

H. de Foresta and G. Michon

## Agroforests in Sumatra

where ecology meets economy

**A**ny newcomer will be impressed by the setting of Krui, a subdistrict capital on the coast of West Lampung district in Sumatra. The city is set on a plain and surrounded by well-managed, irrigated rice fields. Beyond the rice, however, are beautiful forested hills that cover thousands of hectares.

For newcomers with an interest in agroforestry the forests are more fascinating even than they are beautiful. They are dominated by a tree in the family Dipterocarpaceae—the resin-producing species, *Shorea javanica*, known locally as 'damar'. In the forests around Krui, these trees are easily recognized by the tapping holes extending 4–5 m up on the trunks. Given these signs of human use and the high population density in the area (about 80 people per km<sup>2</sup>), one may guess—correctly—that the forest cover is not of natural origin.

The forest cover has been achieved by local farmers who domesticated the damar tree late last century (Michon 1993, Torquebiau 1984). Farmers in Pahmungan, a village close to Krui, say the present forest cover is the result of damar and fruit plantations their grandparents made at the end of the last century, and which subsequent generations have continued to establish and manage. They know that it was a need for a stable source of cash income that first led their forefathers to domesticate the damar tree. They are also well aware of the processes of the damar forest, and of its economic benefits.

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The mature damar forest is an excellent example of an agroforest—producing a variety of tree crops and managed day after day by smallholders. Our inventories of the tree populations (75 plots of 400 m<sup>2</sup>) show 39 tree species and a mean density of 245 trees ha<sup>-1</sup>. There is a close structural similarity between natural forests and the mature damar forests.

About 65% of the forest is damar trees, which are the main source of regular cash income from the harvesting and sale of the damar 'mata-kucing' resin, the main dipterocarp resin currently on the national and international markets.

Fruit trees comprise almost a quarter of the tree community and also provide an additional, but irregular, source of cash income. Two major commercial fruits, 'durian' (*Durio zibethinus*) and 'duku' (*Lansium domesticum*), go to urban markets, even to the Indonesian capital, Jakarta. During the fruit season it is not unusual to see two or three 6-tonne trucks pass each day, fully loaded with fruit for urban centres.

The remaining 10–15% of the tree community is made up of wild trees that farmers have allowed to establish themselves and grow, either because they have no adverse effects on planted trees or because they have other uses, particularly

timber. This wild component in the agroforests provides smallholders with many of their domestic needs—fruit, vegetables, medicinal plants, fuelwood, wood for construction, bamboo. The villagers manage natural regeneration processes in this agroforest; when necessary they plant to enrich the diversity of trees. They are skilled at management techniques that promote both forestry and agricultural production; in short, they have developed their own strategies to make the most of the agroforests.

Apart from their economic importance, the damar forests afford environmental benefits. They protect soil and water resources, which is particularly important in this area where steep slopes are prone to erosion and landslides. These agroforests are unique among agricultural systems for preserving biodiversity. Our inventories show



Women transport damar resin their main source of income.

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that the damar forest harbours hundreds of forest plants—including rare epiphytes, herbs and shrubs, 46 mammal species of which 17 are protected by Indonesian law (Sibuea and Herdimansyah, unpublished report 1993), 92 bird species (Thiollay, unpublished report 1993) and the whole soil fauna (Deharveng, unpublished report 1993).

### Tapping the damar tree ...

Damar trees can yield resin for 30–50 years when they are regularly tapped. However, the wait for the trees to produce is long, especially for smallholders. After seedlings are transplanted, 15–20 years may elapse before the first tapping, when the trunk diameter reaches 20–25 cm. Not surprisingly, smallholders have developed an agroforestry technique to solve this problem. Damar and fruit tree seedlings are planted within young coffee or pepper stands that are established after one season of rainfed rice cultivation. This technique resembles the classic taungya system, except that here the farmers, and not the forestry services, own the trees, choose the species and reap the benefits themselves.

The smallholders often plant erythrina and gliricidia trees to protect young plantations. This mixture imitates natural forest succession: rainfed rice as the first grass phase, coffee and pepper as the pioneer tree stage, damar and fruit trees associated with various wild trees as the mature phase. Throughout these stages smallholders can harvest commercial and domestic products. The unproductive period when trees are growing is reduced to 5–10 years; during this time no cropping is done and only a few fruits and forest products are harvested.

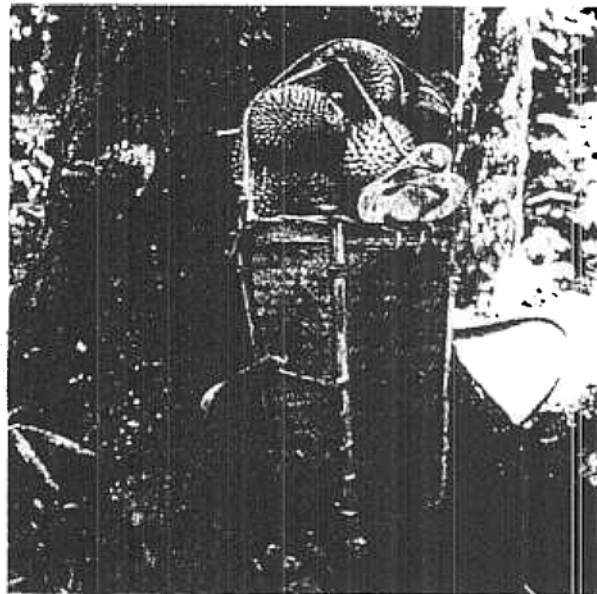
The starting point of this reforestation process is shifting cultivation. The end result, however, is a permanent forest cover and a sustainable, productive land-use system—a system that is a successful, indigenous alternative to shifting cultivation.

### Tapping the agroforest ...

The damar agroforestry system, as are most agricultural systems, is evolving. Nurseries have been established to replace collection of seedlings in natural forests. New species, such as gliricidia, have been integrated into the establishment process, cocoa into the mature agroforests. However, there are still improvements to be made. The unproductive period during growth of the damar trees could be shortened by introducing other species, such as cinnamon (*Cinnamomum burmanii*) and rattan (*Calamus* spp), fruit such as 'jengkol' (*Archidendron pauciflorum*) and 'melinjo' (*Gnetum gnemon*). These could produce after coffee and pepper stop, and provide cash until damar can be tapped.

Another way to increase the profitability of the mature agroforest is to increase the value of its timber. Villagers have shown tremendous know-how in silviculture and forest management but the potential value of the timber in their agroforests has not been fully exploited. This could be done without disturbing the system's function, by diversifying the products of the agroforests, thus decreasing risks to smallholders who depend so heavily on the damar resin. Indeed, this is already being done; smallholders are managing more and more timber trees and have added some valuable timber species, such as *Peronema canescens*, to agroforest plots.

So, smallholders have developed agroforests that help the local, regional and national economies and the environment. Shouldn't this system be expanded to other areas? While the damar system could be replicated, there is a danger in doing so. The damar resin market, like all commodity markets, is delicate: flood



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Agroforests provide smallholders with many of their domestic needs and fruit for market.

the market with resin and the price will fall, removing the economic incentive for this agroforestry system.

However, the damar model, a complex agroforestry system with great potential in the search for alternatives to shifting agriculture, can and should be extrapolated to other areas. Prerequisites for such a model include secure land tenure, adequate infrastructure and markets and the presence of traders.

The damar model teaches us many things about agroforests. It clearly illustrates the importance of associations of trees that provide, over a long period, cash income regularly and seasonally and provide domestic needs as well. It is one of only a few agroforestry systems—complex indigenous systems—that both look and function much like a natural forest and can conserve biodiversity and help fill the farmers' pockets. ☺

### References

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