and (iii) strong dependence on concessionaires. These factors drove the Batak to diversify their activities in the early 1990s. Besides off-farm employment, the Batak have taken advantage of locally developing markets in NTFP. They engaged in the commercial collection and direct sale of more 'traditional' products with a high social value, like honey and game meat, which give them more independence and help to better distribute incomes over the course of the year.

The Batak still rely heavily on indigenous knowledge systems for the collection of almaciga and rattan. They have their own rotation system for the gathering areas, whereby a particular portion of the forest is left to regenerate for a period of time —usually five years— before being harvested again. The Batak system of tapping almaciga trees may not be ideal, but they are aware that they should not wound the tree to such an extent that it will die. The sustainability of almaciga and rattan collection is endangered by external factors, among which is the entry of professional collectors from the lowlands. Competition for the resources erodes the strict adherence to positive indigenous knowledge systems, and as lowlanders are gathering rattan from the fallow areas, the Batak are forced to harvest the canes before the usually observed term. Lowlanders introduced the deep wound system of tapping almaciga trees to maximise the oozing of resin, and there were cases of resin poaching from trees the Batak considered their property.

Historically, honey defined the relationship of the Batak with the forest. During their lives as nomadic hunters and gatherers, they used to temporarily settle where honey was abundant. From these spots, they enjoyed other resources available for extraction. Now that they are relatively stationary, honey is losing social meaning, but may be more commercially important. Palawan honey has considerable demand outside the province. Some fly-by-night processors, however, sell the honey in adulterated form, to the detriment of those who sell pure honey. In terms of resource management, the Batak know the factors that enhance bees' honey production and their association with certain tree species, and they have a distinctive way of gathering honey from the hive.

Though extractivism provides 80% of Batak household income, it is difficult to conclude that village economy is exclusively based on extractivism. Contrary to the situation observed among the Talang Mamak, extractivism here is not an integral professional activity, but one among other strategies to ensure food security at the village level. The Batak have kept a highly communal social organisation based on the sharing of all available resources. The economic behaviour cannot be encompassed at the household level, but at the village level. The economic activity of each individual household converges towards the collective subsistence strategy. Agricultural production at the village level is insufficient to provide enough food for all villagers. But income provided by extractivism allows them to balance the insufficiencies of the food production systems. Some individuals produce more than others, in terms of either direct food production or income provision, but individual benefits are redistributed among the community. Whereas many families cannot provide food security, kin food —the interhousehold sharing of food— circles permit resource repartition and, then, the survival of the community.

6. Forest collection and survival in the Bungo valley, Jambi, Sumatra, 1997–98

The extreme drought of 1997–98 in most of South-east Asia under the influence of El Niño, which entailed the almost complete failure of rain-fed rice crops, illustrated how forest collection and extraction can suddenly become essential even to settled farming communities situated on the edge of the forest and engaged in commercial agriculture, communities which, in normal times, hardly rely upon the forest for subsistence or cash income[9].

In the Bungo valley of Jambi Province in the eastern lowlands of Sumatra, farmers live in settled villages, grow wet rice in seasonally flooded lands and dry rice in swidden fields opened in secondary forests, and produce rubber and cinnamon for export markets. Initiated 100 years ago through integration into local shifting cultivation systems, rubber cultivation is the main income-generating activity. It is practiced not in specialized stands but in complex agroforestry gardens, which also include fruit trees, timber species and other useful plants. Few patches of natural forests remain on the borders of agricultural lands. Gathering of wild plants for subsistence usually occurs in the rubber agroforest belt, while some commercial extraction activities take place in the natural forest.

Together with the near-total failure of rain-fed rice crops, the prolonged drought of 1997–98 entailed the collapse of vegetable and fruit production in open fields and gardens, and a sharp decrease in rubber sap flow, which translated into a more than 50% fall in daily harvest. At the same time prices of basic commodities soared, while prices of export commodities

9. Clément *et al*. 1998.

decreased. For all farmers, income sources literally dried up while expenses increased dramatically.

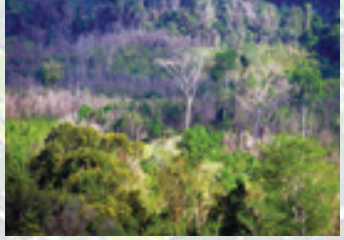
The immediate reaction in all villages along the valley was a generalised rush towards the forest in order to harvest any potentially edible or marketable product available. Collection of forest game and plants significantly improved the villagers' diet, while extraction of forest resources for trade boomed, witnessing both a generalisation of commercial fishing and bird catching and a diversification towards new products including lower-value birds, tortoises, wild cats and bears, but also rattan, the edible pods of *Pithecellobium lobatum* and *Parkia speciosa* of the legume family, which exhibited an unusually plentiful fruiting season, and honey, which also enjoyed exceptional production, allowing 'miracle' harvests for more than two months. The profitability of this quite aggressive emergency extractivism was impressive. For example, a single honey tree, harvested by a group of a dozen people, yielded between 100 kg and 400 kg of honey, which sold at Rp. 4500/kg (about US$1.60 in November 1997), enough to cover the expenses of the families involved for more than two weeks. The gathering of legume pods yielded a daily average of 25 kg of husked fruits, worth Rp. 7500 (US$2.60). Compare these returns with those from rubber tapping, which usually provides about Rp. 4000 (US$1.40) per collector per day.

The sudden burst of forest-related activities was quite different from regular forest harvesting. It was really aggressive and unsustainable, even for a medium term, and it targeted any source of food and cash at whatever costs in human energy. The best illustration of the desperation was the revival of rattan collection, formerly considered unprofitable because of the low market prices and the long walking distances. the emergency extractivism did not involve rubber agroforests, which did not have enough untapped resources or unexplored space to accommodate the needs of whole villages. It did not rely on external demand—but rather stimulated it—or external organisation. It was not confined to a given social group, but attracted all classes and ages, men and women, elders and children, wage labourers as well as landlords and shopkeepers.

Conclusion: the irreplaceable complementariness of forest and agriculture in the tropics

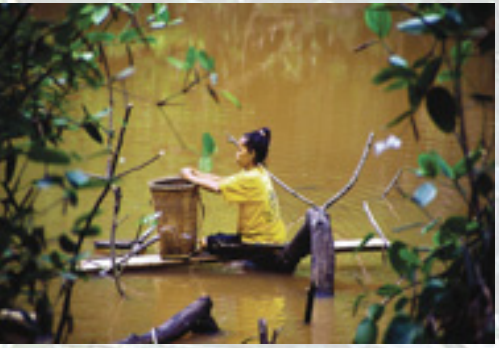
This forest-related emergency strategy developed in many places of Sumatra and Kalimantan during the long El Niño period in 1997–98. It highlights the ultimate complementariness of forest and agriculture in relation to risk management. The buffering role of forests is not only essential in remote forest communities, but persists even in communities where farmers have a diverse production system and are well integrated into a market economy and commercial channels. Indirectly, it points to the invisible consequences of rapid and massive forest conversion, for example, conversion to monocrop tree plantations by estate companies. Most farmers in the rural areas of tropical countries lack the capacity for income accumulation, saving or hoarding. They usually consume all they produce and are therefore highly vulnerable to any unexpected decrease in their regular food production or income. Maintaining patches of natural forests in farmlands in order to retain this forest–agriculture complementariness is essential, especially until other strategies can be found.

When farmers survive through the forest: Muara Bungo, Sumatra 1997



Bush fires followed the drought.

During the long drought of 1997, settled farming communities in Sumatra survived the total loss of their rice crops and the decrease of rubber production by turning to the forest to collect any potentially edible or marketable product available.



Commercial fishing and bird catching boomed, providing important income.

The whole village, including women and children, rushed to the forest in order to survive.

Legume pods (*Pithecellobium* and *Parkia*) were abundant and constituted an important vitamin supply as well as an interesting source of cash income.

Hunting significantly improved the villagers' diet.

The honey season was exceptional and the sale of honey allowed to purchase complementary foods.

Timber harvesting drastically increased during the drought period.

A worker cleans the bark of Lauraceae, used in the manufacture of incense sticks.

Extractivism in the Batak lands

Extractivism in the Batak area is totally opportunistic and driven by the dynamics of traders. Managed so as to get maximum return in minimum time with minimal labour input, it temporarily affects resources negatively. After having exhausted the stock of aromatic Lauraceae bark, collectors switched to illegal timber harvesting and to an intensive collection of singing birds for large city markets.

This debarked Lauraceae tree is not going to survive.

Many of the singing birds collected for city markets die before reaching their destination.

Timber harvesting, though illegal, provides important amounts of money.

The few extractive activities that remain sustainable are mainly 'traditional' ones linked to old markets, like the collection of rattan or, here, of *Uncaria* leaves. The leaves are locally processed to produce *gambir,* a substance locally used in the preparation of betel, and processed industrially as a tanning agent.

7. Extractivism in the Toba Batak highlands, North Sumatra: the opportunistic nature of forest products extraction for settled farming communities

Forest extractivism in the Batak highlands is marked by a succession of generalised rushes on a given fancy product involving the whole population. There is always a strong correlation between this sporadic forest extraction and the intensity of benzoin tapping. In rush periods, benzoin harvesting may temporarily be neglected.

One fancy forest product was the tree bark of *Lauraceae* and related species, presumably for the processing of incense sticks. Tree bark is an easily accessed and harvested resource. Most of the Batak highlands households responded to the solicitation of traders and rushed to any available tree. The rush exhausted the resource, including from saplings, in less than two years, and traders moved to new areas. The next rush seemed to concern singing and ornamental birds for city markets in Indonesia and surrounding countries.

There is also a more regular background of specialized harvesting carried out by 'professional' individuals. This specialized extractivism recently switched from rattan to timber. As far as profitability is concerned, timber is the most profitable of all collected forest products in the area. Timber is risky business, however, as it requires investment for chainsaws and sometimes minivans; labor organisation with a boss, chainsaw operators for cutting trees and preparing boards, and transporters; and proper connections to the authorities in charge of the timber business, as marketing of timber collected by farmers is totally illegal. Because of the high risk, not everybody engages in timber harvesting and there is a marked tendency to maximise short-term profits, which translates into cutting as many trees as possible as long as business goes on.

This form of illegal timber harvesting seems to have generalised over Sumatra and Kalimantan since 1995-96. It was observed in the Riau and Muara Bungo sites, as well as in the Rantau Layung valley in Pasir, East Kalimantan. In most places, it was correlated to the development of illegal local sawmills. With the rates of extraction observed in all the surveyed areas, the timber business was destined to last for a brief period, with most of the more valuable and accessible trees probably gone within two years.

Conclusion: the relation between dynamics of demand for forest products and lack of sustainability of extractivism

Extractivism in the area illustrates the totally opportunistic and unsustainable management of modern demand- and profit-driven forest collection. In the array of economic activities available to benzoin farmers, extractivism is one way of getting the maximum return in the minimum time with minimal labour input. This attitude towards forest collection is strongly correlated to the highly fluctuating and fleeting nature of external demand for forest products conveyed by outside traders. Farmers react to this uncertainty by maximising the profitability of extraction, without long-term concern for sustainability, as there is no related, intrinsic sustainability in the market. Traders also maximise their profits by targeting places where there is ample supply, which they exhaust before switching to another promising place.

8. The rush on birds' nests in East Kalimantan: who benefits from the trade? Lessons from Long Apari

The birds' nests referred to here are the nests produced by several species of swiftlets (*Collocalia* spp.), which are made of the bird's saliva and certain other materials. Several trade categories are recognised, which correspond to either zoological subspecies or varieties, or to local environmental or possibly seasonal factors. The most highly valued is the 'white nest' (*sarang putih*) made by *C. fuciphaga*. Others are the 'black nest' (*sarang hitam*) made by *C. maxima*, 'mossy nest' (*sarang lumut*), 'bald nest' (*sarang gundul*) and 'pink nest' (*sarang merah*).

Birds' nests have been collected and traded in Borneo for centuries, and probably well over a millennium, mainly or solely for the Chinese market. Up to this day, the market for these nests is China and the overseas Chinese communities, where they are used as a tonic and medicinal food. Although macroeconomists call it a residual market, it involves huge amounts of money. While the bulk of Indonesian birds' nests is now produced in 'domesticated' conditions (see section 10 below), people in East Kalimantan still exploit the nests found in natural caves in the forest.

The remote district of Long Apari along the Mahakam river in East Kalimantan is, with the regency of Berau, one of the principal producers of birds' nests in Kalimantan. In 2001, it exported an estimated 30 metric tons, for a value of about Rs. 60 billion.

The Aoheng people living in Long Apari have long known and occasionally collected and traded the edible nests of swiftlets. Because nests fetched low prices, however, the Aoheng preferred to collect other forest products. In the 1930s, Long Apari exported mainly the *jelutung* latex (*Dyera costulata*). The focus shifted to timber in the late 1960s, to *damar* resins in the mid-1970s and then to rattan canes. In the early 1980s, the birds' nest trade in Long Apari was suddenly and powerfully boosted by rapidly rising world market prices. From 1987 on, birds' nests became the most sought-after forest

product, along with incense wood (*gaharu*, *Aquilaria* spp.). Prices rose steadily to reach Rp. 500,000 per kilogramme in 1990, and production rose to between four and five tons per year. This development marked the beginning of deep trouble for Long Apari.

In local customary systems, caves were privately owned by their finders, the rights passed from one generation on to the next. Collectors could freely sell the nests to traders in Samarinda at market prices. In 1978, the regent of Kutai issued a decree on birds' nest exploitation, ruling that all birds' nest caves in the regency were the property of the regency government, which could appoint a concessionaire to exploit them on government's behalf *. The decree was not enforced in Long Apari until 1990, when a concessionaire for Long Apari was appointed through an auction held by the regency government. Traditional cave owners then had to sell their harvest to the concessionaire at a set price much lower than market price. Over the following years, the local collectors increasingly tried to evade the concessionaire's monopoly and smuggle nests to Samarinda. The concessionaire reacted by involving army and police to catch the smugglers.

In 1993, the situation started to deteriorate. People were harassed by plain-clothed police and military personnel. Hundreds of outsiders flooded Long Apari. Exploration of the territory intensified dramatically, with hundreds of men roaming the vast forests and discovering many new caves. The district's overall production rose to 20 tons per year.

In 1995, and again in 1997, the Foundation for Aoheng Development, an association of Aoheng personalities with supposedly nonprofit goals, entered the game as the winner of the concessionaire auction. It proved even worse than its predecessors in the eyes of the local people. It bought birds' nests at only Rp. 1 million per kilogramme in Long Apari, while the price in Samarinda had risen to Rp. 2.5 million. It brought more outsiders to the district and relied in a more heavy-handed way on army and police to catch smugglers and intimidate the population. Worse, it contributed to pitch community leaders against one another and split the local communities into warring factions.

In 1997, new administrative and legal problems added to the already tense situation. In an effort to gain control over the birds' nest trade, the Directorate General of Forest Protection and Nature Conservation (PHPA), viewing the swiftlets as wild fauna and thus lying under its jurisdiction, began to grant concessions to large companies to exploit the nests. Thus it appointed the LBPS company for the district of Long Apari. The Foundation for Aoheng Development called on special units of the army to prevent LBPS from effectively operating in Long Apari. In 1999, after Soeharto's fall, the situation became even more complicated. While the director general of PHPA and the regent of Kutai were suing each other over the question of which had authority to control the birds' nest trade, the law on Regional Autonomy (Law No. 22 of 1999) established the new regency of West Kutai, among others. The newly installed regent of West Kutai invalidated the concessions previously granted by the head of the former regency of Kutai, and he issued exploitation rights over various sectors of Long Apari to several local parties. Those and the earlier concession holder then sued each other.

In 2001, Long Apari had a registered resident population of 4,000 to 4,500, some 800 of whom were outsiders. There were also possibly over 1,000 unregistered people wandering in the forest, in the vicinity of cave areas, where base camps

* This measure primarily intended for the government to appropriate the profit of the strongly developing market of white birds' nests in Sangkulirang in the northeastern part of the regency, where concessionaires were indeed appointed.

had been established. The police, in turn, established stations (*pos*) at strategic locations to control the collectors, appropriating 10% of their harvest as a sort of tax. Plundering of caves by masked and armed gangs became common, and some fifteen birds' nest–related murders were recorded over the period 2000–2001. Following the murder of one customary chief in May 2001, the Aoheng started retaliating by stalking isolated outsiders in the forest.

Among the Aoheng, suspicion and factionalism prevailed. In the course of time, most of the traditional leaders had been involved in rather shady deals with one concessionaire or another, and not a single one of them retained any substantial measure of confidence among the population. With people spying on one another, occasionally robbing one another's caves, the social atmosphere became extremely pernicious. The traditional custom was no longer abided by, mutual help activities were no longer performed, and the traditional customary community fell to pieces.

Who, in fact, benefited from the birds' nest trade? Winners included the bigger cave owners, who could afford a private militia to protect their caves or were able to bribe the police to do so; the traders, be they Aoheng or strangers, who could make a profit, thin or fat, on small or large quantities of nests; various government agencies including the regency government and the directorate general of PHPA; the police, through licit or illicit 'taxes' and honorariums, as well as the army; and a handful of lawyers, since the confusing legal situation triggered a large number of lawsuits. But most small cave owners could not afford to guard their caves against being plundered repeatedly until they ceased to be productive and were abandoned. Others had to grant exploitation rights to traders, went deep into debt and eventually relinquished ownership of their caves. All in all, few Aoheng have benefited from the birds' nest bounty.

The bird populations were also heavily affected as the collection was carried out in a highly unsustainable way. Instead of the two-and-a-half-month interval that is needed for the birds to reproduce, nests were collected only 45 days, 30 days, or even 10 days after the birds had started building them, which did not allow sufficient time for the young to leave the nests.

What are the prospects for such a business? The combination of the scattered nature of caves in the forest, highly insecure tenure and complex legal framework, extremely high prices and the extractivist approach to the collection of forest products for trade commonly displayed by local groups leaves little hope for a long-term, sustainable exploitation of birds' nests. It is possible that the swiftlets will not become extinct. The disturbed birds may move away to another cave area. Or the birds' nest boom may eventually recede —because of supply depletion or price recession— and, subsequently, outsiders would leave the area and the swiftlet population could grow again.

Beyond its disastrous social effects, this example illustrates the highly unsustainable nature of forest extraction for trade. From the point of view of the local communities, birds' nests, like other forest products, are trade resources, mere commodities, which they exploit in a highly opportunistic way, following market demand and fluctuations, and without any qualms. When supplies of a product are exhausted or market prices fall, they redirect their attention towards other products. In the course of history, the Aoheng and their neighbours have repeatedly switched from one forest product to another.

When birds are gone, the Aoheng will focus again on their swiddens, at times taking advantage, as a side activity, of some new opportunity, be it the collection of yet another forest product, wage work or the growing of magic mushrooms. The birds' nest frenzy will remain in their collective memory as only one episode among many in the long history of their highly diverse successive economic pursuits.

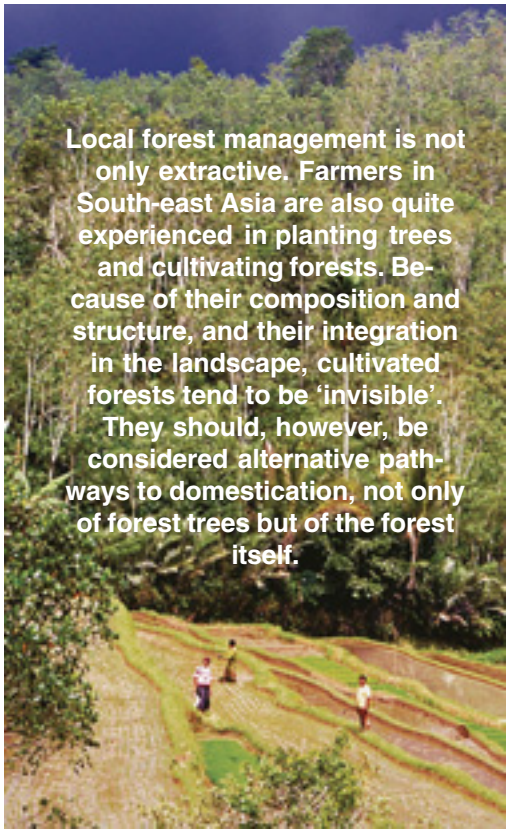
9. Birds' nests: towards domestication?

Before the above-mentioned rush, many of the birds' nest caves, especially in Java, were managed in order to increase production and ensure sustainability. These practices did not really relate to domestication, but at least humans were positively influencing the birds' habitat for production purposes.

Another process of more intense 'domestication', which has been underway for some time, is presently booming. For several decades in Java, more recently in Sumatra, and probably in relation to the reduction of their natural habitat, swiflets have been coming closer to villages. Some of these birds have started to nest in dark, abandoned houses, and the nests have started to be collected. In Java bird nest production from naturally colonised houses has developed slowly but never boomed. But recently, in conjunction with increasing demand and the related soaring prices, this rather 'traditional' production has been developing the idea of artificial 'caves' that would simulate the environmental conditions of the natural breeding places —constant darkness and humidity—, attract more birds and give incredible returns. Such 'cave houses' have burgeoned during the last few years, especially in the south of Sumatra, and have introduced new domestication patterns. Whereas 'traditional' breeding is usually carried out in a passive mode, by which owners just let their house be invaded by birds (success therefore becomes a matter of good luck), modern breeders engage in active and large-scale breeding. They build huge, concrete birdhouses with all facilities for the birds. They try to attract birds with recordings of swift songs, by spreading guano on the ground or by using other swiftlet species as a relay. The knowledge and practices involved in this modern attempt at breeding are inspired by traditional empirical knowledge —knowing a bird's habits is definitely important— but have also integrated scientific data on bird ecology, as well as technical recommendations conveyed by specialized sources, and modern gadgets like tape recorders, watering systems with timers, barometers, laying machines, etc. In addition to knowledge and practices, some moral norms have to be respected, which include respect for the birds, a humble attitude, patience and a lack of greed. This modern breeders' ethic is a reflection of cultural practices observed by forest collectors, which aim at 'attracting good luck' on the collector.

Unusual 'breeding' through unusual 'farmers'. Does birds' nest production in artificial caves constitute a true process of domestication? The breeders do not manipulate the resource itself (the bird) or its habitat. Swiftlets are more commensal with humans than domesticates. The main domestication action concerns the breeding place, which is strongly manipulated, even reconstructed, in order to attract the bird and capture its produce. This practice reminds of the current way of beekeeping in the region, whereby farmers capture wild bees and put them into locally built wooden hives. The swiftlet breeders are not former birds' nest collectors. Whereas collection is carried out by local people living in forest areas, bird breeders are usually not even farmers. Until rather recently, breeding was mostly carried out by middle-class shop owners, often ethnic Chinese. The activity was linked not to the countryside or to the forest, but rather to semi-urban environments like large villages, small cities and the surroundings of large cities. A new process is presently being developed, whereby rich businessmen from large cities, who engage in bird breeding as they would in any other business activity, build large birdhouses in opened rice field areas.

IV – Forest culture on farmlands



Local forest management is not only extractive. Farmers in South-east Asia are also quite experienced in planting trees and cultivating forests. Because of their composition and structure, and their integration in the landscape, cultivated forests tend to be 'invisible'. They should, however, be considered alternative pathways to domestication, not only of forest trees but of the forest itself.

1. Does smallholder forest culture exist?

Forest culture refers to the art and practice of cultivating forests. A common perception in the professional forestry world is that indigenous forest management is exclusively extractive, and can therefore hardly be called 'management'. For technical reasons as well as for considerations related to long-term investments and economic profitability specific to tree culture, foresters usually do believe that forest plantations can be successfully managed and worked only by trained professional foresters, should be designed with specific (usually homogeneous) patterns and be located in specialized sections of the forest land-use system[1]. They also argue that local farmers, because most of their reasoning is geared to short-term considerations and because they lack proper financial capital, are definitively incapable of engaging in cultivating forests[2]. These assertions stand against reported facts and scientific observations showing that local farmers, and in particular swidden farmers, are commonly growing forest resources on their farmlands. The main argument that is usually opposed to this evidence is that the observed systems are not really 'cultivated forests', but anthropogenic vegetations derived from agricultural antecedents (like fallows in the shifting cultivation cycle or secondary forests born from deep perturbation of the primary forest ecosystem) or, at best, the unplanned form of early stages of 'primitive horticulture'. It is therefore quite urgent to bring forward the evidence (facts) and the scientific arguments (analysis) that can lead to the acknowledgement that local farmers actually are quite experienced in tree planting and forest cultivation.

Forest culture is widespread in the region but constitutes what could be called 'the invisible face of forest management'. It is practiced within farmlands and follows various patterns and models. Most of the existing examples, however, exhibit general patterns typical of natural forest ecosystems. As a consequence, locally cultivated forests, even though usually established outside the boundaries of natural forests, are easily confused with either primary or secondary forests.

Forest resources in South-east Asia are not managed exclusively through *harvesting* stocks of natural resources in largely undisturbed forests. Smallholder forest management often involves a considerable amount of *production* through active *planting* and *domestication* of forest crops[3]. In 8 of 12 of our study sites, local people have proven to be original creators of forests, either from scratch (five sites) or through active planting but integrated into existing forest vegetation (three sites). Though dominated by planted trees, these smallholder forests are significantly

1. Lanly & Clément 1982; Wormald 1992.
2. Evans 1992; Peluso 1990.
3. Michon & de Foresta 1997.

different from the uniform plantation model designed by professional foresters. The scale as well as labour, capital and technical inputs invested in the establishment and maintenance of the cultivated forest are far less intensive than in monocrop plantations. Local efforts of forest domestication and cultivation exhibit a noticeable diversity and have created many types of complex ecosystems that, unlike monocrop tree plantations, hold obvious forest qualities. These smallholder cultivated forests range from occasional forest culture occurring within in a matrix of undisturbed natural forest ('interspersed forest culture') to planted forests maintained or restored on farmlands ('integral forest culture')[4].

1. **Interspersed forest culture** involves local, though rather large-scale modification of the natural forest for the benefit of introduced individuals planted and protected in specific places or periods in time. This kind of 'enrichment planting' is integrated within existing forest structures, without totally destroying or replacing them. The interaction between human production efforts and natural forest cycles varies in intensity, time and space, from the planting of a few rattan clusters under a thinned forest canopy in some rattan gardens in East and Central Kalimantan, to cyclic benzoin cultivation in the Toba highlands, Sumatra (see further in this volume). In the latter case, the silvicultural pattern integrates an intensive but temporary phase of forest production into a matrix of unmanaged old-growth forest.
2. **Integral forest culture** involves a more drastic modification of the original forest, as it usually arises from an initial destruction of natural vegetation—either primary or secondary forest—through slash-and-burn practices and evolves as a gradual reconstruction aimed at specific production purposes. Depending on the choice of the cultivated species as well as on economic or social logic, integral forest culture is either rotational or permanent. In rotational systems, the cultivated forest regenerates through the total slashing of the cultivated stand, followed by massive replantation through swidden methods. This forest culture is cyclic, and it is fully integrated into the local, shifting cultivation cycles. Rattan or rubber cultivation are examples of such rotational systems (see further in this volume). In permanent systems, the cultivated forest develops and regenerates without any further massive clearing and replanting. Rejuvenation of the productive stand occurs through tree-by-tree replacement. Damar agroforests, kemiri forests, tembawang and lembo are good examples of such permanent silviculture.
   a. ***Rotational forest culture*** follows the succession patterns observed between swidden and fallow in traditional shifting cultivation systems. The forest crop is established in the swidden along with, or just following, the staple food crops. The next phase includes a maturation stage for the forest crop ('fallow') and a production stage, which may vary from 8 to 50 years, with regularly spaced harvests of the main product. When the forest crop declines, the whole stand is renewed through slash and burn, and replanting with the above-mentioned patterns. This is the case of most rattan gardens in East Kalimantan (see this volume) and all rubber agroforest in Sumatra (see this volume) and Kalimantan.
   b. ***Permanent forest culture*** results in the establishment of perennial structures closer to that of old-growth

4. Michon *et al.* 1998.

forests, which do constitute outstanding examples of true forest culture. As in rotational systems, these forests are established through slash-and-burn agriculture, where tree seedlings are directly planted in the swidden. But after the establishment and early maturing phases, the forest will be maintained and, diversifying over the years, it will increasingly resemble a mature natural forest with a high, closed canopy, dense undergrowth, high levels of biodiversity and perennial reproduction of established structures through punctual renewal mechanisms. Unlike foresters' plantations, which evolve through cycles of specialized planting and total harvest, these smallholder forests are managed over extensive periods of time without reversal to a phase of massive regeneration, decaying trees being replaced one by one whenever needed. Damar agroforest in Krui, Sumatra (see this volume), mixed tree gardens with durian, fruit trees and timber trees in Maninjau, Sumatra (see this volume) and fruit forests in Kutai, Kalimantan, constitute perfect examples of this long-term management cycle.

Smallholder forest culture tends to be 'invisible'. Because of their composition and structure, and because they are often in direct continuity with remaining patches of natural forest, cultivated forests are often confused with natural forests. They do not appear on maps; they are not integrated into forestry statistics though they are governed by forestry regulations. Although they cover several million hectares of Indonesia, they are not mentioned in currently adopted land-use categories. There is not even a tacitly acknowledged concept or a proper term commonly adopted to unify such systems, either in agriculture, forestry or agroforestry. In scientific literature, the existing examples are referred to as 'improved fallows'[5], 'managed forests'[6], 'man-made-forests'[7] or 'forest gardens'[8]. In a former program, which studied these systems in Sumatra, we used the term 'agroforests' to direct attention to the close integration between forest culture and agriculture (see for example Michon *et al.* 1983; de Foresta & Michon199; Michon & de Foresta 1999). At the Lofoten workshop of July 2000, which featured findings and discussions of FORRESASIA and of a CIFOR project on NTFP, we introduced the unifying concept of 'intermediate system'[9], in order to emphasize the existence of a continuum of management practices that extends from pure extraction to intensive monoculture plantations. (We insist on the fact that 'intermediate' here refers to intensity of inputs and ecosystem structure, but does not imply any temporal evolution.)

This invisibility and lack of a proper reference term is a consequence of a combination of ignorance, diverging perceptions on forests, vested interests and political economy. But it has important consequences. Ignoring the reality of existing systems and denying their conceptualisation can easily threaten the future of smallholder forest culture.

5. Cairns 1997.
6. Momberg 1993.
7. Torquebiau 1984.
8. Salafsky 1994.
9. Angelsen, Belcher *et al.* 2000.

Conclusions and recommendations

For the reasons above we strongly recommend combined efforts towards a more effective and efficient acknowledgement of this diversified smallholder forest culture through a combination of scientific, political, statistical and legal approaches. This acknowledgement should include a great deal of effort to conceptualize and to change the dominant paradigms of forest management and forest production. It has to be assessed through visible changes in land-use categories and in land-use mapping. It has to include significant moves to define the regulatory and policy frameworks governing forest culture and management of farmlands.

The main objective of this book is to facilitate such an acknowledgement and suggest pathways for its materialization.

Forest culture within the forest matrix

Silvicultural patterns integrate a temporary phase of forest production into the existing forest matrix, without destroying or replacing it.

Three main silvicultural models

Integral, rotational forest culture

The forest crop is established in the swidden, matures with the fallow vegetation, produces for a few decades and is renewed through a slash-and-burn cycle before being replanted in the same pattern.

Integral, permanent forest culture

Silvicultural patterns establish perennial forest structures, which are integrally maintained over very long periods of time, without reverting to a phase of massive regeneration, the decaying trees being individually replaced whenever needed. Over years, these cultivated forests increasingly resemble mature natural forests with a high, closed canopy, dense undergrowth and high levels of biodiversity.

‘Horticulture’ refers to the management of *hortus*, the diversified garden.

Two models for resource domestication and production: *ager* and *hortus*

Several ethnobotanists consider the global process of plant domestication and cultivation to have followed two divergent models: the development of specialized open fields, and that of diversified gardens.

‘Agriculture’ refers to the management of *ager,* the open field developed for domestication and culture of grain crops.

2. Does forest culture relate to the conventional model of production and domestication?

The models exhibited in the Indonesian examples that will be described further raise several important questions that relate to the basic concept of production and domestication. Does modern production, in either agriculture or forestry, imply strong artificialization, specialization and homogenization of productive structures? Why should the patterns of forest plantations be different from those found in natural forests? Why should productive plantation systems necessarily escape natural ecological laws? Why should wild forest species need to be adapted through domestication to collective treatment in an industrial plantation? Are strong specialization of productive structures and intensive human control always the best methods for intensification of forest production?

In order to better understand the basic differences between the forest culture models developed by smallholder farmers and the models of conventional plantation forestry, we can rely on the analysis proposed by ethnobotanists for the interpretation of agricultural development. Haudricourt and Hédin (1943), Geertz (1966) and Barrau (1970) have proposed to distinguish two main patterns of plant domestication and field development based on major differences observed between temperate agriculture and smallholder agriculture in the tropics.

The first pattern refers to the 'grain model' developed from an extrapolation of the historical development of cereal domestication in ancient Mesopotamia and around the Mediterranean. It epitomises 'agriculture' in its narrow sense, the cultivation of *ager*, the open field. In this model, cultivation involves a clear distinction between the cultivated field and the natural ecosystem, as well as between wild plants and domesticates. The cultivation patterns rest on homogenization, artificialization and specialization: a single, genetically homogeneous and evenly aged plant population, which excludes other components like 'weeds' and 'pests', and a clear focus on production of a single commodity. Management relies on collective plant treatment. It involves heavy human control and highly specialized knowledge. In the modern version of the open-field model, production and reproduction of components (plant clones or hybrids, if not genetically modified) and structures totally depend on humans. Artificialization culminates in intensive resort to chemical and mechanical inputs, associated with very high energy consumption, aiming at maximum yields while overcoming natural constraints. The *ager* model reflects the productivist mentality, which sustained the development of modern agriculture. It has achieved incredible results in raising food production all over the world.

The second model refers to the development of tuber crops in 'gardens', *hortus*, as currently found in many farming systems in the tropics. The garden retains the complexity of the natural ecosystem in order to accommodate the ecological exigencies of the cultivated plant. Diversity is the key word in the 'garden model', ranging from plant types —herbs, tuberous perennials, trees,

lianas— to species and genotypes, and including architectural as well as functional diversity. Management operates through individual treatment of plants, punctual interventions at key points in time, and makes full profit of natural vegetation dynamics for production and reproduction. Through their evolution, tropical gardens have integrated many exotic species, but even their modern version maintains these basic patterns of diversity and complexity. The garden, devised for multipurpose production as well as for optimum management of ecological and economic risks, does not comply with the strict exigence of short-term productivity in agriculture. Tuber gardens of Melanesian horticulturists, but also swiddens[10], mixed rice-field ecosystems, or home gardens[11], which represent variations of the *hortus* model, are still major components of indigenous agricultures in the tropics.

It is essential to understand the profound opposition of these two diverging models. On the one hand is ecological simplicity supported by technical complexity, high control and massive inputs. On the other hand there is ecological complexity supporting technical simplicity, minimal intervention and fluent production. The *ager* model has proven successful in raising production levels quickly, but its long-term impact on the environment and societies is worrying. The *hortus* model is less productive, but certainly more sustainable in the long term, environmentally as well as socially. The *ager* model is presently considered the only valuable model for efficient agricultural development, and it is also the only available model. This open-field preference is so important that it efficiently displaces or destroys systems related to the *hortus* model, which are considered 'primitive' and 'inefficient'.

Though it was initially devised for annual grain crops, the open-field *ager* model has deeply influenced the development of modern tree culture and forest plantations. In the tropics, forest plantations based on eucalypts or acacias, as well as modern coffee, rubber or oil palm plantations, replicate the biological model and the technical options of a corn field. In spite of this historical gross tendency, we do think that switching from annual crops to trees, and from fields to forests, especially in a tropical context, can allow to question the appropriateness of the 'open field' as the dominant model for resource management. The main question is not to discuss the theoretical efficiency of one model versus another, but which appears to be the most adapted to present ecological and socio-economic constraints of the tropics and the most conducive to sustainable development in the near future. Forest culture, as devised by smallholder farmers, has elaborated on a model that relates more to *hortus* than to *ager*. Its close affinity with the natural forest and the role assumed by humans as an occasional, but determining factor in the evolution of the system, give it new dimensions. Through this 'forest preference', humans do not try to imitate natural structures, as in the *hortus* model, but use and tune them for their own needs, more or less as new experiences of 'ecological engineering'. This 'forest preference' directly addresses these issues of adaptability and sustainability.

10. Pelzer 1945; Geertz 1966.
11. Barrau 1970; Price 1982; Landauer & Brazil 1990.

Conclusions and recommendations

The models developed by professional tropical forestry for increased production of selected forest resources has resulted in total partition of domesticated forest species and the forest ecosystem. They globally follow models devised for intensive agricultural production and produce monocrop fields that retain few forest functions. In contrast, the forest culture

The *ager* model in agriculture and forestry

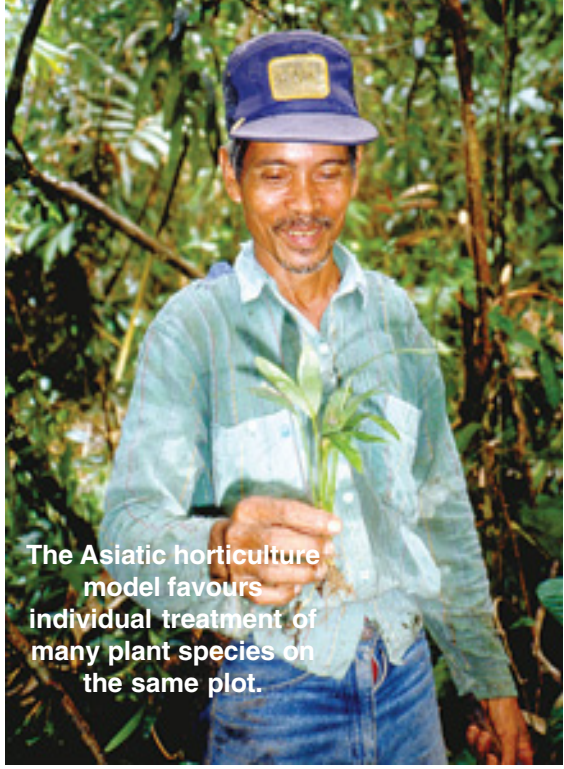
The middle-oriental model developed for grain culture focuses on adaptation of wild plants to artificially simplified open fields.

The *ager* model operates through increased control of a uniform crop and artificial simplification of the ecosystem structure.

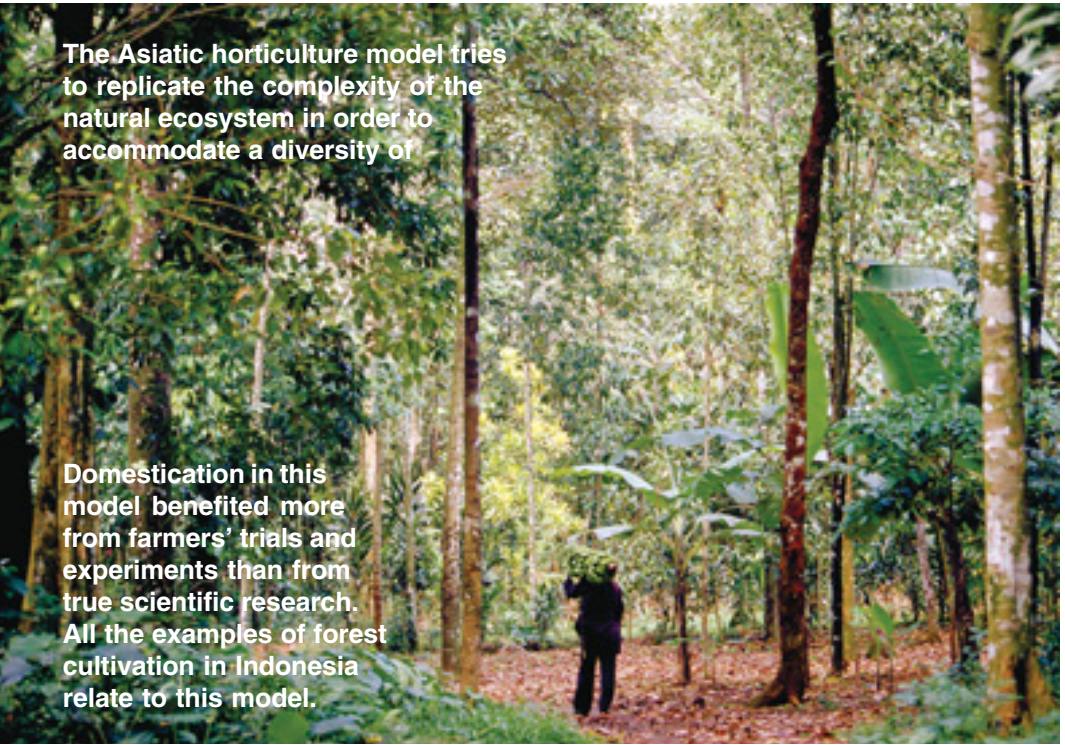
Intensification through the *ager* model has achieved astonishing results in raising food production all over the world. It tends to be considered the only valuable model for agricultural development. Though initially devised for annual crops, it has deeply influenced tree culture in the tropics: forest plantations and estates based on forest trees such as rubber, oil palm or cocoa constitute giant replicates of a corn field.

The *hortus* model and forest culture

Horticulture can be characterized by high plant diversity, including mainly tuberous perennials as well as trees, a somewhat chaotic architecture and a diverse production from foods to various plant materials.



The Asiatic horticulture model favours individual treatment of many plant species on the same plot.



The Asiatic horticulture model tries to replicate the complexity of the natural ecosystem in order to accommodate a diversity of

Domestication in this model benefited more from farmers' trials and experiments than from true scientific research. All the examples of forest cultivation in Indonesia relate to this model.

In the *hortus* model, the gardener observes what Haudricourt called a 'respectful friendship towards plants'

models devised by local farmers in South-east Asia rely on processes that replicate forest patterns, structures, functions and qualities in agricultural land for the sake of production.

The intensive and specialized cropping model derived from Western grain culture (the *ager* model of ethnobiologists) has produced an agricultural paradigm that mainly considers indigenous agriculture as lower stages of a universal and uniform evolution leading from collection of wild resources to intensive production of foods and commodities. We consider that local examples of forest culture allow the establishment of a new forest paradigm, related to the *hortus* model of ethnobiologists. More than representing 'intermediate stages' between extraction and intensive production, the existing examples of forest culture constitute a true alternative for the management of natural resources. Their interest lies in a particular conception of production and domestication, which emphasizes diversity (biological as well as economic) and makes full use of the particular reproduction dynamics and production processes of the forest ecosystem itself, rather than reconstructing an artificially homogeneous ecosystem around a selected resource. This conception allows for an optimum combination of production and conservation, and it fully relies on local representation and knowledge systems evolved from former forest traditions. It seems therefore quite suitable to the sustainable development of forestlands, as well as perfectly adapted to the present environmental and socio-economic conditions of farm development in the tropics.

The following examples and derived models should therefore be considered not as intermediate stages in a linear path leading to a full domestication of forest species, but as alternative pathways to domestication, not only of forest trees but of the forest itself. These pathways urgently require help from scientific research and technical extension, especially in the field of joint expertise and experimentation on the part of plant breeders and ecologists.

3. Producing forest products: a historical perspective

Active production of forest commodities is by no means a recent strategy in South-east Asia. It probably set the basis of plant domestication in this part of the world through the transfer of forest trees producing essential materials, such as tannins for fishing nets and bark fibres for clothes, to artificial environments near dwellings[12].

Systematic production of resources formerly taken from the forest developed under two complementary processes.

- One was linked to forest foods and materials for daily use. It led to the domestication and cultivation of more than 100 fruit and nut tree species. The originality of this forest horticulture is that it did not derive into specialized open fields, but has been carried out, until today, in various models of diversified home gardens or fruit forests surrounding dwellings.
- The other process developed with the expansion of trade in forest products. It probably emerged with the early trade with China and the Middle East, with the domestication of forest species producing spices and stimulants—cloves, nutmeg, pepper and tea. It vastly expanded much later, during colonial times, with the expansion of extractivism for European markets and industries[13]. This later process gave rise to original models of true forest culture into farm lands, with diversified, forestlike plantations or agroforests (developed and illustrated in this volume), which presently constitute an important facet of local farming systems in the region.

12. Sauer 1952; Barrau 1967; Harris 1972.
13. Michon & de Foresta 1997.

This production and domestication process by local swidden farmers was working in parallel to that conducted by the colonial services. The colonial dynamics included some local species (pine plantations in Java for turpentine, Agathis plantations for resin, Palaquium for *gutta percha*), but really expanded with exotic species like oil palm and rubber, cinchona and cocoa. It launched the bases for modern plantation agriculture through highly specialized stands controlled through large-scale estates.

New trials for controlling commercial forest products through production are still emerging. Apart from the integration of timber production on farmlands under various models such as teak on the border of rice fields in Lampung and Sumatra, *Peronema canescens* in managed secondary forests or in rubber agroforests in Sumatra or mixed with oil palm in East Kalimantan, the most recent example among smallholders targets birds' nests through the establishment of artificial caves in Java and Sumatra (see chapter III).

Among the commercial forest products that were incorporated into indigenous agricultural systems, cinnamon might be the oldest. In the central highlands of Sumatra, indigenous plantations have been established for more than two centuries. Some form specialized, homogenous gardens, while others, established on steep slopes, often associate cinnamon trees in the undergrowth with higher canopy trees grown for fruits or timber (see section 8 in this chapter; see also Michon & Bompard 1987; Aumeeruddy 1994).

Benzoin is managed as a fallow crop in what represents a true rotational agroforestry system in Laos[14]. Such rotational systems are also mentioned in North Sumatra as long ago as the eighteenth century[15]. However, there are other cultivation practices, also developed through more complex and permanent systems which associate benzoin trees with either a mix of useful tree species or timber and fruit trees (see section 4 in this chapter).

In western Borneo, swidden farmers have established, for at least 150 years, highly diversified tree gardens that integrate oil-producing Dipterocarp species together with tens of other fruit and nut species as well as rattans, latex-producing trees and timber species (see section 9 in this chapter; see also Momberg 1993; Padoch & Peters 1993; Sundawati 1993; de Jong 1994).

In Central and East Kalimantan rattan has traditionally formed the bulk of trade in forest products and has been incorporated into shifting cultivation systems for more than 100 years (see section 5 in this chapter). In rattan gardens, cultivated canes are planted along with fruit and timber trees, as well as with numerous other useful species that have established spontaneously.

In the south of Sumatra, swidden farmers started cultivating damar trees one century ago. They have since established more than 50,000 ha of complex forestlike gardens. The damar trees grow together with fruit species as well as numerous managed forest species (see section 7 in this chapter; see also Michon *et al*. 2000).

Native rubber trees were also planted in complex gardens, but rubber agroforestry really developed with the incorporation of the Para rubber tree in local swidden systems at the beginning of the twentieth century. The Amazon rubber tree has

14. Kashio & Johnson 2001.
15. Marsden 1783.

Damar —a collective name for Dipterocarp resins— is among the oldest traded items from natural forests in South-east Asia. First traded as a base for incenses, dyes, adhesives and medicines, it was developed for varnish and paint industries at the beginning of the twentieth century.

Damar from *Shorea javanica* started to be cultivated a century ago in complex forests in the south of Sumatra. The damar forest presently covers more than 60,000 ha.

Wild rubbers were one of the main products extracted from Sumatra and Kalimantan in the nineteenth century. They have been totally displaced by Brazilian rubber, cultivated by swidden farmers in fallow forests, for about a century now.

Tengkawang, or illipe nut, is a fatty nut produced by 15 *Shorea* species (Dipterocarpaceae). The oil extracted from the fruit serves as a substitute for cocoa butter in chocolates and margarine. It has also important cosmetic utilizations.

Tengkawang trees are traditionally cultivated in fruit forests all over Kalimantan.

Benzoin, a fragrant resin used in incense preparations, is produced by *Styrax* spp. (Styracaceae), medium to large size trees native to lower montane forests in continental and island South-east Asia. Probably one of the oldest traded NTFP in Indonesia, benzoin is mentioned in Chinese writings from the fifth century. It has been cultivated in forestlike gardens in North Sumatra since the eighteenth century.

Cinnamon, or cassia vera, is the aromatic bark produced by a small tree from the Lauraceae family, native to the lower montane forests on the islands of Sumatra and Borneo (*Cinnamomum burmanii* in Sumatra and probably other species in Kalimantan). It is used as a spice in food industries and as an essential oil in perfume and pharmaceutical industries. It has been cultivated in West Sumatra under a forest canopy for more than two centuries.

'Rattan' represents hundreds of climbing palm species used in all kinds of handicrafts and construction works, as well as in mats and furniture industries. It is the most valuable NTFP in Indonesia in terms of traded and exported volume. It has been cultivated in the lowlands of Sumatra and Kalimantan for more than two centuries, as a cyclical forest culture integrated in the shifting cultivation cycle.

Fruits are among the oldest forest species to have been planted and domesticated. Cultivated fruit forests are common all over South-east Asia.

South-east Asian spices (here pepper, nutmeg and clove) have been traded for more than two millennia.

Spices have been cultivated for centuries in diversified forest groves around villages, both in Sumatra and the Moluccas.

found its ecological niche in complex tree gardens, where it is associated with numerous other species either planted or spontaneously established. It quickly replaced native rubbers in the economic niche of the local swidden farmers (see section 6 in this chapter; see also Gouyon *et al* 1993; Dove 1994).

4. Interstitial forest culture: benzoin gardens in North Sumatra

The fragrant resin of benzoin has been exploited in the wild and traded from Sumatra for at least 10 centuries, first to China, then to the Middle East and finally to Europe, with an amazing historical continuity. Benzoin was and still is highly valued as an ingredient in incense for burning in rituals and religious ceremonies, not only in all western Indonesian islands, but also in mosques and churches all over the Middle East, North Africa and Europe. It was and still is used for traditional and modern medicinal purposes, a component valued by the pharmaceutical industry. It was and still is used in perfumery[16]. Benzoin's main destination for the last 50 years, however, which absorbs 60% to 70% of total production, is the cigarette industry in Java, which processes it for the production of *kelembak*, *kretek* and other fragrant cigarettes sold in the country.

The Batak highlands in North Sumatra are known as one of the oldest and most important centres for benzoin production and trade[17]. Batak farmers have been collecting benzoin from natural forests for centuries, but they have also been growing the benzoin tree for more than two centuries. In the highlands surrounding Lake Toba, benzoin is grown in forestlike gardens, which form an extensive forest belt surrounding villages and open rice fields. Benzoin cultivation, in this area, is basically a cyclical system characterised by a few decades of tree cropping followed by long-lasting forest 'fallows'. Benzoin plantations have also been described as 'benzoin fallows' in shifting cultivation systems, where they alternate with short periods of rice production[18], but this practice is apparently much less common nowadays in the highlands.

In the present benzoin cultivation system[19], benzoin trees are first planted in the undergrowth of old-growth montane forests. As the benzoin develop, surrounding canopy trees and undergrowth species are managed in order to maintain a balance between high light and low temperature in the microenvironment of the young tree. Some high trees are maintained, like good hardwood species and pines; others are cut or pruned, and bush vegetation is slashed from around benzoin trees. After eight years, the benzoin trees can be tapped, and if done properly, resin may be extracted for about 60 years. This means that three generations of benzoin farmers can live on it, although yields decrease after 30 years. As long as benzoin

16. Katz *et al.* 2002.
17. Marsden 1783.
18. Marsden 1783; Braam 1917; Heyne 1927.
19. Garcia-Fernandez 2000; Katz 2000; Garcia Fernandez *et al*. 2003.

trees are tapped for resin, the benzoin garden is regularly managed, which mainly implies regular slashing of bushes and vines around productive trees, not in the whole garden, and the eradication of parasitic plants (particularly mistletoe), which colonise many trees in these montane ecosystems. Even though benzoin cultivation represents a rather specialized metho, in that benzoin trees are the only planted species in this cultivation system, there is a gradual increase over time in species diversity. Benzoin gardens often contain large trees retained from former forest vegetation by benzoin farmers, and even though herbs, seedling and shrubs are cleared before harvesting, the undergrowth retains many bushes and epiphytes typical of the surrounding montane forest. An aging plantation is then gradually abandoned, after a maximum of 65 years, with less and less control being exerted over self-established tree and bush species. The increasing scarcity of maintenance allows the abandoned garden to quickly revert back to a typical high growth forest. After several decades, the resulting 'pristine' montane forest can again be utilised for benzoin production.

The historical evolution of benzoin cultivation in North Sumatra shows an interesting displacement from the lowlands to the highlands following the spread of rubber cultivation. Its main interest, however, relies on the illustration of the relationship between forest culture and forest policies. It shows how local forest culture has been used to curb unbalanced power relations established between village communities and the government for the control of forestlands[20]. At key periods in Indonesian political history, the expansion of benzoin cultivation over natural forests appears to have been congruent with local concerns for reinforcement of the visibility of customary land tenure structures and authority. Many of the present gardens were planted in order to prevent clan forestlands from being gazetted as 'protection forests' by either the old colonial forest services or the Indonesian Ministry of Forestry. More recently, the presence of productive benzoin trees on these forested lands has allowed Toba Batak farmers to resist the total logging of their lands by the Indorayon Company, which built the first pulp mill in Indonesia and has been granted logging and eucalyptus plantation rights over all the Batak forestlands.

20. Michon 2000.

5. Rotational forest culture: rattan gardens and shifting agriculture in East Kalimantan

Most of the rattan traded in the world is collected in primary or secondary forests from naturally established, though sometimes intensively managed, plants. However, some active production also exists in Indonesia, as well as in south-western China, for both local use and international trade. This cultivation usually concerns small canes used for weaving, in particular for mat production for the Asiatic markets. Rattan production through cultivation in Indonesia is

Benzoin forests

The undulating plateau of the Toba Batak highlands is covered by a mosaic of openfields (ricefields, vegetable gardens, grass savanas) and benzoin forests adjoining the remnants of the primary forest, now restricted to the highest reaches of the mountain massif.

The benzoin tree produces a fragrant resin.

Benzoin is a medium-sized tree that naturally regenerates in the undergrowth of lowland and montane forests in the region.

Benzoin resin is used in pharmacy and perfumery as well as the manufacture of incence and cigarettes. It is locally important for rituals.

Harvesting the resin

Cleaning the resin

Benzoin silviculture

A plot selected in an old growth forest

Benzoin seedlings planted in the cleared undergrowth

Young benzoin tree developing in the modified forest

A Productive tree

The abandoned benzoin plot reverts to forest with remnant benzoin trees. After a long rest period it can be used for another cycle.

The garden canopy

Inside amature garden

around two centuries old. It seems to have been quite widespread, especially in flat areas bordering large rivers and on the coastal plains of Sumatra and Kalimantan, and is now more or less restricted to the provinces of East and Central Kalimantan [21]. Rattan production for international trade boomed in the late 1970s and through the 1980s, but restrictive policies on trade led to a dramatic drop in the 1990s.

In the Pasir regency of East Kalimantan Province, rattan production through long-standing forestlike gardens is still one of the main activities for farmers. Rattan is cultivated as part of local swidden cultivation systems. As in any shifting cultivation system, plots for rattan production are opened in old secondary forest or, less commonly, primary forest. These swidden plots are first planted with rice, but rattan seeds and/or seedlings are soon added, together with other swidden field crops. Rice is usually planted for two consecutive years, with the young rattan seedlings slowly developing. Then the plot is left to 'fallow'. Rattan vines, most commonly from the species *Calamus caesius* (*rotan sega*), continue to develop with the regenerating forest vegetation, climbing together with coppice shoots of cut trees or with pioneer trees they use as support. These early 'rattan fallows' are not visited during the whole period of rattan growth. It takes a minimum of 7 to 10 years before the first canes can be harvested. *Rotan sega*, as well as the other commonly cultivated rattan species, grows in clumps so that harvest of individual canes does not entail the death of the plant. After the harvest, immature canes and new rattan shoots continue to develop. New canes can be harvested usually at intervals of two or three years.

The rattan plot can be managed for 50 or more years, which goes along with a notable enrichment of the plot with fruit trees and other planted or spontaneously established species. These long-standing rattan plots resemble a naturally regenerated secondary forest except that they have a higher density of rattan and useful species. The vegetation is then slashed back for a new cycle. In some cases, productive gardens may be recycled in the swidden cycle earlier, after two or three 'crops' —three to six years after the first harvest— for a new rice-and-rattan cycle.

Since the mid 1980s, oil palm and pulpwood plantations represent the major land uses in the Pasir area, together with some ongoing forest extraction and logging. The evolution of rattan production from the golden years of rattan trade (late 1970s to mid-1980s) until now constitutes an interesting example of a direct negative effect of public policies on producers.

- National restrictions imposed on rattan trade and exports, established in the early 1990s, entailed a drastic drop in prices paid to farmers, which led to a virtual stop in rattan harvesting. It did not entail the conversion of rattan gardens, however, but rather an abandonment of management and harvest. Instead of a brutal conversion, the rattan policy entailed a 'dormancy' of rattan activities, as most farmers kept their rattan gardens inactive, but intact, 'in case prices went up again'. Rattan clumps survive well in unmanaged gardens, and the harvest can resume at any time.
- The main threat to rattan production comes from the government-supported plan for oil palm expansion through large estates, which has effectively eliminated a good percentage of former rattan gardens, both directly and indirectly—directly because 'forestlands' allocated to oil palm estates were also 'customary lands' belonging

21. Weinstock 1983; Mayer 1988; Fried 2000; Belcher *et al.* in 2000.

Rattan forests

Rattan, a climbing palm

Rattan gardens look like dense secondary forest. Rattan palms climb on planted trees and natural fallow species.

A swidden containing young rattan, and mature rattan gardens in the background

Inside the tangle of rattan vines

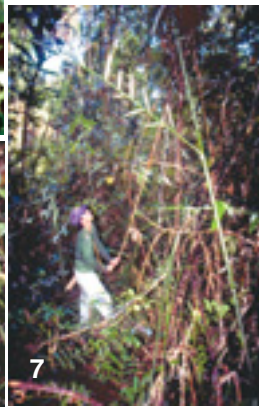
Harvesting rattan


5


5


3


6


7


8


Cutting rattan
9


Transporting rattan
10

The rattan stem is cut in 3 m long pieces and carried back to the village, where it is split in fours or eights before being processed in home industries or larger manufacture. The resulting mats are exported to Singapore and Japan.


2


Splitting rattan
11


Splitting rattan
11


1

Harvesting rattan is a strenuous task. Old leaves are cut back as far as possible, then the vine is pulled vigorously until it detaches from the supporting tree.

to indigenous villages and located in the rattan production area with most of them bearing productive rattan gardens, and indirectly because the combination of incentives for farmers to join the oil palm enterprise and true disincentives directed against rattan production, which sometimes included harassment, led many farmers to quit the rattan business[22]. Climatic events, including dramatic droughts and fires in 1985, 1992 and 1997, showed the exemplary resistance of oil palm to prolonged drought, whereas rattan died *en masse,* which directly eliminated rattan gardens, as they were not replanted afterwards.

22. Michon 2000.

6. Semirotational forest culture: rubber gardens in Sumatra

Rubber agroforests in the lowlands of Sumatra and Kalimantan represent an outstanding example of rotational forest production. These rubber agroforests are commonly found in areas with little agricultural potential as a consequence of acidic, leached soils and grass weeds. The cultivated rubber tree (*Hevea brasiliensis*) is not a native species; swidden cultivators in Sumatra and Borneo adopted it into their swidden production system not long after its introduction in 1910 on colonial estates[23].

In order to incorporate this new tree in their agricultural system, farmers planted the rubber seeds in the swidden shortly after the dry land rice. They then abandoned the swidden plot after one or two years and allowed a rubber-enriched fallow to develop[24]. After 8 to 10 years, rubber trees that have matured in the fallow vegetation can be tapped. Tapping can last for a minimum of 30 years. A gradual replacement of decaying trees by self-established rubber seedlings can sometimes be favoured, but when yields are definitively declining some 40 to 80 years after the planting, the garden vegetation has to be totally slashed for a new cycle.

This cultivation pattern has proven to be highly successful. Soon after the adoption of the rubber tree by swidden farmers, rubber agroforests became far more important than industrial plantations. As early as 1930, they had overtaken plantations in terms of both planted area and production. Rubber is still largely planted and managed in the same way. Rubber agroforests represent a dynamic and expanding form of land use. For the last 20 years in the lowlands of Sumatra and Kalimantan, they have represented the major land-use system in smallholder farming systems. They cover between 2.5 million and 3 million hectares and involve 1.3 million families farming rubber. In Kalimantan, near Kembera, the proportion of rice swidden planted in rubber rose from 25% to 83% between 1990 and 1995[25]. In spite of intensive government programmes for the promotion of monoclonal rubber plantations, rubber agroforests produce about 73% of the nation's

23. Pelzer 1945; Dove 1994; Gouyon *et al.* 1993; Angelsen 1995; Joshi *et al.* 2002.
24. Dove 1993.
25. Lawrence 1996.

rubber latex. In the 1990s, the value of this trade was between US$1.5 billion and US$2 billion [26].

The structure of mature agroforests is similar to that of classic late-succession vegetation, and rubber gardens fulfil many of the environmental benefits of a natural fallow, with rubber trees effectively replacing pioneer trees. They are often confused with and classified as 'natural secondary forests'. Because of their relative perennial nature, combined with tending practices that leave a major role to natural processes, they harbour a considerable diversity of plant species—between 250 and 300 plant species per hectare[27]. This diversity plays a determining role in the conservation of plant and animal biodiversity in the lowlands of Indonesia. This role has been dramatically increasing with the depletion, during the last 10 years, of the last unlogged Dipterocarp forests of this ecotone[28].

Barlow *et al.* (1994) have indicated that smallholders are the most efficient natural rubber producers in the world. Even though the average rubber yield from these agroforests —593 kg/ha— is about half the yield obtained from rubber estates [29], this is at least in part compensated for by the other products coming from the agroforests. Farmers often plant useful tree species along with the rubber, in particular fruits trees like durian, langsat, mango and rambuta,. In addition, farmers manage spontaneously established plants, retaining interesting species in order to increase the supply of plant foods and materials, but also for timber and game meat. These secondary products make up an economically interesting additional harvest from both a subsistence and income-generating point of view. The total value of rubber agroforests may increase, since there has been a growth, for the last 10 years, in the number of outlets for rubber wood, which is now used extensively for plywood and furniture. In 1992, at the very beginning of the rubber wood processing industry, farmers in Indonesia made Rp. 600,000 (US$300) per hectare from wood harvested from old rubber plantations[30].

The most interesting aspect of the history of rubber appropriation by smallholders in Indonesia is that it exemplifies how the complementariness of the swidden cycle and the introduced forest tree production can ensure the success of the whole system. In the case of rubber growing, this complementariness was as much political, as it was economical and technical [31]. Beside its advantages in terms of labour productivity, it first allowed indigenous rubber production to remain 'invisible' in a time where the trade of both wild and cultivated rubbers was the privilege of concessionary collectors and colonial estates, and as a consequence, forbidden to swidden cultivators. In the political context of the 32 years of the Suharto regime, it allowed for the reinforcement of customary control over forest lands, which happened to be especially important in cases of dispute over land allocation or compensation related to government-sponsored forest conversion.

26. Barlow *et al*. 1994; Budiman 2000.
27. Gouyon *et al*. 1993.
28. de Foresta and Vincent 2002.
29. Penot 1995.
30. Gouyon *et al*. 1993.
31. Dove 1995.

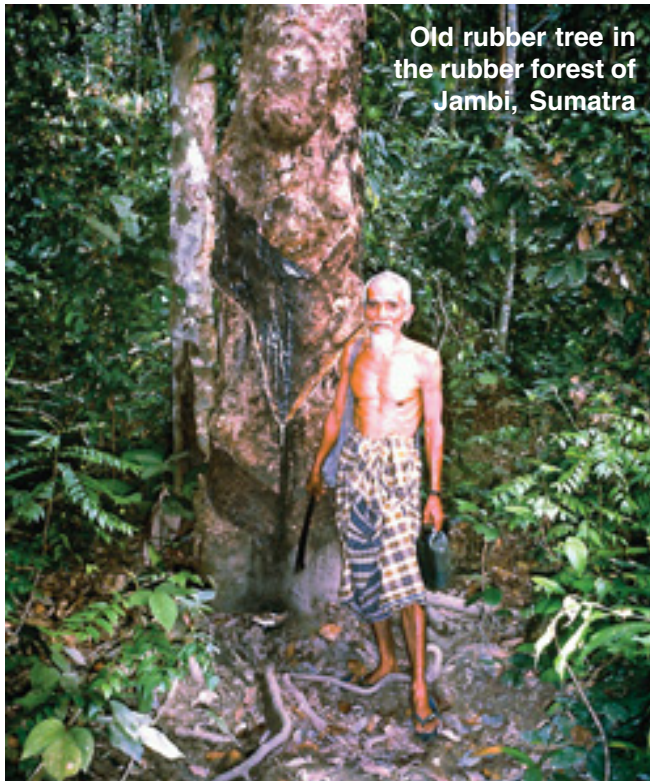
Rubber forests

From the ricefields to the rubber forest, Jambi, Sumatra

Harvesting secondary products (here, *Pandanus* leaves for mats) in the rubber forest

Common appearance of rubber forest in Riau, Sumatra

Transporting rubber slabs in the Jambi rubber forest



Old rubber tree in the rubber forest of Jambi, Sumatra

Stand of old fruit trees in the middle of the rubber forest

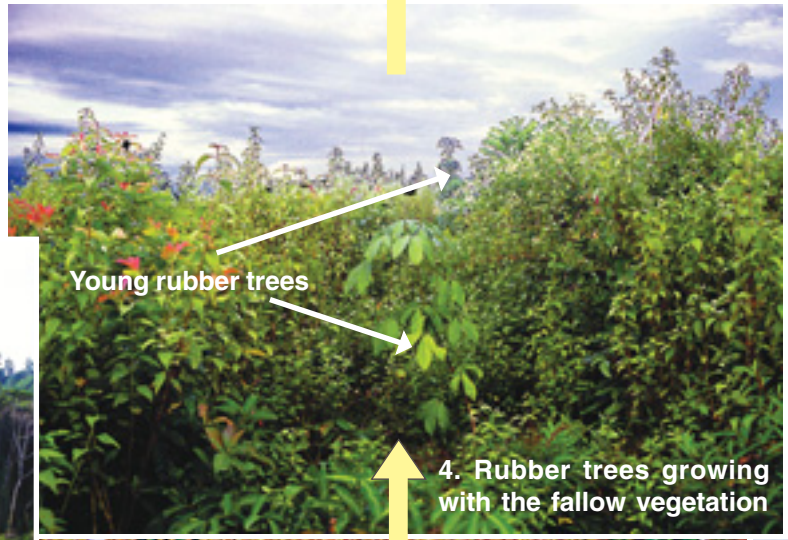
Some parts of the forest contain many secondary and self-regenerated forest species.

A rather specialized rubber forest in South Sumatra


1. Opening old growth forest


5. Young rubber forest


6. Maturing rubber forest


Young rubber trees

4. Rubber trees growing with the fallow vegetation


7. Old rubber forest


2. Planting rubber seedlings in the swidden rice

Rubber seedlings


3. Rubber growing with successive rice crops


8. Renovating the forest plantation through slash and burn

The rubber forest cultivation cycle

Activities around rubber

Harvesting latex

Coagulating latex

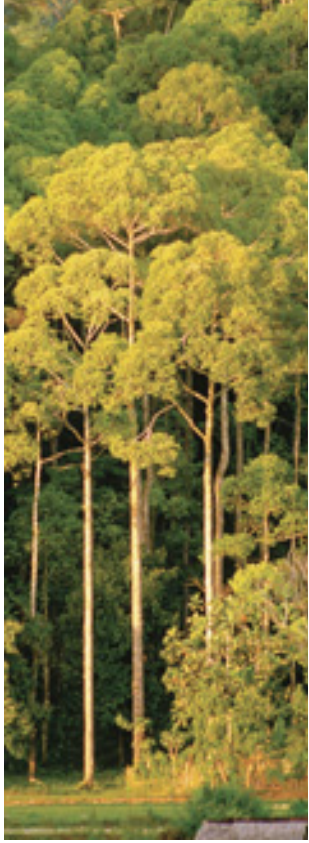
Transporting latex

Transporting latex

Weighting and trading

A true forest canopy, but a cultivated forest

The damar forest adjoining ricefields



Canopy of a damar forest

Damar, a large canopy tree in natural forests

The damar forest in Sumatra

7. Permanent forest culture: damar agroforests in Pesisir, Lampung, Sumatra

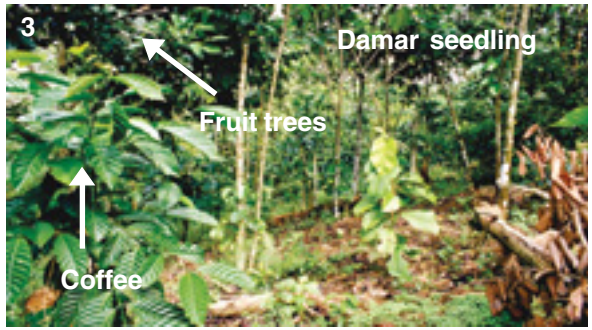
Dipterocarp resins (collectively known as damar) are among the oldest traded items from the forests in South-east Asia[32]. They entered the first long-distance trade that developed with China from the third century. They acquired a new commercial value by the middle of the nineteenth century with the development of industrial varnish and paint factories in Europe. Until the end of the nineteenth century, damar was exclusively collected from the natural forests of western Indonesia. Today, more than 80% of the damar resin produced in Indonesia comes from trees cultivated in the Pesisir district of Lampung Province in South Sumatra.

Damar cultivation illustrates how swidden farmers have achieved a true process of forest reconstruction after slash-and-burn agriculture, creating a perfectly balanced and diversified forest plantation based on one of the most valuable species, a Dipterocarp[33]. Pesisir farmers have succeeded in doing what most foresters dream of doing, but fail: establishing, maintaining and reproducing over the long term and huge areas, at low costs, a healthy Dipterocarp plantation. This success story is still unique in the whole forestry world. Its success is inextricably linked to shifting cultivation.

Damar seedlings (*Shorea javanica*) are planted with young coffee bushes in dry rice plots opened in secondary forests. This coffee–damar association is maintained during the eight years of coffee production, after which ageing coffee is abandoned and damar trees continue growing alongside the regenerating forest. The 'damar fallow' increases in complexity over the years with the introduction of various fruit trees as well as with the establishment of forest trees and bushes among the cultivated damar. The first trees are tapped after 20 to 25 years, and after 40 to 50 years, they reach their full production period. The mature plantation exhibits a complex structure with a high canopy, several under-canopy layers, and dense undergrowth. A typical damar garden is composed of 60% to 75% damar, but it exhibits fairly high biodiversity, including economic trees either planted or protected in the stock of self-established species, such as *Durio zibethinus* (durian), *Parkia speciosa* (petai), *Lansium domesticum* (duku), *Gnetum gnemon* (tangkil), *Syzygium aromaticum* (cengkeh), *Garcinia parvifolia*, *Plectonia glabra* and other tree species, as well as inutile species like epiphytes, lianas and undergrowth herbs and shrubs. Once established, the damar plantation evolves with minimum human input. Decaying trees are replaced on a tree-by-tree basis, but globally, damar plots are never reopened for a new rice –coffee– damar cycle.

Though resembling a forest, damar gardens are part of a farming system that includes rice fields, swidden fields and coffee gardens. They are managed mainly as a diversified but clearly agricultural enterprise. Occupying this vague interface between agriculture and forest, they have been called agroforests[34].

32. Dunn 1975.
33. Michon *et al.* 2000.
34. Michon *et al.* 1983.



Damar silviculture, from swidden to forest

Damar silviculture starts with the plantation of coffee in the swidden rice (1, 2). Damar trees are planted under coffee bushes and shade trees (3, 4). Once established some 30 years later, the damar forest (5) regenerates through the controlled colonisation of gaps in the canopy (6, 7)

Main products from the damar forest

Harvesting damar resin

The damar forest provides a variety of products—including resin, fruits, timber, rattan, among others—and services like biodiversity conservation

Transporting damar resin to the village

Transporting fruits from the damar forest to the village

Intensively used damar timber

Weighting the langsat harvest before selling it to Jakarta traders

Langsat fruits (*Lansium domesticum*) are consumed locally and sold on the distant Jakarta markets

Fruit, spices and timber forests in West Sumatra

Cultivated forests in Maninjau are dominated by large durian trees and various timber species (*Pterocarpus, Toona*), with spice trees (cinnamon, nutmeg, clove) in the undergrowth

Production is for both local markets (fruits, timber) and spices export

Timber production

Durian production

Cinnamon production

The foret seen from above, adjoining rice fields

Old durian and timber trees with cinnamon in the undergrowth

Mature cinnamon trees in the undergrowth

The high, forestlike durian canopy

Durian season

Fallen durian fruits are collected and brought to the village.

In durian season, the whole village lives in the cultivated forest watching over the fall of durian fruits.

Preparation for fermented pasta durian

Durian fruits are collected by traders and sold all over Sumatra.


Durian and cinnamon trees

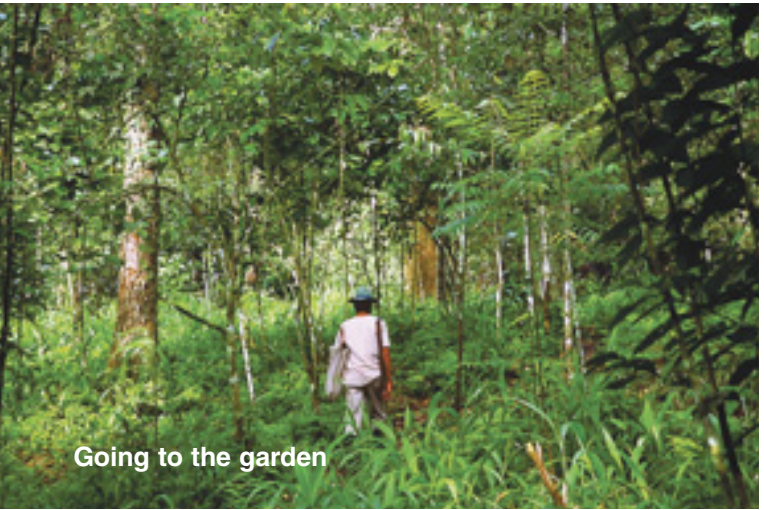
Harvesting cinnamon


Chosing the tree


Preparing branches for peeling


Havestable and young cinnamon trees


Peeling the trunk


Going to the garden


Peeling the trunk


Cleaning the bark

In the damar example it is not only the technical and ecological aspects that are of interest. It also illustrates some of the essential qualities of farmers' strategies for forest plantation, which are embedded in legal, social, political and symbolic appropriation of forest resources through domestication. The present damar forest covers about 80,000 ha. Planting trees in their swidden, Pesisir farmers have managed to re-create, on a large scale, a new forest landscape. This forest landscape, however, is quite different from the original one, especially as far as economy, rights, symbolic and social values are concerned. This damar forest is entirely tailored to the farmers' needs and represents an important patrimony[35]. But it also represents an attempt at symbolic and legal reinforcement of customary rights over resources and lands, which were constantly denied by the forest administration[36]. If the first damar gardens were established as a response to the damar resource exhaustion, the present damar forest is also established against the natural forest itself, as a claim over the closure, because of present forestry regulations, of forestlands and resources for local communities. Through domestication and culture, farmers claim that they have purposefully restored, in the middle of an agricultural territory upon which they believe to hold a firmer control, a privileged space in which not only damar, but their entire forest resource is protected.

35. Levang & Wiyono 1993.
36. Michon *et al.* 2000.

8. Permanent forest culture: fruit and timber agroforests in Maninjau, West Sumatra

On the slopes bordering the volcanic lake of Maninjau in West Sumatra, the land sequence includes permanent rice fields in the swamps and the slightly undulating lower slopes. The villages are then bordered uphill by a large belt of forestlike tree gardens, which dissolves into the upper montane forest on the steepest parts of the slopes up to the ridge of the caldera[37].

The tree gardens include three typical components.

1. *Fruit trees.* Durian (*Durio zibethinus*) represents the major species both in structural, social and economic terms. Large durian trees represent the permanent skeleton of the tree gardens, forming a high canopy, which culminates at more than 40 meters high. During each durian season, families gather from all over the archipelago. All activities, night and day, are devoted to durian collection in the gardens, transport to the villages, trade and processing. The fresh fruit is traded all over Sumatra and locally processed into various pastes for long-distance trade and preservation. Other fruit species include several under-canopy species like jack fruit and cempedak (*Arthocarpus* spp), rambutan (*Nephelium lappaceum*), langsat, golden berries (*Baccaurea* spp.) and water

37. Michon *et al.* 1986.

apples (*Eugenia* spp). These fruits are sold in the local markets from village centres to the regency city of Bukittinggi or used for household consumption.

2. *Timber species.* Timber production from agroforestry gardens is quite important and original. It relies on both actual cultivation of timber species and management of naturally occurring forest species as well as the utilisation of fruit trees. Cultivated species include 'surian' (*Toona sinensis*, a Meliaceae) and 'bayur' (*Pterospermum javanicum*, a Sterculiaceae). Both are native to the local forest ecosystem. They make up 30% to 70% of the canopy tree cover. Both can be harvested after 25 to 30 years when their diameter reaches 35 cm. Processing into boards is done by village carpenters, who also deal with sale outside the Maninjau area. Managed forest species include mainly Meliaceae, Lauraceae, Fagaceae, Myrtaceae and scattered Dipterocarpaceae. They are not planted but reproduce from seeds produced by mother trees conserved in the tree gardens or carried by winds and animals from the nearby forests. The villagers select seedlings or saplings, which can be transplanted whenever needed and which benefit from the care given to spice tree crops. Utilisation of the wood of overaged or bad-producing fruit trees is also important. The preferred species include durian, cempedak and various *Baccaurea* species. Altogether, timber production from the gardens in Maninjau relies on around 30 species, each of which has a preferred use. Foresters occasionally use some of the species but not the common commercial species (mainly Lauraceae and late pioneer species like *Acrocarpus* or *Terminalia*). Labour devoted to silviculture is totally mingled with that needed for commercial tree crops.
3. *Spice trees.* The commercial value of this group of trees, in contrast to fruit trees and timber species, tends to fluctuate in response to the fluctuations of the international spice market. The most important species is cinnamon (*Cinnamomun burmanii*). Cinnamon is a medium-sized tree native to local montane forests. It has been exported from West Sumatra for several centuries, and grown in Maninjau for more than one century. If forms dense stands in the undergrowth. Cinnamon cultivation evolves along a cycle of 8 to 15 years. New stands are established under the durian canopy in cleared undergrowth, either from seedlings collected in the gardens or from coppice shoots from the former stand. The trees are left to grow until the bark is harvested. The stand does, however, benefit from the seasonal slashing of grasses, bushes and vines, carried out before each fruiting season. The cinnamon stand is usually totally harvested and then replanted. However, some gradual harvesting does occur if needed. Cinnamon can also be mixed in the undergrowth with coffee and nutmeg as well as scattered fruit trees. Other spice species include coffee (*Coffea robusta*), which is generally poorly managed, nutmeg (*Myristica fragrans*) and more recently cardamum (*Aframomum*). Clove (*Syzigium aromaticum*) used to be intensively grown until 1980, when it suffered from a disease that killed all the trees and prevented replanting.
4. *Other species.* Apart from the above-mentioned timber tree species and some wild fruit trees, self-established vegetation includes late pioneer as well as forest trees, small undergrowth trees, an astonishing diversity of epiphytes including orchids, small lianas and herbaceous species typical of forest undergrowth.

The most interesting point of the Maninjau example is not that it is associated with shifting cultivation, but with a permanent rice cropping system. The management is highly flexible and adapts to market evolution by the inclusion of timber, formerly for self-consumption, as a trade commodity and the emphasis on spice species correlated with market profitability.

9. Other examples of permanent forest culture: Indonesia

Extensive areas of cultivated forests based on the cultivation of a particular forest resource, or of diversified tree gardens associating fruit trees, commercial crops and forest trees, can also be found in many other places on Indonesian islands[38].

***Candlenut agroforests of South Sulawesi*:** The Bugis of the interior of South Sulawesi are traditionally rice farmers (with permanent or swidden fields). After migrating to the highlands in the second half of the nineteenth century, farmers started establishing forest gardens, dominated by candlenut trees (*Aleurites moluccana*), on their farmlands. These gardens presently form a continuous forest belt that extends between the highland pastures and forests and the villages located on the lower parts of the slopes and surrounded by rice fields. The candlenut agroforest covers most of the medium-altitude hills, which have been developed through slash and burn. The total area is estimated to be around 20,000 ha. The main product is candlenut, the oil of which is extracted and processed for regional and international cosmetic industries. Cocoa trees have recently been introduced under the canopy of candlenut trees and represent a reasonable source of income. Other useful species include fruit trees, forage trees and timber species for local use. The price of the candlenut has dramatically dropped during the last few years, but in spite of low profitability, candlenut gardens are still maintained. Some new plots are still being planted, more as a land appropriation strategy than for real economic purposes, especially on former pasturelands in the upper slopes that have been reclaimed by the Department of Forestry and 'rehabilitated' through Pinus plantation[39].

***Fruit forests (*lembo*) of the Mahakam river*:** In the Damai subdistrict of East Kalimantan, on the alluvial terraces bordering the Mahakam basin, where the Kutai people have been established for a long time, farmers have developed impressive fruit forests, which usually surround permanent villages[40]. These forests have evolved from former swidden fields, through the planting of various fruit trees. The diversity of the fruit species cultivated and managed in these fruit

38. de Foresta *et al*. 2000.
39. Marzuki 2003.
40. Seibert 1988; Seibert 1989; Sardjono 1992.

forests is quite impressive. They include several species of large durian trees (*Durio*) and mangoes (*Mangifera*), many of which are endemic to the island, forming a high canopy typical of primary forest ecosystems, as well as relatives of the jackfruit (*Arthocarpus*), *Nephelium*, *Baccaurea*, and some nut species such Canarium. These forests have been established mainly for subsistence. Some of them have been converted into mixed rubber gardens, but the recent development of a large fruit market in Samarinda has given new value to some fruit species, particularly durian.

***Illipe-nut forests* (tembawang*) in West Kalimantan**: In West Kalimantan, swiddeners also used to grow highly diversified, communal fruit forests around their dwellings. For at least 150 years, they have incorporated oil-producing Dipterocarps (illipe nuts) in these fruit forests[41]. The fat of the illipe nut is extracted and traded as a raw material for cosmetic industries. These cultivated forests are managed through very specific technical and social rules which have resulted in the restoration of a complex and diversified forest ecosystem. Tembawang forests form large forest islands (several tens to hundreds of hectares) integrated into the traditional shifting cultivation territory. As the natural forest has been seriously depleted in West Kalimantan because of logging and conversion to oil palm plantations, these *tembawang* forests have allowed to conserve tens of fruit and nut species, as well as rattans, latex-producing trees and timber species, and hundreds of self-regenerated forest species including trees, lianas, orchids and bushes. They presently tend to incorporate more and more rubber trees.

***The durian forests of West Kalimantan*:** Around the Gunug Palung National Park in West Kalimantan, local swidden farmers have established durian-dominated forest gardens, which have managed to restitute a true forest environment[42].

***The fruit and cinnamon agroforests of Kerinci*:** In the mountains surrounding Lake Kerinci in the centre of Sumatra, local farmers are renowned for their intensive cinnamon cultivation system. On the lower part of the slopes, cinnamon is cultivated under a tall canopy of durian and other fruit trees as well as some timber species[43]. These cinnamon agroforests are quite similar to those found around Lake Maninjau in West Sumatra (described in this volume).

***The fruit agroforests of Jambi and Palembang*:** A large belt of fruit forests surrounds most villages in the eastern lowlands of Sumatra. Some of them are quite old, as in the former Hindhu kingdom villages of Jambi[44]. They exhibit a high canopy of large durian trees or true forest species, under which grow numerous smaller fruit trees including langsat, rambutan, various *Baccaurea* species and legume trees grown for their edible pods. These gardens cover extensive areas. However, the extension of rubber, oil palm and Acacia estates in these lowland areas is putting a serious threat to their survival.

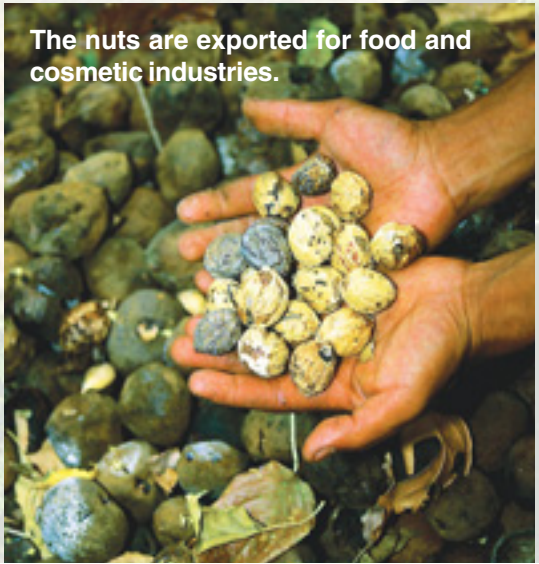
***The sugar palm and* salak *agroforests of Bali and Lombok*:** In the eastern parts of mountainous Bali, as well as on the lower slopes of Mount Rinjanni on the neighbouring island of Lombok, farmers have established agroforests dominated by palm species[45]. The sugar palm (*Arenga pinnata*) is forming the skeleton of these agroforests in

41. Momberg 1992; Padoch 1993; de Jong 1994.
42. Salafsky 1994.
43. Aumeeruddy 1994.
44. Michon Pers. Observ. 1994.
45. Michon Pers. Observ. 1996.

Candle nut forests cover all the slopes surrounding irrigated and rain-fed rice fields, up to the limits of natural forest.

Candlenut forests in South Celebes

In several mountain districts in the province of South Celebes, the slopes surrounding rice fields are covered with cultivated candlenut forests, developed about a century ago. Large candlenut trees are associated with various fruits trees and forest species. Locals have recently integrated cocoa trees in the undergrowth. Candlenut forests provide regular income and useful products for everyday life.



The nuts are exported for food and cosmetic industries.

Candlenut trees with silvery flushes of young leaves

The canopy of candlenut trees can reach 30 m high

Cleaning nuts

The candlenut forest starts just beyond the village limits.

Old gardens exhibit a typical forest structure and diversity.

Harvesting nuts in a candlenut and cocoa grove

‘Lembo’

Fruit forests in East Kalimantan

Along the Mahakam River, impressive fruit forests are cultivated around villages. Dominated by large fruit trees (*Durio, Mangifera, Arthocarpus)*, with lower species in the undergrowth (*Nephelium*, *Baccaurea*, *Lansium*), they exhibit the high diversity in tree species and structural patterns typical of a natural forest.

Shifting cultivators in West Kalimantan have cultivated highly diversified forests dominated by oil-producing Dipterocarps for at least 150 years. The main product is the illipe nut, fat from which is extracted as a raw material for cosmetic industries. These forests also integrate tens of other fruit and nut species as well as rattans, latex-producing trees and timber species. Recently, they have also integrated rubber trees.

‘Tembawang’

Illipe nut forests in West Kalimantan

Lombok, mixed with some fast-growing timber species and various fruit species. In Bali, the *salak* (*Zalacca edulis*), a small palm producing edible fruits, is grown under a mixed canopy of fruit and nut trees.

***The fruit gardens of West Java*:** Villages in West Java are surrounded by old and diversified fruit gardens that form compact forest islands of several tens of hectares each in the middle of rice fields[46]. These village agroforests may cover up to 35% or 40% of the land area, in areas where the average population density is between 700 and 1000 inhabitants per square kilometre. They thus represent the main 'forest' cover in some parts of the province. Because of their high diversity in both cultivated and self-regenerated species, they also constitute the main reservoir of forest biodiversity on this overpopulated island.

***The bamboo gardens of West Java*:** In the mountains of West Java, farmers have established a rotational silviculture system where a 'forest' phase—dominated by either bamboos or fast-growing timber species—alternates with rejuvenation phases devoted to the cultivation of vegetables[47].

***The spice and nut agroforests of the Moluccas*:** On the famous spice-producing Molucca islands, nutmeg and clove, or a mixture of both, are grown in association with banana groves and nut-producing *Inocarpus* trees, under a tall canopy associating coconut and tall *Canarium* trees with various local forest species[48].

46. Terra, 1953; Soemarwotto 1981; Christanty 1982; Michon and Mary 1994.
47. Christanty 1982; Karyono 1990.
48. Michon Pers. Observ. 1996.

10. Other examples of permanent forest culture: South-east Asia and elsewhere

Various forms of cultivated forests can be found outside Indonesia, as demonstrated during the Lofoten Workshop on 'intermediate systems' of forest management. In South-east Asia, these include the following.

- In the cardamom gardens of southern Laos, cardamom is cultivated under a true forest canopy[49].
- The benzoin fallow gardens in northern Laos are fallow fields established after upland rice cultivation in which planted and naturally regenerated benzoin trees grow in association with pioneer species. They are managed for two to three decades[50].
- In the mixed coffee–fruit–forest gardens of southern Laos, coffee bushes are integrated into a cultivated fruit forest or a mixed stand of self-established forest trees and fruit species[51].
- In the Miang tea agroforests of northern Thailand, tea trees (*Camellia sinensis*) are mixed with fruit trees and other species for local use under a thinned forest canopy[52].

49. Aubertin 2000; Foppes & Ketphanh 2000.
50. Kashio & Johnson 2001.
51. Michon Pers. Observ. 1995.
52. Watanabe *et al*. 1990.


Spices and nuts agroforests
in Maluku Province


Village forests in the
Baduicountry, West Java


Mixed tree gardens and
rice fields in Bali


Old fruit forests in Jambi, Sumatra


Rotational bamboo and timber forests
in West Java


Fruit forests in West Java


Fruit islands in West Kalimantan


Cinnamon and durian agroforests
in Kerinci, West Sumatra

In Cameroon, local cocoa plantations, established in mature swidden fields, associate cocoa bushes with three different types of components: a high canopy of remnant forest trees spared from felling during the creation of the swidden, some late-pioneer tree species and a mixture of planted native and exotic trees[53].

Other famous African examples include

- The Chagga home gardens of Mount Kilimanjaro in northern Tanzania have a low strata of coffee and banana groves under a tall canopy of local Albizzia species mixed with various local forest species[54]. These agroforests constitute a continuous forest belt on the middle slopes of the mountain, bordering the protected forest of the upper slopes. Their role in water regulation, soil protection and biodiversity conservation is essential.
- In the coffee forests of Ethiopia, local varieties of arabica coffee are grown in association with cultivated species and self-regenerated forest trees[55].
- The village agroforests of southern Nigeria are based on local forest fruit species such as the 'African mango' *Irvingia gabonensis*, the 'bush grape' species from the Sapindaceae family, the 'African plum' *Dacryodes edulis*, the 'chestnut' *Coula edulis*[56], the cola nut (*Cola* spp.) and sometimes local varieties of oil palm.

In South America, examples of cultivated forests include the Maya home gardens[57], the fruit agroforests of Carnero island in the Amazon estuary[58], Brazil nut groves[59] and palm forests of the Amazon region[60], and extended home gardens planted by *caboclos* on the banks of the numerous rivers of the Amazon basin, which include fruit trees, useful palms and timber species[61].

53. Dounias 2000.
54. Fernandez *et al*. 1985; Verdeaux 2003.
55. Roussel and Verdeaux 2004.
56. Okigbo 1990; Okafor 1991.
57. Alcorn 1984; de Miguel *et al*. 2000.
58. Bahri 1992.
59. Cleuren & Henkemans 2000.
60. Anderson 1988; Mogenburg 2000.
61. Padoch *et al*. 1985; Pinedo-Vasquez & Padoch 1996; de Jong 2001.

11. Common principles in smallholder forest culture

Even though the species and techniques presented in the cases we have analysed vary greatly, we have found important common principles in smallholder forest culture[62].

1. The first one is the principle of ***close 'integration' with agriculture,*** and particularly with the practices, logistics and dynamics of swidden agriculture. This integration between agriculture and forest culture deeply contrasts with the vision of professional forestry, which sees agriculture and plantation forestry as worlds apart.

62. Michon 1999.

2. The second principle involves ***continuity with the natural forest,*** which is expressed through vegetation structure, forms or functions, and concerns ecological as well as economic and social qualities. This continuity contrasts with professional monocrop forestry in the tropics, which clearly breaks with the patterns and dynamics of natural forest production.
3. The third is a principle of ***multifunctionality.*** Smallholder forests, though designed for the production of a single product, or a small number of products, are quite diverse in both composition and utilisation. Moreover, production is not their sole aim, as social and political objectives may sometimes be as important as the productive function. This model, again, contrasts with the monocrop stands and single-purpose utilisation of professional forest plantations.

a. A close integration between smallholder forest culture and agriculture

The foundation of professional forestry implies a deep opposition between forestry and agriculture, especially smallholder agriculture, which used to be seen as the main threat to the forest. In the tropics, timber extraction, and moreover industrial forest plantations, strictly exclude local farmers and their agricultural practices and vie with agriculture for land development. Shifting agriculture is universally blamed for deforestation (see the rationale of the 'Alternative to Slash and Burn' project)[63]. How well do these perceptions fit with the reality of smallholder forest culture?

There is a real symbiosis between shifting agriculture and smallholder forest culture. The strong foundation of smallholder forest development on swidden agricultural practices and dynamics explains its success, and has deeply changed slash-and-burn agriculture.

Shifting cultivation and the creation of smallholder forests

Shifting cultivation plays a central catalytic role in the establishment, reproduction and long-term maintenance of smallholder forests, which usually develop from the swidden itself. In both interstitial and integral forest culture, the swidden and postswidden stages are fundamental in establishing the forest plantation, as seeds or seedlings of the selected forest species are planted in the swidden together with annual food crops, among which they grow during the first years and then develop with the early fallow vegetation. The mature forest plantation may allow the perpetuation of shifting cultivation cycles, as massive rejuvenation often occurs after a cycle of slashing and burning, which refreshes the productive stand and allows the farmer to introduce new forest crops.

In contrast to the standards of industrial forest culture —large-scale monocrop plantations, increased technology, energy and chemical inputs— the mimicry of the swidden–fallow–old-growth forest silvigenetic cycle on small surfaces of around 1 ha reduce both the costs and the risks linked to the establishment of a plantation. Moreover, it helps the

63. Sanchez *et al.* 1993.

farmer increase what is the scarcest input in smallholder systems, namely, the labour productivity of forest clearing for subsistence cropping. This process of establishment and rejuvenation is based on the logic of the economy of labour, which maintains the establishment investments at low levels and allows forest culture to be profitable even on small plots. This arrangement is in contrast to industrial forest plantations, which depend heavily on economies of scale.

Forest 'destruction' linked to the first stages of shifting cultivation finally restores an economically profitable forest, which is usually more mature and better controlled than the common fallow.

Economic and social complementariness

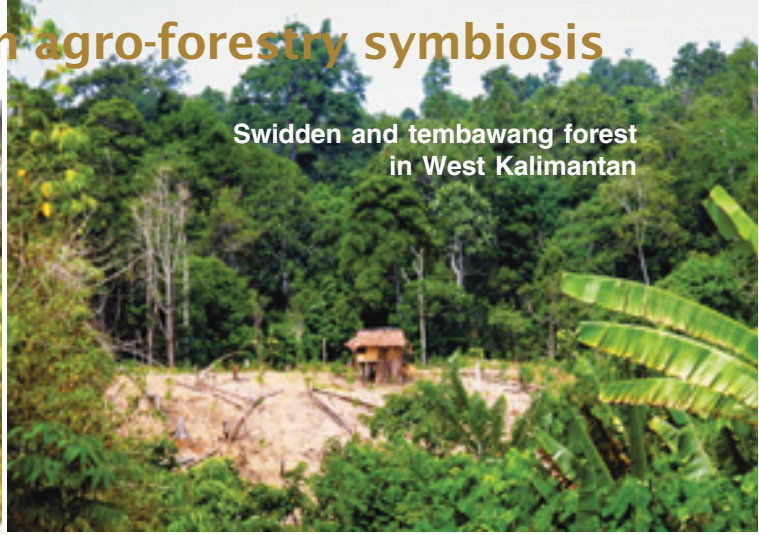
The way in which forestry and agriculture complement each other is also expressed at the level of household and village economies. In contrast to conventional professional forestry, smallholder forest culture is not a sectoral activity, and forest culture is not an exclusive professional activity. It represents one component of farmers' livelihood strategies, which introduces the complementariness of subsistence cropping and commercial agriculture.

From a social and institutional point of view, the forest plantation is an important element in land appropriation strategies, an aspect mentioned by farmers in all the studied cases (see also Michon & de Foresta. 1999). It gives farmers the opportunity to create land property, under the recognised authority of the planter. The land property can be transferred to descendants as patrimony. With increased pressure on land, this opportunity constitutes an interesting counterpoint to shifting cultivation, whereby lands are usually managed more collectively at the village level with little possibility of individual or family land appropriation and in which productive and social investments are difficult. Farmers may use this visible privatisation of rights over forestlands as a tool for collective or individual negotiation with outside competitors for land control and utilisation more easily than if the land were just used in a swidden–fallow cycle. For example, see the collective negotiations between benzoin farmers and the Indorayon company or the individual negotiations with oil palm companies for compensation in rattan areas. The privatisation through forest culture is not really strict, however. Even when governed by individual appropriation rules, the 'community'—the lineage, the extended family, the clan, the village community—exerts moral control over the utilisation of the forest by the individual owner, and strict control over the alienation of the property to third parties. Moreover, the forest plantation maintains a space and a pool of resources, which can be used collectively, by the family or the whole village, for subsistence harvesting or in case of necessity. This maintenance of collective use, which seems typical of forest management, contrasts with stricter privatisation linked to the establishment of open fields devoted to short-cycle crops.

Forested farmlands: an agro-forestry symbiosis

Permanent rice fields and cultivated forest in West Sumatra

A young swidden with rattan, the adjoining rattan forest in the background



Swidden and tembawang forest in West Kalimantan

Permanent rice fields in the flatlands, rubber forest and swiddens on the slopes, and the forest in the background mountains

Rice fields in the middle of the fruit and timber agroforest in Maninjau

Even when cultivated forest dominates the landscape, farmers in West Sumatra keep some rice fields.

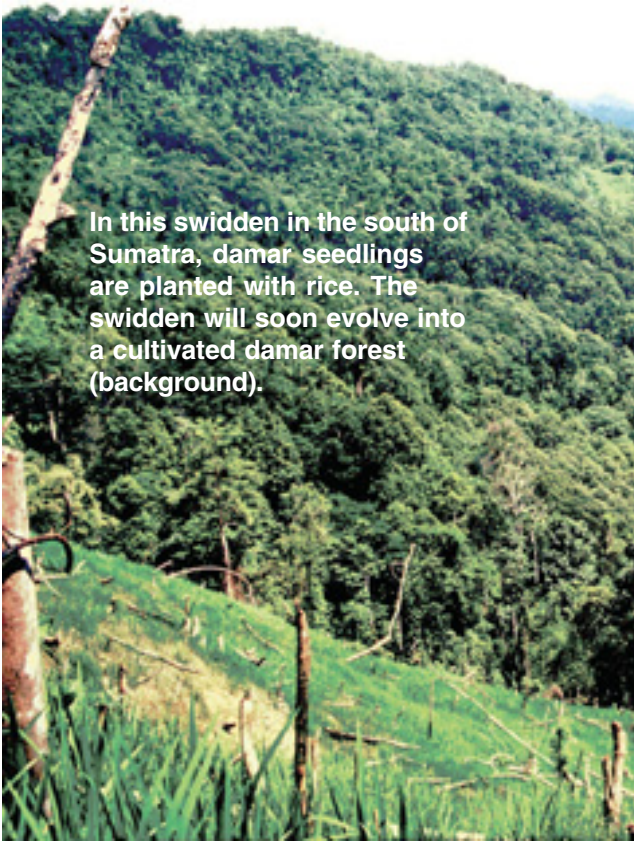
Forest culture as practised by smallholder farmers in the region is not an exclusive professional activity, but one component of farmers' livelihood strategies. Never existing in isolation, cultivated forests are part of lands claimed and developed from natural forest through agricultural techniques. They are closely integrated within the farming systems, where they complement swidden or sedentary rice farming. Through their products and income, they efficiently support local agricultural economy.

Rice fields, the cultivated forest, natrural forest: a common toposequence in Sumatra

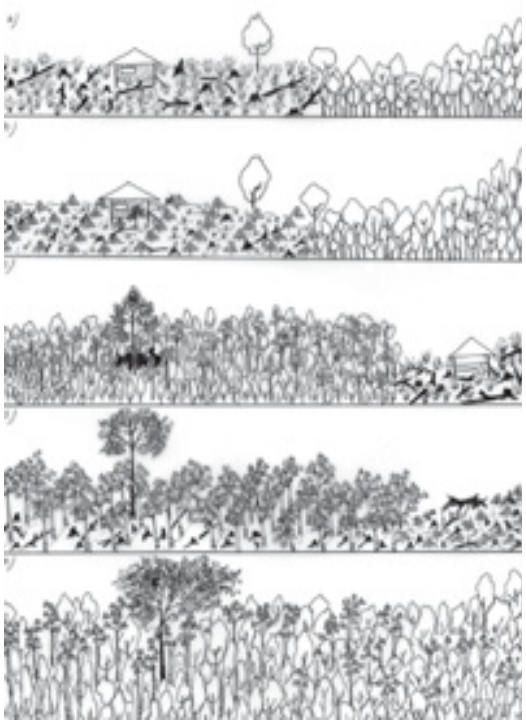
Forest culture and swidden agriculture

Shifting cultivation plays a catalytic role in the creation and reproduction of smallholder forests.

Forest culture on farmlands usually starts from the swidden. Seedlings of selected forest species are planted together with rice, and the young trees develop along with the fallow vegetation. This strategy reduces the labour costs linked to plantation establishment and buffers the risk of failure during the first years. Forest culture through swidden cultivation thus is profitable even on small plots.

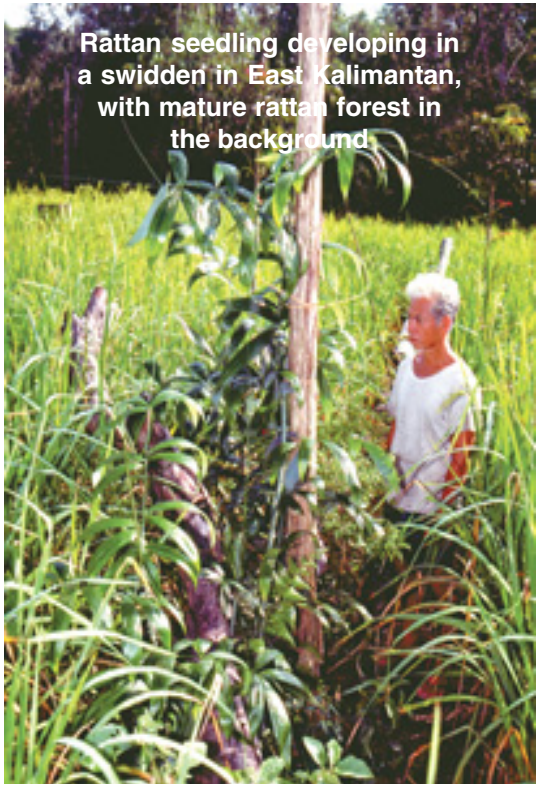


In this swidden in the south of Sumatra, damar seedlings are planted with rice. The swidden will soon evolve into a cultivated damar forest (background).



Development of rubber forest culture through slash-and-burn cultivation in Sumatra

Many cultivated forests like this rubber forest in East Kalimantan are regenerated through slash-and-burn practices. The new swidden is planted with rice forest crops.



Rattan seedling developing in a swidden in East Kalimantan, with mature rattan forest in the background

Swidden farmers are the most active forest cultivators in Indonesia.

Conclusion: a real agroforestry symbiosis

Beyond this technical and socio-economic articulation, there is also a real symbiosis between smallholder forest culture and swidden. Agricultural and forest-related practices are co-evolving and this co-evolution is usually positive for both sides.

Foresters usually assert that forest culture cannot be conceived on a small scale. We have shown that small-scale forest culture is possible without increased costs or with acceptable economic returns if, and only if, it respects a close integration with slash-and-burn systems and other existing agricultural practices. The swidden field allows the planted forest to be established, developed and renewed. Slash-and-burn agriculture may disappear when the silvicultural system has sufficiently matured, as in damar areas, but it is essential in the early stages of the system. In return, the substitution of a productive forest stand to former tree fallows allows a quick intensification of swidden agriculture without drastic changes in practices or dynamics. The introduction of forest culture increases labour productivity as well as global productivity on a per hectare basis of both the swidden–fallow system and the whole farming system. Unlike traditional fallows, planted forest provides cash and other economic resources, without major constraints on land and labour utilisation. In rotational systems, the qualities inherent in the cyclic dynamics of food production are maintained, since in swidden–fallow cycles, the planted forest restores soil qualities and nutrients that will be available to the next food crop. And so the degradation process that usually develops when pressure on land increases is avoided.

This intensification is achieved through a smooth adaptation of practices, not through a painful revolution of the whole farming system. This adaptation has obviously important social consequences, as it avoids the marginalization and impoverishment of a whole class of farmers. A sign of success is that migrant farmers quickly adopt local forest culture. In this respect, the association of swidden and forest culture epitomises a true complementary agro/forestry system (could not we say a true agroforestry complementariness?), where the association of 'agro' and 'forest' components occurs at the level of the farming system itself.

Recommendations

Our recommendations for research and development of this close interrelationship between smallholder forest culture and agriculture concern the following points.

1. Local examples of forest management and culture are part of the farming systems and agricultural land development. They must therefore be analysed in the whole context of productive activities, especially farming systems and household livelihood strategies. This analysis should include an understanding why farmers choose forest management as an alternative, as well as the clarification of all types of links between farming and forest-based activities.
2. Agroforestry research usually concentrates on the complementariness of trees and crops at the field level. We strongly stress that it should pay more attention to the complementariness of agriculture and forestry at the level of local farming systems.
3. Small-scale forest culture cannot exist independently from agricultural practices. Therefore its development, in new areas, must be integrated into existing agricultural systems and traditions.
4. In areas where natural conditions seriously limit continuous annual food cropping, forest culture integrated into former shifting cultivation cycles represents a good strategy for intensification of economic systems, which serves both farmers' interest and environmental concerns. This strategy should be more systematically developed and applied, especially on pioneer fronts and other types of fragile forest margins.
5. Instead of being systematically combated by development interventions, shifting cultivation practices and dynamics should be considered both the entry point to and a tool for the development of improved forest management that fully involves swidden farmers.
6. Forest culture usually compensates for the depletion of natural forest resources by a transfer of the most important forest resources to farmlands. The cultivated forest then facilitates the re-establishment of other, noneconomic forest species. This contribution of agriculture to forest conservation outside protected areas should be more systematically supported by policies and technical services.

b. A clear continuity between smallholder forest culture and natural forest

Professional forest culture, which embodies forest domestication and culture, has often stressed that the only way to achieve a rationalisation of costs and a maximisation of forest production relies, as in modern agriculture, on an artificial simplification of forest structures, and that diversification of cultivated species or an increase in the complexity of a structure, if technically feasible, is not economically sustainable[64]. This productivist approach inherited from the rational model of open-field crop production has induced a true movement of dissociation between the forest resources selected for domestication and their original ecosystems, as well as between forest plantations and natural forests. The promotion of intensive monocrop tree plantations actually discards smallholder models of integrated agriculture and forest utilisation.

Smallholder forest culture presents a remarkable continuity with the natural forest and its complexity, in ecological, economic, social and symbolic terms.

The above assumption seems obvious in examples where the forest planting is conducted in a cyclical mode and fits into a spatial or temporal forest matrix. These temporary forest plantations can be considered as a particular facies in a manipulated silvigenetic process that preserves global forest structures, functions and qualities over space and time. In that respect, forest culture, even though it is a true intensification process, induces minimal disruption of the original forest structures.

In permanent forest culture, the structural and functional continuity with natural forest is ensured through other types of practices and strategic choices. These practices include management of individual trees rather than of uniform stands, preference for uneven-aged population of trees, introduction of secondary forest crops, minimal and selective cleaning of 'weeds'. Permanent forest culture develops in order to intensify the production of naturally occurring products, and smallholder forests do start as specialized plantations. But in contrast with what happens in industrial forest plantations, further diversification into a mixed stand of various planted forest crops and naturally regenerated species results in the restoration of structures that mimic the original habitat and preserve the original qualities of the environment, including soil protection, control of water flows and conservation of high levels of biodiversity. (We will, henceforth, use the term 'forest preference' in reference to this silvicultural strategy that emphasizes heterogeneity and restores true forest structures; Michon & de Foresta 1999.) It also guarantees that the established forest will be able to regenerate in the long term with minimal input.

64. Evans 1992; Wormald 1992.

Conclusions and recommendations

Our main conclusion about this continuity between smallholder forest management and natural forests concerns the need to redefine the place and the role of forest culture in the dynamics of forest ecosystems. Professional forest culture in the tropics deals mainly with short-lived tree species and quick rotations, which are spatially as well as temporally disconnected from natural forests. South-east Asia swidden cultivators have proven that forest culture can extend over extensive periods of time if management techniques adapt as the forest plantation ages. They have also proven that forest culture can be physically integrated in natural forest areas or can restore the environmental qualities of natural forests.


Farmers in Indonesia have established millions of hectares of cultivated forests. Through these cultivated forests, shifting cultivators, who are generally blamed for deforestation and erosion of biological diversity, make an essential contribution to reforestation, biodiversity conservation and economic development in forest areas.
Coffee gardens with forest seedlings
Young damar forest
Swidden with rice and coffee and shade trees
Secondary forest, to be transformed soon

Because of this ‘forest preference’, it is often impossible, without close observation of the plant composition, to differentiate cultivated forests from natural vegetations.

Continuity of structures and functions between natural forests and smallholder cultivated forests

The ‘forest preference’ in forest culture results in cultivated forests that exhibit true forest ecological functions, including water regulation.

Forest culture exhibits a striking continuity with natural forests, particularly in terms of vegetation patterns and structure.

Both international agroforestry and forestry research have recently emphasized *ecosystem management* and *ecosystem development* as new conceptual approaches to development. This convergence between practices and theory should give way to new experiments and development projects.

The forest culture of smallholder farmers should not, however, be assimilated into an intensified form of natural forest management. In establishing plantations, farmers have chosen to break with former extraction practices and logics (see chapter VI). Smallholder forests do not aim at improving the management of wild resources in their original habitat. They embody the voluntary adoption of selected forest species as new crops in global farming systems. They are managed as important assets in a productive system. They are governed by rules and regulations that clearly differentiate them from the collective forestlands. As long as farmers differentiate them from managed natural forests, outsiders should acknowledge this difference and then build projects upon the social, cultural and economic implications of this differentiation.

c. Can forest culture fulfil economic as well as environmental and social functions?

Large-scale forest plantations have emphasized the production function of the forest. As productivism was transferred from agriculture to forestry, the evaluation of the plantation function has focused on tree crop productivity, usually timber. The term 'productivity' has many different meanings. Yield per unit area per unit time is a definition often used for convenience. But if this approach is reliable in the productivist agricultural context, it is more questionable when dealing with forests, where many other economic as well as ecological and social demands have to be integrated. Additional economic factors include the investment function—planting and inheriting of trees are particular dimensions related to time scales different from that of production—, the multipurpose function of individual tree species yielding fruits or exudates on a regular basis and timber as a final product, and the reversibility versus irreversibility of production choices, among others. Noneconomic factors refer to social benefits or political advantages.

Even though specialized in the production of a targeted commercial forest product, smallholder forest culture is not an exclusive enterprise. The forest preference expressed in management allows the system to fulfil numerous functions.

The main focus is on income generation, as with industrial tree estates. But this function is achieved through a diversification rather than a maximisation strategy. Diversification involves income sources (management of several commercial species like damar and cloves in Krui in the 1980s or cinnamon, fruits and timber in Maninjau) or rhythms (regular with resins and latex, seasonal or annual with fruits, exceptional with timber). This diversity in income generation is essential as, in most areas, habits of storing cash money are not developed and credit is expensive. The cultivated forest also allows for the maintenance of other economic functions, which evokes the ancient multipurpose collective forest: provision of wild foods for regular consumption or 'just in case', supply of materials including firewood, building and handicraft materials. This diversification appears as an important risk management strategy.

It also ensures short- and long-term flexibility and reversibility, two important aspects of multifunctionality. Tropical products typically cannot be stored, but harvest can be delayed without any threat to the system's structure, the species' survival or the harvest quality. FORRESASIA has analysed how low rattan prices have led farmers to store

rattan in their gardens by stopping regular cutting of the canes, which are still growing and storing future harvest, and how farmers adjust the tapping of rubber according to market fluctuations. Moreover, smallholder forests shelter species that can be further developed for market if the main production fails or if markets suddenly develop. (Timber and fruits, the main potential components in most systems, have been seriously developed during the last 10 years in damar agroforests and in some rubber agroforests.) New, economically interesting forest crops can be easily integrated into the system without disrupting its overall structure. Examples are the damar farmers who integrated clove trees under the damar canopy in the 1980s and farmers in Maninjau who are intensifying timber production through the colonisation of the undergrowth by redwood species.

Multifunctionality also encompasses ecological (see above) as well as socio-cultural aspects. The most significant are:

- re-creation of a forest space that can be used collectively, if needed, and the related restoration of important social activities such as hunting, free harvest of medicinal plants, fallen fruits or firewood, and collection of material for collective ceremonies
- creation of various jobs and the emergence of related socio-professional classes such as regular or seasonal wage-labourers (for rubber or damar tapping, for rattan harvesting, for transportation, for sorting) and traders
- legal appropriation of land through tree plantations in a context where collective customary rights over natural forests are constantly weakening
- creation of real patrimony in the form of inheritable property managed according to special social rules and objectives for all types of social categories, with related social mutations in marginalised sections of village societies
- definition, or redefinition, of a collective identity and the strengthening of 'tradition', as evidenced by farmers in the studied areas defining themselves as damar growers, rubber farmers or benzoin farmers
- creation of a potentially valuable asset for negotiation processes with outsiders regarding land rights. Examples are damar gardens used in negotiations with the Department of Forestry for land rights acknowledgement and benzoin gardens used to prevent Indorayon pulp company from entering an area for logging.

Conclusions and recommendations

Multifunctionality is emerging as a new concept for global agricultural and forestland development. It usually tends to be translated into landscape segregation, with some elements being defined for production, others for conservation, still others for re-creation, etc. The validity of a close integration of various functions in a single system is often questioned. Smallholder forest culture shows that multifunctionality can be achieved through the integration of various functions in a single system, provided the system is diverse enough.

V - Comparative advantages

versus monocrop tree culture?

What are the comparative advantages of diversified smallholder forest culture

or pure forest extraction

What are the comparative advantages of diversified smallholder forest culture versus monocrop tree culture or pure forest extraction?

The advantages of local models of forest culture and management over more professional forms of forest management are often denied, especially when economic benefits are discussed. This judgement is both based on and leading to or reinforcing a great disrespect for local systems, as well as a lack of official acknowledgement and inadequate technical support.

Our conclusions indicate that smallholder forest management based on close integration between cultivation of forests on farmlands and extraction of self-established resources from the landscape base, including natural forests and the various vegetation systems established on farmlands, is able to simultaneously meet economic, ecological, social and political objectives of smallholder communities more efficiently than either pure extractive systems or specialized, intensive plantations. The following discussion focuses on the comparative advantages of smallholder forest culture versus pure extraction or monocrop forestry. We insist on the fact that a good quantity of resource extraction is allowed directly through local models of forest culture, and that the management of cultivated forests, as always embedded in a larger system of activity, is most often combined with the management and extraction of forest resources in natural ecosystems. Therefore, 'forest culture' goes beyond just 'producing selected forest commodities on specific portions of the landscape'.

1. Ecological qualities

The development of forest culture on farmlands represents a true process of forest conversion, as cultivated forests are established on former forestlands. Because of the particular silvicultural patterns and management options, however, this process of forest conversion enables reversion to a real forest (to forest structures and functions) in a more significant way than any conventional process of a forest plantation. This translates into important ecological qualities.

Ecological studies in FORRESASIA and former IRD projects have given much room to the discussion of the role of smallholder forest culture for the conservation of biodiversity. These discussions have tried to emphasise the various aspects of the link that exists in these systems between conservation and production.

Ecological advantages of smallholder forest culture come from the 'forest preference' expressed in the management practices. This forest preference allows an optimum combination between intensification of the production of selected products (as in

monocrop plantations) and restoration of the ecological qualities of a natural forest, including important conservation aspects. The striking feature of smallholder forest culture compared to specialised forms of forest plantations is that plants established through natural mechanisms of dispersion and germination are not considered 'weeds' and wild animals wandering in the cultivated forest are not thought of as 'pests', but are clearly and deliberately integrated as true components of the system. Unlike useful species that farmers introduce through planting in the cultivated forest, these spontaneous components may or may not have an economic interest. But they always have an essential ecological role. From a strict environmental point of view, smallholder forest culture does not constitute an irreversible change or an ecological revolution as it restores the formerly prevailing forest environmental qualities. The conservation of this ecological integrity constitutes the foundation of most of the cultivated forests qualities. It is vital from other, nonenvironmental perspectives as well: it allows for low-cost production, simple establishment and maintenance, diverse economic benefits, flexibility and adaptability to changing conditions and the maintenance of social integrity.

a. Is smallholder forest management a threat or a tool for biodiversity conservation?

The perception of local forest communities in conservation circles oscillates between two extremes. Indigenous people are viewed as either a threat to the integrity of the natural system —a point of view formerly dominant in strict forestry and conservation circles, and still very much represented among supporters of the 'deep ecology' movement— or the stewards of its riches—a vision conveyed by indigenist movements and appropriated by a large fraction of conservationists in the 1990s. The results of our studies bring new light to this debate.

With the comparative assessment of biodiversity in various examples of forest culture we have shown that there is no significant difference between forest managed for collection and extraction and natural forest, whereas forest culture entails a visible modification in biodiversity levels. Nevertheless, cultivated forests represent the best model for a true combination between specialized forest production and biodiversity conservation.

When cultivated forests replace natural forests, a first, localised reduction in biodiversity levels can be observed as the original vegetation is removed, either selectively or entirely, for establishment of the plantation. While the cultivated forest matures, however, biodiversity levels increase. The degree of biodiversity restoration depends on the silvicultural system, and its quality locally varies along a gradient of increasing human input. Species composition still indicates a certain degree of disturbance if compared to primary forests. However, all the examples of mature cultivated forests analysed in our successive studies[1] retain a reasonable proportion of plant and animal species found in natural forests (up to 80% for animals and certain plant groups like epiphytes, usually closer to 40% or 50% for tree species), and usually with a good distribution of individuals in each species. Commonly, cultivated forests exhibit a higher proportion of generalist species, wider distribution and broader regeneration strategy, with lower ecological

1. Michon & de Foresta. 1995; Sibuea & Herdimansyah 1993; Michon & de Foresta 1995; Thiollay 1995; García-Fernández *et al.* 2003.

Plant and animal biodiversity in forests cultivated by smallholders reaches quite high levels.

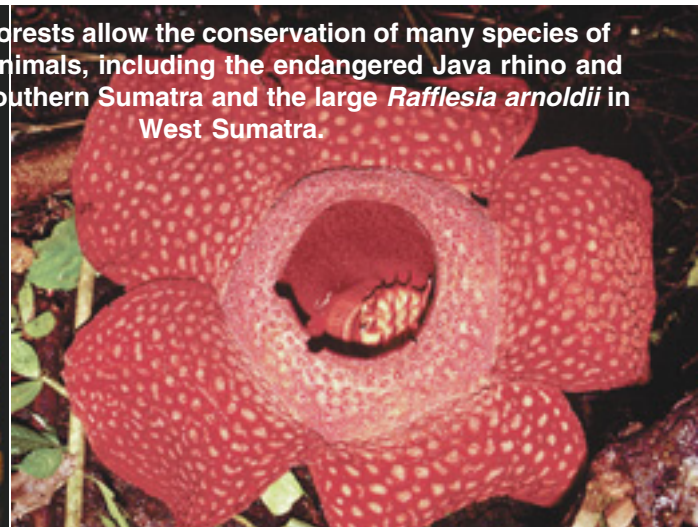
Wild *Baccaurea* fruits for curries

Biodiversity restored in cultivated forests provides products that can be consumed or sold, thus increasing the economic benefits from the forest plot.

Many orchid species in cultivated forests of Sumatra are newly recorded for the island.

Biodiversity in cultivated forests

Cultivated forests allow the conservation of many species of plants and animals, including the endangered Java rhino and the tiger in southern Sumatra and the large *Rafflesia arnoldii* in West Sumatra.



If biodiversity levels in cultivated forests are not as high as in natural forests (left), they are much higher than in monocrop plantations like the old oil palm plantation below. Smallholder cultivated forests represent the best model for a true combination of forest production and biodiversity conservation.

values than primary forests, which are characterised by a predominance of species with restricted distribution and a regeneration strategy linked to conditions that are difficult to reproduce in artificial environments. In that respect, smallholder forest culture may appear as a threat to biodiversity. Whereas an important proportion of local forest species is preserved in mature cultivated forests, an important part of forest biodiversity, especially strictly primary forest species (plants as well as animals), is lacking.

Smallholder forest culture, however, is targeting not conservation, but intensified forest production. Unlike other plantation systems, which do not allow for much in the way of biodiversity conservation, it represents a quite original management strategy. Forests cultivated by smallholder farmers contain more primary forest species than any other models of forest plantation, especially monoculture forestry or estates tree crops. Even though biodiversity conservation is only a derived benefit, not an objective, smallholder forest culture represents a unique process of land conversion for intensification that allows us to preserve high levels of biodiversity and that do not compromise ecosystem resilience in the long run[2].

2. Michon & de Foresta 1999; García-Fernández *et al.* 2003.

Conclusions and recommendations

Biodiversity conservation is *not* an expressed objective of local systems of forest culture, but is an important consequence of the ideology and practices underlying the existing examples. Global dynamics of development, as well as the strong dominance of conventional models of professional forestry and specialised agriculture in all tropical countries, might alter these practices, if not the underlying local representations of resource management.

Therefore, if policy makers and development professionals aim at promoting local forest management as a tool for biodiversity conservation, local practitioners have to be rewarded or encouraged by substantial incentives including

- a reduction in restrictive policies on the transportation and marketing of timber and valuable NTFP,
- technical and policy support for diversified systems,
- official acknowledgement and legal recognition of the existence and value of the system,
- tax reductions and
- direct cash benefits.

b. Is smallholder forest management an alternative to protected areas for biodiversity conservation?

In areas that are already populated (which represent most of the forestlands in Southeast Asia), strict conservation, which sees wilderness as an area free of any kind of management and devoid of any type of human population, is questionable from both an ethical and a social perspective. Can smallholder forest culture fully solve the problems posed by the integration of conservation and development?

Whereas forests managed for extraction can compete with natural protected areas for biodiversity conservation, cultivated forests cannot. However, they provide interesting alternatives for biodiversity conservation in former forest areas devoted to productive conversion, or in areas already transformed (either buffer zones surrounding protected areas or development areas).

The last decade has seen an oscillation in conservation policies between segregation (strict conservation areas adjoining areas devoted to production) and close integration (integrated conservation and development projects have introduced the zonation concept for parks, where the core zone is surrounded by a 'traditional use zone' or a buffer zone, which allows a certain level of production). Both approaches have failed to reach their goals. Except for predominantly undeveloped areas of true wilderness (some regions of the Amazon and the Congo basins), full segregation usually bears inherent threats to the maintenance of protected areas because of pressure coming from adjacent areas. The integrated approach has never succeeded in achieving real development at a local scale, nor has it provided sufficient incentives to discourage encroachment into the protected areas. Conservation areas based on the maintenance of 'traditional' extractive activities (usually subsistence harvesting plus some commercial handicraft activities like basket weaving) have proven efficient in maintaining local people in their former level of poverty, whereas other economic options linked to forest conversion or to more aggressive forms of extractivism may allow for social and economic change to take place locally. The only economic 'successes' observed have been achieved through the extreme marketing of a mythical image of 'forest people'. The sale of the representation, or of the production, of an exotic culture to tourists has allowed some local people to make a lot of money, for example on Siberut island or in some Papuan tribes.

Yet, the replacement of true conservation efforts by the development of forest culture is not a full solution either. Management and production are the main objectives of smallholder forest culture, and the development of smallholder forests necessarily affects the original plant and animal diversity. Therefore they cannot compete with undisturbed primary forests for biodiversity conservation. It is consequently unrealistic and misleading to assess that smallholder forest culture can be substituted for strict conservation measures. Compared to other plantation systems, however, smallholder forest culture constitutes an unrivalled system for 'conservative conversion of forest lands', as it allows economic development while maintaining forest essential qualities, including the maintenance of water control, the restitution of habitats for many forest species, and, as a consequence, the maintenance of a good level of plant and animal biodiversity. Therefore, it offers a valuable compromise between biodiversity conservation and profitable development of natural resources while providing a source of income for local communities. As such, in the present context of conservation, it constitutes a potential complement to strict conservation areas. But it could also offer original ideas for the renovation of the conceptual framework of conservation[3].

3. Van Noordwijk *et al.* 1997; Angelsen, Belcher *et al*. 2000.

Conclusions and recommendations

In strict conservation areas, the smallholder model of cultivated forests has limited prospects, even from an integrated conservation and development project perspective, as it does not offer enough guarantees for the conservation of the whole pool of noneconomic forest species or of the diversity of primary forest tree species. But it has an important role to play in the development of buffer zones surrounding core zones defined for conservation.

We suggest, however, that if smallholder forest culture is to have a large role in conservation, it should occur mainly outside protected areas. Acknowledging the value of extraction for local communities can allow the maintenance of patches of natural forests inside agricultural

lands, whereas the development of cultivated forests can represent an effective buffer against conversion to either inefficient slash-and-burn or intensive agriculture. In areas where development is the main objective and where forest conversion is difficult to avoid, a mosaic of cultivated forests, secondary forests and patches of primary forests maintained for extraction, altogether integrated into farmlands, can be a tool for maintaining or restoring the environmental qualities of the original forest, including the conservation of some biodiversity. In that respect, smallholder forest culture represents a useful complement, rather than an alternative, to conservation policies.

2. Technical qualities: Is forest culture a technical specialization that should be reserved for trained professional foresters?

By planting forests on farmlands, smallholder farmers have achieved astonishing results from a silvicultural point of view. They have succeeded in what remains a dream for most foresters: establishing, maintaining and reproducing healthy diversified forests, at low costs and over large areas. Some of these forests are based on the dominant component of natural forests in South-east Asia—Dipterocarps. Unlike natural forests, these cultivated forests rely on selected tree species, with high-density stands and good productivity. But they also exhibit ecological sustainability and easy regeneration over years, which is uncommon in conventional plantation forestry.

Professional foresters often claim that both logging and forest culture are unfeasible on the farmer's scale because of financial and technical constraints. They consider that the engineering of heterogeneous forest systems is too complex in the tropical context. They therefore claim that profitability of forest culture in the tropics can only be achieved through single-species stands established for single-purpose utilisation, not through the restoration of diversified forest structures. Large-scale monocrop plantations are so highly artificial that they require high maintenance, for which specialized technical and scientific knowledge is needed. As a consequence, the uniform model promoted by professional forestry is out of the reach of smallholder farmers.

Smallholder diversified forest culture has proven to be successful and replicable partly because of its technical simplicity, linked to the importance given to natural processes in establishing and reproducing the productive structures, and partly because it relies on knowledge systems that are commonly shared among local communities.

An important feature of smallholder forest culture models is technical simplicity, which implies:

- Low levels of energy, capital and labour input. Unlike highly specialized large-scale plantations, which involve high maintenance costs, smallholder forest culture is always diversified, and its establishment is

integrated into slash-and-burn agriculture, which reduces labour and other input costs.

- Reliance on low-cost technology and simple techniques that all shifting cultivators in humid tropical countries have at their disposal, including local species that farmers can easily propagate. This approach is in contrast to the genetically altered plant materials of large-scale plantations, reproduction of which involves a high level of technology.
- Knowledge based on local wisdom shared by all farmers. The pure technical skills required for the maintenance of smallholder forests are much less important than basic ecological and plant knowledge, which is usually well shared among local communities, whereas industrial forestry relies on specialized technical and scientific knowledge.
- Small-scale operations. Smallholder forest culture is always practiced on a small scale. Some of the forests cultivated by smallholder farmers do cover huge areas (more than 2 million ha of smallholder rubber gardens in Sumatra and more than 50,000 ha of Dipterocarp agroforest in Lampung), but they are an aggregate of small units, each one being managed by an individual owner. Swidden cultivation villages sometimes claim collective rights over large forest territories (several thousand hectares), but they rarely actively manage the totality. In contrast, logging concessions and industrial tree plantations often own and manage tens of thousands of hectares as a single management unit or a few.

These qualities are linked to the 'forest preference' expressed in management[4]. They are strictly correlated to the maintenance or restoration of ecological processes, biological diversity and other forest features. These natural processes schematically replace the complex technical requirements and high energy cost that sustain forest plantations. Plants and animals that colonize the cultivated forest are not pests or weeds but support these essential processes that are crucial to the maintenance of the natural integrity of the cultivated forest as an ecosystem. The restoration of this biological and ecological integrity has become the main tool in the management of the cultivated forest. It maximizes the benefits of 'minimized intervention' that gives the major role to natural processes in the shaping and the evolution of the cultivated forest. It avoids resorting to sophisticated techniques or costly technology, while maintaining labour and technical input at low levels. Commodity production in these cultivated forests is linked to the full use of these biological and ecological processes. It relies on the natural levels of primary production of the vegetation and the continuous recycling of minerals between plant components. Establishment and reproduction of the system also depend on the expression of natural silvigenetic dynamics, and on inputs generated by the forest itself. In this respect, forest cultivation can be assimilated to an original process of 'ecosystem domestication'[5]. The active reproduction of productive structures through anticipated interventions, such as foreseeing the replacement of decaying trees or speeding up the recovery of 'chablis'* through the introduction of pioneer-equivalent species, is close to the modern attempts of ecological engineering. It is important to emphasize, however, that farmers do

4. Michon & de Foresta 1999.
5. Michon & de Foresta 1997.

*A chablis is the gap created by the fall of a large tree.

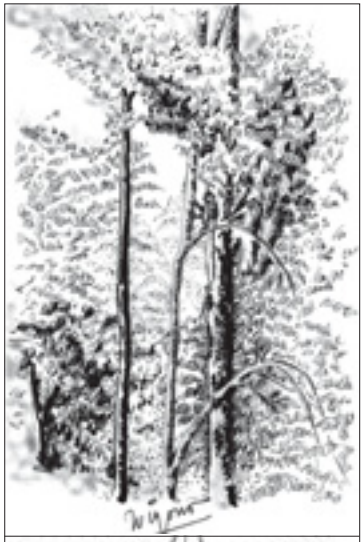
Technical qualities

Professional foresters consider the engineering of heterogenous forest ecosystems technically too complex in the tropics, and therefore concentrate on simple, hoenous forest plantations.

Foresters claim that forest culture in the tropics is unfeasible at farm scale because of financial and technical constraints. They believe the profitability of forest culture can only be achieved through uniform plantations, which require high maintenance and specialized knowledge.

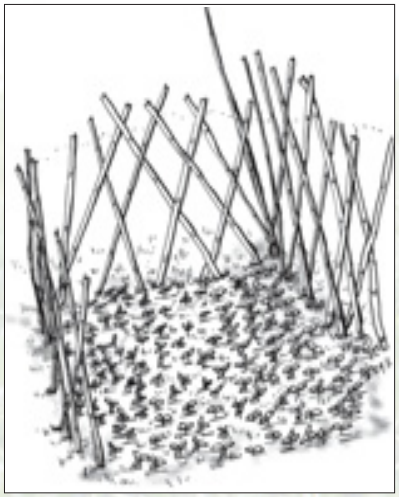
Smallholder diversified forest culture has proven to be successful and replicable, partly because of its technical simplicity linked to the importance afforded natural processes in establishment and regeneration phases, and partly because it relies on knowledge systems that are commonly shared among local communities.

In heterogenous forests cultivated by smallholder farmers, the restoration of biological diversity and ecological processes constitutes the main management strategy. It replaces the highly technical nature and energy cost that sustain the specialized plantations of professional foresters.

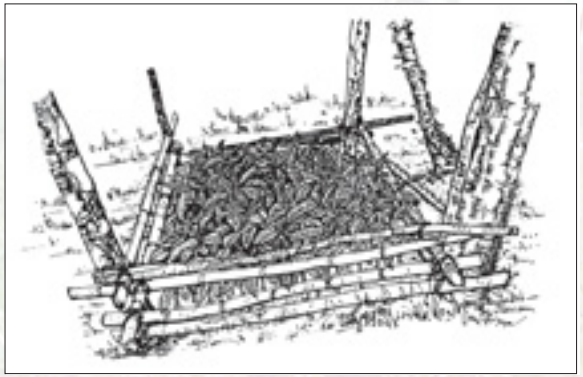


Plants and animals that colonize the cultivated forest are not weeds and pests but support biological processes that are crucial to the maintenance of the cultivated forest ecosystem.

Whereas management in professional forest plantations involves mass treatment of the vegetation, in cultivated forests it relies on individual treatment of plants.



Cinnamon nursery, with seeds collected from the cultivated forest



Seedlings in a damar nursery can survive four years, from one fruiting season to another.

Seedlings are fertilized with the skin of durian fruits or other plant manure collected in the forest.

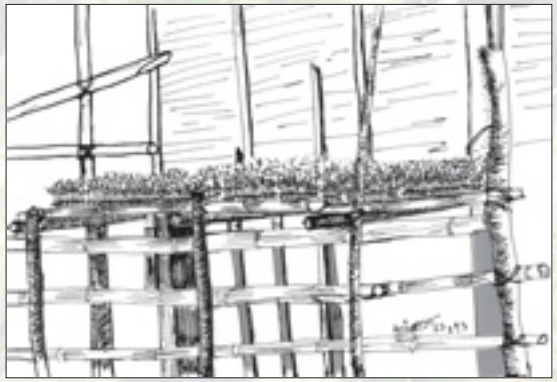
Technical qualities

The example of industrial and on-farm nurseries

The establishment, maintenance and reproduction of large-scale monocrop plantations require specialized technical and scientific knowledge. Smallholder diversified forest culture relies on knowledge systems and techniques that are commonly shared among local communities, as illustrated here with nursery techniques.

Selected durian seeds are planted in bamboo pots.

Coconuts germinating in the shade of fruit trees



A clove nursery

not try to simulate natural processes, but just let them happen, and intervene slightly at key points.

These qualities also determine the flexibility of smallholder forest plantations. Large-scale, specialized plantations are not capable of quick conversion, whereas farmers can easily change the management patterns or redirect economic objectives according to market fluctuations or opportunities.

Conclusions and recommendations

The technical simplicity of smallholder forest management is not only key to local success, but may also facilitate extrapolation of current models to other regions. It ensures that forest culture is feasible on the farmer's scale without major financial or technical constraints. It proves that engineering of heterogeneous forest systems can easily be achieved through the implementation of good botanical and ecological knowledge. It shows that profitability of forest culture in the tropics can be achieved through multi-species stands established for a multi-purpose utilisation. This model of heterogeneous forest culture should be more systematically investigated and tested by professional foresters in the tropics.

3. Economic qualities

The economic advantages of forest culture versus extraction clearly come from the entrepreneurial aspects linked to the establishment of a long-lived plantation. Unlike forest extraction, forest cultivation relies on labour and capital investments, which provides increased benefits while constituting incentives for sustainable management. Compared to intensive planting, forest culture remains highly diversified. Its comparative advantages are related to this diversity, as well as to the related flexibility and reversibility of technical or economic choices.

a. What are the economic advantages of smallholder forest culture?

Economic considerations play a crucial role in the decisions made by farmers. The emergence and evolution of smallholder forest culture is closely linked to the economic advantages of the system compared to other options, and it is therefore important to understand them. We stress that the economic aspects to be considered cover much more than simply the average income from the system, as discussed below. To understand the role of smallholder forest culture in the rural economy and assess its comparative advantages, we need to consider how the system is integrated into the overall household economy and livelihood strategy. Otherwise it is impossible to understand why it is maintained and how it evolves over time.

The economic aspects that are crucial in understanding the comparative advantages of smallholder forest culture (including elements of forest extraction on farmlands) versus integral extractivism, specialized plantations or food crop cultivation are not restricted to income generation, but also to safety net functions, multiple benefits, labour allocation, capital accumulation and land use systems.

Income generation

While much of the literature on forest products has focused on the safety net role of the forest, FORRESASIA has tried to precisely quantify the combined role of both cultivation and extraction in the overall income-earning strategies of villagers. The results show this role can be very significant[6]. In the survey area of Siberida, rubber from jungle rubber gardens contributes about 60% of total household income, whereas forest products (timber and nontimber forest products, here mainly harvested from the surrounding natural forest, but in other areas also provided by the cultivated forest and through anthropogenic forest vegetations on farmlands) make up an additional 15%. In Pasir, East Kalimantan, more than half the income of the average household in the survey comes from forest products harvested from rattan gardens as well as from the natural forest (honey, rattan, timber). In North Sumatra, income from benzoin amounts to 14% of total income for the whole population sample, which includes both benzoin farmers and traders, and represents 30% of benzoin farmers' total income. In other words, the combination of forest production from the cultivated forest and forest extraction from the landscape base represents much more than a safety net. It constitutes a principal income-earning strategy in all the communities surveyed.

Safety nets and risk management

The role of forest products as a hedge against risks is nevertheless still important. Forest products from farmlands and natural forests have proven to be important safety nets during the economic crisis in Indonesia in 1997–98 (see example given for Sumatra in chapter III). They also have important gap-filling functions. Households rely more extensively on forest products in the months before the main harvest of dry land rice. However, more than passive safety nets, cultivated forests should be considered an important element of risk reduction strategies. Risk management through diversification is a common strategy for smallholder farmers. The development of commercial strategies in agriculture usually assumes the conversion of a large proportion of the existing production systems to monocultures, which introduces higher risks of ecological failure as well as vulnerability to market fluctuations. Forest culture is both intensive and diversified, which constitutes a good economic balance between income generation and risk buffering. Through the diversification of resources and productions, the cultivated forest can be used as a bank account, from which regular withdrawals can be made to cover day-to-day expenses (regular or seasonal productions), but that can also be used as an emergency fund. Villagers consider —and manage— certain forest products present in their cultivated forests as a reserve to be withdrawn from when needed. This is particularly true for products whose quantity increases when not harvested, like rattan and timber. This safety net function is essential in areas

6. Lutnæs and Løken 1999; Angelsen *et al*. 2000b.

Benzoin resin revenues are for day-to-day expenses and costs associated with the schooling of children.

Fruits like these wild mangoes represent nutritionally and economically highly interesting species.

The main production from cultivated forests is for regular expenses.

Capital accumulation is possible through seasonal products with good markets and large production.

Economic functions of cultivated forests (1)

Secondary products are for household consumption or trade to cover regular or annual expenses.

Many secondary species constitute a stock of potentially marketable products.

Some years, fruit production (here langsat) provides huge amounts of cash income.

Langsat in the damar forest used to be for local consumption. The opening of a road initiated a profitable business through trade on Jakarta markets.

Damar cleaning and grading provides jobs to many poor villagers.

Local processing of cultivated forest products creates added value, which allows for better distribution of the benefits.

Activities derived from harvest and the handling of cultivated forest products create local employment.

Damar trader sitting halfway between cultivated forest and village

Economic functions of cultivated forests (2)

Damar timber has been sustainably traded for decades. In spite of high prices, benefits are limited as trade outside the district is forbidden by law.

Timber represents a promising commodity from cultivated forests, with good potential for income generation.

Timber and rattan constitute an interesting standing capital that can be harvested whenever needed, fulfilling a safety net role.

The timber of durian is a good substitute for red meranti.

where habits of cash storing are not developed and where credit is expensive, which represents the bulk of rural areas in the tropics. It also partly explains why cultivated forests are not clear-cut during periods of low prices, but not exclusively, as certain social functions are also essential in explaining the resilience of forest culture. The benzoin gardens in North Sumatra are kept even in the present situation of stable low prices, as benzoin trees can still be tapped when needed. The rattan gardens in East Kalimantan were not abolished even after a period of eight years of true recession of the rattan market, as they were considered a reserve that could either be used in case of necessity or kept as a fructifying capital waiting for better market prospects. Recent price hikes for both commodities, and the economic crisis in the case of rattan, made it attractive to resume harvesting. Further, evidence from Riau shows that forest products integrated on farmlands and in the agricultural economy can be particularly important during the early stages of life, especially for young couples who need capital to establish their household.

Capitalisation

Forest culture represents a process of land development through the management of forest resources that allows for capitalisation. Income generation through extractivism can be important at certain times, but does not usually allow for the sustainable drawing of surpluses and the creation of durable wealth, not even for high-value products, since collectors are often in debt to the traders and lose most of their gains through debt recollection. Shifting cultivation does not generate wealth, in spite of fairly good levels of labour productivity, as labour investment is converted into immediately consumed food production and not saved for capitalisation. Forest culture substitutes profitable production structures to land-use units formerly reserved for subsistence through either collection (harvesting of forest products) or cultivation (slash-and-burn culture), which constitutes a true capitalisation process. It also generates wealth through direct tree production, because it consistently minimizes labour inputs, allowing for spare time to pursue extra-agricultural activities for income generation if needed. When income exceeds expenses, surpluses from forest culture can be either stored or invested. After the World War II, the management of benzoin gardens released surpluses that provided for the astonishing development of local societies. Benzoin farmers have capitalised and massively invested in their children's schooling (up to university level). Because of this effort, the benzoin wealth has been transferred into durable social wealth, as schooling has resulted in increasing the influence of Toba Batak people in economic and political circles far beyond the Batak lands, at the scale of the country itself[7]. Similarly, between 1975 and 1990, rattan in East Kalimantan went towards the impressive development of rattan farmers[8]. The same holds true for damar, until the late 1980s[9].

Multiple benefits and flexibility

Although smallholder forest culture has developed in order to increase the productivity of a selected forest product such as damar, benzoin or rattan among others, cultivated forests, because of their diversified nature, normally provide a wide range of products or benefits, particularly compared to specialized tree plantations. They maintain a large variety of foods —especially fruits and vegetables— and materials for immediate consumption. They also harbour resources that can be

7. Lutnæs & Løken 1999.
8. Belcher *et al*. 2000.
9. Mary 1987; Levang & Wiyono 1993.

harvested if needed in order to balance a temporary weakness of the main forest crop. But one of their main benefits is that they allow for flexible management and easy evolution. Unlike specialized forest plantations or horticultural fields, the cultivated forest can easily survive undisrupted even if unmanaged or unharvested for a long period. Its production can easily be revived. Finally, there is a possibility of easily switching from existing productions to more profitable ones either through harvest or through the sale of already existing, but neglected, products or through the integration of other, more profitable forest crops in the existing structures and their integrated substitution to the main crop. This reversible switch is a common practice in the agroforests of Maninjau, where cinnamon, coffee or nutmeg are emphasized as the main production according to market opportunities whenever needed.

Labour allocation

Farmers allocate their labour to various activities based on the return derived, both in terms of income, food security and minimizing risk. Smallholder forest culture often shows great flexibility in terms of when management and harvesting can take place, which allows them to adapt to annual variations and the relative inflexibility of labour requirements in agriculture[10]. The labour demand from agriculture varies considerably throughout the year. In shifting cultivation, for example, the high labour season, from forest or bush clearing to harvesting, covers about six months from July to January. The remaining six drier months represents the long 'slack' season during which the opportunity costs of labour are much lower. Rubber tapping, for example, is preferably done during the dry season, which is also better for latex yields, and is therefore complementary to dry land (swidden) rice cultivation.

Land use systems

Finally, smallholder forest culture should be understood as part of an overall land use system, and attention should be paid to how it complements other land uses[11]. The complementarity can be in *time,* as happens in rotational systems, where the forest culture phase alternates with an 'agricultural' phase, the forest being cleared and planted with rice and other food crops for one or two years, before being replanted with rubber or rattan, for example. Or the complementarity can be in *space*, with clearer zonation between forest gardens and agricultural fields, the location of the smallholder forest being determined by distance to village, soil quality, slope etc. In most survey areas, forest gardens are located farther from the villages and are therefore not competing directly with agricultural land under more intensive cultivation.

10. Angelsen *et al*. 2000b.
11. Mary 1989.

Conclusions and recommendations

Our analyses have demonstrated the role of smallholder forest culture and forest products not just as safety nets, but also as essential for cash income generation. The main conclusion, however, is that smallholder forest culture must be evaluated and analysed not only from a productivity or income perspective, or a cost and benefit point of view, but also, and mainly, in the light of how it fits within the overall household strategies, with respect to labour and land allocation, risk management, income generation and provision of subsistence products and other benefits. In these respects, with the possible exception of per-hectare productivity and income, smallholder forest culture has obvious economic advantages compared with

specialized plantations. A central characteristic of many smallholder, cultivated forests is that they effectively complement other activities and land uses the household is involved in. An economic analysis must therefore go beyond simple calculations of average annual household income or income per hectare.

b. What are the economic drivers of the evolution of smallholder forest culture?

Productivity and income are considered the major economic drivers in the evolution of agricultural systems. How far does this tenet apply to the evolution of smallholder forest culture, which includes the transition from extractivism to smallholder forest culture, the development of smallholder forest culture and its improvement, and its abandonment for specialized plantations or other activities? Do the drivers reflect deep-rooted changes in land pressure, population growth and preferences? Or do policies directly or indirectly discriminate against the systems?

An important part of the resilience of smallholder forest culture is found in the answer to the previous question on how smallholder forest culture is integrated as part of the overall household economy and land use. Some more specific factors that constitute important, driving forces are discussed below.

The *price of the main forest product* is a crucial factor, as it determines the income generation potential and overall profitability of the system[12]. The market for the main product cultivated in the smallholder forest, which shapes the price level and fluctuations, should be one of the keys for the viability of the whole forest cultivation system. Reality shows that this factor does not influence the development or the maintenance of forest culture systems in a uniform way. Both rattan and benzoin are examples of systems that during the last decade or so have not been actively developed because of steadily low product prices. Nevertheless, a fall in the price of the main cultivated product will usually not result in abandonment of the cultivation. Rather, harvesting of the related product will be abandoned until the market re-establishes at reasonable prices—as has happened in the case of rattan forests in Pasir. We also have examples of cultivated forest systems being developed as the price of the main commodity drops, namely, damar in its first decades and benzoin after Independence.

Our conclusions indicate that, over the past one to two decades, the opportunity costs of labour and land have been important for the evolution of these systems. The widely held claim that forest extractivism is mainly an activity for the poor to some extent reflects the lack of economic opportunities of poor people (i.e., the low opportunity costs of labour). Forest culture usually offers better income opportunities than forest extraction, and appears to be one of the important evolutionary factors for intensification of forest use through smallholder forest culture. This view is well illustrated in Riau, where the dependence on NTFP has declined significantly over the last decade, reflecting better income opportunities in other activities, especially through development of rubber-based forest culture, which provides a relatively remunerative and secure income for a large share of the population[13]. The observed examples of replacement of rattan cultivation by oil palm plantations in Pasir can also be related to better income opportunities, though in this case policy

12. Angelsen 1999.
13. Sunderlin *et al*. 2000; Sunderlin *et al*. 2001.

factors have been more determining in the evolution.

The economic literature suggests that increasing *land scarcity,* which is related to increasing population density, is a major driver towards more intensive land use[14], inducing a general move from extractivism to forest plantations to intensively managed (monoculture) systems. Generally, this phenomenon was *not* observed in the study areas, and in the few areas where it does occur it was the result of the promotion of large-scale plantation projects (oil palm or transmigration) strongly supported by government policies.

Policies, and particularly *discriminatory policies,* can hamper the development of smallholder forest culture and contribute to its abandonment, and this factor was observed at the project's field sites. Such policies may include a lack of respect for smallholder or community rights to the land, discouraging investment in the system, as well as monopsonistic markets and gains being captured by the elite at the expense of the primary producers. At the more general level, the lack of recognition of the system means few public resources are directed towards developing the systems compared with, for example, intensive agriculture and commercial plantations.

14. Angelsen & Kaimovitz 2001.

Conclusions and recommendations

Economic drivers of the systems' evolution, as other driving forces, can be either incentives or disincentives. These two opposite categories are equally important in the development or collapse of these systems. In some cases smallholder forests are weakened or abandoned because people switch to alternatives considered more lucrative or 'modern'—the pull factor. In other cases land is taken, tenure becomes insecure or the price of the product becomes so low, for example because of taxation, that people abandon the system. This is the push factor. Although the results may be the same, their economic, social or political impact is completely different. In particular, the implication for people's welfare is quite different. Under the pull alternative, they switch to better options and should in principle be able to improve their livelihoods. Under the push alternative, local people are likely to lose.

c. How sensitive is smallholder forest management to market fluctuations?

Market prices fluctuate, reflecting economic cycles in demand and supply, climatic conditions etc. This fluctuation affects farmers' decisions about harvesting, management, planting or cutting of smallholder forests and makes risk management an important part of their decision making. We have seen how market dynamics affect extractivism. Does the same hold true for forest culture?

Contrary to forest extraction, smallholder cultivated forests show great resilience vis-à-vis price fluctuations of their main commodities, an indication that these forests function with other logics than the ones related to short-term economic considerations.

The correlation between the price level of a given product, the decision to harvest and the final decision whether to maintain a forest plantation or not can be theoretically summarized as in Table 5.1.

Table 5.1
Decision matrix

Price range (present or expected)	Harvest (collect)?	Plant, maintain or cut?
1. High	Harvest	Plant
2. Medium high		Maintain
3. Medium low	No harvesting	
4. Low		Cut

The decision whether to harvest or not, whether to expand or to reduce the area of the cultivated forest system is, of course, determined by a number of factors in addition to the (expected) price. Harvest decisions, for example, are determined by the opportunity costs of labour, while the opportunity cost of land is particularly important for the plant-or-cut decision. While *present* prices are key for harvest decisions, the plant-or-cut decision would also be strongly influenced by expectations about *future* prices. Considerations about safety nets or buffering functions of the system, as well as its long-term social functions, must also be factored in.

Using Table 5.1, benzoin in North Sumatra would fall between category 2 and 3. There is actually limited new planting taking place, but benzoin tapping is still an important source of cash income. In one village, agricultural intensification in open fields through vegetable gardening has entailed (temporary) abandonment of benzoin tapping. Though unmanaged, the benzoin plots are, however, maintained. This might be explained by the factors linked to land availability. Whereas benzoin gardens are located on the slopes, some distance from the village, there is still plenty of wasteland close to the village available for vegetable gardening. There are other important explanatory factors, including livelihood security reasons (benzoin gardens are kept as a safety net for the future, in case horticulture fails), and reasons related to social factors (among which is respect for past investment linked to the planting of benzoin).

The dynamics of smallholder rubber production show a constant 'switching' between intensive tapping periods and periods of almost total abandonment of harvesting and maintenance of garden plots. These periods strictly reflect fluctuations of rubber latex prices. The permanence of rubber agroforests is, however, remarkable. Rubber agroforests can remain 'in state of dormancy' for several consecutive years, and they are easily activated, when that option becomes profitable. This irregular management dynamic is not possible for intensive rubber plantations, where rubber trees are fragile and need continuous maintenance[15]. The flexibility of the agroforest structure is essential, as it has allowed the social and economic reproduction of swidden farms in the lowlands of western Indonesia and explains the success of smallholder rubber

15. Gouyon *et al.* 1993.

production.

Damar prices have appeared to encounter important variations over time. Expansion occurred even at a time when market prospects where low. Acknowledging the social benefits linked to damar culture (see above, and further), it is clear that the decision to harvest, cut, plant or maintain the damar agroforest is determined by a complex combination of economic and social factors[16]. In periods when the economic function of the agroforest was reduced, the social function alone was enough to justify maintenance or expansion of the agroforest.

The same holds true for candlenut in South Celebes, which used to be sold for a good price until recent years. The activity is not at all profitable today in the wake of a significant and sustained price drop. Candlenut is, however, still harvested, and the candlenut gardens are maintained, mainly because their disappearance would entail social damages that are not presently acceptable[17].

Rattan was for a long period of the 1990s in category 3 of Table 5.1. Hardly any harvesting went on, but also very little rattan forest conversion has been linked exclusively to that low price level[18]. The price increase at end of the 1990s revived harvesting and planting. Factors related to land-use policies, however, appear to have been a stronger determinant in the plant-or-cut dynamics[19].

Smallholder cultivated forests show a great resilience to price fluctuations. Volatile prices are part of the farmers' lives. They have adapted to them by diversifying their livelihood sources and take a long-term perspective. Periods of low prices do not mean that the system is abandoned, unless there is a high degree of land scarcity, (which generally is not the case in the areas covered by the project). In addition, strategic thinking in terms of keeping the rights to the land provides an incentive for keeping the gardens.

16. Michon *et al*. 2000.
17. Marzuki 2003.
18. Belcher *et al*. 2000.
19. Michon 2000.

Conclusions and recommendations

Whereas market and price fluctuations are an important explanatory factor for the dynamics of forest extractivism, they have a less significant impact on smallholder forest culture for a number of reasons.

- Management of risk is central to smallholders' decision making (and not unique to smallholder silviculture). Even a prolonged period of low prices of the main commodity does not entail replacement of the cultivated forest by another system. Living in a high-risk environment makes it important to keep the cultivated forest as a reserve for potentially brighter prospects in the future, or even for harvesting when prices are high.
- Smallholders take a long-term perspective on decisions about planting and abandoning systems, and long-term trends may be more important than annual fluctuations.
- The social, cultural and political benefits linked to forest culture are often as important as economic considerations linked to profit gain or loss, which explains why forest culture as a global activity is not linked to market fluctuation as was observed for extractivism. The noneconomic values of cultivated forests transcend short-term fluctuations in commodity prices.

4. Social qualities

The success of forest culture development on farmlands can be directly related to its economic interest. But restricting its foundation and advantages to that single, though, as noted above, complex and multidimensional, economic interest is both inaccurate and misleading.

The economic advantage of cultivated forests varies with time as a consequence of the price variation of the main traded commodity both in absolute terms and relative to the price of basic commodities. We have seen that cultivated forest systems were able to buffer the ups and downs in immediate and medium-term profitability. However, even when adverse economic conditions tend to endure, these forests are usually not abandoned or replaced by something more profitable. In trying to explain this incongruous dynamic, we have analysed how the social —and political— qualities attached to the cultivated forest can become so important that they justify the maintenance of the system even when it appears unprofitable. These social qualities include the value of the standing forest as a land patrimony, its relationship with the construction and maintenance of social status (in other words, its potential as a motor for social change or a guarantee for social stability), the redistribution of benefits to poorer people in the community and the reinforcement of an original local identity.

a. Patrimony, social cohesion and social change

Through the establishment of perennial structures on lands that are claimed through labour investment, forest culture creates not only production structures (assets that increase the production capacity of the farm), but also property rights over land that can be transferred to future generations[20]. Because of this particular quality, and unlike natural forests, which cannot be durably appropriated by individual segments of the community, cultivated forests constitute the basis of a true patrimony. The dimension of this patrimony, which comprises both land and labour invested in land development, is more social than economic. In most agrarian societies (including shifting cultivator societies), which are largely defined by their relationship to the land they control and develop, the land base of a patrimony constitutes the main foundation of a social group. Cultivated forests represent the visible and symbolic justification of the creation and continuity of a social segment, be it a family, a lineage or a clan. In the Toba highlands, where one dominant clan creates a village that constitutes the only recognised class of landlords, benzoin forests, more than other land-use components, serve as the appropriation mark of

20. Mary 1987; Dove 1995; Peluso 1996; Michon & de Foresta 1999.

well-defined village lands. Even though divided into lots managed by individual families, the benzoin forest of a village constitutes the indivisible patrimony of the village clan. It embodies the cohesion of the clan and reinforces the special status of the leader, who is responsible for safeguarding the properties of the clan for present and future generations. In Pesisir, damar gardens belong to the descendents of the first creator. The damar patrimony, in which the created plots are indivisible, has allowed former landless swidden cultivators to become 'landlords', a privilege formerly reserved for a few rice field owners, and thus acquire real status in the village, including the right to build a permanent house in the village. This has completely changed the power and wealth balance in the villages and constituted an essential driving force for the expansion of the damar forest on former communal forestlands[21].

b. Redistribution of benefits to the poorer

Management rules of cultivated forests include many egalitarian aspects formerly attached to forest collection. The first one is a form of access for harvesting special categories of useful but noncommercial products (firewood, small fruits, medicinal plants, sometimes sugar palm sap or rattan) to whoever needs and asks for it. This function can be extended to the main commercial products if the owner judges that harvesting is not interesting enough for him (in times of low prices, for example, the main forest commodity tends to be collected by the less endowed in the society). The second is the granting of 'tail harvest' of commercial products to the poorest groups in the village. Damar drops fallen on the ground after harvest, off-season candle-nuts and fallen durian fruits can be harvested and sold by those in need, usually widows or children of poor families who use the collected money to cover their weekly schooling expenses. Other social redistribution mechanisms include the creation of jobs related to forest production, such as the transport of damar resin from the gardens to the village, which is usually carried out by widows, and the sharing of valuable fruits with the extended family. For example, in Maninjau or Pesisir, distant relatives may come and join a durian party or leave with a basketful of langsat, which is considered a valuable practice for keeping family cohesion. These mechanisms create important networks of reciprocity that act as a counterpart to merchant networks, which become more and more dominant, and that help maintain a social balance between well-endowed people and those without resources and the poor[22].

c. Forest culture and local identity

Forest culture constitutes a strong element of the definition or reinforcement of the identity of local groups. Farmers practicing one form or another of forest culture always define themselves as 'damar farmers', 'rattan farmers' or 'benzoin farmers'. Having grown trees and planted forests for at least a century, or more in many examples, they feel better defined by this silvicultural dimension than by any other economic activity, even when forest culture is perceived negatively (usually as 'backwards') by external observers, and sometimes by the practitioners themselves. This inclusion of a strong material element in the definition of their identity bears obvious, though undisplayed, dimensions of territorial and political claims. Being defined as a 'benzoin farmer', being bound altogether economically, socially and symbolically to the benzoin forest,

21. Michon *et al.* 2000.
22. Michon & de Foresta 1999; Marzuki 2003.

Social functions of cultivated forests (1)

Anybody may collect fallen durian fruits. A lady sells the fruits she has thus collected in the local market.

Part of the production —the last resin flow, fallen or off-season fruits, wild fruits and vegetables, dead wood— of the cultivated forest is left in open access for the poorer, which allows a sharing of direct benefits and contributes to social cohesion.

The plantation of forest trees on former collective forestlands creates special bundles of property rights that can be passed on to the next generation. In some societies, this circumstance allows the constitution of land patrimonies that form the main foundation of lineage groups.

Children stand in front of a damar tree planted by their grand-grandfather. One day they will pass on the tree, as well as the rights established on the land, to their children.

A concrete post in the central square of a village in Jambi represents a rubber tree, the foundation of local economy and the symbol of local identity.

Forest culture has been integrated as a major element of the cultural foundation of local groups, and presently constitutes a strong element of local identities. Forest cultivators perceive themselves as 'damar farmers', 'benzoin farmers' or 'rattan farmers'.

Wild foods from the cultivated forest (here, the sugar palm) are important for a balanced diet.

Through self-established species, the cultivated forest allows the maintenance of extractive activities from hunting to gathering and extractivism, which still play an important role in local economy.

Social functions of cultivated forests (2)

In durian season, relatives of local farmers usually bag their share of the looked-after fruit. This practice maintains important family links.

Anyone may collect deadwood for self-consumption.

Hunting is currently practiced in the cultivated forests.

provides a stronger claim for the official acknowledgement of local rights on the benzoin lands. This latter point shows how social and political dimensions of forest culture are intertwined.

5. Sociopolitical qualities : What makes the cultivated forest an important social or a political resource?

Forest management by 'foresters' has been based for centuries on the exclusion of peasants from the reserved forest domain. This attitude has changed over the last decades, but it still impregnates forestry regulations and current practices, as well as the perception of smallholder farmers or shifting cultivators in forest development[23]. Farmers have at best been forgotten in forestlands, but usually either physically displaced, dispossessed or marginalised. As a consequence, farmers have shown little concern for the future of the forest from which they were excluded. Smallholder forest culture is not based on exclusion, but on integration. It has evolved both independently from and in reaction to professional forest management. It has always developed from internal needs and dynamics, neither from projects nor from external advice or incentives. It is based on local value systems, on local knowledge and beliefs, not on other systems imposed from outside. And it integrates with other farmers' activities. The consequence of this antagonistic movement of exclusion of farmers from the public forest domain and integration of local forest management on farmlands is that most forest components in heavily populated areas, such as Java and south Sumatra, are not on 'forestlands' anymore, but on lands developed through agriculture and 'forgotten' by foresters.

Forestry is often conceived as a practical field defined by norms, techniques and production objectives, and concerning mainly forests and trees. It is rarely understood as one among other fields of interrelations among different groups of people. In that context, conflicts about forest use have long been considered as superimposed on the forestry context, as external to forestry matters. But forestry is also undoubtedly about people. Historically, forestry has been managed more through regulations than by silvicultural techniques. By definition, regulations aim at clearly defining content and boundaries, concerning forest use and benefit sharing, of the relations between categories of actors. Directly or indirectly, they define the rules of access to utilisation and control of forest resources, including forestlands[24].

Even though local forest management has been abundantly described and commented upon over recent decades, its sociopolitical dimensions have been clearly overlooked. Can the existing examples be understood without clearly addressing this sociopolitical dimension? Can the related models be extrapolated without due reference to the social and political implications of their development?

23. Dove 1993; Colchester 1994; Rossi 2001.
24. Fay & Michon 2003.

We have shown in the section above how local regulatory systems can determine the success of forest culture (see also Michon *et al.* 2000) and relate its development to social strategies. How does the national regulatory framework of forest management and land development affect smallholder forest culture on farmlands?

The analysis of smallholder forest management cannot ignore the political ecology of forest conversion in general, and of forest reconstruction in particular. Forestry is a heavily regulated domain. In the context of this burden of regulations, forest management, and moreover forest cultivation, have obvious political dimensions. Compared to the collection of wild resources, the act of planting forest resources bears an inherent dimension of appropriation, which cannot be foreseen in the context of insular South-east Asia, where all forestlands remain under the supreme authority of the State.

It is seldom mentioned that the transfer of wild resources into cultivation, whether trees or annuals, immediately affects the bases of authority over these resources. Colonial plantations of forest products have clearly demonstrated how domestication can deprive smallholder collectors from both the benefits and the rights of forest collection. Most smallholder forest culture has developed in reaction to policies restricting swidden farmers' access to forestlands and resources[25]. It represents an appropriation strategy in situations where traditional forms of control and ownership are questioned or threatened by external actors and/or the state. Through the act of planting, farmers aim at securing or recovering their specific rights[26]. Rubber in Riau, and elsewhere in Indonesia, is perhaps the best example of such an appropriation strategy[27]. This does not mean that these rights are legally acknowledged, but it at least gives farmers more negotiation power. It renders possible a renegotiation of relations between local communities and the state regarding forest resource management.

The particular process of forest development, through the restoration of numerous other forest resources in the cultivated forest, allows farmers to redefine bits and pieces of the former forest economy linked to extraction, through the elaboration of new rules and regulations. This redefinition helps them to capture more securely the benefits of forest management. The efficiency of local systems lies in their flexibility and their adaptability: unlike official legal systems, which are rigid and difficult to change, customary systems of rights usually evolve easily in order to react to the emergence of new economic and social needs or to accompany environmental change. But this forest similarity may have adverse consequences. We found that some farmers were giving up diversified forest culture and moving to the much more intensive (and low biodiversity) alternative of oil palm for a number of reasons, including the lack of legal recognition given to traditional rubber gardens.

The productivist model in forestry involves resorting to large-scale operations, which considerably reduces costs of production (or costs of exploitation), but holds attributes that clearly exclude smallholder farmers from forest management and from forestlands. In the monocrop plantation model, the developed technology and plant material are available to farmers only through market or

25. Michon 2000.
26. Dove 1995; Lynch & Talbot 1995; Doornbos *et al.* 2000; Zerner, 2000.
27. Angelsen, 1999.

Forestry is not only a heavily regulated domain, but also a large arena of conflicts. Forest policies and regulations do not only concern technical management, but also the legal definitions of access to forest resources and of benefit sharing. For centuries, all over the world, forest management has been based on the exclusion of many social categories, particularly farmers, from the reserved forest domain. This situation has entailed various kinds of conflicts between the legal—or actual—beneficiaries of forest policies and those who feel excluded from the forest benefits.

Considering that the management of forestlands and forest resources represents a field of social relations in which the power relationship is an essential factor of evolution, the replacement of 'natural forests' by cultivated forests has to be viewed within its political dimension. Because the act of planting trees on customary lands bears an inherent dimension of material and symbolic appropriation, forest culture cannot be assimilated to the management of resources in natural forests, especially in countries where most forestlands remain under the supreme authority of the state, as is the case in most countries endowed with tropical forests.

The delineation of ‘state forest lands’ in Indonesia does not acknowledge the existence of smallholder forest culture and associated customary rights. Here (right), a sign has been posted in the damar agroforest indicating the limit between ‘production forest’ and ‘private lands’. This lack of official acknowledgement constitutes a real threat for the future of forest culture by local people.

Policies restricting harvesting rights for sandalwood (above) have led to the almost total exhaustion of the species on the island of Timor. Moreover, they constitute a true disincentive for sandalwood cultivation. As all sandalwood trees growing in Indonesia legally belong to the state, farmers uproot seedlings that naturally regenerate on farmlands.

How much do policies favour or hamper smallholder forest management and culture? (1)

Policies protecting forests as particular domains can be counter-productive, as here (below) in the south of Sumatra, where the local forest administration, through expulsion of local inhabitants, has reclaimed a ‘protection forest’ converted decades ago into a multistoried coffee plantation with forest trees. The local reaction has been to destroy all the planted trees, resulting in the obliteration of what was a cultivated forest performing all the protection functions of a natural forest.

Timber policies restrict the trade of timber harvested outside of timber concessions. Farmers are not allowed to transport or market timber collected from their cultivated forests (like here, left, damar timber) outside of subregency boundaries. This restriction represents a true disincentive for timber culture in farmlands and favours illegal and unsustainable collection of natural timber sources.

A rattan forest planted by local farmers in Pasir, where the government heavily recommends oil palm development, has been 'accidentally' burned. Conflicting situations resulting from the confrontation between national policies and current practices on forestlands leads, more than often, to the destruction of forest resources.

Policies in Indonesia encourage the development of oil palm estates (right, oil palm trees in the background) against local forms of forest management and culture. Local farmers who would like to integrate oil palm cultivation and the more traditional culture of rattan forests (like in the picture on the right) are discouraged.

How much do policies favour or hamper smallholder forest management and culture? (2)

The establishment of protected areas often conflicts with local forest management and culture. This conflict unavoidably results in the destruction of natural resources and landscapes, like here in East Kalimantan.

In the context of insular South-east Asia, where all forestlands remain under the supreme authority of the state, the act of planting a forest bears an inherent dimension of appropriation. In planting benzoin trees, Batak farmers have been able to resist the claims made upon their forest resources by the pulp company Indorayon.

credit, and the risks involved are often too high for smallholders. Therefore, intensive forest production is developing under the control of private or state corporations, who physically as well as legally replace forest people on forestlands. Smallholder models operate at low costs and low risks, which makes them accessible to every single farmer, even ones with low financial capacity or no social or political connections.

Conclusions and recommendations

The technical and legal forestry frameworks all over the planet have introduced rigid regulations and created strict hierarchies between various categories of actors on the forest scene, with expected social and political consequences. They clearly disadvantage local forest managers. The establishment of original models of smallholder forest culture, and especially of forest culture on farmlands, opens new grounds for the restitution of local forest management in a policy and regulatory context that, being totally different from the one currently in use in professional forestry, could be more favourable.

The acknowledgement of alternative models of forest management and culture offers alternative ways to restore a real role in forest development to smallholders, through practical, conceptual or legal approaches. This necessary readjustment of representation systems, technical models, social relation systems and regulatory framework may help renovate the forestry framework and re-establish the necessary balance between presently conflicting sociopolitical groups in forest management.

We do not suggest that granting exclusive rights to local communities or securing local tenure are the exclusive keys to successful forest management. But we do conclude that forest management first and foremost concerns the definition of the social and political relationship between people for the use and development of forest resources and of its tangible and intangible benefits. More than a technical prêt-à-porter model, smallholder forest culture offers original perspectives for a refreshed definition of the social and political aspects of forest development.

Tropical forests will not survive without forest people, especially those who were born and live in them, but they may not survive untouched. The current dynamics in South-east Asia, which associate the same unit of time with the destruction of natural forests and the restitution of cultivated forests in farmlands, clearly illustrate the social fracture between farmers and conventional professional forestry in general. The models derived from these dynamics propose alternative solutions for local forest development, which foresters and policy makers should not ignore any longer.

6. Weaknesses

The existing examples of forest culture on farmlands also bear weaknesses, which are closely related to their qualities. The main weaknesses concern their environmental and economic assessment.

From an environmental point of view, one can blame the expansion of forest culture for forest conversion and biodiversity loss. Cultivated forests do not allow biodiversity to be restored to its original levels. But one could also argue that they are not meant for biodiversity conservation, and that the levels of biodiversity encountered in the existing examples are the highest known for any cultivated system, which is certainly more an asset than a weakness as far as environmental protection is concerned.

From an economic point of view, they presently appear to have low profitability compared with intensive production models, which in part stems from their management option of diversification rather than intensification, as diversification makes the yields of the main production—and the related gross income—lower than for specialized forest plantations. Taking into account the additional productions, however, or considering the returns on labour investments, this assessment of 'low profitability' can easily be revised, as noted above. For one, the scale of operation makes economies of scale ineffective, but allows the maintenance of an activity that both produces and keeps all farmers active. The main reason for the observed decrease in profitability lies in external factors. It relates to the global drop in the prices of basic agricultural and forest commodities, which affects the whole production sector. Because of the global liberalization of the world's commercial exchanges, it is increasingly difficult to make a profit in agriculture unless the activity is heavily subsidized. For most of the productions of cultivated forests, this phenomenon becomes obvious since, unlike basic food commodities, they are not subsidized by the state, and since potentially profitable activities linked to true forest production (especially timber, but also clove in the 1980s or rattan in the 1990s) are so heavily regulated that they cannot be carried out by farmers.

From a technical point of view, the lack of standardisation of planting techniques or planting material and the low control over pests and diseases are factors that lead to a decrease in potential yields. Forest culture dramatically needs technical support, but in a form that understands and integrates the particular specificities of the existing models, namely diversity and complexity.

Forest culture globally shows only a few internal weaknesses. The main weakness concerns the fragility of these systems in the global context of economic and agricultural development. The strong preference of governments in many countries for an open field model in agricultural development, which values intensification through specialisation rather than through positive diversification, and increase of production levels in the short term rather than the integration of sustained production and environmental concerns for the long term, clearly leads to the marginalization of forest farmers and potentially even to their total exclusion from the future management of forest resources and forestlands.

The 'green revolution' has entailed the abandonment of diversification patterns of local agricultures by replacing local varieties with uniform improved cultivars, diversified cropping patterns with uniform crop arrangement, and diversification of on-farm activities with high levels of specialization in a particular culture. For financial and structural reasons created by political choices and supported by adequate policies, the same holds true for the present development of forestlands and resources, as observed in the dominant conversion dynamics of natural forests formerly under extraction or local management. Plantation forestry, and rubber or oil palm plantation agriculture in general, develops following estate models of large areas, crop specialization, uniform cropping pattern and huge financial investment. It develops under the control of private or state corporations that physically and legally displace local farmers from their lands, as they are located on the public forest domain. Farmers who are not directly touched by eviction policies and the physical conversion of the lands they have developed are so strongly 'encouraged'—through incentives as well as harassment, if not physical, moral or symbolic violence—to follow the dominant model that they may quit forest culture to join in the new development patterns.

VI – Evolution

Are local forest management systems only early stages in a universal process leading from primitive horticulture to modern agricultural intensification? Or do they constitute alternative models of forest production and domestication representing an original but, rather universal evolution in smallholder forest management?

The question of evolution of smallholder forest management is a central one, especially in the perspective of extrapolating alternative models to other regions.

Many people in professional forestry or policy development, as well as some forestry and rural development experts and scientists, think that local and diversified forest management systems that have been conceived by local people and have evolved outside any project framework, as most of the examples we have studied in the project, represent backward systems of little interest for the future of global forest management. The arguments against smallholder forest management are a supposedly high local specificity, low economic profitability, a lack of ecological sustainability and a fading future. It is commonly said (see forestry reports and speeches in most tropical countries) that these systems are bound to disappear in the course of rural development and globalisation. These conclusions are linked to the common analysis that these systems, especially local examples of forest culture, are nothing more than 'primitive horticulture' and should only be considered transitional stages in the universal process of conversion of old forms of harvesting systems towards domestication and intensification.

The conclusions of our studies on current evolution of the existing systems demonstrate that local forest management systems hold many elements of universality, that their diversity usually tends to be reproduced rather than giving place to more specialization in resource management, and that their collapse is often a consequence of policies or market regulations that aim at promoting more 'official' models of resource management.

1. What are the current evolution dynamics of forest extraction?

Forest extraction has always existed in the region under study. Except for a few fragile animal species (especially rhinos), it has not led to a drastic reduction of existing resources or to an obvious degradation of the ecosystem itself. But is the practice decreasing or on the rebound as an economic activity and a support for livelihoods? What are its prospects and limiting factors?

We have shown that the economic niche of extracted products (local subsistence, local trade, national or international trade) and the policy environment in which the extractive activities are framed (land-use policies, concessionary policies for forest collection, restrictions on harvest and trade, mechanisms for formal recognition of local rights) are the two main factors driving the evolution of forest extraction.

Globally, there is a major difference between the evolution of extraction for subsistence and that of extraction for trade (extractivism). Talking about forest extraction in general, one therefore has to consider whether this extraction is undertaken primarily for the satisfaction of local needs in food or materials (including sale in local markets) or for external and distant markets.

a. Forest collection for subsistence purposes

1. Extraction of forest foods for subsistence purposes concerns small quantities, compared to extractivism, and seems to be stable over long periods of time.

- The collection of forest staples such as tubers, bananas and sago for flour is presently quite limited in the region, as it has generally been replaced by cultivation or exchange. In areas that are rich in sago palm, however, managed sago groves still provide an important part of the starch in people's diet, as noted amongst the Talang Mamak and the Punan of our study. Management of wild sago is preferred to swidden rice cultivation as it requires less labour and is less exposed to environmental and climatic hazards.
- Several tens of species and varieties of fruits may co-exist in the forest and in domesticated forests. Even though most of the fruits consumed in the region come from cultivated trees, wild fruits are still intensively collected in the forest, especially in Kalimantan, which exhibits an astoundingly high diversity in edible forest fruits from mangoes to rambuttan jackfruit relatives, durian and langsat, lengkeng.
- The forest is still an essential source of protein and minerals. Inhabitants of villages at the forest margins collect game meat, fish and greens mainly from natural sources.

2. Collection of forest materials for subsistence uses is globally decreasing over the region and being replaced by purchased manufactured products. This decline has resulted from the reluctance to engage in the time-consuming and physically demanding activity of harvesting and processing the wild product, when manufactured goods for the same use are available, and from the prestige bestowed upon manufactured goods. Thus farmers would rather go to the forest to collect products for sale (extractivism) and use the money to purchase material. The perverted form of exchanging forest material against manufactured goods is represented by the exchange of timber for cement-based building material, in which case the profit obtained from selling timber largely exceeds the cost of a concrete house.

3. Collection of forest resources for subsistence purposes tends to increasingly be carried out outside of the 'forest', in cultivated forests and anthropogenic forest vegetations on farmlands. The importance of agroforests and fallows is often essential, because of the high diversity in spontaneously occurring species. Preferred species (especially fruits) tend to regenerate easily in these vegetations, from seeds dispersed by people. Old forests, however, keep their first role as providers of honey, game and fish.

4. The collection of forest products for subsistence purposes remains essential in times of crisis. This buffering role has increased, as climatic catastrophes have tended to become more frequent over the last 20 years.

b. Extractivism

5. Extractivism is still abundantly practiced. It is an important cash-earning activity for forest farmers and has a significant place in household and village livelihood strategies. Most farmers are aware that maintaining the possibility of resorting to the forest is a safeguard against economic and climatic unpredictability. It allows for flexibility in the allocation of scarce resources (labour, land, capital and chemicals) and maintains a certain independence from credit providers and traders.

6. Extractivism as an integral, or dominant, economic activity has lost its former place in household and village economies of forest areas, however, and is presently practiced more sporadically than before, in a highly opportunistic way. This decline stems from villages' increasing distance to natural forests and the development of alternative options for income generation. When given the opportunity, farmers generally prefer to engage in wage labour or commercial agriculture. This choice is not exclusively driven by profitability considerations, but commonly results from the combination of several factors:

- For high-value products (eagle wood, sandalwood, birds' nests, timber logs), prices of which have soared during the last two decades, extractivism at first encountered a quick renewal, with people rushing to the forest in order to make a fortune. Extraction of high-value products tends to be so fiercely competitive and risky, however, that only 'the big ones' finally make a profit. Engaging in the collection of such products requires capital facilities and good connections with powerful people. As a consequence, the organisation of this potentially highly profitable extractivism tends to be pyramidal, whereby the ones holding capital and power hire smallholders as wage earners for the collection. This practice makes the activity less interesting for the latter category of people.
- Everywhere, the collection of less-profitable products (rattan, latex, resins) is considered physically difficult and backwards. It is now mainly strong young people who need capital to start a new household who practice it.
- The trade in forest products is highly variable and unpredictable, especially for long-distance trade and high-value products. Collectors are completely dependant on traders' decisions regarding which products they will buy, in which quantities and at what price. This dependence of an economic activity on the presence, goodwill and local power of one particular agent in the whole process plays against its sustainability.
- The degree of collectors' dependence on traders is increased because most are indebted to them as a result of the prevailing financing systems of collection expeditions, especially for high-value products. The funding mechanisms of extractive expeditions often involve going into debt for the collectors, who borrow food and materials from the

trader and pay their debts with collected products, a scheme which considerably lowers the profitability of the activity, as those providing the credit and buying the product are one and the same.

7. There is a general tendency of diversification of extractivism in the region through new actors and new products geared at nontraditional markets. Because of the economic crisis, many villagers who had migrated to city centres returned to their villages. As they have no land, forest extraction represents an interesting economic option for them. Aware of the forest products sought in the cities, they developed an extraction sector aimed at city dwellers, with products such as ornamental fish, songbirds, tortoises, orchids and tree ferns. However, this neo-rural extractivism is practiced in a plundering mode and has a highly negative impact on coveted resources in most of the surveyed cases.

8. Forest extraction gains importance in indigenous political movements. In Kalimantan and in Riau, extraction has been revived as a 'tradition' linked to the reinforcement of a sociocultural identity connected to the forest. It is used as an argument to negotiate the maintenance of villages and forest-related activities in conservation areas. The Kenyah people in Kalimantan and the Kerinci people in Sumatra define themselves as the 'stewards of the forest' and have revived 'sustainable' forest collection practices in order to maintain their authority, and presence, over the forestlands on which they live.

9. Many regulations have recently been introduced to protect coveted extractive resources from overharvesting. The various economic and policy instruments include measures such as exclusive concessionary rights and periodic bans for sandalwood, a total ban governing rattan and an auction system for birds' nests. Timber collection was totally forbidden for local people until 1999, but is now permitted through village-level concessions. It appears that the impact of most of these coercive regulations has been contrary to what was intended. They have increased illegal operations and smuggling for all products concerned, leading for example to the almost complete exhaustion of sandalwood in the Molluccas and to a rapid depletion of bird nest caves in Kalimantan.

10. The decline of true forest areas in the region because of overlogging and conversion to nonforest uses deeply affects extractivism. However, extractivism can partly survive through integration of wild forest resources into cultivated forests and anthropogenic vegetations, but not on a sustainable basis. If the reduction in old-growth forest areas does not necessarily affect forest collection for subsistence purposes—as forest collection is actually reviving in other spaces around villages—, it does put a threat on classical extractivism because most of its products are either lost or managed through forest culture on farmlands: extractivism from forest cultivation is restricted (except for rattan) and unsustainable as economically interesting products tend to be cultivated.

Conclusions

The current evolution of the management of wild resources in the region follows various dynamics. Its importance for subsistence purposes remains through the transfer of collection activities from natural forests to managed vegetations that are still able to harbour wild resources. As a cash-earning activity, it decreases in some places because of competition

with more stable activities, negative perception of the activity, lack of market and discouraging policies, while it revives in others through a combined set of factors including new products, new markets, new actors and new political strategies. This revival, however, often entails a quick exhaustion of the resource. The future of extractivism finally depends on the maintained presence of the forest itself, as well as on a regulatory framework and institutional bases that do not push towards resource plundering, but rather promote sustainable management.

2. Why do farmers move from forest extraction to forest culture?

Most economists stress that the main driving forces for the development of forest resource domestication and cultivation are of an economic nature, among which are developing markets and the reduction of the costs of production [1]. Social and political factors are not recognized as significant driving forces. This assumption is based mainly on the analysis of large-scale operations of domestication and plantation. The introduction of examples of forest cultivation by smallholder farmers may changes this perspective.

The historical evolution of the cases analysed in our successive studies shows that the factors initiating the domestication process and those influencing its general adoption are usually quite different. In both cases, however, economic factors are not necessarily the dominant driving forces.

The emergence of domestication is mostly driven by the conjunction of two types of factors. These are

- increased access to existing markets for the cultivated forest product, which encompasses increased external demand and diversification of traders, credit and transportation facilities; and
- decreasing access to the wild resource, which encompasses natural exhaustion, restriction of or disrespect for local rights and regulations, and increased competition for collection.

The presence of local innovators is critical to achieving the first domestication trials and solving initial technical problems. The role of key actors, often outsiders, is important in suggesting the idea of cultivation or in supporting the first initiatives. Examples of the former influence include Chinese traders for rubber[2] and a local Haj for damar in the Pesisir[3], while the local forest administrator for damar in the Pesisir[4], leader villages for benzoin in the Toba highlands and the local sultan for rattan in Pasir district are examples of the latter.

Massive adoption of cultivation is catalysed by factors outside the economic field. Even though the generalisation of cultivation requires some market certainty and the resolution of the main technical problems, it appears to be driven mainly

1. Homma 1992.
2. Dove 1994.
3. Michon *et al.* 2000.
4. Rappart 1937.

by social and political considerations.

These considerations may be internal to the social group. The need of younger branches of lineages to acquire a real social status through the establishment of a land patrimony catalysed massive planting of damar in southern Sumatra[5]. The true expansion of damar cultivation happened at the moment when international demand for natural resins was declining, a development that has not affected the plantation dynamics until today.

The sociopolitical drivers often concern the relationship between a social group and outsiders. They relate to changes in forest-related policies or practices of external actors. Massive planting of benzoin in the highland forests after Independence aimed at strengthening, in a visible way, traditional authority of Toba Batak lineages over their customary forestlands in the context of postindependence uncertainty regarding land tenure and land status [6]. The adoption of rubber in Sumatra in the early 1920s[7] was aimed at compensating for the double restrictions imposed upon swidden farmers on the collection of wild rubbers (from free harvesting to concessionary rights) and the participation in colonial plantation schemes (reserved for Dutch planters).

5. Michon *et al.* 2000.
6. Michon 2000.
7. Dove 1994.

Conclusions and recommendations

Massive conversion of former forest collection systems into forest culture appears successful when forest cultivation allows farmers to both meet their economic objectives *and* achieve noneconomic goals related to the social, political or institutional sphere. Planting trees has a starkly different social and political dimension than just extracting tree products from the wild. These dimensions should be fully understood and taken into account. Basing policy support for smallholder forest culture on economic incentives is not the best way to ensure the success of the so-called 'social' or 'farm' forestry projects, if local social and political goals go unfulfilled.

3. What are the forms and impact of intensification of local forest culture ?

The term intensification here refers to changes in management practices that result in increased productivity of production factors. In agriculture intensification usually means more production per unit of land, which is achieved through strict specialization and 'rationalization' of crops and fields. In this intensification process, land is valued more highly than labour, and all inputs (labour, capital, chemicals) are increased, except for land. These changes allow for increases in the size of the management unit and the scale of operations. How much does this process apply to forest production? Why did farmers choose diversified rather than monocrop forestry? Do they stick to the diversified model when intensification (both internal and external) proceeds?

South-east Asian forest culture favours diversification over specialization. More than representing a 'primitive' attitude towards production, we suggest, as many ethnobotanists did for tropical horticulture, that forest culture as practiced in the studied area represents an alternative model of forest domestication. Unlike Western agriculture, which targets the improved control and increased production of individual resources, South-east Asian forest culture aims at domesticating the production processes of an entire ecosystem, which goes through encouraging diversity.

The switch from extraction to production represents the first stage of the intensification process in agriculture as well as in forestry. In their initial phases, tropical horticulture and agriculture were diversified rather than much 'intensified'. Scientific analyses of the evolution of farming systems usually assume that the second step in the intensification process of smallholder systems is towards more specialization for a more intensive use of scarce resources[8]. However, opting for uniformity and productivism in tropical agriculture also happened under the impulse of external policies brought in first by colonial administrations, then by development agencies. As far as forest culture is concerned, we did not find any evidence that intensification leads to more specialization. We even have evidence to the contrary: all the attempts farmers made to increase the productivity of their cultivated forest consisted of the introduction of more economically interesting tree species into existing structures, which practice adds diversity to the original stand.

Most examples of true specialization dynamics observed can be related to policy changes and incentives, or policy and economic disincentives aimed at local patterns of tree cultivation. The observed switch of Pasir farmers from diversified rattan gardens to monocrop oil palm plantations happened in the context of important policy changes for the rattan trade and policy support for oil palm development, a combination that constituted strong disincentives for rattan cultivation. Most farmers said that, given the choice, they would opt for a combination of oil palm fields and rattan gardens. Farmers in rubber areas would like to try improved varieties of rubber under 'jungle' conditions[9], but clonal material was distributed only to those engaged in changing their cropping patterns towards specialized rubber fields. In Maninjau, extension agents refused to work in the agroforest, offering technical advice for cinnamon, coffee or nutmeg cultivation only when these crops were 'properly' grown, that is, in uniform, monocrop stands.

In developing forest culture, rather than controlling the species genes and the population structure, farmers have chosen to retain and manage the diversity of species, structures and functions inherent to local forest ecosystems. To the question, 'Why did you choose this model rather than monocrop forestry?' farmers respond by asking, 'Why should we choose monocrop forestry rather than our diversified model?' This inversion of a simple question reveals the fundamental opposition that exists between an Asia-Pacific model of horticulture and the grain-crop based theory of agricultural development. It shows that this opposition, which

8. Boserup, 1965.
9. Joshi *et al.* 2002.

has already been amply discussed by ethnobiologists working in the region, is valid beyond the observed systems and concerns resource and ecosystem domestication and management as a whole. Farmers in the study areas have achieved a model that emphasizes domestication of ecosystem structures and processes rather than domestication of individual species, conserved diversity rather than imposed uniformity.

Conclusions and recommendations

Intensification in forest culture should not necessarily follow the way of classic agricultural intensification. The way suggested by farmers cultivating forest goes through a full use of diversity, and it is based on the conception of ecosystem domestication rather than on individual plant species domestication. These alternative ways of intensive forest production through diversification remain to be explored, technically and conceptually. Instead of transforming forest species into light-demanding cultivars (which has happened with the domestication of rubber, cocoa and coffee for example), the technical options include testing the existing high-yielding varieties of forest plants in the environmental conditions of diversified forest, or developing improved plant material specially designed for an heterogeneous forest environment. Forest domestication in the tropics still needs to be re-invented, and indigenous examples provide interesting models for that task.

4. Are local models of forest culture only transitional ? Will they disappear as development proceeds?

The common perception in agriculture and forestry sectors is that smallholder forests are just semidomesticated stages of primitive horticulture in a transitional process that leads from predation systems to modern agriculture or forest culture[10]. Selected forest species managed in these smallholder forests are still considered semidomesticates, if not just managed species. It is assumed that smallholder forests will either evolve towards true plantations or disappear. A critical analysis of these assumptions is essential. What can we learn from the observed collapse or success of smallholder forest culture? How can the scientific interpretation of the evolution of smallholder forest management in the light of the evidence collected through our research change this dominant concept of forest domestication?

The analysis of long-term evolution of local forest culture allows for the conclusion of its permanence beyond the observed evolution of individual systems, not only as an original land-use model in forestry, but also as a new paradigm for 'forest domestication'.

Some of the studied examples are old practices (fruit forests have been in use for several centuries; benzoin, rattan and cinnamon for 150 to 200 years), while others are more recent (rubber and damar, which began in the early twentieth century), and the literature reports the recent creation of durian-based forests in Kalimantan. Some of these systems,

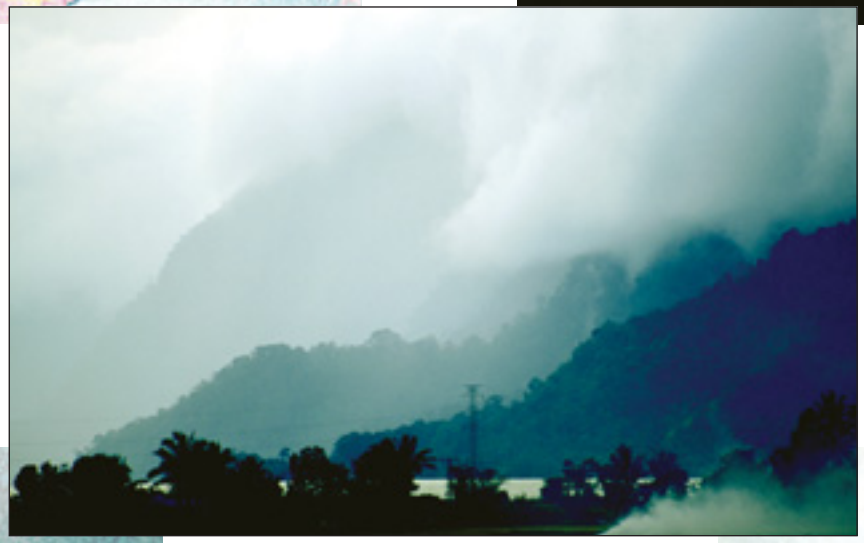
10. Angelsen, Belcher *et al.* 2000.

including damar gardens in Sumatra, timber gardens in Java and rubber gardens in Kalimantan, are still expanding. We have analysed examples of limited or massive collapse of smallholder forests. From our studies, we can conclude the following.

- The age of a system is rarely a key factor for its evolution. Some may be quite stable over long periods of time, while others may exhibit shrink-and-expand dynamics.
- The collapse or success of a system is not linked to the nature of the dominant production in the forest garden. Damar gardens have collapsed in South Sumatra while they are still expanding on the west coast of Lampung. Rattan gardens have more or less disappeared from the East Sumatran lowlands, where they were reportedly important until 1930, whereas they have been expanding in Kalimantan until recently. After 1945, benzoin gardens have been replaced by rubber gardens in Palembang while largely expanding in the Toba highlands.
- The temporary collapse of a market for a given product does not usually entail the extinction of the related systems. The markets of damar and rubber, for example, have encountered wide variations over the last century, but these variations did not prevent damar or rubber agroforests from emerging, developing and expanding until today. Long-term recession, however, or better alternatives for a product may influence the composition or the permanence of a system. Rubber has replaced both rattan and benzoin in smallholder forests of the lowlands of Sumatra. The farmers themselves have questioned the future of rattan gardens, if export policies keep prices low.
- Massive destruction of smallholder cultivated forests has, to a significant extent, to be attributed to government policies favouring large-scale operations of forest—or export crop—production. The relationship between estate development and the collapse of local forest culture systems is either direct, as in the planned expansion of estates in the forest domain, or indirect, as through incentives for the conversion of local systems to estate crops or through disincentives for the pursuit of forest culture. In reality it is a combination of both categories of factors. For the last decade or so, current policies in Indonesia have favoured the development of pulp and oil palm estates. Plantation companies have slashed and burned rattan gardens in the Bentian area in East Kalimantan to make way for government-sponsored pulpwood plantations. Rattan gardens in Pasir are being converted because of a combination of the reported or perceived economic attraction of oil palm on the one hand, and the physical and symbolic violence against farmers who do not join the dominant oil palm project on the other hand. These factors are also threatening the existence of rattan gardens in Pasir and rubber agroforests in Riau and Jambi.
- There are positive examples of smallholder forest cultivators' resistance against the dominant land uses sponsored by the government. Damar growers successfully resisted the threatened conversion of their agroforest, first by logging in the 1980s, then through oil palm development in 1995–96. In the late 1990s, benzoin farmers resisted the total logging of their benzoin forest and its conversion to eucalyptus plantations by a pulp-producing company.

Conclusions and recommendations

Considering smallholder forest management as an alternative rather than a transition towards modernity requires a shift in dominant perceptions about forest, agriculture and development, followed by a shift in policies determining land development. What is needed is more a conceptual change and the invention of new paradigms, rather than the multiplication of nice case studies. Our studies have established the bases for elaborating on this original association between short-term imperatives of production and long-term perspectives of forest conservation and development. This foundation opens the way for practical, alternative strategies for forest management, domestication and culture to be devised.



VII - Extrapolation

What are the preconditions for a successful development of smallholder forest culture versus monocrop tree culture ?

We have shown how forest culture on farmlands has emerged in various periods of history through different strategies related to complex sets of circumstances, which has resulted in the creation of different types of structures. These structures have evolved through existing conditions and are still maintained and developed by farmers.

We have gathered enough evidence to conclude that diversified smallholder forest culture, which goes along with the maintenance of extraction of wild 'forest' resources from either natural forests or farmlands, does not represent a transitional stage in a modernization process of primitive horticulture, but constitutes a true alternative of natural resource management devised in the context of smallholder production systems.

Forest culture is not only important where it exists. It does have potential for wider application. Our analyses allow the conclusion that examples of forest culture on farmlands are not local variations of a highly specific culture that cannot be extrapolated. They clearly demonstrate that forest culture, as an alternative model for the management of forest resources, can play a more global role in improving farmers' livelihoods and preserving ecological stability and biodiversity. Moreover, it could allow for the establishment of a new balance between smallholder farmers presently managing forest resources and lands and other actors in forest management, especially foresters, forest administrators and forest policy-makers.

1. What are the preconditions for the successful development of smallholder forest culture?

The successful development of diversified smallholder forest culture in other parts of the world will depend on a combination of factors from different sectors. Extrapolation should at least meet the following criteria.

1. Potential practitioners must perceive the proposed models as the best option. Factors include
   - economic considerations, taking into account the trade-off between cash income, labour and land inputs, and risk management
   - social considerations related to the attractiveness of the proposed solution: the proposed forest culture model should neither be restricted to a group of less-endowed farmers, nor restrict the possibilities for social change. In particular, it should not lock the less well off into relative poverty but be flexible and attractive enough to be integrated into social strategies for development
   - cultural considerations: forest culture has to be incorporated locally not as an external factor, but as part of farmers'

identity (or contributing to the strengthening or redefinition of their identity or territory) and valued beyond the boundaries of the region

- political considerations: forest culture should contribute to empower practitioners, and in particular help them maintain or regain local authority over land or resources, as well as assure them full access to the benefits of management.

2. The technical feasibility and the scale of cultivation in space and time must be carefully assessed with the framework of existing farming conditions and with the farmers concerned. For example, technical and strategic features have to be designed so that incomes or other benefits are provided until the planted forest becomes productive. This can be achieved through a well-tailored establishment process, reducing concerns of short-term profit on forest production and allowing long-term speculation.
3. There must be a good complementarity between forest culture and other farmers' activities, especially agricultural activities, in terms of labour and land allocation, overall income and risk management strategies. Forest culture should be more systematically encouraged in areas where shifting cultivation has to be intensified.
4. Farmers must be convinced of the long-term success, benefits and reproducibility of the forest they establish. Besides economic and social considerations inherent to the proposed model, this condition mainly implies full respect from technical and policy bodies involved for the difference between the commonly valued models of professional forestry and smallholder models of forest culture. Farmers' adhesion will come from
   - the sustained presence of a market for the main product, or possibilities of substitution, when needed, by other, more profitable forest products that can be easily integrated into established forest structures
   - the acknowledgement by forest administrators and policy makers of the value of the model of forest culture, not for local economic reasons, but more globally for the environmental and economic benefits it provides at the regional or national scale, as well as for global environmental concerns, when appropriate
   - the official acknowledgement of (even contingent) transferable rights over the land or the trees, especially entitlement policies
   - the official acknowledgement of the relevance and flexibility of locally devised rules, which are the warrant of the forest systems' adaptation to changing conditions.
5. Restrictions imposed by policy makers on the management of cultivated forest, or the utilization of some of its products, must be carefully justified. In particular, there should be no *a priori* restriction on farmers' utilization and marketing of locally produced timber as long as rules and practices for sustainable production are devised.

The assessment of (potential) success should be based primarily on local valuation criteria using farmers' needs, constraints and expectations. Valuation of environmental benefits should come in second place. This prioritisation means that if the cultivated forest appears to be nonprofitable in the long term, its conversion should be encompassed.

We want to stress that the proposed models of forest culture and management of wild resources on farmlands are not supposed to solve all the problems encountered in global forest management. But there are particular domains where they seem to be quite relevant. These application domains concern the following areas.

- The already converted forestlands, where local tree farming and forest culture are burgeoning and constitute the main warrants of the maintenance of tree and biodiversity cover, constitute major arenas for the successful implementation of forest culture, as most of the bases mentioned above are present.
- The sustainable development of pioneer fronts and other types of fragile forest margins where slash-and-burn agriculture is dominant, and where natural conditions seriously limit the intensification of annual food cropping.
- The development of semi-intensive use zones surrounding protected areas, where a mosaic of smallholder cultivated forests, combined with secondary forests and patches of primary forests maintained for extraction, can be a tool for maintaining or restoring the environmental qualities of the protected forest.
- Biodiversity conservation outside protected areas, where development is the main objective, where forest conversion is difficult to avoid and where the development of smallholder forest culture can represent an effective buffer against conversion to inefficient slash-and-burn or intensive agriculture.
- The implementation of social forestry programs, where local communities need to be empowered technically as well as legally to ensure sustainable management of forest resources and equitable sharing of benefits.

2. The main condition for successful extrapolation: a general change in current paradigms of global forest management

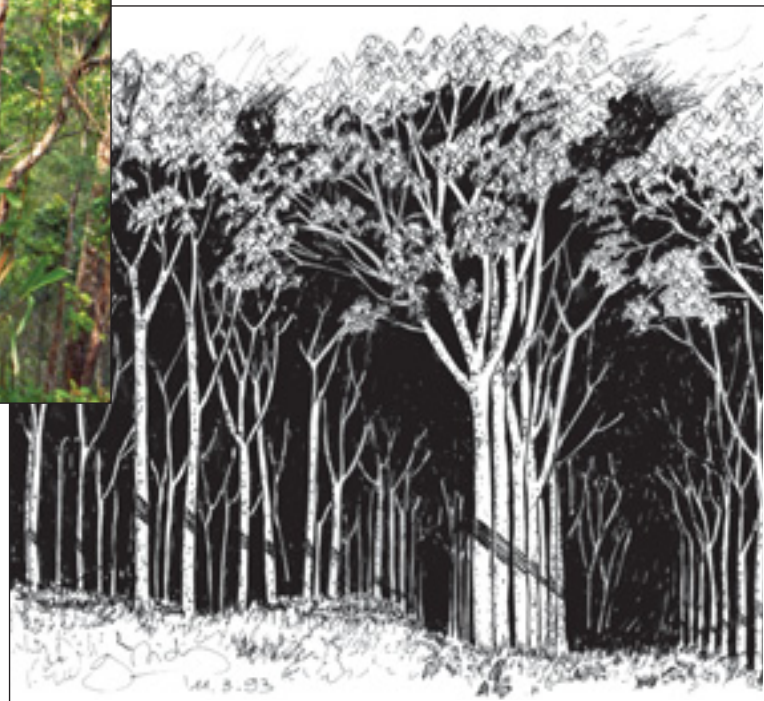
The main warrant for a successful development of alternative models of forest management is a general shift in the dominant paradigms that have dominated forestry and land development in general for the last centuries. The models of forest culture developed in this book relate to representations and logics that are different from those from which 'modern' forestry has evolved from the European forest services of the seventeenth and eighteenth centuries. These logics and representations directly question, among others, the distinction between forest and agriculture, between 'natural' and 'cultivated' systems. They challenge the allegedly universal model of domestication, which relies on species adaptation to productivity and open-field conditions, and the agricultural intensification models, which rely on crop specialization and high input levels.

They put into perspective the modern quest for a total mastery of natural processes by humans. They shake up the idea that humans are not part of ecosystems, but either perturb or control them. They finally question the disciplinary approach of resource management where science and technique are supposed to be totally disjointed from economy and politics.

Theses examples encourage us to revisit our global relation to what we perceive as 'nature'. Whereas the productivist agricultural model (the *ager* model and the open-field preference defined above) has been based on centuries, if not millennia, of attempts of mastering nature*, the forest culture paradigm (the *hortus* model revisited through the above analysed forest preference) emphasizes taming and integration. The choice here is between confrontation and connivance. This choice does not only address technical issues, but clearly challenges conventional social and political approaches of forestry in particular, and development in general.

* And where nature conservation is encompassed as the redemptory activity of this excessive mastering of nature

VIII – Concluding remarks



The last 10 years have seen a change in the attitude of professional foresters and scientists from various disciplines towards local knowledge and forest-related practices. Central to this change is the idea that local users can be at least great inspirers, if not the legitimate managers of the forest. This shift in intention is important, but, if not coupled with changes in the intellectual, methodological, political and implementation tools, could contribute to the standardization of 'local knowledge' into a few simple 'blueprint' techniques of forest production and the idealization of indigenous people as the universal, legitimate and talented stewards of the forest for the future.

In our studies, we were not looking for a catalogue of relevant knowledge and practices. We did not try to support local systems unconditionally. We were aiming at reporting more globally on the local science that underlies management systems, including its very clear and sometimes major social, political and symbolic components, in order to challenge conventional views of forest development and local forest management. Based on this global assessment, we have tried to discuss the comparative advantages of smallholder models of forest management, and especially of forest culture, against those developed by professional forestry. We have also tried to define their evolutionary trends and driving forces. We have elaborated on the potentials and limits of smallholder models for forest conservation and development. We have insisted on the fact that models are not only about techniques, but mainly about representations, economic strategies and sociopolitical relations between human groups.

We have made our best effort to relate our analyses to the current priorities in international research and development in forestry and agroforestry, as well as in sustainable development in general. We have indicated the contribution that local forest culture could have for the larger problems of mitigation of deforestation, biodiversity conservation and poverty alleviation in a context of global environmental and social change. We have insisted on the fact that the aim of the proposed models was not restricted to capturing forest physical or physionomic components on farmlands, but also to enhance the restitution of forest functions and benefits, as well as of the socio-cultural dimension of forest management, in a context that appears different from that of conventional forestry.

As a final statement, we reassess that there is a strong rationale and an urgent need for investment and policy interventions to support existing smallholder forest management as defined in this book, that is, a close integration between forest culture on farmlands and extraction of self-established resources from the landscape base, including natural forests and the various vegetation systems established on farmlands. There is a strong rationale and an urgent need to promote the expansion of the models that can be derived from the existing examples, granting special attention not only to the techniques, but also to the social modes of management and to the underlying systems of representation and knowledge.

Special attention should be given to the way policy-makers, trying to improve the global context of forest management, perceive, encompass and regulate local practices of forest management. The alternative models driven from the real world encourage us to work on the appropriate relations between farmers managing forest resources on their own lands and the administration in charge of forest management for the public interest. The relation between the actual benefits derived from

forest culture on farmlands (for the farmers themselves, the nation and the public interest) and the perceived 'public environmental services' should be carefully examined, so that the enforcement of regulations aimed at preserving these environmental services does not actually hamper the ability of forest culture to develop and provide its benefits.

At the same time, we want to stress that smallholder forest culture will not solve all the technical and social problems related to forest management. It should therefore be seen as a complement to more conventional approaches of production forestry and forest conservation, more specifically suited to the numerous areas where smallholder farmers represent the main actors in resource management and where natural forests are being converted by agricultural dynamics.

The age-old distinction between forest and agriculture as two technically, juridically and institutionally distinct sectors is totally questioned by the evolution of forest landscapes in the tropics. A large part of farming lands are under the jurisdiction of forestry services. A large share of not only managed forests but also successful forests are established on farmlands, through methods related to swidden agriculture. Farmers manage them as part of a global resource management strategy including the cultivation of short-lived crops in open fields, the cultivation of long-lived crops in complex ecosystems and the management of self-established plant and animal species throughout the landscape base. A new form of relation has to be invented between forestry and farming, in conceptual terms as well as from more technical or juridical considerations.

The models of forest culture on farmlands through cultivation and extraction discussed in this book do not only address the technical issues of integrating forest cultivation and agriculture. They aim at constituting a new paradigm that can help revisit the relations between farming societies, policy-makers and forest administrations for the management of forest resources at local, national and global levels. They call for the development of a new conceptual and legal framework for local forest management by farmers through the transfer of management responsibilities not necessarily into an agricultural context, but rather into an innovative context of integrated resource management. And it is clear that this approach also addresses the renovation of the conventional framework of forest management in general, and beyond that, the developing context of sustainable development itself. The models derived from the local examples of forest management and culture call for a new concept of land management where production and conservation are compatible, where there is no choice to be made between humans and nature. This concerns much more than just forests.

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‘It would not be the spontaneous tropical forest . . .

‘But it would have the merit of being protective to the environment and of bearing sustained yield.’

‘In this sense, man could continue to live in the forest, even if an anthropogenic forest. And some natural forests could continue to live.’ (Clarke 1978)

Local people in South-east Asia are often cited as skilled forest managers. It is barely acknowledged that an essential part of this forest management does not concern natural forests, but forests that have been planted, often after the removal of pre-existing natural forests; forests that are cultivated not by professional foresters, but by sedentary or swidden farmers, on their farmlands; forests that are based not on exotic, fast-growing trees, but on local tree species, and harbour an incredible variety of plant and animal species.

This book concentrates on forest cultivation by smallholder farmers in South-east Asia, not only because it constitutes altogether the most original and lesser known aspect of local forest management in the region, but also because, in our opinion, it represents the most promising field for the design of alternative strategies for the management of forest resources and forest lands.

Natural forests are still present and actively managed in the region. So, why do people cut natural forests to replant the same species of forest trees they have just chopped down? Why have professional foresters, or the decision-makers in forest management, never seriously considered these examples of indigenous forest culture, however sustainable and profitable they may be?

Many elements of the answer to these questions are given in this book, which is built on the conclusions of 10 years of multidisciplinary research and analysis on these systems. We show how forest culture by farmers constitutes a strategy that questions the practical, conceptual and legal aspects of conventional forest management. We speak for more scientific and political support to these systems, because they are altogether neglected, endangered and full of potential. We explain why it is important to consider these examples as interesting alternative models to either forest extraction or specialized forest plantations, especially in the present context of depletion of natural forests all over the planet.

Can the transfer of these original examples to other parts of the world be achieved? How can it be successful?

We do hope this book will help to answer these important questions.

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