PEOPLE, PLANTS, AND JUSTICE: THE POLITICS OF NATURE CONSERVATION

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CHAPTER 7

The Damar Agroforests of Krui, Indonesia: Justice for Forest Farmers

Geneviève Michon, Hubert de Foresta, Kusworo, and Patrice Levang

The modern history of forests in Indonesia merges with a history of a continuous process of land and resource appropriation by the state at the expense of indigenous forest people, through a fair amount of ideological imperialism and a convenient use of legal and technical instruments as well as a touch of power abuse. From the very beginning of the Indonesian archipelago's history, the forest has represented the only large field for demographic, agricultural, economic, and geopolitical expansion, as well as the major instrument by which to attain wealth and power. While conflicts for forest appropriation or control in the past have occurred predominantly between equivalent groups of forest users and warriors, they presently involve structural opposition between the state and its political or economic elite on the one hand, and local communities on the other (figures 7-1, 7-2, 7-3).

In spite of the important contribution of wood industries to national development, the ecological, economic, and social damages related to forest management in Indonesia can no longer be concealed. Cases of resource exhaustion, violations of local populations' basic rights by forestry projects, and reports of ongoing local resistance are being publicized more and more through the local and national press. However, even though the discourses of policymakers at the highest levels integrate new objectives of social and environmental justice in forest management, forest development and conservation projects are still constrained by laws and regulations that still prevent the recognition of local people's practices and rights.[1] Actual benefits of local utilization and management of forest resources are seldom encompassed in a critical and nonpartisan way. The value of customary systems for controlling local forest management practices is either underestimated or misunderstood. The legal mechanisms for acknowledging local people's rights over forest lands and resources remain dramatically underdeveloped.

Figure 7-1 Indonesia

In this current context, alternative successful forest management strategies developed by local communities may represent an important support for the development of formal recognition of local people's rights over forest resources. Among these strategies, the agroforestry strategy exemplified in this chapter could well be promising. In adapting the traditional modes of forest extraction through a logic of agricultural production, farmers have invented new and original agroforestry systems that reshape forest resources and structures. These complex agroforestry structures that combine forest species and tree crops have evolved from shifting cultivation practices and can be encountered in many forest farming systems all over the archipelago. As they are not, in spite of their appearance, natural forests but man-made agroforests—"forest gardens"—they could allow farmers to affirm, maintain, or regain control over forest lands and resources.

Starting from the broad context of local communities and national circles with competing ideologies, regulations, and practices regarding forest management, this chapter will focus on the history of an agroforestry landscape in the south of Sumatra, elaborating on the originality and efficiency of this particular strategy for forest resource control through agricultural development. We will then analyze the chronology of external pressures that threaten the agroforest, and farmers' reactions to repeated violations of their basic rights: from avoidance action to active resistance. As a conclusion, we will try to analyze how, in the present ideological and legal context that clearly does not favor local people's appropriation of natural resources, an integrated management of conflicts in forest resource use could evolve in a totally original way through the acknowledgment of the benefits derived from the integration of local forest management into agriculture.

Figure 7-2 Sumatra

CONFLICTS IN FOREST AREAS: FRAMING THE ISSUES

The analysis of local conflicts pitting indigenous communities against the state or its economic elite cannot be conducted without mentioning the ideological and political, as well as the practical, dimensions of the global differences in the way each protagonist conceives, appropriates, and manages forests. These two main categories of actors are differentiated by every aspect of forest development, from cosmogonies and representations of the world, political ideologies, and legal and institutional systems,

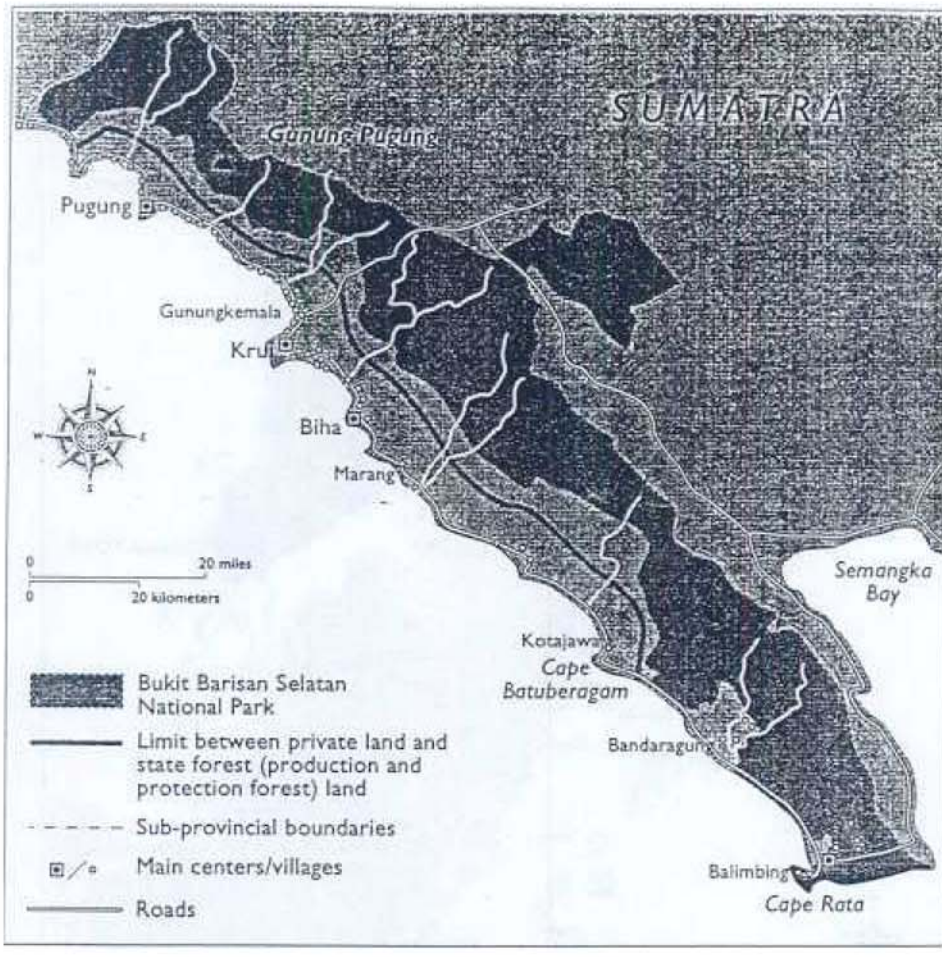


Figure 7-3 Bukit Barisan Selatan National Park, Private Land and State Forest Boundaries, Sumatra.

to technical, labor, and financial capabilities for resource exploitation, and to negotiation and implementation power.

Ideology and Practice of Forest Management: Two Diverging Visions

As the dominant land cover of the archipelago, forest has been a major element in cosmogonies and representations of the world for the various ethnic groups that presently constitute the Indonesian nation, as well as for their ruling authorities. Based on these representations, various management systems have evolved.

Forest: In the Center of the World

For forest communities,[2] most of the society origin myths involve marriages between humans and forest spirits. Forest is the central place for both the spiritual and

the economic life. Forest is considered a multiple-use resource and defined as a combination of facies, each being defined by a combination of potentially extractable resources and possible activities.

Forest utilization and management by local communities developed around two poles. The first includes subsistence resources: game and fish, plant foods, and material, and the forest dynamic itself as an essential resource for shifting cultivation. The second includes extractive resources, harvested for trade: incense, spices, and animal products of the precolonial trade; resins and latexes in the eighteenth and nineteenth centuries; rattan and timber since the beginning of the twentieth century. As a result of increasing space constraints during the last fifty years,[3] land also emerged as an essential forest resource for local communities. Interest in land and commercial resources represents the only common point between indigenous communities, the state, and private companies. But it is also the major cause of their conflicts.

Systems devised by indigenous communities for the management of forest lands and resources usually combine "production"—usually through forest clearing—and "harvesting"—in situ management of economic resources. But, contrary to what is commonly acknowledged by either policymakers or researchers, production is not limited to agricultural products, and forest resources are not managed only through harvesting: indigenous forest management often involves a considerable amount of production through active plantation of forest crops. Many of these forest production systems deserve more attention than they usually receive, as they do represent outstanding examples of sophisticated, multipurpose forest resource development.

Forests on the Border of Civilization: A World to Control and Exploit

From the Javanese kingdoms of the tenth century to the Indonesian Republic, through three centuries of colonial administration, state authorities have tried, through their political and coercive power, to impose their representation and modes of forest management over indigenous communities. The perceived need for absolute state control over the forest is dictated by two imperatives: the economic importance of appropriating natural resources and the political imperative of assimilating alien cultures.

The official perception of the forest in modern Indonesia has been shaped both by the Javanese civilization, which valued clearings more than wilderness and permanent ricefields more than shifting agriculture (Dove 1985; Peluso 1992b), and by the occidental conception of Dutch colonial forestry. The underlying philosophy that seems to condition all forest policies and management regimes in modern Indonesia—as in any centralized political organization—is that forest is basically a domain that could easily escape state authority and control. Because of its very nature—a world based on principles alien to an organized state—and because of its geographic position in the periphery of the "civilized" world, forest, including forest lands, resources, and inhabitants, is perceived by the state as a fundamentally dissident area that must be strictly controlled. While forests contribute to the process of national development through their space and resources, the forest as an entity is not embedded as such in

the philosophy of national development. State-sponsored agents of forest utilization are exclusively state or private companies. Forest people as a whole are globally denied any right to participate in forest management. They are considered squatters on state lands and plunderers of state riches.[4]

The economic utilization of forests by the state is characterized by an intense reductionism. For the last forty years, management has exclusively focused on mining the timber resource; most of the forest lands logged during the last two decades are no longer covered by forest. This chronic unsustainability of state-sponsored harvesting practices is another factor that differentiates national and customary systems of forest management.

Policy, Legal, and Institutional Bases of Forest Management: Two Parallel Systems

Policy, juridic, and institutional levels also exhibit a juxtaposition of two different definitions and practices of forest appropriation that are not fundamentally incompatible but are in actuality mutually exclusive.

National Modes of Control

Forest policies in Indonesia are burdened by several ambiguities: they must simultaneously ensure that the utilization of forest lands and resources serves as a major instrument in the building of national development, and they also need to enforce the protection of these resources for the present and future. This double task is assigned to a single state body, the ministry of forestry, which also has to harmonize profit building for the nation and social justice for the nationals. The strategies chosen to reach these political objectives have evolved along three main streams: separation of forest and agriculture; segregation of forest domains into production, protection, and conversion; and delegation of forest utilization and management to concessionaires, which releases the state from practical aspects of forest development and allows it to concentrate on the acquisition of revenue. As a consequence of these strategic choices, the first objective—development and profit—has been much emphasized, whereas the second—conservation and justice—has been considered an ideal target for the future.

These policies are implemented through the Basic Forestry Law issued in 1967. The law defines the extent of state forest lands, their functions, and their modes of utilization in a list that comprises many qualities and land-use categories, some unexpected,[5] but denies any right of existence to shifting cultivation. The law attributes the authority and jurisdiction over forest lands to the ministry that delineates the forest domains, defines their functions, and allocates—or denies—rights over them to (un)privileged users. Acquisition of revenue occurs through a system of regulations and legal taxation.

Like any national legal system, the forestry legislation constitutes a rigid body that is not easily susceptible to change. Accommodating local people's needs, or de-

veloping community forestry agreements, although theoretically desirable and possible, faces many legal impediments. Another chronic disease in the forestry system is the dramatic weakness in law enforcement: institutions in charge of the implementation of the forestry regulations are prone not only to political influence but also to collusion of any kind with those wealthy partners who do not really respect the laws.[6]

Community Modes of Control: "Tradition" as an Evolving Body

Control of and access to forest resources by local communities usually involve a system of rights and regulations, ranging from pure forms of common property to exclusive private rights over lands or resources. The definition of rights commonly varies according to the nature of the involved resource(s) or the type of ecosystem. It also varies from one community to another, and for a given community it may vary over time. Indeed, unlike the national legal system, flexibility, mobility, and adaptability are the main characteristics of customary systems. Contrary to the common view, "tradition" in appropriation systems is not a rigid concept. Regulations and rights for resource control and access constantly evolve to accommodate external or internal changes—resource availability, destination, value, extraction or production techniques, and so on. Another important principle that differentiates customary and national legal systems is that, in most customary systems, use or property rights are usually accessed through labor investment, not through lobbying for or purchasing of concession rights. The main weakness of customary systems is the current lack of efficiency in controlling outsiders' abuses.

Management in Practice: Implementation of Forestry Regulations and the Confrontation Between National and Customary Systems

All over its territory, including the portion designated as state forest land, the Indonesian constitution acknowledges customary rights over land and resources. However, this is most often ignored in the practice of forest management.

Forest Land Designation, Delineation, and Mapping

The delineation of state forest lands has set aside 144 million hectares (ha), representing 74 percent of the whole nation's lands, for "forest" production and protection. Lands outside the forest domain are designated as "appropriated lands." This distinction between forest and appropriated domains implicitly designates forest lands as lands that can in no way be legally appropriated by either individuals or groups. As more than 95 percent of the land under customary control is—unfortunately!—included in state forest lands (Gillis 1988), indigenous farmers cannot expect to ever receive any legal land title.

The acknowledgment of customary rights stands "as long as these rights do not interfere with national interests." The formulation is ambiguous enough to allow the widest, as well as the most narrow, interpretations. In the real Indonesian

world, customary rights unavoidably recede when government-sponsored projects or activities are carried out.[7] The practical interpretation of forest policies not only denies rights to forest lands and resources to local communities, it also denies the very existence of their forest production systems. State forest lands and their limits have been mapped for the whole archipelago, and these maps serve as basic documents for development planning. In harmony with state dogma, forest lands are intrinsically uninhabited: indigenous land-users do not appear on official documents. Rattan gardens (Weinstock 1983; Fried 1995), fruit forests (Michon and Bompard 1987a; Sardjono 1992; Momberg 1993; Padoch and Peters 1993; de Jong 1994), damar gardens (Michon and Bompard 1987b), rubber agroforests (Dove 1993; Gouyon et al. 1993), all the swidden and fallow systems of the outer islands, and sometimes even forest villages, simply do not exist. It is therefore easier for projects to ignore, or even erase, preexisting forest management systems.[8]

Concession Rights to Resources and the Criminalization of Indigenous Forest Practices

The practical impact of the concession policy, aimed at controlling resource extraction and production through supervision and taxation, has many perverse effects for local communities. First, it clearly favors private companies at the expense of local communities. It has also facilitated the emergence of conglomerates led by timber tycoons closely connected to political elites. The technical, economic, financial, and political power of these tycoons gives them an unrivaled advantage in negotiations for land and rights,[9] as well as in the implementation of these rights in cases of conflicts with local communities. They easily obtain the support of forceful negotiators to solve these conflicts quickly and surely. The second consequence of the concession policies is that it clearly criminalizes unlicensed harvesting practices, not only for timber but also for the most profitable nontimber resources: rattan, birds' nests, sandalwood, eaglewood, etc. Communities that lived on free extraction of commercial forest products for centuries are presently outlaws: they would have to purchase temporary rights to harvest these products. But purchasing rights is, again, the privilege of elites who, again, by their political or economic influence, dispossess local communities of their most valuable resources.

From Forests to Estates: Implications of the Latest Trends in Forest Land Development

The switch from logging to estate development started in the late 1980s, and the rate of change began to increase dramatically in the early 1990s. This chiefly involves timber estates, developed on "production forest" lands, and oil palm estates on "conversion forest" lands or empty "appropriated lands."

This new trend in development policies bears important implications for local communities. The first is the increased threat of displacement to give way to projects. After being leased to logging companies, indigenous lands are presently given

to estate firms that not only have full legal rights over the land but also drastically transform them through plantation; the local people are considered merely a cheap labor force. The second consequence for local people is an unexpected "diversification" of the agents whose job it is to resolve conflicts, as well as increased opportunities for making new allies. After dealing exclusively with forest authorities under the forest law, local farmers must now also deal with regional administrators—either at the provincial, district, or subdistrict levels—who have full authority in the granting of conversion forest lands to private companies, and who, in addition, have the right to ask for a legal revision of state forest land boundaries.[10] However, these regional bodies also have the authority to defend and support local management systems and to acknowledge their customary foundations.

In this new phase of the land development game, the conflicts are not only between forest authorities and local farmers but also between "forest" and "agriculture."[11] Local communities could benefit from this rebalancing of forces, as it might appear to be an opportunity for them to assert their right of access and control over the lands they have developed. But they are more likely to be, once again, the main losers in the power game that builds up around forest lands. Caught between the various facets of state authority and the concupiscence and prerogatives of the estate plantation lobbies, local communities might well lose their last opportunity to have their basic rights acknowledged.

Tracing these conflicts takes us to the densely populated province of Lampung in the southern tip of Sumatra island. Westward, beyond the steep slopes of the Barisan range, the Pesisir subdistricts appear as an estranged appendix in the province. Apparently left behind in the intensive agricultural development that occurred in the central and eastern districts, Pesisir retains large tracts of forest. Pesisir farmers still rely on forest agriculture, but more than shifting cultivators, they are now true tree farmers who have developed highly original systems of forest cultivation over the years (figure 7-4).

The situation of the Pesisir farmers in the Krui area perfectly epitomizes that of forest farmers in Indonesia. Although they have occupied the land for more than five centuries, they still have no legal title to it: most of the lands they developed and manage are located on state forest lands. In spite of—or could it be precisely because of?—the ecological, economic, and sociocultural value of the forest management system they developed—a perfectly balanced forest plantation based on the most valuable species for foresters (figure 7-5), dipterocarps—they have encountered more trouble than effective support from the forest administration at the local, district, provincial, and national levels. Only recently did they begin to receive some kind of official recognition of their practices, which has yet to be translated into formal terms. Although covering more than 50,000 ha, their forest gardens are not yet on the maps. After being subjected to repeated (although relatively light) power abuse from the forest authorities, they are presently confronting the concupiscence of the private sector that tries to impose oil palm plantation over lands that are still

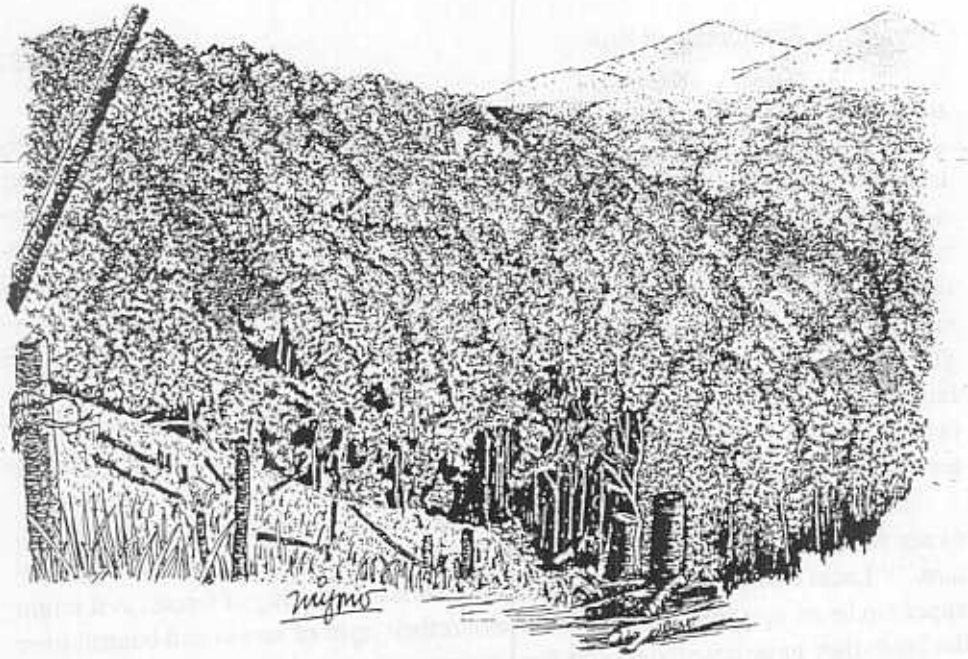


Figure 7-4 Common Landscape in the Krui Area. Mature damar agroforests, initially developed by shifting cultivators, now cover about 50,000 ha, or 50% of the three Pesisir subdistricts total area.

under forest status. Conflicts of interest involve various government and nongovernment agents who all impact on local farmers, either through active support, purposeful ignorance, or direct confrontation.

KEBUN DAMAR: BETWEEN FOREST AND GARDEN

Driving westward from the peneplain, a mosaic of dry fields and pepper plantations along the Sumatra highway, 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 paddy, a few patches of fallow vegetation. Elsewhere, the land is 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 meters. It stretches over three administrative subdistricts.[12]

Wherever possible, irrigated ricefields, and associated permanent villages, have

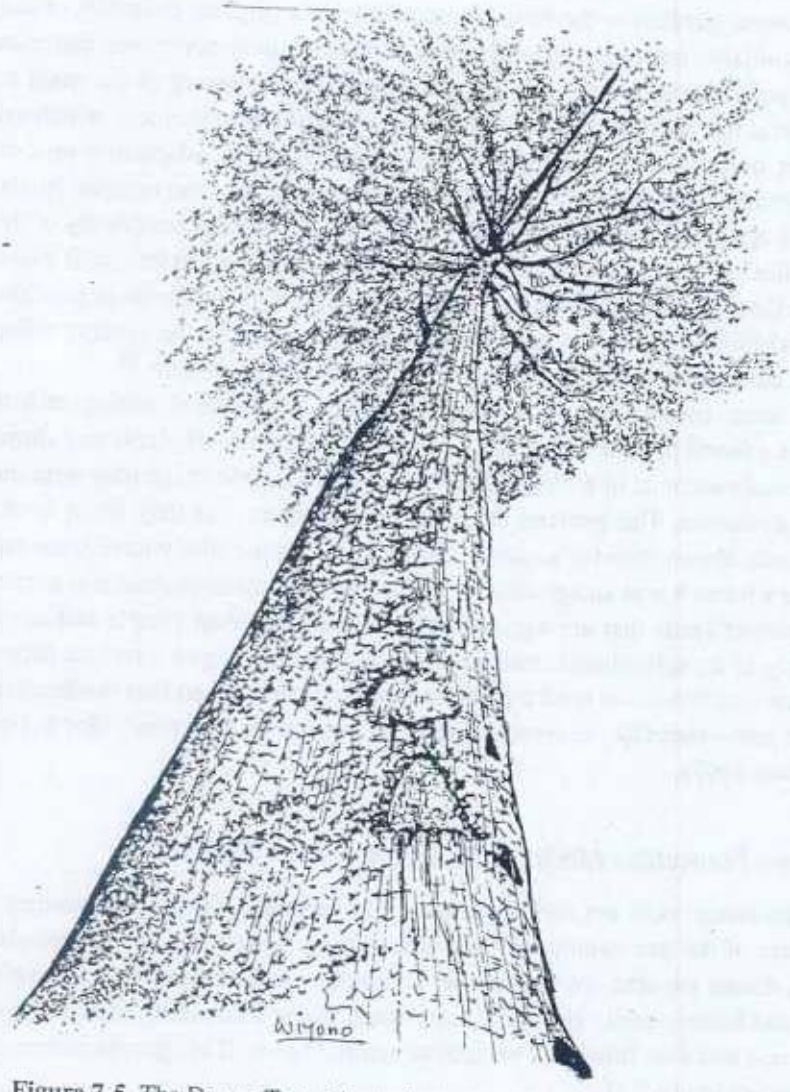


Figure 7-5 The Damar Tree, *Shorea javanica*, a big tree native to local forests in Sumatra, easily reaches 40–45 m high.

been established along the coastal plain, but the rude topography and the relatively low quality of the inland soils have limited the possibilities of further permanent agricultural food production. The hills have long been the domain of a classic agroforestry rotation: mosaics of temporary ricefields 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 man-made forest, although forming an almost continuous massif,

is made up of a succession of individually evolved gardens that the farmers have named after the dominant tree species, the damar[13] (Torquebiau 1984; Michon and Bompard 1987b; Michon and Jafarsidik 1989).

Damar gardens in the Pesisir represent totally original examples of sustainable and profitable management of forest resources, entirely conceived and managed by local populations. Originality lies in the ecological mastery of the main economic resource, the forest tree, not through conventional domestication, which usually involves modification of plant characteristics to achieve adaptation to a cultivated ecosystem, but through an almost total reconstruction of the original forest ecosystem in agricultural lands. Success is due to the proven reproducibility of the system over the long term as well as to its economic results and to its social bases. Today, more than 80 percent of the damar resin produced in Indonesia is provided not by natural forests but by the Pesisir damar gardens. Among the seventy villages scattered along the coast, only thirteen do not own damar gardens.[14]

Damar gardens can be analyzed as a forest, and, indeed, biologically they constitute a forest in their own right, a complex community of plants and animals and a balanced ensemble of biological processes reproducible in the long term through its own dynamics. The gardens can easily be mistaken—as they often have been by common observers—for a natural forest. But they definitely have been established not as a forest but as an agricultural production unit on an agricultural territory. They are part of lands that are agriculturally claimed by local people and are managed mainly as an agricultural enterprise. Occupying this vague interface between agriculture and forest—at least by the conventional perceptions that modern science has promoted—they fully deserve the name of agroforests (Michon 1985; de Foresta and Michon 1993).

A Tree Plantation Modeled as a Forest-Rich Ecosystem

While damar trees are clearly dominant in mature gardens, representing about 65 percent of the tree community and constituting the major canopy ensemble (figure 7-6), 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,[15] as well as specific patterns of forest dynamics (table 7-1).

Plant inventories in mature damar agroforests have recorded around forty common tree species, and several more tens of associated species, including large trees, treelets and shrubs, liana, herbs, and epiphytes. Important economic species commonly associated with damar are mainly fruit trees, which represent 20–25 percent of the tree community. In the canopy, durian and the legume tree *Parkia speciosa* associate with the damar trees. In the subcanopy ensembles, langsat is the major species with, to a lesser extent, mangosteen, rambutan, jacktree, palms such as 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 flavorings

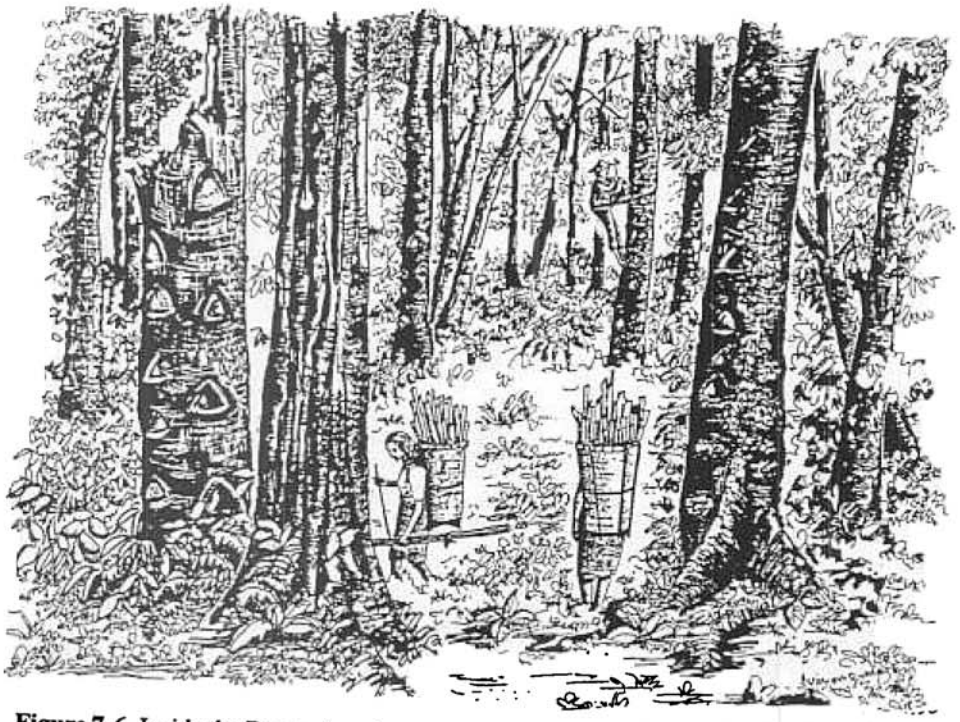


Figure 7-6 Inside the Damar Agroforest. Damar trees are usually dominant in dmar gardens, but density greatly varies among individual gardens in accordance with individual owners' objectives, which include its use as a property marker, as part of a mixed orchard (producing damar and fruit), and as a main production objective.

(*Garcinia* spp., the fruits of which are used as acid additives in curries, and *Eugenia polyantha*, the local laurel tree). The last 10–15 percent 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 mainly include bamboos and valuable timber species (Apocynaceae, Lauraceae, etc.). Nontree species characteristic of a forest ecosystem (Zingiberaceae, Rubiaceae, Araceae, Urticaceae) have colonized the undergrowth of gardens, where they contribute to the maintenance of a favorable environment for the development of seedlings of the upper-layer trees.

Management of mature gardens is centered around the harvest of resin (figure 7-7) and of fruits. Labor allocated to routine garden maintenance is mingled with labor devoted to resin harvest, and the tempo of harvests is determined by labor requirements for wet rice cultivation. Work in the gardens is postponed at the time of the rice harvest or of ricefield preparation, so that tree gardening never competes with subsistence agriculture for labor.

Once established, the damar plantation evolves with minimal human input. The silvicultural process in damar gardens is not conceived, as it is in conventional for-

Table 7-1
Comparison of structural characteristics between damar agroforest and primary forest in Pesisir Krui

Sample number	*1*	*2*	*3*	*4*	*5*
Sample plot area (m^2)	600	1,000	400	1,000	2,000
Damar trees >10 cm DBH (trees/ha)					
Young unproductive trees	200	140	200	150	n.a.
Mature and old productive trees	200	140	250 + 50	190 + 70	n.a.
Total stand density (damar)	400	280	500	410	n.a.
Total trees over 10 cm DBH					
Total stand density (all species)	680	300	650	560	500
Vertical structure					
Number of canopy ensembles	2	3	3	n.a.	4
Distribution of crown coverage					
Emergent trees	0%	0%	0%	n.a.	25%
Upper-canopy trees	130%	88%	114%	n.a.	60%
Lower canopy trees	34%	5%	8%	n.a.	33%
Undergrowth trees	n.a.	12%	12%	n.a.	13%
Immature trees (trees of the future)	41%	38%	33%	n.a.	45%
Total	205%	133%	167%	n.a.	176%

1, 2, 3 = damar gardens in Penengahan, Central Pesisir (Michon 1985).
4 = damar gardens in Pahmungan, Central Pesisir (Torquebiau 1984).
5 = primary forest (Laumonier 1981).
DBH = diameter at breast height.
From Michon (1985).

est plantations, as a mass treatment applied to a homogeneous, even-aged population of trees; instead, it aims at maintaining a system that produces and reproduces without disruption either in structural or functional patterns. Natural processes are given the major role in the evolution and shaping of the cultivated ecosystem. Global continuity is ensured through a balanced combination of natural dynamic processes[16] prevailing in the tree population, and the appropriate management of individual trees of economic species. Since the natural decay of planted trees is predictable, farmers can easily anticipate and plan their replacement. The main task of the gardener is to regularly introduce young trees into the garden plot 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.

Between Plantation Economy and Forest Use: The Economic and Social Value of Damar Gardens

Damar gardens have been established by farmers for commercial production, and their economic management is closer to that of an agricultural smallholder planta-

Figure 7-7 Damar Resin Harvest.

tion than to that of a forest. However, some functions of the damar gardens still relate to the former harvested forests that complemented rice swiddens in ancient production systems.

The Damar Garden as an Enterprise

Damar trees represent the main source of household cash income (figure 7-8), and damar collection is far more lucrative than other agricultural activity 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 and 100 kg per family per month. Resin sale represents a regular income allocated to day-to-day expenses:[17] purchase of additional foods, weekly costs for children's schooling. Five days of work in

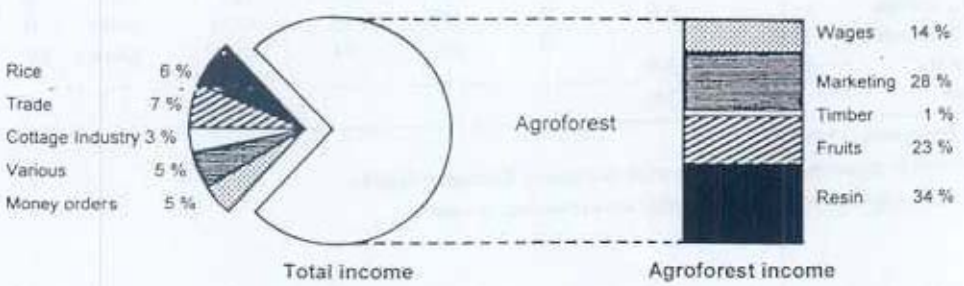


Figure 7-8 Origin of Houshold Cash Income in a Damar-Based Village, Pahmungan (Levang and Wiyono 1993).

damar gardens is usually enough to ensure a month's subsistence for the whole family (Levang 1989, 1992). For those who do not own permanent ricefields, 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 to raise significant amounts, nor is it enough for hoarding.

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 (table 7-2). Harvest, transportation, and sorting are carried out either by the grower himself or by members of his family, 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[18] 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).

As in many other places in Sumatra, the contribution of the fruit component to household economy has been increasing in recent years because of the growing importance of urban markets and because of recent major improvements in the road network. For the last productive years, marketing of the major commercial fruits, durian and langsat, has allowed the global agroforest income to double (Levang and Wiyono 1993; Bouamrane 1996; de Foresta and Michon 1997). However, because of high irregularities in fruiting seasons,[19] income from fruits cannot be fully integrated into daily household budget planning. It is still used mainly for exceptional or "luxury" expenses.[20]

Damar gardens constitute one of the most profitable smallholder production systems in Sumatra (table 7-3). They globally ensure reasonable quality-of-life levels, including high schools for children (given top priority in most villages of the area). In addition, they can be managed—and used accordingly whenever needed—as a

Table 7-2
Main characteristics of the damar resin trade chain inside Indonesia

Agents	*Relative profit margins*[a]		*Activities*[b]					
	1st trade chain	*2nd trade chain*	*Harvest*	*Stocking*	*Drying*	*Sorting*	*Transport*	*Processing*
Damar grower	70%	70%	xxxx	x	x	0	xxxx	0
Village traders	3%	6%	0	xxxx	xx	xx	xx	0
Krui dealers	1%	—	0	xxxx	xx	xx	xxxx	0
Direct traders	—	6%	0	xxxx	xx	xxxx	xxxx	0
Krui wholesalers	13%	—	0	xx	xx	xxxx	xxxx	xx
Expenses	10%	15%						
Losses	3%	3%						

From Bourgeois (1984).

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

[b]xxxx = principal activity; xx = frequent, x = occasional, 0 = never.

Table 7-3

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*	*Labor (family level)*	*Yearly Income*	
					Rp	*US$*
Shorea javanica (resin)	145	1,550 kg	1,500 kg	50		682
Durio zibethinus[a]	25	625 fruits	600 fruits	10	420,000	191
Lansium domesticum[b]	15	600 kg	500 kg	10	250,000	114
Parkia speciosa	8	1,200 pods	1,000 pods	10	100,000	45
Baccaurea racemosa[b]	7	200 kg	50 kg	2	10,000	5
Artocarpus cempedak[a]	6	100 fruits	50 fruits	2	50,000	23
Other fruit trees (6 species)[b]	10	200 kg	50 kg	3	50,000	23
Timber (all species are used)	250	5 m^3	2.5 m^3	0[c]	50,000	23
Total labor (mandays)				87		
Average yearly income					2,410,000	1,106
Minimum income (no fruiting season)					1,650,000	750
Maximum income (fruit season)					3,570,000	,625

From de Foresta and Michon (1997).

[a]Production every 2 years.

[b]Production every 3 years.

[c]No family labor involved in timber harvesting.

safety asset: a garden, or a part of it consisting of several selected trees, can be "pawned" through special agreements called gadai[21] (Mary 1987; Lubis 1996) that allow any family to overcome difficult periods without resorting to selling trees or land,[22] which is considered one of the worst 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 labor invested for a distant term to benefit future generations as well as present, 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 for a household, but also as the land foundation of a lineage.

Damar Gardens as a Useful Forest

Damar gardens also fulfill a role equivalent to that of natural forests in the economies of forest villages. Wild resources associated with damar trees support a

wide 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.[23]

Damar gardens also represent, as does any natural forest, a source of products that are potentially marketable commodities at a larger scale: timber, rattan, and medicinal and insecticidal plants can be harvested for sale whenever needed or if market conditions are considered favorable.[24] 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 revolutionize the management of damar gardens[25] (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 and extractivism and used to fulfill the family's immediate needs. This forest function also appears in some of the egalitarian social attributes of the gardens, i.e., product exchanges, sharing and donations,[26] and free harvesting rights.[27] This creates important networks of reciprocity that act as a counterpart to mercantile networks created through agricultural activities, and that help maintain a social balance between well-endowed people and those without resources.

In replacing natural forests by damar agroforests, the villagers' aim has been to amplify commercial strategies linked to the forest ecosystem. This is a widespread dynamic all over Indonesia: slash and burn practices are usually not targeted to staple food production, but primarily to the establishment of income-generating agroecosystems (Pelzer 1978; Scholz 1982; Dove 1983; Weinstock 1989). Here—and this is one of the main originalities of the land conversion process in the area—although converting natural forests into a commercial plantation, Pesisir farmers also managed to restore a wide range of economic products and functions originally derived from the forest. Forest conversion did not go along with a radical process of biological simplification; rather, it restored plant and animal diversity through cultivated, preserved, and spontaneously established species. Specialization did not entail economic reductionism; instead, it restored the whole range of economic choices present in a natural, untransformed ecosystem. From the perspective of an integrated conservation and development program, this preservation of existing and potential economic diversity appears as important as that of biodiversity.

BUILDING A FOREST RESOURCE: SPECIES DOMESTICATION OR FOREST RECONSTRUCTION?

The damar story in the Pesisir constitutes a highly original example of spontaneous appropriation of a forest resource, the damar tree, by local farming communities. It

was achieved as the wild resource itself was vanishing (Michon et al. 1995a, 1996). If human history is rich in examples of natural resource appropriation through cultivation to achieve domestication, the originality of the damar example is that, while cultivating this particular forest resource, villagers have achieved the global restoration of a forest in the middle of agricultural lands (Michon and de Foresta 1996). Biologists will argue that the damar agroforest is far from a natural, pristine tropical forest: although close to it, damar gardens cannot totally replace the natural forest *ecosystem*. However, they represent a rather integral forest *resource*, which is much more significant for local people than a natural forest that increasingly eludes their control, the conservation of which is not, for longstanding and external institutional reasons, within their power. Besides the technical success linked to the establishment and reproduction of a large-scale dipterocarp plantation over more than a century,[28] it is this appropriation of the global forest resource through an agricultural strategy, and its integration into farmers' lands, that are worth analyzing.

From Extractivism to Culture: A History of Resin Harvesting and Production in the Pesisir

Damar Resin: An Ancient Forest Resource

Resins, which are sticky plant exudates found in various families of forest trees,[29] are among the oldest traded items from natural forests in Southeast Asia: they entered short-distance trade between Southeast Asia islands as far back as 3,000 B.C. and were probably included in the first long-distance exchanges that developed with China from the third to fifth centuries (Dunn 1975). The word *damar* appears in the lists of items traded to China from Southeast Asia in the tenth century (Gianno 1981, citing Ma Huan 1451). The first exports to Europe started only in 1829 and those to America, in 1832 (van der Koppel 1932). 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 last 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 because 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, processed, and reexported as incense or a base for paint, ink, and varnish factories in industrial countries. Other destinations include handmade batik industries and the manufacture of low-quality incense (Bourgeois 1984; Dupain 1994; Lembaga Alam Tropika Indonesia 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.

Resin Extraction in the Pesisir in the Past

From at least the eighteenth century onward, agricultural economy in the Pesisir combined subsistence strategies (with swidden rice production dominating until the end of the nineteenth century) and market-oriented strategies, thus associating the production of copra along the coast, and pepper, coffee, and clove[30] on the hills, with commercial gathering of forest products, mainly gutta-percha, wild rubbers, rattans, birds' nests, and damar. Chinese traders waiting in all the small harbors along the coast ensured the export of agricultural and forest products northward to Bengkulu or southward to Tanjung Karang, Batavia (Jakarta), and Singapore.

Damar production is reported to have been a major activity in the whole area (figure 7-9). As early as 1783, the British historian Marsden mentions a type of resin "yielded by a tree growing in Lampung called *Kruyen* [one cannot but think about Krui] the wood of which is white and porous . . . and which differs from the common sort, or dammar batu, in being soft and whitish. . . . It is much in estimation for [lining] the bottoms of vessels. . . . To procure it, an incision is made in the tree" (Marsden 1783). Harbor accounts in Teluk Betung, from the middle of the eighteenth century, stress that the trade of damar mata kucing was a source of considerable profit in Lampung, 285 tons being exported in 1843 (cited in Sevin 1989). A map drawn by the Belgian geographer Collet in 1925 mentions damar as one of the three main exports of Krui (Collet 1925). Rappard, a Dutch forester who visited the area in 1936, mentions that damar ranks third in the agricultural exports of Krui, after coffee and copra, but before pepper; the total production in 1936, for the Krui area alone, was more than 200 tons (Rappard 1937).

In villages, there is still a vivid memory of the importance of wild resins, and people can point to old wild damar trees that were protected in the *ladang* (the Indonesian word for swidden) while the forest itself disappeared.

Building a Tradition: Damar Cultivation as a Heritage of the Past?

When and why did the cultivation of damar trees start? Farmers present it as a "tradition" inherited from their "ancestors"—*nenek moyang*—which roughly means, "That's what we do, what we can do; that's the basis of our lives." However, this tradition is certainly not older than a century or so and probably occurred through a combination of internal factors and external influences. Some villagers trace its origin to the beginning of the twentieth century, the result of a visit by two respected hajjis from Singapore, who were convinced of the damar market's bright prospects and returned to establish plantations. Other informants in the ancient producing area of Pugung assert that, about six generations ago (at least 130 years ago, i.e., circa 1870), villagers came from the central subdistrict to ask for damar

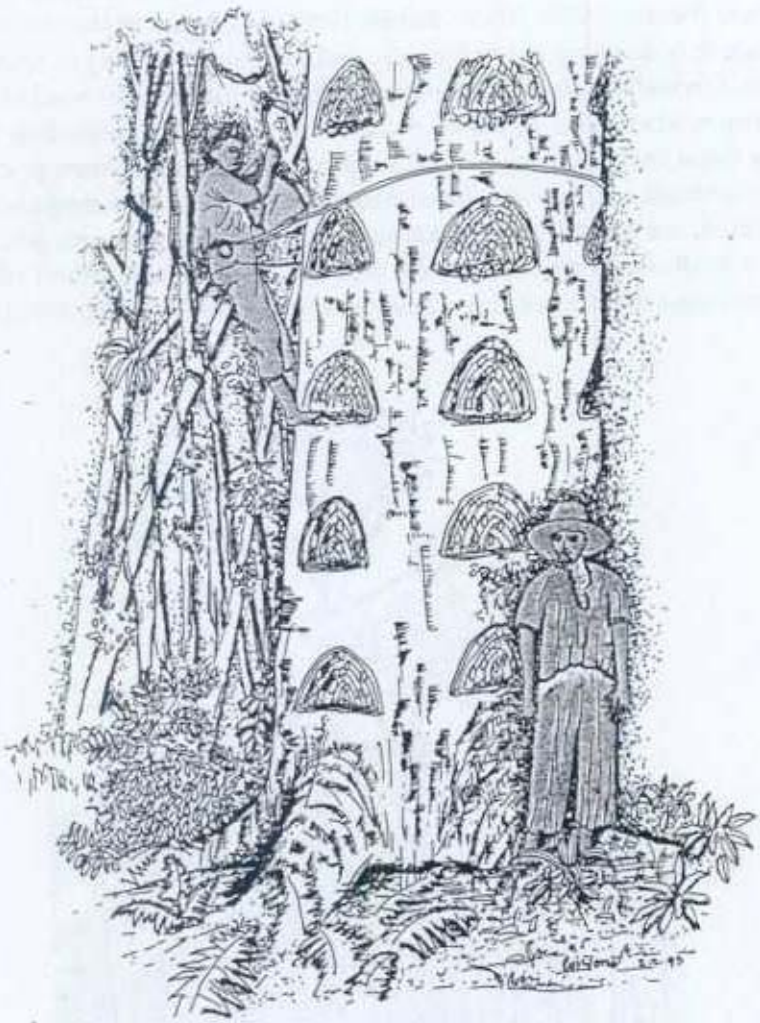


Figure 7-9 Tapping wild damar trees in natural forests used to be a major economic activity in the Krui area until the beginning of the twentieth century.

seedlings, which were then taken from Batu Bulan forest where natural damar trees were famous (Dupain 1994). Villagers commonly agree that the oldest planted damar trees are to be found in the south, where "you can find huge trees that were planted more than 200 years ago." The only written material is provided by Rappard (1937) who reports that he encountered 70 ha of plantations around Krui, among which several were at least fifty years old, which indicates that the first plantations might have been in 1885. Rappard mentions that 80 percent of the damar produced in Krui in 1936 is from cultivated trees, and that *Shorea javanica* no longer exists in a wild state in the area. He notes that production increases from year to year, with 120 tons in 1935, 201 in 1936, and an estimated 358 for 1937 (Rappard 1937).

Among the imperatives leading to the initiation of a generalized cultivation

process, the main one was probably the increasing 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 1983b, 1992c; Siebert 1989). At the turn of the century, the high increase in resin prices led to intensive and generalized 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 (figure 7-10) 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 (and within) villages concerning access to the remaining damar trees (Levang and Wiyono 1993).

Figure 7-10 A Wild Damar Tree Preserved in a Swidden. Damar trees were systematically preserved in converting natural forest to damar agorforests. These trees could continue to be tapped. They were sometimes used as a source of seed for damar nurseries. However, the low density of damar trees in natural forests and their erratic and unpredictable regeneration prevented spared trees from playing a significant role in damar garden establishment, and farmers had to plant the trees to ensure sufficient densities of productive trees in their gardens.

Damar gardens also appeared to be an answer to increasing problems in commercial agriculture. For example, pepper plantations encountered serious difficulties on the western coast of Lampung around 1920, when a serious disease reportedly killed most pepper vines (Levang 1989). The induced disturbance of the balance between subsistence and commercial strategies in cropping systems could partly explain the development of damar plantation after 1930. Colonial administration might have played a role in advising local people to continue their process of domestication. It is also most probable that Chinese traders actively encouraged the diffusion of damar cultivation, as they did for rubber in other parts of Sumatra (Pelzer 1978).[31]

Damar gardens have gradually spread in the Pesisir, and productive gardens presently cover at least 50,000 ha [according to a recent interpretation (December 1997) by the Department of Forestry and the International Center for Research in Agroforestry (ICRAF) of a Landsat image dated November 1994], the main center of cultivation being located around the city of Krui, where the hills are almost totally covered with a mature damar forest. Yearly damar production was estimated to be 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.

How Cultivation Techniques Evolve into Forest Appropriation Strategies

The reconstruction of a forest by Pesisir villagers was not planned as such. Rather, it appeared a posteriori as the consequence of a particular cropping system that minimized labor input and maximized the use of natural production and reproduction processes of an artificial ecosystem dominated by trees. In that sense, it is the choice of particular cultivation techniques and patterns, more than the initial selection of a given forest tree, that allowed true forest reappropriation (de Foresta and Michon 1997).

Technical Appropriation of the Damar Resource: Overcoming Biological Constraints and Using Biological Advantages

The main ecological disadvantages of the selected forest species are typical of dipterocarps: difficult natural regeneration due to irregular and only occasional flowering, lack of seed dormancy (figure 7-11), and need for mycorrhizae association. But one important advantage should be noted: unlike many dipterocarp species, *Shorea javanica* appears to be rather light-tolerant, which made it suitable for cultivation in plots already cleared for agriculture.

Villagers solved the regeneration problem through a technology of "assistance storing of seedlings" (Michon and Bompard 1987a,b; Michon and Jafarsidik 1989). The establishment of small nurseries, where the seedlings could be kept for several years and used whenever planting material was needed, allowed growers to overcome fruiting irregularity and lack of seed dormancy. The mycorrhizae problem was

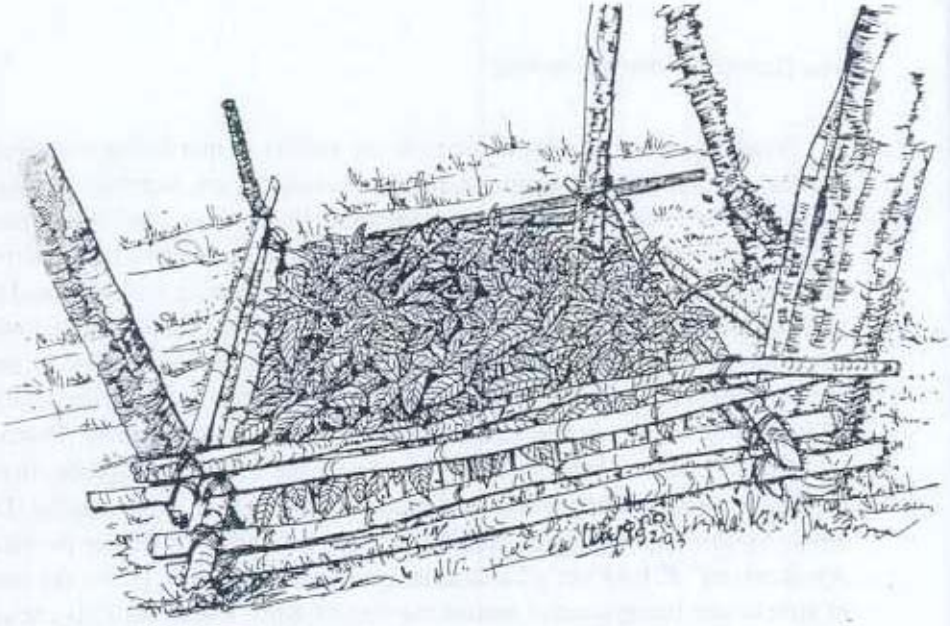


Figure 7-11 A Damar Seedling Nursery. The fruiting season of *Shorea javanica* is highly unpredictable: seeds are only available ever 4 to 6 years. Also, seeds cannot be stored more than a few days. Local farmers have solved these two problems storing seedlings, using a locally devised technique. This enables them to have access to seedlings whenever needed (for replacement of dead trees or establishment of new gardens). In season, seeds are selected and collected in gardens; they are then planted in small nurseries located in damar gardens, in the village or in the swidden. Density in the nursery is very high, which results in seedlings that do not grow more than 20–30 cm high and that can survive 4–5 years.

avoided through a first phase of direct transplantation of seedlings from the forest to the plantation site.

Among other biological constraints is the long renewability rate of damar as a resource: it takes at least one generation—twenty to twenty-five years—for a tree to attain a minimum tappable size. The economic consequence is that, for the first twenty-five years, a pure damar plantation would be of little, if any, use for the planter. This difficulty has been solved through a strategy of crop succession starting from the ladang and planned over the medium term.

Integration of a Forest Tree in a Farming System: The "Ladang Way"

Expansion and success of damar cultivation are indeed closely related to swidden agricultural practices (Michon and Bompard 1987a,b; de Foresta and Michon 1994b). It is through the ladang, 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 into either coffee or

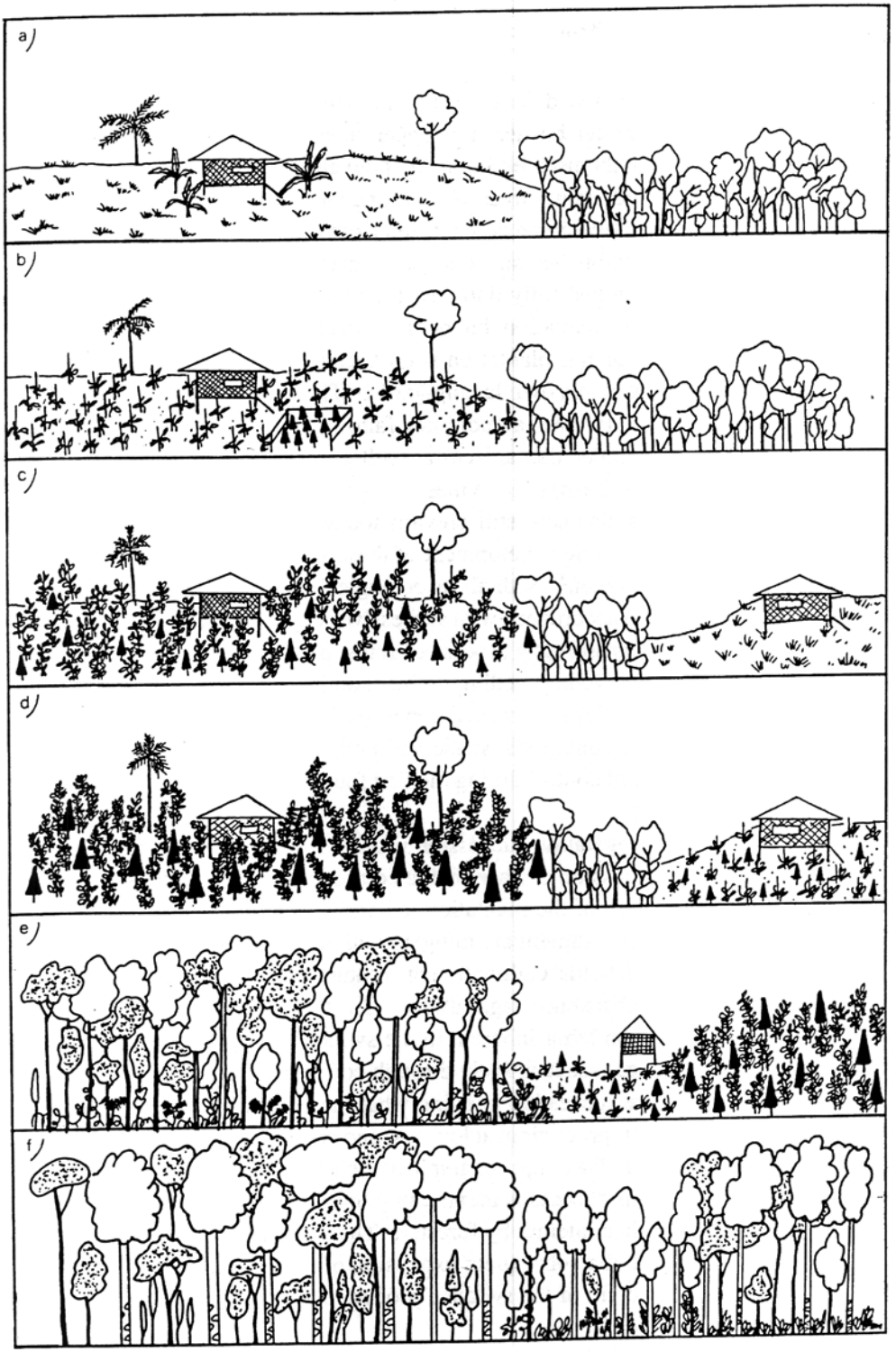
pepper plantation.[32] The first damar trees were introduced in these successional ladang gardens, amidst coffee bushes and pepper vines, where they found a suitable environment to establish themselves and further develop. After the abandonment of the coffee or pepper stand, damar trees were strong enough 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 twenty to twenty-five years after the plantation, but no more than ten years after the plot abandonment (figure 7-12). Damar plantation soon became a success story: everyone started to plant seedlings in his own ladang garden. 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.

This process of establishment still prevails today in areas that are being converted. Ecologically, the whole development of these successive crop mixtures imitates natural forest succession,[33] with all its ecological benefits: soil protection and microclimate evolution in accordance with successive component needs. Technically, it is similar to a classic agroforestry process of forest plantation establishment—the taungya system—in which young seedlings of economic tree species start to grow in favorable, controlled conditions. Here, maintenance of the coffee/*Erythrina* stand secures good microclimatic conditions, shade and humidity, favoring transplantation success, and provides weed control during the first four to fifteen years following the introduction of seedlings.

Economically, this 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 five to ten years. Costs of labor devoted to damar establishment are mingled with those devoted to rice and coffee cultivation on swidden fields. Cultivation of commercial tree crops does not compete for labor with subsistence agriculture. On the contrary, it allows the maximization of returns on labor inherent to the swidden system—vegetation cutting and field maintenance—successively through coffee and trees.

Pesisir villagers have succeeded in doing what most foresters dream of: establishing, maintaining, and reproducing, at low cost and on huge areas, a healthy dipterocarp plantation. This is still a unique example in the whole forestry world. The best part of the story is that this success is inextricably linked to shifting cultivation, the agricultural system held in contempt by foresters. The acceptance of the wild tree as a cultivated tree crop and the subsequent expansion of the plantation were permitted by the particular structure of the swidden production system, and ladang was at the very heart of this success.

In achieving the switch from the "natural and sometimes protected" status of the damar tree in traditional extractivism systems to its adoption as a new crop in the farming system, farmers have clearly reinvented the common process of resource appropriation through (agri)culture. Indeed the control of the damar resource, based


a)
b)
c)
d)
e)
f)

on the mimicry of natural forest processes which adapts the cultivated ecosystem to the plant characteristics, runs counter to conventional domestication processes, which emphasize modification of biological and ecological characteristics to achieve adaptation of the plant to a cultivated ecosystem (Michon and de Foresta 1996).

Further Appropriation of the Forest Resource: Restoring Biodiversity

The plantation process that usually associates damar with fruit trees and leaves pioneer trees establishing naturally in the ladang garden basically recreates the skeleton of a forest system. But the real appropriation of forest richness and diversity is achieved through the free development of natural processes of diversification and niche colonization. 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 neighboring 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: favoring resources, through introducing economical trees and protecting their development, or tolerating development and reproduction of nonresources as long as they are not considered "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 to 800 m above sea level 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 de Foresta 1992, 1995). The agroforest also shelters many animal species, some of which are highly endangered, such as the Sumatran rhino and the Sumatran tiger.[34]

Seen from the planter's point of view, while the introduction of economic species in the damar agroforest is intentional, global biodiversity reestablishment is "accidental." But it is precisely this "accident"—the establishment of diversified flora and fauna as in any silvigenetic process—which reconstitutes the real forest aspect of the

Figure 7-12 *(on previous page)* From a Mosaic of Swidden Field to a Damar Agroforest. Most damar gardens begin with a rain-fed rice phase, followed by a coffee plantation phase, in the following steps: (a) Year 1: Slash and burn of secondary vegetation (sometimes primary forest) area, and planting of the first rain-fed rice crop, along with vegetables and fruits such as papaya and banana. (b) Year 2: Introduction of coffee seedlings and establishment of the second rain-fed rice crop; damar seedlings in the nursery are ready to be planted. (c) Year 3: No more rice crop on the field; introduction of damar and fruit seedlings between the coffee rows. (d) Years 4 to 8: (but sometimes to year 15): Coffee trees begin to produce significant amounts and are usually harvested for 3 to 5 years (but sometimes managed so that they still produce at year 15). (e) Years 15 to 20–25: The field has been temporarily abandoned after the last economic coffee harvest; a spontaneous component is now developing (trees, lianas, shrubs, forest herbs, epephytes), along with the planted damar trees and fruit trees. (f) Damar trees begin to be tapped; the damar garden continues to develop; farmers' management ensures that the garden produces and reproduces without having to return to a slash-and-burn phase.