Chapter 65

The Role of Land Tenure in the Development of Cinnamon Agroforestry in Kerinci, Sumatra

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When traditional shifting cultivation becomes unsustainable because of population pressure and scarcity of land, the adoption of agroforestry systems can be an alternative. These systems often start with the introduction of trees into cleared swidden land during or after food crops have been harvested. The trees grow to partly replace the natural vegetation of the shifting cultivation system and are then known as an "improved tree fallow." Typically, continuing population pressure forces an evolution from low- to high-intensity management of planted tree fallows. The final stage of this enrichment of shifting cultivation is referred to as an agroforest. It is a major land use in Sumatra (de Foresta and Michon 1991), where important tree crops such as rubber (*Hevea brasiliensis*) and cinnamon (*Cinnamomum burmannii*, known as cassiavera) have begun in this fashion. This transformation of farming systems, driven by population pressure, has been summarized by Tomich (1994) and appears in Table 65-1.

This chapter examines cinnamon agroforestry as an example of an improved tree fallow, in the Kerinci district of Jambi Province in Sumatra (see color plates 49 and 50). Specifically, it focuses on the effect of land and tree tenure on the development of cinnamon agroforestry. Although some cinnamon is grown in agroforest-type systems in the Kerinci valley, a significant portion of the local crop is essentially a monoculture. Our analysis is based on a community-level survey of 19 villages and an intensive follow-up survey of 100 households in two of the 19 villages. The sample villages are located in the zone surrounding Kerinci Seblat National Park (Figure 65-1), the largest area of continuous primary forest in Sumatra, covering 14,847 km^2.

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Table 65-1. Farming System Transformations

	Increasing Population Density →				
Rotation (years)	*Sustainable Shifting Cultivation*	*Unsustainable Shifting Cultivation*	*Agroforests*	*Agroforestry*	*Tree Monoculture*
0	Slash–and–burn	Slash–and–burn	Slash–and–burn	Slash–and–burn	Slash–and–burn
1–2	Food	Food	Food	Food	Trees
3–5	Fallow	Food	Trees	Trees	Trees
5–10	Fallow	Weeds	Trees	Trees	Trees
10–19	Fallow	Weeds	Trees	Trees	Trees
20	Slash–and–burn	Weeds	Trees	Trees	Slash–and–burn
21–22	Food	↓	↓	Trees	Trees
23–24	Fallow			Trees	Trees
25	Fallow			Slash–and–burn	Trees
26–27	Fallow			Food	Trees
28–39	Fallow			Trees	Trees
40	Slash–and–burn			Trees	Slash–and–burn
		Infinity (?)	Infinity (?)		

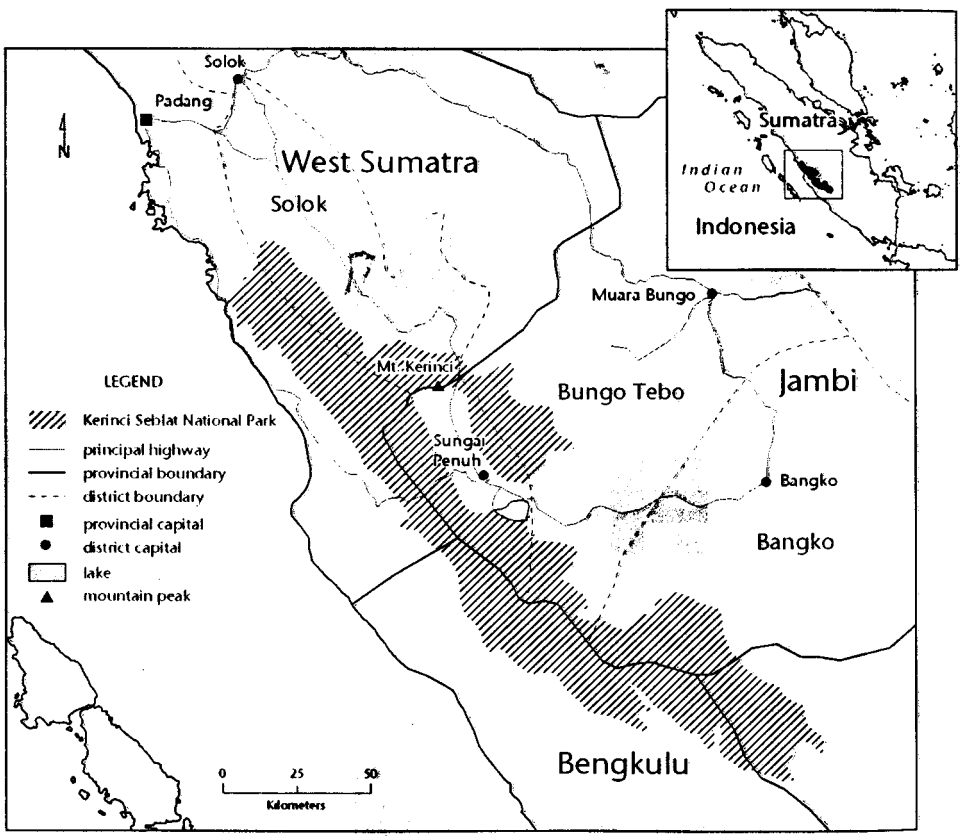

Figure 65-1. Map of Study Site

Results

During the 19th century, the main agricultural practice in Kerinci was shifting cultivation (Marsden 1811). At that time, *Cinnamomum burmannii*, a species native to Kerinci, grew and was harvested in the Bukit Barisan mountain range. The change from traditional shifting cultivation to cinnamon agroforestry began in the 1920s, when the Dutch colonial government began developing roads, the population began to grow, and farmers began planting *Cinnamomum* in their fallowed swiddens. Cinnamon production increased rapidly, and the agricultural landscape in Kerinci became a mosaic of cinnamon trees. Today, it is the major crop in Kerinci, accounting for nearly 70% of Indonesian cinnamon production (Scholz 1983, Rismunandar 1989). Almost all of it is cultivated by smallholders.

Throughout this region, indigenous societies have traditionally followed a matrilineal inheritance system, with joint ownership that limits individual rights to land and others assets. However, along with the change of land use from shifting cultivation to agroforestry systems, land tenure has also been evolving toward individual ownership. In cinnamon agroforestry, individualized tenure institutions are dominant and their incidence is increasing. In fact, land tenure appears as a major determinant in the development of cinnamon agroforestry, and we suggest that secure individual land rights actually stimulate farmers to adopt more efficient and sustainable land uses.

We have two specific hypotheses: that greater individualization, or the evolution of tenure systems toward full private-property rights, will lead to the adoption of more intensive agroforestry systems, and that greater profitability of tree crop production will lead to the greater individualization of land tenure. If, on the other hand, individual land rights do not evolve, we expect there to be less development of agroforestry and a continuation of less-intensive shifting cultivation of annual crops.

It follows from these hypotheses that, with secure land and tree tenure, high profitability of cinnamon production, and diminished access to forest land, farmers will tend to continue converting bush-fallow areas to cinnamon agroforestry, rather than maintaining traditional shifting cultivation of annual food crops.

In this chapter, we present a preliminary analysis of the survey data to characterize land-use patterns, cinnamon agroforestry practices, and the evolution of land tenure in response to population pressure.

Land Use Patterns and Cinnamon Agroforestry Practices

The three main agricultural land uses in Kerinci are wet rice fields located in valleys and flat areas, 18%; perennial crop systems on surrounding hills, dominated by cinnamon agroforestry, 77%; and annual crops, including bush-fallow areas, 6% (Scholz 1983). The total area of cinnamon in Kerinci increased at a rate of 3.64% per year between 1985 and 1995, from 36,766 to 52,564 ha. Annual production over that decade nearly tripled, from 5,737 tonnes in 1985 to 16,357 tonnes in 1995 (Biro Pusat Statistik 1995).

Our survey of 100 farmers in two villages (Lempur Mudik and Lempur Tengah) confirmed Scholz's earlier finding that tree-based systems are the most important land use. The average household owns 6.2 ha of land, to which must be added land that is sharecropped or borrowed, making an average operating unit of 6.9 ha. Of this, the average area of perennial crops per household is 5.3 ha, or 77% (see Table 65-2).

In this analysis, we distinguish between young perennial crops less than four years old and mature perennials older than four years. Within a total sample of 424 plots, 153 plots are young and 271 mature.

Cinnamon accounts for 96% of young perennial plots and all of the mature perennial plots. Most farmers grow cinnamon without other trees. However, 31% of young cinnamon plots are planted in association with other trees, compared to only about 18% for mature cinnamon gardens. This suggests that intercropping cinnamon with other trees is becoming more important.

In contrast, cinnamon agroforestry occurs on land with a higher degree of individualization. Around 62% is on land with single family tenure, 33% is on private land, and only 6% is on joint family land. This suggests that secure land tenure with a high degree of individualization may be a prerequisite to investment in cinnamon agroforestry. Its establishment requires significant effort in land preparation, tree planting, weeding, and pruning. Without secure individual ownership rights, those who plant and grow the trees might not be able to reap the benefits.

It is reasonable to hypothesize that population pressure influenced the evolution of land tenure toward a higher degree of individualization. Demand for land has increased as the population has grown, and as a consequence, land has become scarce. Under these conditions, communal land tenure systems cease to work efficiently and may evolve toward more secure individual ownership (Ault and Rutman 1979).

According to the 1930 census, Kerinci district then had a population of 50,248 (Table 65-10). By 1990, this had grown to 280,017 people and, in 1994, Kerinci's population density was 68 people per km^2. This compared with an average 40 people per km^2 for the whole of Jambi Province, of which Kerinci is a part (Table 65-11).

Tables 65-9 to 65-11 suggest that the influence of population pressure on land tenure depends on land-use types. Ownership of wet rice fields is the least individualized of the land uses; ownership of perennial plots is the most individualized. A large investment in clearing forest land and planting trees creates stronger rights than a small investment in establishing a rice field. This confirms Shepherd's argument in 1991 that it is an investment of labor, more than anything else, that creates ownership.

The Change from Shifting Cultivation to Cinnamon Agroforestry

Boserup (1965) hypothesized that farming systems change from shifting cultivation to more intensive systems in response to population pressure. Our survey data show that, in the Kerinci area, upland food crop production always occurs in association with young cinnamon. This suggests a change from shifting cultivation, which Marsden found in 1811 to be the area's dominant agricultural system, to cinnamon agroforestry.

Farmers are clearing forest and bush-fallow land to establish cinnamon agroforestry, rather than to open swiddens for shifting cultivation. Of forest land, 83% is converted to perennials within one year of farmers clearing it, and at present, 84% of forest-land plots are planted with perennials. The same trends apply to bush-fallow land. Of bush-fallow land, 79% is converted to perennial plantations within one year of its acquisition, and at present, 86% of bush-fallow plots are planted with perennials (Table 65-12).

Table 65-9. Percentage of the Area under Different Land Tenure Systems by Land Use Type

Land Use Type	*Joint Family Ownership*	*Single Family Ownership*	*Private Ownership Purchase*	*Private Ownership Clearance*
Paddy fields	74	6	6	8
Cinnamon agroforestry	6	62	14	19
Bush-fallows	30	43	14	13

Table 65-7. Percentage of Villages Observing Inheritance Rules, by Field Type

Inheritance Rule	*Wet Rice Fields (%)*	*Dryland Fields (%)*
Matrilineal	35	22
Matrilineal and undifferentiated	30	28
Undifferentiated	35	50

Table 65-8. Land Tenure Categories and Their Major Characteristics

Land Tenure Categories	*Members*	*Inheritance*	*Joint Ownership*
Communal	A group of lineages or all people in the village	Inherited communally	Yes
Lineage	Lineage coming from a common grandmother	Daughters, sisters and nieces	Yes
Joint family	Members of nuclear family	Daughters	Yes
Among daughters		Daughters and sons	Yes
Daughters and sons		Sons	Yes
Among sons			
Single family	Family members	Daughters	No
Among daughters		Daughters and sons	No
Daughters and sons		Sons	No
Among sons			
Private land	Those who have privately acquired land (cleared forest land or purchased land)	Daughters Daughters and sons Sons	No

Source: Otsuka 1996.

Joint Family Tenure. In this category, joint ownership of land involves more than one family and encompasses families of the same generation or two generations. Inheritance may be among daughters, daughters and sons, or only sons, depending on the specific village. The joint family system is an equitable one because rights to use a field are rotated among households.

Single Family Tenure. Single family land tenure seems to have evolved from joint family tenure. Land may be inherited by daughters or sons, or daughters and sons, depending on local inheritance rules. Under this system, a single family has clear rights to use, rent, or mortgage the land, even though the consent of other relatives is often required in order to sell it.

Private Land Tenure. Full private-property rights are acquired by clearing forest land or by purchasing land. Owners of private land are free to rent, mortgage, or sell it.

Distribution of Land by Tenure Type

Table 65-9 divides land into paddy fields, perennial gardens, and bush fallows, then shows the percentage of each land-use type held under the various tenure categories. The area of communal and lineage land is very small, so for this analysis we have combined these two tenure types with joint family tenure. The area of paddy fields under joint family tenure is 74%; single family tenure, 8%; and private ownership, 14%. The traditional tenure system predominates for paddy fields because there is only a very small investment required. The irrigation systems are of a simple, traditional variety that requires a minimum of effort to maintain and repair.

Table 65-6. Harvesting of Intercropped Plots

Details		*Mature Perennial*
Number of plots		271
Harvesting of pucuk/pruning (%)	Yes	16
	No	84
Year of harvesting pucuk	Year 3	11
	Year 4	41
	Year 5	25
	Year 6 and above	23
Selective thinning	Yes	47
	No	54
Year of thinning	Year 4 and below	25
	Year 5	32
	Year 6	24
	Year 7 and above	19

Inheritance Rules

Kerinci society basically follows matrilineal inheritance and matrilocal residence patterns. Property is classified into two types: *harta pusako,* or ancestral property, and *harta pencaharian,* or earned property. Ancestral property such as paddy fields and houses are inherited by a daughter and cannot be sold. Earned property may be inherited either by sons or by sons and daughters. This inheritance rule has undergone substantial change over time. In our 19 survey villages in Kerinci we found significant changes, from matrilineal inheritance by daughters, to undifferentiated inheritance by both sons and daughters. Some villages use both systems.

Table 65-7 shows the percentage of villages that follow the various inheritance rules. For wet rice fields, for instance, 35% of the villages follow the matrilineal inheritance rule, 35% follow the undifferentiated inheritance rule and, in 30% of villages, there is a combination of both. The transformation from matrilineal to undifferentiated inheritance seems to have gone faster for dryland than for wet rice fields. About 50% of the villages follow undifferentiated inheritance for dryland fields, 28% follow a combination of both systems, and only 22% stick with the old matrilineal inheritance rule.

Land Tenure Categories

Table 65-8 shows the major land tenure systems in Kerinci and their characteristics, with the tenure systems arranged from the weakest individual ownership rights to the strongest.

Communal Land Tenure. Under this system, land belongs to a group of lineages or jointly to all people in the village. Members of specific lineages or villagers have rights to cultivate this land, but they cannot rent, pawn, or sell it. Moreover, they cannot plant tree crops without the approval of the customary or village chief.

Lineage Land Tenure. Under this system, the land belongs to descendants of a common grandmother. Land is collectively owned by the lineage and can be inherited by daughters, sisters, and nieces of a woman who dies. A lineage head is selected among uncles, that is, male members of the second generation, and he exercises strong authority over land inheritance.

Table 65-4. Intercropping Cinnamon with Food Crops

Intercropping Details		*Young Cinnamon*	*Mature Cinnamon*
Number of plots		153	271
Intercropping with food crops (%)	Yes	87	90
	No	13	10
Number of years food crops planted (%)	1	31	36
	2	36	39
	3	22	19
	4	4	6
Type of food crops intercropped with cinnamon (%)	Chili	51	32
	Chili and tobacco	23	39
	Chili and other food crops	21	26
	Others	5	3

Table 65-5. Planting Materials and Land-Clearing Techniques

Details		*Young Perennial*	*Mature Perennial*
Number of plots		147	271
Type of planting material (%)	New seed	52	40
	Stumps	48	60
Use of fire in land-clearing technique (%)	High	33	31
	Low	31	49
	None	19	17

Farmers usually harvest cinnamon after eight or more years. However, there are possibilities for smaller harvests before that. These are called *panen pucuk* and involve the pruning of branches, which yield the lowest-quality cinnamon. Our survey showed that this type of pruning was performed on only 16% of the plots, usually after the third year. On about 46% of plots, farmers selectively felled low-quality trees when they were between four and six years old to reduce competition with higher-quality trees (Table 65-6).

Cinnamon quality is classified according to the part of the tree from which the bark comes and the bark's thickness. Generally, there are three different qualities: Kc comes from branches and is about 1 mm thick; Kb also comes from branches but is between 1.5 and 2.5 mm thick; and Ka comes from the trunk of trees ages 8 to 15 years, and is also between 1.5 and 2.5 mm thick. In addition, there are three premium quality grades: KA1 which comes from the trunk of trees ages 15 to 18 years and is between 2.5 and 3 mm thick; KF, which comes from the trunk of trees ages 18 to 25 years and is between 3 and 5 mm thick; and KM, which comes from the trunk of trees over 25 years of age and is between 5 and 10 mm thick.

Coffee is the major tree planted in association with cinnamon. Among the plots of mature cinnamon planted in association with other trees, 63% are planted with coffee, 25% with *surian* (*Toona sinensis*), and 13% with fruits. For young cinnamon plots that are intercropped with other trees, 92% are planted with coffee and only 8% with surian and fruits (see Table 65-3).

When the cinnamon is young, food crops can be grown under the trees until they are four years old. At this stage, the canopy closes out the sunlight. More than 86% of all cinnamon plantations in the survey were either intercropped with food crops or had been intercropped during the immature stage (see Table 65-4). In more than 90% of these cases, chili was, or had been, the most important annual crop. In the case of mature cinnamon plots, most farmers had planted chili in association with tobacco (39%); chili with other food crops such as peanuts, potatoes, and vegetables (26%); or chili only (32%). Most young cinnamon plots were currently planted with chili only (52%), chili with tobacco (23%), and chili with other food crops (21%).

Food crops had been grown mostly in the first to third years after planting the cinnamon. Only a few farmers intercrop annuals into fourth year; the figures were just 6% of currently mature plantations and 4% of young cinnamon (See Table 65-3).

Cinnamon is harvested by felling the trees, and the stumps remain in the field. While the stumps coppice, annual crops are grown in between. Farmers burn the biomass, but the fires are very limited compared to slash–and–burn because intense fires can destroy the young cinnamon coppices. Only light burns are used on more than half of all cinnamon plots (Table 65-5). Therefore, the release of CO_2 to the atmosphere from burning to clear land for agroforestry is reduced compared to traditional practices of shifting cultivation.

Table 65-2. Average Land per Household (ha)

Land-Use Type	*Owned*	*Cultivating Other People's Land*	*Total*	
			ha	*(%)*
Wet rice fields	0.73	0.26	0.99	14
Cinnamon	4.91	0.69	5.31	77
Agroforestry	0.56	0.00	0.56	8
Bush-fallows	6.20	0.95	6.86	100
Total land				

Table 65-3. Intercropping Cinnamon with Other Tree Crops

Characteristics		*Young Perennial*	*Mature Perennial*
Number of plots		153	271
Main trees (%)	Cinnamon	96	100
	Coffee	4	0
Intercropping with other trees (%)	Yes	31	18
	No	66	82
Trees intercropped with cinnamon (%)	Coffee	92	63
	Surian	0	25
	Fruit trees	8	13

Table 65-10. Population of Kerinci District between 1930 and 1994

Year	*Population*	*Growth (%)*	*Population Density (people/km²)*
1930	50,248		11.96
1960	155,874	3.85	37.11
1971	186,615	1.82	44.43
1980	241,081	2.59	57.40
1990	280,017	1.51	66.67
1994	285,621		68.00

Source: Biro Pusat Statistik 1994.

Table 65-11. Population in Jambi Province by District in 1994

District	*Area (km²)*	*Population*	*Population Density (people/km²)*
Kerinci	4,200	285,621	68
Bungo Tebo	13,500	383,108	28
Saralangun Bangko	14,200	372,749	26
Batanghari	11,130	358,831	32
Tanjung Jabung	10,200	384,202	38
Kodya Jambi	206	343,489	1,670
Jambi Province	53,436	2,128,000	40

Source: Biro Pusat Statistik 1994.

The area of forest land acquired for cinnamon agroforestry increased until the 1970s and then started to decline. This was a result of increasing enforcement of the conservation status of the forests, which in 1991 became a national park. As a result, forest clearing declined, and the conversion of bush-fallow to perennial areas increased (Table 65-13). Along with that, the tenure of bush-fallow ownership became stronger. Our survey data show that 37% of bush-fallow land is now under single family tenure and 35% is privately owned.

It is not surprising that the incentive to plant commercial trees is very high when it is an important way to obtain and maintain secure land rights. According to customary rules, people who clear communal forest land and plant commercial trees receive relatively strong individual ownership rights. Such rights are given to those who make the land fruitful, or it reverts back to the communal pool. Although these owners may leave the land from time to time, they still retain their ownership because the land is covered by perennial crops that do not require continuous maintenance (Aumeeruddy 1994).

Conclusions

There is significant evidence that customary land tenure institutions in Kerinci district have evolved toward greater security of ownership as a response to a growing population. However, the change to individualized tenure depends on the type of land use. Most of the perennial crops, in this case cinnamon agroforestry, are under a high degree of individualized land tenure, while most paddy fields are under a lesser degree of individual ownership. Secure land tenure with a high degree of individualization may be a prerequisite to investment in cinnamon agroforestry.

Table 65-12. Land-Use Conversion to Cinnamon Agroforestry

Land Use	Number of Plots	Plots Planted to Cinnamon Agroforestry within One Year of Acquisition (%)	Plots Planted to Cinnamon Agroforestry at Present (%)
Cinnamon	215	99.53	99.53
Bush-fallow	163	78.53	86.50
Forest	82	82.93	84.15

Table 65-13. Conversion of Forest and Bush-Fallow to Cinnamon Agroforestry (ha)

Year	Forest Area Acquired	Converted to Cinnamon Agroforestry		Bush-Fallow Area Acquired	Converted to Cinnamon Agroforesry	
		One Year after Acquisition	1996		One Year after Acquisition	1996
Pre–1959	9.15	9.15 (100%)	9.15 (100%)	7.58	5.38 (71%)	6.55 (86%)
1960–69	38.44	36.44 (95%)	29.59 (77%)	31.31	31.31 (100%)	31.31 (100%)
1970–79	74.02	50.32 (68%)	69.70 (94%)	31.65	23.88 (75%)	30.42 (96%)
1980–89	36.62	27.14 (74%)	26.28 (72%)	77.07	63.81 (83%)	68.44 (89%)
1990–96	17.23	15.84 (92%)	15.84 (92%)	68.00	50.16 (74%)	48.51 (71%)

With more secure land tenure linked to the profitability of cinnamon, the traditional land use, shifting cultivation, has been largely converted to a tree crop system of cinnamon agroforestry.

People are now clearing forest to establish cinnamon agroforestry rather than for traditional shifting cultivation. Also, when they clear communal forest land, the incentive to plant commercial trees, such as cinnamon, is very high because this is a way to obtain more secure land rights.

Acknowledgments

We used data from a land and tree tenure survey conducted by ICRAF and Jambi University, with financial support from the International Food Policy Research Institute, the government of Japan, and the Overseas Development Administration. We also acknowledge the excellent work of our field assistants, Noviana Khususiyah, David Varianto, Idris Sardi, A Khoiri, and Delfi Andra.

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