Chapter 13

Damar agroforests in Sumatra, Indonesia: domestication of a forest ecosystem through domestication of dipterocarps for resin production[1]

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

OVERVIEW

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

INTRODUCTION

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

Wherever possible, irrigated rice fields, and associated permanent villages, have been established along the coastal plain, but the rude topography and the relatively low quality of inland soils have limited the possibilities of further permanent agricultural food production. The hills have long remained the domain of a classic agroforestry rotation: mosaics of temporary rice fields and coffee plantations with secondary, fallow vegetation. But for about a century or so this traditional pattern of forest conversion to agriculture has evolved into a complex system of forest redevelopment. Planting valuable fruit- and resin-producing trees in their swiddens, Pesisir farmers have managed to create a new forest landscape entirely tailored to their needs. This forest made by humans, though forming an almost continuous massif, is made up of a mosaic of individually evolved gardens which the farmers have named after the dominant tree species, the damar[4] (Torquebiau 1984; Michon and Bompard 1987; Michon and Jafarsidik 1989).

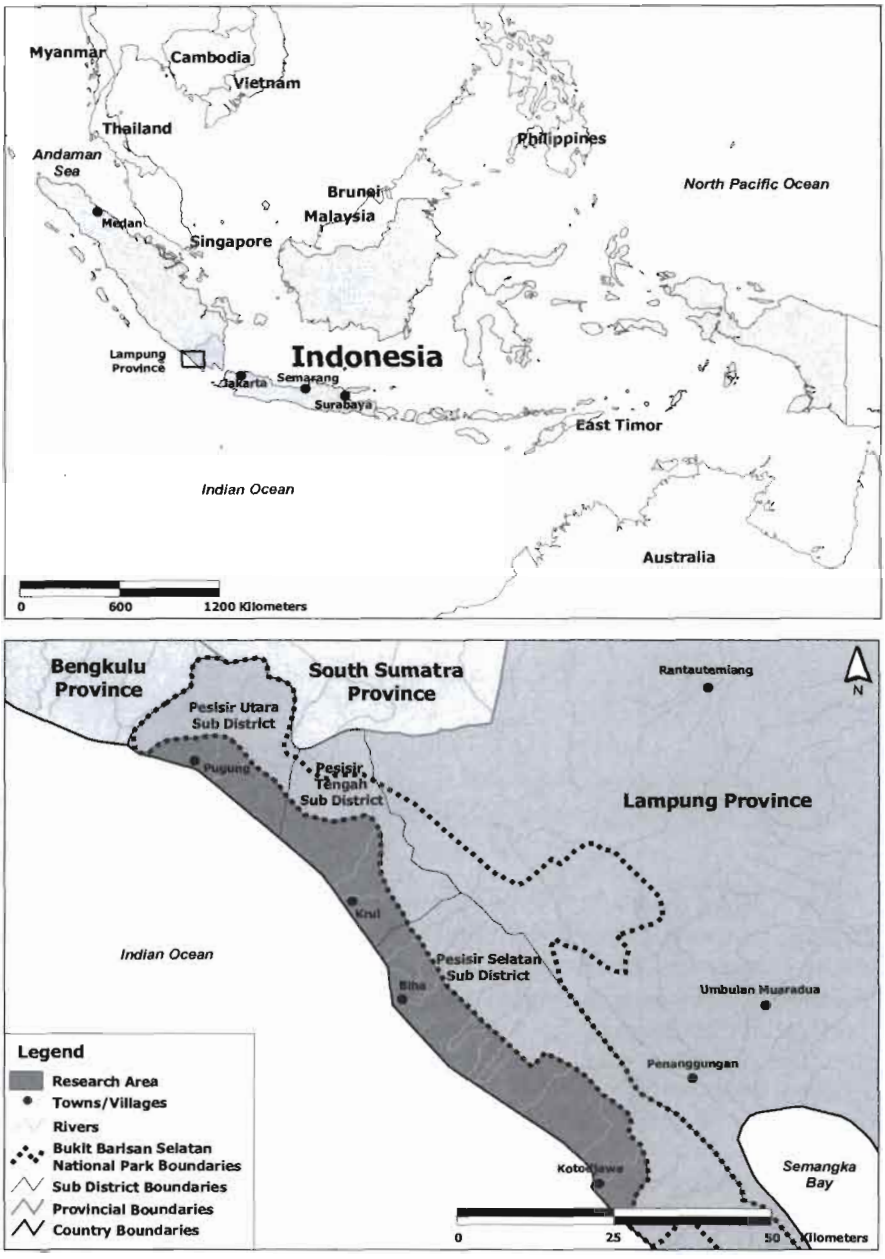
Damar gardens have gradually spread in the Pesisir, and productive gardens presently cover at least 50,000 ha, according to a December 1997 interpretation by the Department of Forestry and International Center for Research in Agroforestry of a Landsat image dated November 1994, completed by ground-checking.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

PRODUCTION-TO-CONSUMPTION SYSTEM

The damar garden

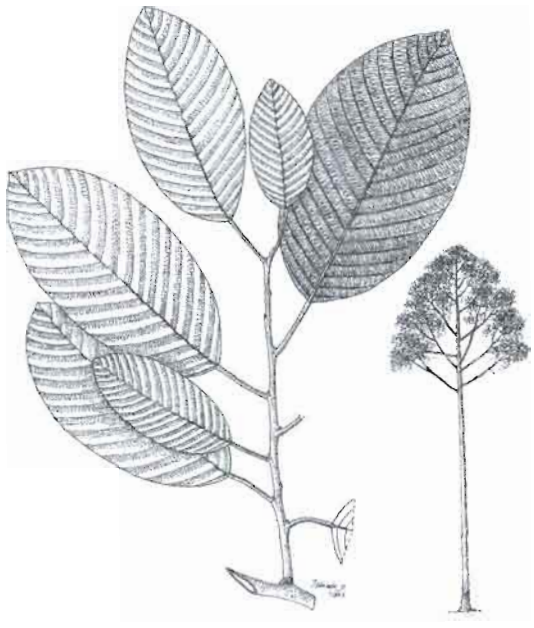
Damar gardens can be analysed as a forest, and indeed, biologically, they constitute a forest in their own right, a complex community of plants and

Figure 1. Location of the research area



Source: ESRI Data and Maps 2002.

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



(*Shorea javanica*)

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

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

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

the local laurel tree). The last component, 10% to 15% of the tree community, is composed of wild trees of different sizes and types, which have been naturally established and are protected by farmers, either because they do not have adverse effects on planted trees or because of advantageous end uses. These species include valuable timber species (Apocynaceae, Lauraceae, etc). Non-tree species characteristic of a forest ecosystem (Zingiberaceae, Rubiaceae, Araceae, Urticaceae) have colonised the undergrowth of gardens, where they contribute to the maintenance of a favourable environment for the development of seedlings of the upper layer trees.

Management of the garden

Management of mature gardens is centred around the harvest of resin and fruits. Labour allocated to routine garden maintenance is mingled with labour devoted to resin harvest, and the tempo of harvests is determined by labour requirements for wet rice cultivation. Work in the gardens is postponed at the time of the rice harvest or of rice-field preparation, so that tree gardening never competes for labour with subsistence agriculture.

Once established, the damar plantation evolves with minimum human input. The silvicultural process in damar gardens is not conceived, as in conventional forest plantations, as a mass treatment applied to a homogeneous, even-aged population of trees, but aims at maintaining a system that produces and reproduces without disruption either in structural or functional patterns. The main task of the gardener is to regularly introduce young trees in the garden

plot in order to constitute and maintain an uneven-aged pool of replacement trees. In a well-managed garden, the size of the replacement pool ensures the sustainability of the productive stand.

Photo 2. Tapping the damar tree (*Shorea javanica*) in damar agroforest (Photo by H. de Foresta © IRD)

Integration of a forest tree in a farming system: the *ladang* way

Expansion and success of damar cultivation are closely related to swidden agricultural practices (Michon and Bompard 1987; de Foresta and Michon 1994b). It is through the *ladang* (swidden), and through its traditional crop succession structure, that damar trees have been restored to the landscape. In the former dry land cultivation system, *ladang* were opened primarily for rice production, but some did not directly return to fallow. Instead, they were further transformed to coffee and pepper plantations. The first damar trees were introduced in these successional *ladang* gardens, amidst coffee bushes and pepper vines, where they found a suitable environment to establish themselves and further develop. After abandonment of the coffee or/and pepper stand, damar trees were strong enough to grow along with secondary vegetation and to overcome competition from pioneers. The subsequent fallow was a mix of self-established successional vegetation and deliberately planted damar trees, which developed fully until reaching a tappable size some 20 to 25 years after plantation, but no more than 10 years after the last coffee or pepper harvest. Damar plantations soon became a success story. Everyone started to plant seedlings in his own swidden. Through this very simple cropping technique, after two decades, a traditional fallow land had changed into a managed tree

garden that included damar trees as well as other introduced fruit species and self-established trees, bushes and vines.

Economically, the vegetation succession process is of tremendous importance as it is the basis of a succession of harvestable commercial products, thus reducing the unproductive time span of the plantation to some 5 to 10 years. Costs of labour devoted to damar establishment are mingled with those devoted to rice and coffee/pepper cultivation on swidden fields. Cultivation of commercial tree crops does not compete for labour with subsistence agriculture. On the contrary, it allows the maximisation of returns on labour inherent to the swidden system–vegetation cutting and field maintenance–successively through coffee/pepper and trees.

Among the imperatives leading to the initiation of a generalised cultivation process, the main one was probably the growing difficulties encountered in the collection of wild damar, which could closely resemble the conflictual processes regarding access to common property resources encountered today for other forest products (Peluso 1983, 1992; Siebert 1989). In the late nineteenth century, the high increase in resin prices led to intensive and generalised tapping of trees in natural forests. Overcollection entailing the rarefaction of mother trees blocked natural regeneration, whereas the extension of the cultivated territory entailed the rarefaction of the forest itself. Damar trees were spared in the slash and burn process and could easily survive in the modified environment of *ladang* and secondary vegetation, but natural regeneration in these conditions appeared difficult. Some serious conflicts are reported to have occurred between villages as well as within villages concerning access to the remaining damar trees (Levang and Wiyono 1993).

Preserving biodiversity

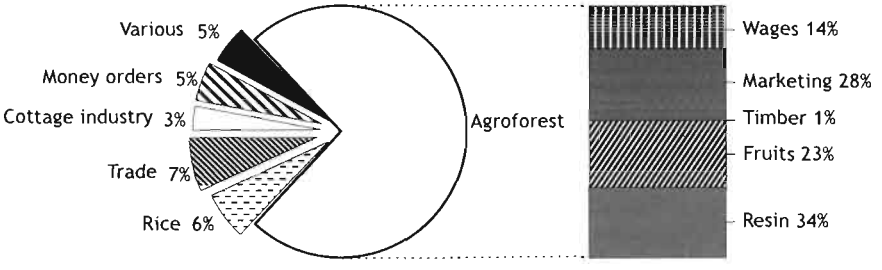
The real appropriation of forest richness and diversity is achieved through the free development of natural processes of diversification and niche colonisation. As in any secondary vegetation dominated by trees, the newly maturing damar plantation provides a suitable environment and convenient niches for the establishment of plant propagules from the neighbouring forests through natural dispersion. It also offers shelter and food to forest animals. In this natural enrichment process, farmers merely select among the possible options offered by the ecological processes: favouring resources, through introducing economical trees and protecting their development, or tolerating non-resources development and reproduction as long as they are not considered as 'weeds'. After several decades of such a balance between free functioning and integrated management, the global biodiversity levels are fairly high. As natural forests below 700 m to 800 m a.s.l. have almost disappeared in the Pesisir, damar gardens constitute the major habitat for many plant species characteristic of lowland and hill dipterocarp forests that would otherwise have disappeared (Michon and Bompard 1987; Michon and de Foresta 1992, 1995). The agroforest also shelters many animal species, including some highly endangered species like the Sumatran rhino and the Sumatran tiger.

Seen from the planter's point of view, while the introduction of economic species in the damar agroforest is intentional, biodiversity reestablishment is 'accidental'. These combined processes, the intentional and the accidental, are essential for several reasons. They restore resources that otherwise would not have been conserved purposefully because they do not appear as important economic resources. These noneconomic resources in turn help support viable populations of pollinators and dispersers that are essential for the long-term survival of commercial tree species, thus allowing the restoration of biological and ecological processes that are crucial for the functioning and reproduction of the agroforest as a commercially productive forest ecosystem.

The economic and social value of damar gardens

Damar trees represent the main source of household cash income (Figure 2), and damar collection is far more lucrative than other agricultural activities in the region (Mary 1987; Levang and Wiyono 1993). Resin is harvested on a regular basis: individual trees are usually tapped from once a month to once every two weeks. A single villager can harvest an average of 20 kg of resin a day. In the central subdistrict villages, average harvests are between 70 kg and 100 kg per family per month. Resin sale represents a regular income allocated to day-to-day expenses such as the purchase of additional foods or the weekly costs of children's schooling. Five days of work in damar gardens are usually enough to ensure a month's subsistence for the whole family (Levang 1989, Levang and Wiyono 1993). For those who do not own permanent rice fields, the damar income also allows for the purchase of some rice and thus complements dry rice culture where it still exists. However, the damar income is usually not sufficient for hoarding.

Figure 2. Origin of household cash income in a damar-based village, Pahmungan



Source: Levang and Wiyono 1993.

The damar activity also generates a series of associated activities: harvest, transportation from the field to the village, stocking, sorting, and transportation to wholesalers in Krui (see Table 1). Harvest, transportation, and sorting are carried out either by the growers themselves or by members of their families, or by specialized agents who are paid employees. Independent entrepreneurs ensure resin stocking in the village. These activities raise significant additional income for the village and allow those who do not own a damar garden to benefit from damar production (Bourgeois 1984; Mary 1987; Levang and Wiyono 1993; Nadapdap *et al.* 1995).

Damar gardens constitute one of the most profitable smallholder production systems in Sumatra (Table 2). They ensure reasonable quality-of-life levels including high school attendance for children, which is given top priority in most villages of the area. In addition, they can be managed—and used accordingly whenever needed—as a safety asset: a garden, or part of it consisting of several selected trees, can be 'pawned' through special agreements called *gadai* (Mary 1987; Lubis 1996) that allow any family to overcome difficult periods without resorting to selling trees or land, which is considered as one of the worse things that might happen to a family.

Indeed, in accordance with an agricultural conception of resource management, damar gardens also represent a patrimony. Arising from a strategy of land property creation, the fruit of labour invested for a distant term, which will mainly benefit future generations, the damar garden constitutes an inalienable lineage property (Mary 1987; Nadapdap *et al.* 1995). In the very particular social and institutional context of the Pesisir, where families are defined mainly by their land assets, this notion of lineage patrimony defines the agroforest not only as the source of living of a household, but also as the land foundation of a lineage.

Damar gardens as a useful forest

Damar gardens fulfil a role equivalent to that of natural forests in the economies of forest villages. Wild resources associated with damar trees support a whole range of gathering activities that are more typically linked with natural forest ecosystems—hunting, fishing, and harvesting of plant products—and provide important complementary subsistence resources for households. These include various noncommercial fruits, vegetables, spices and firewood, as well as other plant material and timber for housing purposes.

Damar gardens also represent, as does any natural forest, a source of products that are potentially marketable commodities at a larger scale: timber, rattan, medicinal and insecticide plants can be harvested for sale whenever needed or if market conditions are considered favourable.[5] As new markets develop, some of the traditional subsistence products have actually emerged as new commodities. Timber presently stands as the major 'new' commodity that might even revolutionise the management of damar gardens (de Foresta and Michon 1992, 1994a; Michon *et al.* 1995a; Petit and de Foresta 1996).

Damar gardens have taken over the essential role traditionally devoted to natural forests in household economy: a place opened to subsistence gathering

Table 1. Main characteristics of the damar resin trade chain inside Indonesia

Agents	Relative profit margins[a]		Activities[b]					
	Trade chain 1[c]	Trade chain 2[d]	Harvest	Stocking	Drying	Sorting	Transport	Processing
Damar grower	70%	70%	xxxx	x	x	o	xxxx	o
Village traders	3%	6%	o	xxxx	xx	xx	xx	o
Krui dealers	1%	none	o	xxxx	xx	xx	xxxx	o
Direct traders	none	6%	o	xxxx	xx	xxxx	xxxx	o
Krui wholesalers	13%	none	o	xx	xx	xxxx	xxxx	xx
Expenses	10%	15%						
Losses	3%	3%						

[a] Expressed in percentage of the resin price in Tanjung Karang or Jakarta.

[b] xxxx = principal activity, xx = often, x = occasionnally, o = never.

[c] Trade chain 1: village traders —> Krui entrepreneurs —> outside trading.

[d] Trade chain 2: village traders —> outside trading.

Table 2. Average production per hectare per year in mature damar agroforest, Pahmungan village, Central Pesisir subdistrict, April 1995

Species	Density trees/ha > 20 cm DBH	Production	Traded	Labour family level	Yearly income (data: 1995)	
					Rp	US$
Shorea javanica (resin)	145	1550 kg	1500 kg	50	1,500,000	682
*Durio zibethinus**	25	625 fruits	600 fruits	10	420,000	191
Lansium domesticum°	15	600 kg	500 kg	10	250,000	114
Parkia speciosa	8	1200 pods	1000 pods	10	100,000	45
Baccaurea racemosa°	7	200 kg	50 kg	2	10,000	5
*Artocarpus cempedak**	6	100 fruits	50 fruits	2	50,000	23
Other fruit trees (6 spp.)°	10	200 kg	50 kg	3	50,000	23
Timber (all species may be used)	250	5 m^3	2.5 m^3	0#	50,000	23
Total labour (man-days)				87		
Average yearly income					2,410,000	1106
Minimum income (no fruiting season)					1,650,000	750
Maximum income (fruit season)					3,570,000	1625

*: production every two years.
°: production every three years.
#: no family labour involved in timber harvesting.

and extractivism and used to fulfil the family's immediate needs. This forest function also appears in some of the social attributes of the gardens, i.e., product exchanges, sharing and donations and free harvesting rights (noncommercial garden products may be collected by anyone who needs and asks for them). This creates important networks of reciprocity that act as a counterpart to mercantile networks created through agricultural activities and helps maintain a social balance between well-endowed people and those without resources.

Damar trade

Resins, which are sticky plant exudates found in various families of forest trees, are among the oldest traded items from natural forests in Southeast Asia. They entered short-distance trade between Southeast Asian islands as far back as 3000 B.C. and were probably included in the first long-distance exchanges that developed with China from the third to fifth centuries (Dunn 1975). Locally, damar served for lighting purposes and for caulking boats. It was traditionally traded as incense, dyes, adhesives, and medicines (Burkill 1935) and acquired a new commercial value by the middle of the nineteenth century with the development of industrial varnish and paint factories. Collection intensified for export trade to Europe and the United States, and then to Japan and Hong Kong. After 1945, however, exports dropped rather sharply as a result of competition with petrochemical resins, which are preferred for most industrial uses.

Nowadays, Indonesia is the only damar-producing country in the world. Damar resins are marketed through both interinsular and export markets. Major end users are low quality paint factories in Indonesia, which use the lowest grades. The best quality damar is reserved for export, mainly to Singapore, where it is sorted and processed, and re-exported as incense or a base for paints, inks, and varnishes manufactured in industrial countries. Other destinations include handmade batik industries and the manufacture of low quality incense (Bourgeois 1984; Dupain 1994; Anonymous 1995).

In the glorious period of intensive harvesting for export, from the beginning of the twentieth century until World War II, the main damar producing areas were the natural forests of southern and western Sumatra, as well as West Kalimantan (van der Koppel 1932). Today, West Kalimantan and South Sumatra still produce some damar, but the main producing area is certainly Lampung, the southernmost province of Sumatra.

Access systems

According to the ancient customary tenure system, forest lands and resources were managed as common property by the local community, unlike irrigated lands for rice production, which were privately owned. Individual claims over economic resources in the communal land were acknowledged for certain species and through certain technical processes. Thus, a wild damar tree could be appropriated by those who first began tapping it; collecting damar from

that tree was then considered their own and exclusive right. However, nobody could claim rights over a piece of unmanaged, pristine forest. Access to land for subsistence and cash cropping was usually gained through clearing a piece of land in the communal forest and cultivating it. Distribution of access rights between the various families consisted of long-term individual usufruct rights. The land itself remained the property of the community. These individual usufruct rights were in fact tacitly maintained long after the crops were abandoned, and the same family could recultivate the land after a fallow period without asking permission. However, customary rights strictly forbade the planting of perennials on these communal forest lands, except for short-lived perennials like coffee or pepper.

As more people developed an interest in damar cultivation, the assembly of community heads, responsible for the customary law, formally accepted the removal of the prohibition against planting perennials in the communal lands, which boosted the spread of the plantation movement and led to drastic land appropriation activities by individuals in the former communal forest domain (Levang and Wiyono 1993). However, land property could only be claimed through tree plantation, and the old tenure system—communal property of the land and usufruct rights—prevailed for unplanted plots.

As the plantation process was conceived in a context of the relative failure of common property systems, its success required the assurance that the planter's children would effectively enjoy the right to harvest the trees, which implied that not only property rights are acknowledged and enforced, but that transmission rights are also secured. The consequence is that created land properties never returned to the community; the commons gradually disappeared. However, the privatisation process remained original as it did not entail promotion of individual control nor fragmentation of the agroforestry domain (Mary 1987; Levang and Wiyono 1993; Michon *et al.* 1995b).

Common property rights and values in the framework of private agroforests

As forest resources and structures have been re-established, common property traditions have been redefined and reinforced in the context of privatisation. Important economic resources such as resin and commercial fruits, as well as land, are effectively individually owned assets. However, on these private agroforest lands many resources are still considered as common property or open access resources. Noncommercial fruits, sap from the sugar palm, bamboos, and special thatching leaves provided by species commonly considered as 'planted' remain at the disposal of the community.

In the same way that the technical appropriation of the forest resource did not fundamentally change the Pesisir landscape, the institutional re-appropriation of the former forest commons through 'controlled privatisation' did not result in a total institutional revolution that erased old values. This maintenance of the communal philosophy in agroforest management is essential. In the way that former common property regulations controlled the permanence of the commons, the new property ethics in the Pesisir ensures that trees and land will be integrally transmitted to future generations.

For village communities the private property legal framework could secure a better bargaining position with external bodies than common property, which is still negatively perceived or easily denied by most state bodies as well as by private companies. The Indonesian administration more easily acknowledges, and compensates for, private claims over land. Privatisation could therefore be used as a political strategy for local communities to protect their resources.

TRENDS AND ISSUES—DEVELOPMENT AND CONSERVATION LESSONS

From extractivism to cultivation

Agroforest establishment in the Pesisir does constitute a true revolution in both the forestry and agriculture contexts. As a forest plantation strategy, the damar agroforest model runs counter to the conventional model of timber estates that are presently being developed. While favoring a selected resource, as estates do, the agroforest allows the maintenance of numerous other resources that otherwise would not have been conserved purposefully, and species that are not direct resources to be restored as well. Moreover, the establishment process allows the restoration of integral biological and ecological processes which are crucial to the overall survival and reproduction of the agroforest as an ecosystem. If encompassed in the framework of agricultural plantation strategies for the development of forest lands, extension of the damar agroforest represents a process of forest conversion that does not go along with economic reductionism. On the contrary, through the restoration of biodiversity in the agroforest, farmers have achieved the restitution of a whole range of economic choices for the present and the future, which appears indispensable in a sustainable development perspective. The agroforest development also represents a successful strategy for agricultural intensification that has helped to set farming system patterns without any disruption in food availability or living standards, while maintaining intact the productive potentialities of the land itself.

Agroforests are *not* natural forests that have been gradually modified through management. They represent an artificial area, which has been created by farmers' communities. They result from a voluntary decision of these communities to re-establish forest resources and to recreate forest structures. Natural forest management in Indonesia, including extractivism, is still a form of exploitation of nature's gift. Agroforest management is beyond that: it is the invention and the achievement of a new form of forest resource management on former natural forest lands.

The need for legal recognition

Damar farmers are caught between two mutually exclusive administrative mechanisms regarding their lands. Part of the damar gardens have been classified as state forest lands, as either Limited Production Forest or Protection Forest. The remaining areas of damar agroforests are 'unclassified' as far as the Forestry Service is concerned; they are not public land and are therefore

sometimes called 'private land'. However, private appropriation by local people is not formally acknowledged as farmers do not hold any official land certificate for either rice fields or damar gardens. In both cases, their legal position is dramatically weak. To forest authorities, they are undoubtedly outlaws. Conducting any agricultural or harvesting activities on forest lands without permission from the Department of Forestry is constitutionally illegal and implies a penalty. Under a 'private' regime, but with no land title, damar farmers may be considered as squatters on empty lands that are reserved for regional development. In both cases, they are highly subject to eviction in order to give way to 'projects'.

Forests, as well as non-forest lands in the Pesisir, represent the last 'wild frontier' in the already highly populated province of Lampung. Because of its proximity to Jakarta and ongoing road development, it is a tempting invitation for private speculators such as estate developers and agro-industries. For the regional authorities, these potential investors represent highly interesting parties. Besides being important taxpayers, which farmers are not, their investments would greatly increase the regional development index and supposedly increase the level of industrial activity in the area (Kusworo 1997).

Since the early 1990s, following completion of logging operations, the provincial authorities have started allocating 'private lands' as well as part of the logged-over forest lands in the three Pesisir subdistricts to two oil palm companies. Local farmers were not informed of these projects and started asking questions when they encountered field teams measuring land, including their damar gardens and even their rice fields. They not always received the correct answer.

Local authorities specified that oil palm would be planted only on 'empty' lands, though local farmers could also be invited to join with their own lands if they wished. They started campaigning to support the project, asking village heads to speak highly of the economic merits of oil palm planting and to ensure farmers' co-operation. But they also specified that no farmer should be compelled to give up his damar land for the company and that no damar tree should be felled without the consent of the owner. One of the companies soon applied its own conception of 'inviting' farmers to join. After a formal convocation conveyed through the subdistrict head, or *camat*, to village authorities, and given the subsequent lack of enthusiasm from damar farmers, it decided to use fake but positive agreements signed by farmers in lieu of true but negative ones, and started clear-felling damar gardens under moonlight!

The joint claims of farmers, nongovernmental organisations and international research institutions asserting that replacing farmers' damar gardens by oil palm estates was neither ecologically nor socially acceptable, and that the way this replacement was about to happen was clearly a classic case of power abuse by economic and political elites, finally succeeded. In December 1996, the Ministry of Forestry asked the first company to suspend its activities and solve the current conflicts with local damar farmers, while in March 1997, the provincial governor asked the second company to halt its activities.

Justice issues

The Pesisir case addresses many justice issues. The main one concerns civil justice. The basic property and use rights of local people over lands and resources they have not only managed, and sustainably managed, but also developed and enriched over centuries are not fully recognised by the state in spite of constitutional facilities that accommodate the acknowledgement and legalisation of such rights. This issue is not specific to the Pesisir; it constitutes the major confrontation area between the state and forest farmers' communities, while revealing the major impediment to the integration of local communities as groups of fully vested citizens into the Indonesian nation. Closure of the damar lands by the state would constitute not only a violation of basic rights but pure theft. Replacing damar gardens by estates, either forest or agricultural plantations, or reserving the damar gardens for any project of conservation or production forestry would obviously constitute a forceful appropriation not only of other people's lands, but also of the fruit of other people's labour.

The second issue is one of economic and social justice. Replacing damar gardens with specialised oil palm or acacia plantation might prove, in the short term and with a partial economic valuation, an economic gain for the region. However, it is uncertain whether this economic gain will be redistributed to the farmers who will, certainly, contribute to this gain through their—underpaid—labour. In terms of equity, the overall economic characteristic of the damar gardens is that the majority of the benefits they provide go to local people: farmers, wage labourers, local trade entrepreneurs. But the income officially derived from the damar activity by and for the district is almost nonexistent: taxes upon the damar resin represent less than 0.1% of the district budget. Industrial plantation estates provide much higher profits—but to a far lower number of people—whereas levies raised by the district through the estates and the related industrial processing units are numerous and substantial. Seen from the point of view of regional administrators, the choice is obvious.

The last issue concerns environmental justice. The damar garden system developed by Pesisir farmers has proven to be an almost perfect ecological substitute for natural forests, in fact probably the best possible one for a diversified production system. Destroying damar gardens to make room for specialised oil palm or acacia plantation would obviously constitute an ecological crime with, among other immediate consequences, the destruction of the specific habitat for many lowland plant species; a significant reduction in the feeding and breeding areas of many endangered mammal and bird species (Sumatran rhino, tiger, tapir, elephant, siamang, hornbills and rapaces); and a drastic increase in soil erosion with consecutive siltation of the Pesisir coast and of irrigation works in the lowlands, not to mention the increase in ecological risks for people as well as for the plantation. An additional consequence is the uncertain ecological sustainability of monocrop plantation over the long term, which has to be compared to the proven sustainability of the damar enterprise over the last 100 years. Crimes of this sort do not result in immediate punishment, but their long-term costs, for locals as well as for the nation itself, are potentially immense.

Which strategy for conflict resolution?

The damar success story has been strongly endangered. Pesisir farmers have been facing urgently threatening choices: either to become labourers on their land as their damar agroforests might be converted to oil palm estates, or to see their rights strongly restricted by zealous foresters who confound damar agroforest with natural forest and thus forget that there are no damar agroforests without damar farmers.

Indeed, culturally, biologically, economically and socially, damar farmers have succeeded in re-appropriating their forest resources. However, what the last few years of threats have shown is that the re-appropriation was obviously incomplete, enough to ensure the long-term sustainability of the system but not enough to protect its short-term survival. To be ensured against forceful conversion, a fifth element is needed that would translate into legal terms the formal and official recognition of the damar farmers' contribution to overall national and regional objectives.

The agroforest situation did not fit any of the existing legal forest categories. In response to this problem, the Minister of Forestry issued a decree in early 1998 that creates a new forest category in Krui. By this decree local communities are now legally and officially recognised as the sole users and sole managers of the state forest area covered with damar agroforests, as long as it stays as agroforest. The area remains state land, so farmers' ownership rights on the land itself are not recognised, but their usufructs rights on damar agroforest, including transmission rights, are now fully recognised (Fay *et al.* 1998; Fay and de Foresta 2001).

The 'agroforest framework' offers a good opportunity to escape the formal forestry context and to devise new forms of association between farmers, foresters, and regional authorities concerning forest resources. Ecologically, economically and socially the agroforest should not be identified with a natural forest, and indeed, as long as this confusion between forest and agroforest is maintained, as long as local practices for management of forest resources in farming systems are ignored, the chances of survival of agroforests as a unique model of integral forest management continue to decrease. Agroforests, once recognised, open a totally new field for negotiations between foresters and local communities, a field favourable to institutional innovations where ancient conflicts might be resolved without one or the other party losing face.

ENDNOTES

1. Modified after Michon, G., de Foresta, H., Kusworo, A., and Levang, P. 2000. The damar agroforest of Krui, Indonesia: Justice for forest farmers. *In*: Zerner, C. (ed.) People plants, & justice: The politics of nature conservation. Columbia University Press, New York.

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4. 'Damar' is a generic term used in Indonesia to designate resins produced by trees of the Dipterocarp family.

5. The most valuable but also less predictable extractive commodity in the damar gardens is rattan. Rattan cane harvest is subjected to the profit/failure dynamics of local buyers. This important economic unpredictability constitutes the main impediment to the development of rattan harvesting into a real garden production.

REFERENCES

Anonymous. 1995 Strengthening community-based damar agroforest management as natural buffer-zone of Bukit Barisan Selatan National Park, Lampung, Indonesia. Research Report, Lembaga Alam Tropika Indonesia (LATIN).

Bourgeois, R. 1984 Production et commercialisation de la résine "Damar" à Sumatra Lampung. Master's Thesis, E.N.S.A.M, Montpellier, France.

Burkill, I. H. 1935 A dictionary of the economic products of the Malaya Peninsula. Millbank, London.

de Foresta, H. and Michon, G. 1992 Complex agroforestry systems and conservation of biological diversity 2. For a larger use of traditional agroforestry trees as timber in Indonesia: a link between environmental conservation and economic development. *In*: Kheong, Y. S. and Win, L. S. (eds.) In Harmony with Nature: An International Conference on the Conservation of Tropical Biodiversity, Kuala Lumpur, Malaysia. The Malayan Nature Journal Golden Jubilee Issue, 488-500.

de Foresta, H. and Michon, G. 1993 Creation and management of rural agroforests in Indonesia: potential applications in Africa. *In*: Hladik, C. M., Pagezy, H., Linaret, O. F. *et al.* Tropical forests, people and food: biocultural interactions and applications to development, 709-724. UNESCO & the Parthenon Publishing Group, Paris.

de Foresta, H. and Michon, G. 1994a Agroforests in Indonesia: where ecology and economy meet; Agroforestry Today 6(4): 12-13.

de Foresta, H. and Michon, G. 1994b From shifting cultivation to forest management through agroforestry: smallholder damar agroforests in West Lampung (Sumatra). APAN News 6/7: 12-13.

Dunn, F. L. 1975 Rain-forest collectors and traders: a study of resource utilization in modern and ancient Malaya. Kuala Lumpur.

Dupain, D. 1994 Une région traditionnellement agroforestière en mutation: le Pesisir (A traditionally agroforestry area in mutation: Pesisir). Master's Thesis, CNEARC, Montpellier, France.

Fay, C., de Foresta H., Sirait M. and Tomich, T.P. 1998 A policy breakthrough for Indonesian farmers in the Krui damar agroforests. Agroforestry Today 10(2): 25-26.

Fay, C. and de Foresta H. 2001 Progress towards recognising the rights and management potentials of local communities in Indonesian state-defined forest areas. *In*: Vira, B. and Jeffery, R. (eds.) Analytical issues in participatory natural resource management, 185-207. Palgrave (Global Issues Series). 245p.

Kusworo. 1997 Government policies that affect the damar agroforests in Pesisir Krui, West Lampung, Sumatra: research report. ICRAF S.E. Asia, Bogor.

Levang, P. 1989 Systèmes de production et revenus familiaux (Farming systems and household incomes). Transmigration et migration spontanées en Indonésie (Transmigration and spontaneous migrations in Indonesia), 193-283. Departemen Transmigrasi - ORSTOM.

Levang, P. and Wiyono. 1993 Pahmungan, Penengahan, Balai Kencana. Enquête agro-économique dans la région de Krui (Lampung): research report. ORSTOM/BIOTROP.

Lubis, Z. 1996 Repong damar: Kajian tentang pengambilan keputusan dalam pengelolaan lahan hutan pada dua komunitas desa di daerah Krui, Lampung Barat: research report. P3AE-UI and CIFOR.

Mary, F. 1987. Agroforêts et Sociétés. Analyse socio-économique de systèmes agroforestiers indonésiens. Document E.N.S.A.M. - INRA.

Michon, G. 1985 De l'homme de la forêt au paysan de l'arbre: agroforesteries indonésiennes. Ph.D. Thesis, U.S.T.L., Montpellier, France.

Michon, G. and Bompard, J. M. 1987 The damar gardens (Shorea javanica) in Sumatera. *In*: Kostermans, A.G.J.H. (ed.) Proceedings of the third round-table conference on Dipterocarps, 3-17. UNESCO, Samarinda.

Michon, G. and Jafarsidik, D. 1989 Shorea javanica cultivation in Sumatra: an original example of peasant forest management strategy. *In*: Bruenig, E. F. and Poker, J. (eds.) Management of tropical rainforests: utopia or chance of survival, 59-71. Nomos Verlagsgesellschaft, Baden-Baden, Germany.

Michon, G. and de Foresta, H. 1992 Complex agroforestry systems and conservation of biological diversity 1. Agroforestry in Indonesia: a link between two worlds. *In*: Kheong, Y. S. and Win, L. S. (eds.) In Harmony with Nature: An International Conference on the Conservation of Tropical Biodiversity, Kuala Lumpur, Malaysia. The Malayan Nature Journal Golden Jubilee Issue, 457-473.

Michon, G. and de Foresta, H. 1995 The Indonesian agro-forest model. *In*: Halladay, P. and Gilmour Gland, D.A. (eds.) Conserving biodiversity outside protected areas: the role of traditional ecosystems. IUCN, Switzerland and Cambridge, UK.

Michon, G., de Foresta, H. and Levang, P. 1995a Stratégies agroforestières paysannes et développement durable: les agroforêts à damar de Sumatra. Natures-Sciences-Sociétés 3(3): 207-221.

Michon, G., de Foresta, H. and Levang, P. 1995b New face for ancient commons in tropical forest areas? The "agroforest strategy" of Indonesian farmers. Communication to the 4th annual meeting of the International Association for the Study of Common Property Resources, Bodo, Norway.

Nadapdap, A., Tjitradjaja, I. et al. 1995 Pengelolaan Hutan Berkelanjutan: Kasus Hutan Damar Rakyat di Krui, Lampung Barat. Ekonesia 2: 80-112.

Peluso, N.L. 1983. Networking in the commons: a tragedy for rattan? Indonesia 35(1): 95-108.

Petit, S., and de Foresta, H. 1996 Precious woods from the agroforests of Sumatra, where timber provides a solid source of income. Agroforestry Today 9(4): 18-20.

Siebert, S.F. 1989 The dilemma of dwindling resources: rattan in Kerinci, Sumatra. Principes 32(2): 79-97.

Torquebiau, E. 1984 Man-made dipterocarp forest in Sumatra. Agroforestry Systems 2(2): 103-128.

van der Koppel, C. 1932 De economische beteekenis der Ned. Indische harsen (The economic significance of Dutch East Indies resins). Kolff, Batavia.