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The Role of Land Tenure in Improving Sustainable Land Management and the Environment in a Forest Zone in Lampung-Sumatra

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ABSTRACT

This study reveals that clear land ownership and community involvement in managing forests are key determinants in having a better environment and sustainable land management. It demonstrates the failure of past forest policy and management, when the local communities are not involved and military force is used to conserve the forest. In contrast, with less government involvement but more secure land rights (as perceived by farmers), local communities have successfully rehabilitated degraded land located in state forestland, thereby creating a better environment with local and global benefits. The main incentive for local communities to manage land more sustainably is the expectation of secure land rights in state forestland through which livelihood and income are realized. This study found that in fact there is room for negotiation between the forestry department and the local community in managing state forest land and that this could not only generate income for local community but would also improve the environment. This study also argues that legal land rights for local communities in state forestland may be used as a reward for poor upland farmers for environmental services that they provide.

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Background

One setting for forest and land fire problems in Sumatra is repeated fire that occurs in state forestland (protection forest) resulting in conflict between local people and the Forestry Department over tenure and use rights (Suyanto *et.al*, 2000). If this tenure problem is not addressed, it will continue to result in unwanted fires in many parts of Indonesia resulting in negative impacts on the forest environment and the generation of large amounts of emissions and economic losses. For instance, the economic costs of the 1997/1998 fires in Indonesia have been estimated to exceed 9 billion USD with carbon emissions high enough to elevate Indonesia to the position of one of the largest polluters in the world (ADB and BAPPENAS, 1999; Barber and Schweithelm, 2000).

This study argues that the strengthening of land tenure and use rights is a prerequisite for farmers to adopt better land use management. Feder and Noronha (1987) and Feder and Feeny (1993) strongly argue for the efficiency of secure private ownership in providing appropriate incentives to invest in land improvement. Even where the tenure is not a legal right (government title), but an informal right, which is respected by community members, it is already adequate for farmers to adopt better land use management².

This paper outlines a case study in a protection area (Register 39) in Lampung Province, Southern Sumatra, Indonesia, where repeated wild fire has been reduced recently. Figure 1 shows burn scar patterns in 1994, 1997 and 2000. The burn scar pattern in 1994 is similar to the burn scars in 1997 that is very large burn and unity. A previous study (Suyanto, *et.al*, 2000) found that the large burn scars in 1994 and 1997, and probably in earlier years resulted from tenure conflicts, and related revenge burning by the villagers, the area has become unproductive grassland (*imperata cylindrical*) and very prone to annual fires. Since 1975, villagers who live around this area have planted coffee. However, in 1983, 1991, 1993 and 1996, the Forestry Department implemented a reforestation programme by cutting down all of the coffee trees and planting Caliantra (*Sesbania glandiflora*). The government also resettled people in the transmigration areas in the east of Lampung (*Mesuji*). It seems that the

² See Suyanto and Otsuka (2001) who provide statistical analysis of determinants of land tenure (informal) on development of agroforestry in the customary land tenure areas of Sumatra.

reforestation programme was not successful, as is indicated by repeated fire during that period and *imperata* becoming the major land cover. The burn scar pattern in 2000, however, was extremely different, that is small and widely scattered. This indicates controlled fire associated with stable agriculture practiced by smallholders. The change of land management is influenced by stronger informal tenure on land that has been claimed by farmers in the protection forest since the *reformasi* era in Indonesia (mid-1998).

The objective of the study is to investigate how wild fire can be transformed to controlled fire, focusing on the role of strengthening land tenure and adopting more sustainable land use practices. This study also explores the willingness of farmers to participate in community forestry development.

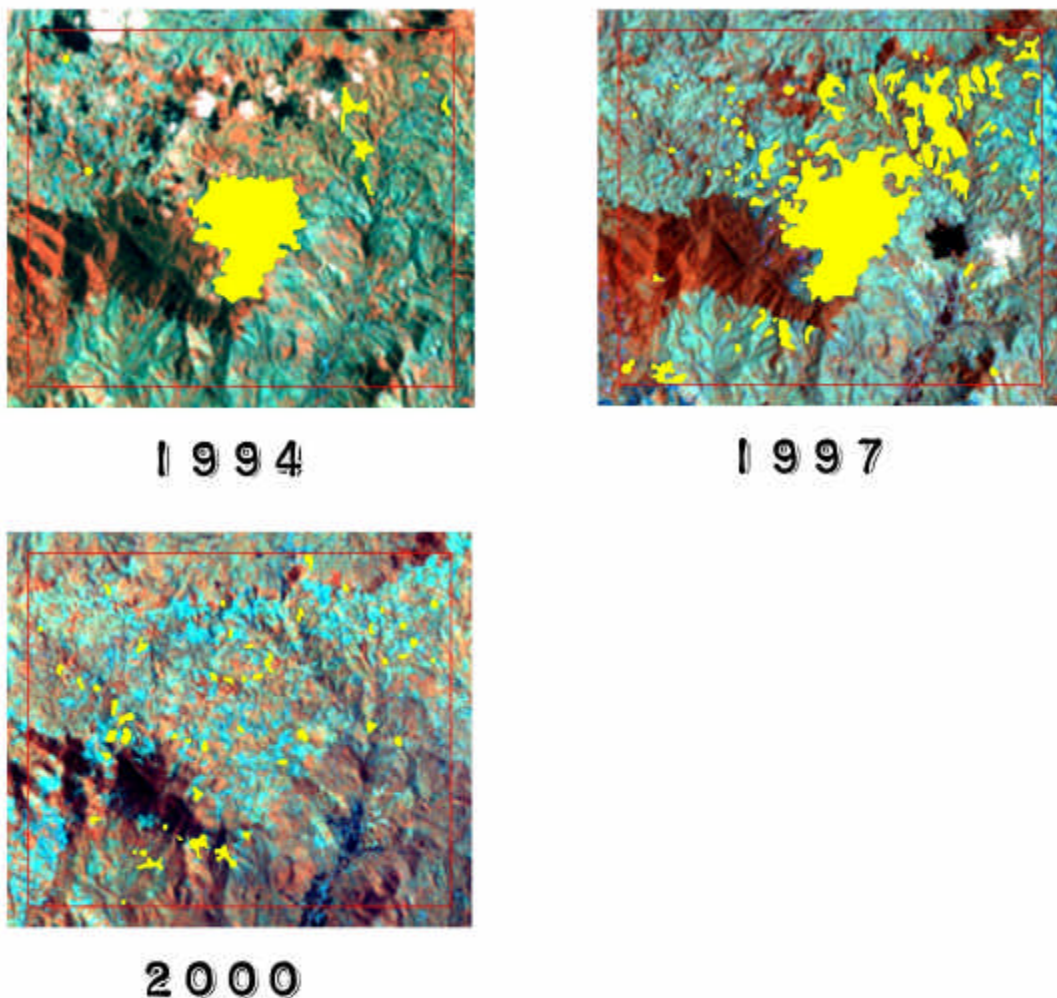


Figure 1. Burn scar pattern (indicated by yellow colour) at the study site.

Method

The method of data collection was divided into two phases. In the first phase, we did a census of all households that claimed the land at the Trimulyo site. Using Rural Rapid Appraisal, we collected information on demography and migration patterns. The results from the household census were used as sampling frames for an intensive household survey in the second phase. We stratified the sampling into two categories: previous (older) migrants (defined as households who came to this site before 1998) and recent migrants (defined as households who came to the site between 1998 and 2001). We conducted a random sample survey of forty households in each of the categories, previous (older) migrants and recent migrants. Both the extensive and intensive survey was conducted in 2001.

Site Description

The study site is called Trimulyo and is located in the protection forest (Register 39) in Lampung Province, Sumatra (See Figure 2). The area is located in two administrative districts: West Lampung and Tanggamus. The size of the area is approximately 3,130 ha. The topography is mountainous with an average elevation of between 800 and 1,200 meters. Natural mountain forest still occurs in small parts of the site but the dominant land cover is young coffee plantations, covering almost 75 % of the site (See Figure 3). Before 1998, almost all land cover in this site was shrub and *imperata*. Since 1998, however, farmers have actively rehabilitated the land by planting coffee.

The study focuses on a farmer's organization called *Tribuana* and consists of 11 sub farmers groups. The farmer's group was established to meet the requirement for getting land rights under the community forestry program (HKM).

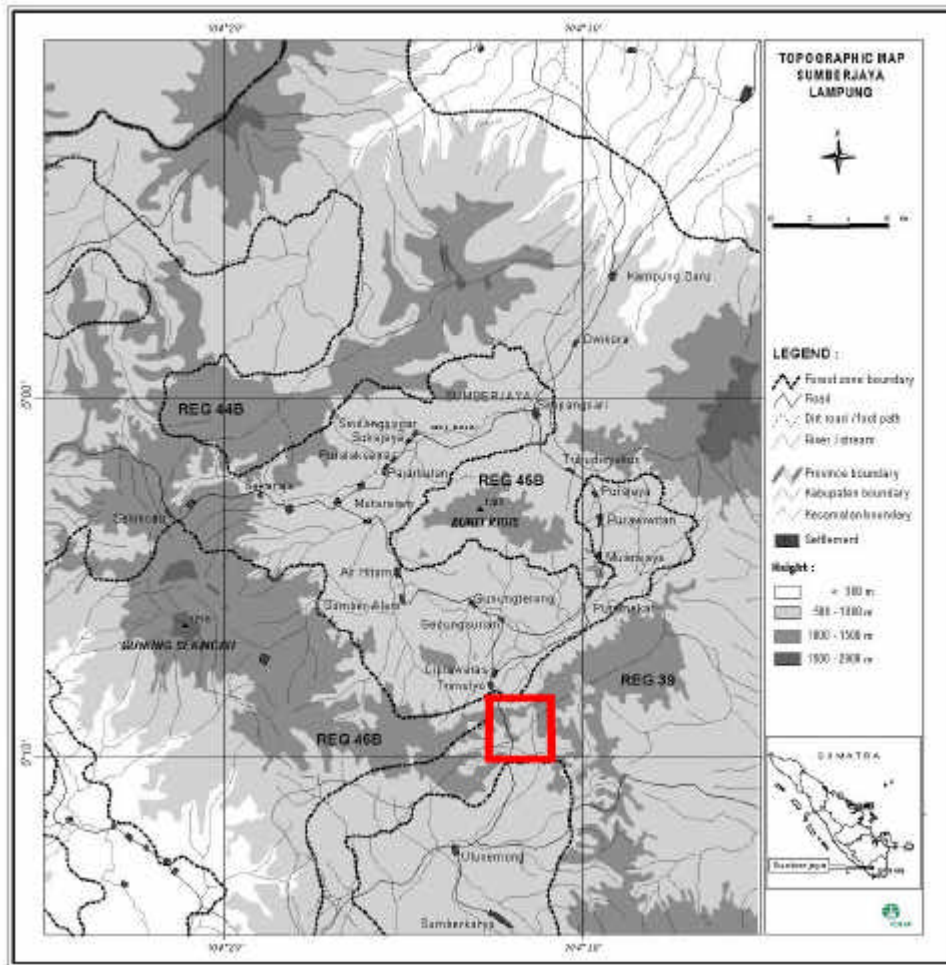


Figure 2. Location of study site (Red Box)



Figure 3. Landscape area of study site. Young coffee plantations and shrubs dominate this area, only a small part is covered by natural forest.

Demographic patterns

Demographic trends in our study site heavily influenced by migration from Java and other Javanese communities from established settlements in Lampung. Extensive survey results show 458 households have claimed and cultivate land in this protection forest area. About 55% of the total households at this site are recent migrants and 45% are previous/older migrants (Table 1). They arrived when pioneers, who were family or friends, showed that they were successful in growing coffee. This indicated a high population pressure and encroachment problem in the protection forest area in this site. Table 1 also shows migration patterns that indicate place of origin. The majority of previous migrants (99%) who claimed the land in our study site are people who live in the villages surrounding the forest zone. In contrast, the recent migrants mostly came directly from Java (58%) and from other parts of Lampung Province. This indicates that Lampung Province is a very attractive area for migrants. According to RePPPProt (1988), 50% of the migrants who have gone to Sumatra since the beginning of the 20th century have settled in Lampung. As the population increased, forest cover in Lampung declined. A World Bank report (2001) stated that forest cover in Lampung decreased from 647,800 ha in 1985 (RePPPProt) to 361,319 ha in 1997 (MoFEC) or was reduced by 45 %.

Table 1. Percentages of households by origin place

Type of respondents	n	Villages around Protection Forest (Forest Zone)	Outside Forest Zone		
			Lampung Province	Outside Lampung Province in Sumatra Island	Java
Previous (older) Migrants	206 (45 %)	99	0.5	0	0.5
Recent Migrants	252 (55 %)	0	35	7	58
Total	458 (100 %)	45	19	4	32

The history of migration at this site began when Semendo people from South Sumatra started migrating in 1876. Between 1920-1930 the Semendo, again, established many settlements in West Lampung (Sevin, 1989). It was common for the Semendo people to open the forest using slash-and-burn practices under the shifting cultivation system in establishing coffee plantations.

In 1951, the special transmigration program for veterans was implemented under the Soekarno government. Since then, the population of Javanese migrants has increased sharply over the population of Semendo people. The Javanese migrants came via a transmigration program (government program) and spontaneous migration to open and settle new areas in Lampung Province. Recently, at our study site, the Javanese have become the majority ethnic group and account for 94% of the total households.

The intensive household survey found that most respondents have a low level of education, about 71% of total respondents obtained less than or equal to 6 years of schooling. The education level of recent migrants is lower than previous migrants (See Table 2). The age of household heads, among recent migrants, is younger than that of previous migrants. 50% of recent migrants are aged below 30 years, while 60% of previous migrants are aged over 40 years (See Table 3). This indicates that migration occurred when the migrants were young.

Table 2. Percentage of households by years of schooling.

Type of respondents	n	Years of schooling (%)	
		<=6 year	>6 year
Previous (older) Migrants	40	63	37
Recent Migrants	40	80	20
Total	80	71	29

Table 3. Percentage of households by age of household head.

Type of respondents	n	Age of household head (%)			
		< 30 year	30 - 39 year	40 - 49 year	>= 50 year
Previous (older) Migrants	40	12	28	40	20
Recent Migrants	40	50	20	23	7
Total	80	31	24	31	14

Characteristics of Land Holding and Land Use Change

Our survey of 80 households revealed that the average land holding of previous migrants (2.53 ha) is higher than that of recent migrants (1.84 ha). The dependence of recent migrants on the land in the protection forest, however, is very high, as is

indicated by the fact that 95% of land holding is located in the protection forest. While the previous migrants have 68% of land holdings located in the protection forest (See Table 4). Coffee plantations are the most important land use at our study site. Coffee plantations account for 89% of total land holdings for previous migrants and 65% for recent migrants. The remaining proportion of land holdings are made up of bush/*imperata*. All bush/*imperata* lands are located inside the protection forest. A larger area of bush fallows/*imperata* land is owned by recent migrants because they have limited capital and labour to establish coffee plantations in the area that they have claimed. Since most of recent migrants are poor, they need to fulfil their basic needs and to earn money for establishing coffee gardens; they work as labourers in coffee gardens owned by previous migrants.

Table 4. Average land holding by land use, type of respondents and location.

Type of respondents	n	Coffee		Bush/ <i>Imperata</i> land		Total	
		Ha	%	Ha	%	Ha	%
Previous (older) Migrants	40	2.24	100	0.29	100	2.53	100
Inside Protection Forest		1.42	63	0.29	100	1.71	68
Outside Protection Forest		0.82	37	0	0	0.82	32
Recent Migrants	40	1.2	100	0.64	100	1.84	100
Inside Protection Forest		1.11	93	0.64	100	1.75	95
Outside Protection Forest		0.09	7	0	0	0.09	5

Forest encroachment or claims on protection forestland has increased since 1998, along with the *Reformasi* area where government control of protection forest is weaker. The economic crisis in 1998 also drove the government to announce a policy allowing farmers to use uncultivated land. Farmers thought that they could cultivate land in the protection forest since most of the forest area was not actually forested anymore, and was covered by *imperata* and bush. As a result, land claims by farmers in this study area have increased. Table 5 shows the distribution of plot holdings by type of respondent and year of acquisition. Land acquisition inside the protection forest has mostly been recent. 74% of the plots owned by previous migrants, inside the protection forest, and 96% of those owned by recent migrants were obtained from 1998 to 2001. On the other hand, most of land obtained outside the protection forest was claimed in the 1980's and from 1990 to 1997.

Table 5. Number of coffee gardens (%) by year of acquisition

Type of respondents	n	Year of acquisition						
		1970's	1980's	1990-1997	1998	1999	2000	2001
Previous (older) Migrants	97	4	18	25	22	19	10	2
Inside Protection Forest	60	3	0	22	30	28	13	3
Outside Protection Forest	37	5	47	32	8	3	5	0
Recent Migrants	48	0	0	4	19	54	21	2
Inside Protection Forest	45	0	0	4	20	56	20	0
Outside Protection Forest	3	0	0	0	0	33	33	33

Table 6 shows land use before acquisition of coffee gardens. Most land use before acquisition inside the protection forest was bush/*imperata* land and burned coffee gardens. Primary and secondary forests account for less than 4%. This suggests, in fact that the pattern of land use change moved to relatively more sustainable land use as indicated by rehabilitation of bush/*imperata* grass land and burned coffee gardens. This resulted in a reduction of the repeated wild fire, which has had positive impacts on the environment (See Figure 1). If we refer to the forest classification (legal basis), however, although farmers have rehabilitated the degraded forestland or bush/*imperata* grassland in the protection forest, this activity is classified as forest encroachment and has negative impacts on the environment.

Table 6. Land used for coffee gardens before acquisition

Type of respondents	n	Land used for coffee gardens before acquisition (%)				
		Coffee garden	Bush fallow	Burn coffee garden	Primary forest	Secondary Forest
Previous (older) Migrants	97	47	26	25	1	1
Inside Protection Forest	60	33	28	35	2	2
Outside Protection Forest	37	70	22	8	0	0
Recent Migrants	48	10	67	23	0	0
Inside Protection Forest	45	4	71	25	0	0
Outside Protection Forest	3	100	0	0	0	0

Strengthening of informal land tenure and farmer's perceptions in adopting more sustainable land management

One main explanation for why repeated wild fire in the protection forest has changed to controlled fire (See Figure 1) is the increase in the strength of informal land tenure in the period after 1998 (*Reformasi era*). To measure the strength of informal land tenure, we asked two questions as indicators: (1) What was the farmers reaction if the government stopped their farming activities in the protection forest area before and after *reformasi* era; and (2) We asked farmers to make their assessment of land value obtained in the protection forest if the land value of private land (located outside protection forest was 100%).

Table 7 shows the results of the first measurement. Both previous migrants and recent migrants fully accepted, or accepted with compensation determined by the government, the governments desire to stop farming activities in the protection forest areas before the *reformasi* era. This indicates that the strength of informal land tenure by farmers was low during that period. The government's control and power over the protection forest was very high. As demonstrated in 1983, 1991, 1993 and 1996, the Forestry Department stopped farming activities in this protection forest and implemented a reforestation programme by cutting down all of the coffee trees and planting Caliantra (*Sesbania glandiflora*). The government also resettled people in the transmigration areas in east Lampung (*Mesuji*). Although the government succeeded in removing people from the protection forest, the reforestation program failed due to weak incentives, for the local community who live in forest zone, to preserve the protection forest. In contrast, most of the respondents, both previous and recent migrants, stated that after the *reformasi* era they would only accept the government's decision to stop farming activities in the protection forest area with compensation determined by farmers or by negotiation between farmers and the government. These answers indicate that the strength of informal land tenure by farmers is high, as is show by the higher influence on farmer's decisions in determining compensation.

Table 8 shows a qualitative measurement of the strength of land ownership in the protection forest area based on farmer's assessments compared to private land. The

land value of land obtained in the protection forest is quite high. 67% of previous migrants and 57% of recent migrants valued their land at between 50-75%. Moreover, 28% of previous migrants and 48% of recent migrants valued their land at more than 75%. The total average value for all respondents is 70%. This means that the uncertainty of land tenure in the protection forest at our study site is 30%.

Table 7. Farmer's reaction if government want to close the farmer's activities in the protection forest

Farmer's reactions	Previous (old) migrants (%)		Recent migrants (%)	
	At present	Before Reformasi	At present	Before Reformasi
Fully Accepted	5	95	0	100
Accepted with compensation determined by government	0	5	5	0
Accepted with compensation determined by farmers	13	0	50	0
Accepted with compensation determined by negotiation between farmers and government	72	0	45	0
Rejected	10	0	0	0
Number of sample	40	40	40	40

Table 8. Qualitative measurement of strengthening of land ownership in the protection forest

Type of farmers	Number of sample	Level of strengthening of land ownership (%)		
		< 50%	50 - 75%	> 75%
Previous (old) migrants	40	5	67	28
Recent migrants	40	5	57	38
Total	80	5	62	33

Based on the two indicators above, we can conclude that the strength of land tenure in the protection forest areas is increasing and is quite high. This result should alert the government to change their policy in managing protection forest from relocating people from the forest zone (sometimes with military power) to working more in partnership with communities. One promising approach is community forestry (*HKM*), in which communities who live around forests are treated as partners in

protecting and managing the sustainability of forest. On going research on conflict management in the state forest land of West Lampung district has been developed and implemented for a year by ICRAF. Conflict among stakeholders needs negotiation. ICRAF argue that the negotiation support model for conflict management needs to be supported by integrated research and development, including research on biophysical, socio-economic, institutional and policy aspects (Pasya, 2001). To facilitate the negotiation support system, research and development organizations need to help in developing the tools as a predictive system, as well as in the process of stakeholder consultations and negotiation, acknowledging the existing inequities in access to resources and information, wealth, political power, and social status (van Noordwijk *et.al*, 2001).

In our survey, we also asked farmer's opinions on the possibility of implementing community forestry development and negotiation support systems of conflict management at our study site. 86% of all respondents (both previous and recent migrants) said they would accept if the government gave them only the right to use the protection forestland while government still own that land. In fact the majority of farmers realize that land in protection forest is state land. Then we asked the farmers about three requirements in managing the land in order to get the right of state forestland: (1). Plant multistrata tree system; (2). Use conservation techniques: and (3). Conserve the remaining natural forest. The results are shown in Table 9. All respondents accept the adoption of the multistrata tree system, but they would prefer to adopt a multistrata coffee system

Table 9. Farmer's acceptance of the requirements to get the rights to state forestland

Type of respondents	Number of sample	Sustainable land management indicators		
		Planting trees (Multistrata)	Using conservation technique	Conserve remain natural forest
Previous (older) Migrants	40	100	77	97
Recent Migrants	40	100	95	90
Total	80	100	86	94

The use of conservation techniques refers to three techniques: ridging, use of sediment pits and strip weeding. Using the universal soil loss equation prediction (USLE)

based on 2 year old monoculture coffee for land with 15-75% slope and 40-100 m slope length, Agus (2000) found that those techniques could reduce soil erosion as much 50 % or more compared to open fields, without conservation techniques.

The farmer's acceptance of conservation techniques as a requirement to obtain land rights is slightly lower than the acceptance of multistrata. 95% of recent migrants agreed to use conservation techniques and only 77% of previous migrants accept it.

The last requirement is the willingness to conserve remaining natural forest. Most respondents (94%) agree to conserve remaining natural forest as a requirement in obtaining land rights. The community's involvement in forest conservation is very important. As has been shown in many cases, the failure of forest conservation projects has often been due to weak partnerships with local communities.

Land Management Practiced

The management of coffee gardens in our study site is relatively more sustainable as indicated by high adoption of coffee multistrata (coffee agroforestry system). We classified the management of coffee gardens into three strata: (1) Coffee monoculture; (2) Coffee with shade³, and (3) Coffee multistrata (coffee agroforestry)⁴. 88 to 89% of coffee garden plots inside the protection forest and 100% of coffee gardens outside the protection forest are planted under the multistrata system (Table 10). This suggests that the strength of land tenure inside the protection forest is as high as the strength of land tenure on private land, and offers enough incentive for farmers to establish multistrata coffee systems.

Table 11 shows the most popular intercrop trees. Among the plots located inside the protection forest, Gamal (*Gliricidia sepium*) is the most popular tree shading (90%), followed by Avocado (*Persea Americana*), Pepper (*Piper nigrum*), Jack Fruit (*Artocarpus heterophyllus*) and Kemiri (*Aleurites moluccana*). Similarly, Gamal (*Gliricidia sepium*) is also the most common tree planted in the plots outside the protection forest (98%), followed by Pepper (*Piper nigrum*), Jackfruit (*Artocarpus*

³ Coffee with shade refers to the intercropping of coffee with shading trees that have no direct economic benefit such as Gamal, Dadap, and Lamtoro.

⁴ Coffee multistrata refers to the intercropping of coffee with shading trees and others trees that have direct economic benefit.

heterophyllus), dadap (*Erythrina subumbrans*), randu (*Ceiba pentandra*) and avocado (*Persea Americana*).

Gamal (*Gliricidia sepium*) is commonly planted as a creeping tree for growing pepper (*Piper nigrum*). As an intercrop, pepper is one of the favourite commercial trees in Lampung and it is also planted as a strategy in distributing risk, especially when the price of coffee falls.

Unlike the adoption of multistrata coffee systems, the use of conservation techniques both by previous migrants and recent migrants is low (See Table 12). The adoption of strip weeding is also very low, only 3% of previous migrants and 11% of recent migrants adopted it. In contrast, 88 to 97% of respondents use clean weeding. There is a popular belief among the farmers that the cleaner the plot the better it is for coffee growing. They argue that cleaner weeding will reduce competition to absorb soil nutrients. This fact is very important in the dissemination of research results that show strip weeding has a lower cost and does not significantly reduce the yield.⁵

Table 10. Distribution of plots by type of coffee garden

Type of respondents	Number of plots	Management of coffee garden		
		Coffee Monoculture	Coffee with shade	Coffee Multistrata (agroforestry)
Previous (older) Migrants	97	4	3	93
Inside Protection Forest	60	7	5	88
Outside Protection Forest	37	0	0	100
Recent Migrants	48	0	10	90
Inside Protection Forest	45	0	11	89
Outside Protection Forest	3	0	0	100

⁵ Results from experimental research by ICRAF on jungle rubber systems in Jambi and West Kalimantan (Boutin, 2000; and Wibawa, 2000).

Table 11. Distribution of plots planted with others trees intercropped with coffee

No	Local Name	Scientific name	Inside Protection Forest		Outside Protection Forest	
			Number of plots	Percentage of plots	Number of plots	Percentage of plots
1	Gamal/Ki Hujan	<i>Gliricidia sepium</i>	95	90	39	98
2	Pepper	<i>Piper nigrum</i>	63	60	39	98
3	Jackfruit	<i>Artocarpus heterophyllus</i>	62	59	35	88
4	Dadap	<i>Erythrina subumbrans</i>	63	60	33	83
5	Alpukat	<i>Persea Americana</i>	69	66	27	68
6	Randu	<i>Ceiba pentandra</i>	50	48	28	70
7	Kemiri	<i>Aleurites moluccana</i>	52	50	10	25
8	Petai	<i>Parkia speciosa</i>	18	17	16	40
9	Cengkeh	<i>Eugenia aromatica</i>	20	19	8	20
10	Mango	<i>Mangifera spp.</i>	19	18	9	23

Table 12. Percentage of coffee garden plots farmed with conservation techniques

Type of respondents	Number of plot	Conservation technique		
		Ridging	Sediment pit	Strip weeding
Previous (older) Migrants	97	27	8	3
Inside Protection Forest	60	18	9	3
Outside Protection Forest	37	41	8	3
Recent Migrants	48	25	25	11
Inside Protection Forest	45	20	27	11
Outside Protection Forest	3	100	0	0

Community based fire management system

The burn scar pattern in 2000 (See Figure 1), which was small and scattered, indicates that the community based fire management system is working well in our study site. Community-based fire management is defined in the paper as the conscious use of fire to meet a specific objective. From the perspective of a community, or an individual, the objective could be the maintenance of livelihood (Suyanto, *et.al*, 2001). For

example in this case study, this may involve clearing forest or bush/*imperata* to plant coffee, or to secure rights to the land.

Among the respondents who obtained coffee gardens from bush-fallow or *imperata* or forest, the use of fire as a tool in land clearing was very high. 91% of recent migrants and 89% of previous migrants use fire for the establishment of coffee gardens. Indonesian farmers have traditionally used fire to clear land for a very long time. The major reason for using fire in land clearing is the fact that fire is very cheap, simple and effective to apply (See Figure 3). Both previous migrants (67%) and recent migrants (64%) stated that this was the major reason. Farmers (18% of recent migrants and 12% of previous migrants) believe that use of fire in land preparation will provide a layer of ash (fertilizer). Another important reason is accessibility to the field. 15% of previous migrants and 9% of recent migrants stated that accessibility to the field is the main reason of using fire. A few farmers also stated that using fire would reduce problems with pests and diseases and reduce problems with weeds. This finding is similar to the research results reported by Ketterings et.al (1999) who investigated the reasons for using fire in land clearing by rubber farmers in Jambi Province, Indonesia.

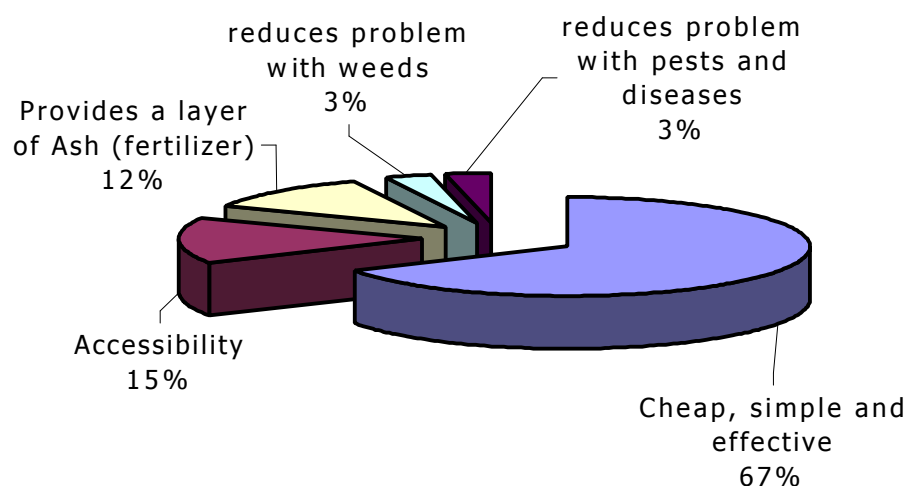


Figure 3. Reasons why Previous (older) Migrant respondents use fire as a Land Clearing Method

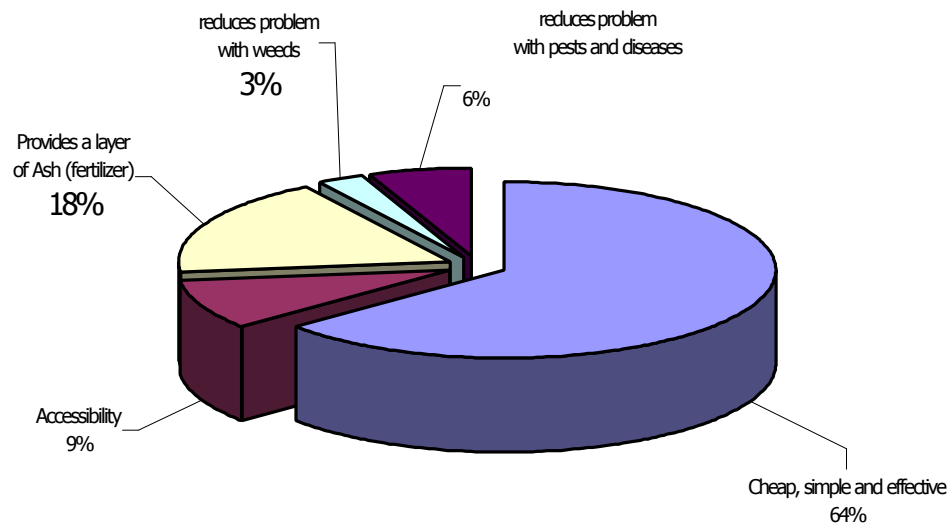


Figure 4. Reasons why Recent Migrants respondents use fire as a Land Clearing Method

The use of fire for land clearing is arranged under the rules that exist in the community, as is shown by the fact that 97% of total respondents stated that there are rules in using fire for land clearing. The most common rule is that farmers are required to make firebreaks if they use fire for land preparation (See Table 13). Other important rules are that the farmer must burn wood residue in the middle of the field, consider the direction of the wind, burn at noon and consider the steepness of the field. Those technical rules have been implemented along with social/institutional rules, in which farmers are required to make an announcement in their neighbourhood or work together with their neighbours to guard against the fire escaping.

Table 13. Community rules in using fire

Type of respondents	n	Fire break	Burn the wood residue in the middle of field	Consider the direction of the wind	Burn at noon	Consider the field steepness
Previous (older) Migrants	40	79	15	3	0	3
Recent Migrants	40	77	7	8	5	3
Total	80	78	11	6	2	3

Those rules encourage farmers to be very careful in using fire. Besides that, a sanction system is also applied if fire is out control and destroys other farmer's fields. 95 to 97% of respondents said that there are sanctions to cover fire spreading and

destroying a neighbour's field (Table 14). The sanctions however, were not rigid and were not strictly enforced. The amount of compensation can be discussed and negotiated amongst farmers. The compensation could be money, labour or seed.

Table 14. Percentage of farmer's perception about sanctions if fire spreads

Type of respondents	n	Sanction	
		There is a sanction	No sanction
Previous (older) Migrants	40	95	5
Recent Migrants	40	97	3
Total	80	97	3

Almost all farmers are willing to help if there is fire in a farmer's field. This is mostly because of their social relationships and to avoid fire spreading to their own fields (Table 15). The study found that the willingness of farmers to fight fire in forest areas is also high. This shows that farmers have a high affinity towards the forest.

Table 15. Percentage of farmers who are willing to help if there is a fire

Type of respondents	n	Willingness to help if there is a fire at	
		Farmer's Fields	Forest land
Previous (older) Migrants	40	97	87
Recent Migrants	40	100	82
Total	80	99	85

Most farmers (82%) at our study site have knowledge of other clearance techniques (zero burning) than using fire. The main zero burning technique is use of herbicide, since much of the area in our study site is covered by *imperata*. The implementation of zero burning, however, is very low. Only 10% of farmers had ever experienced using zero burning.

Because of the advantages of using fire in land clearing, according to farmers, most farmers (84%) will refuse to comply if the government bans the use of fire in land clearing by smallholders (Table 16). 80% of farmers believe that there are no negative impacts in using fire. The results of community fire management may not always be negative, but this also depends on whose perspective is adopted to judge the outcomes. Environmental changes that have global impacts but not local ones are unlikely to be recognized as relevant by communities.

Table 16. Farmer's response if government bans the use of fire

Type of respondents	n	If the government applies the Zero burning policy	
		Agree (%)	Not agree (%)
Previous (older) Migrants	40	18	82
Recent Migrants	40	15	85
Total	80	16	84

Policy Implications

The setting of this study site, where forest cover in protection forest has been degraded, is representative of forestry problems in many regions of Indonesia. Therefore, the lessons from this study can be also used anywhere that has a similar setting. The first lesson is that policy on improving sustainable land management and the environment in forest zones needs to be changed from a forced approach to a partnership approach involving local communities in managing forests. This study demonstrates the failure of past forest policy and management, when the local community was not involved and military force was used to conserve the forest. In contrast, with less government involvement but more secure land rights (as perceived by farmers), local communities have successfully rehabilitated the degraded land located in state forestland, thereby creating a better environment with local and global benefits.

The second lesson is that secure land tenure is a key determinant in improving sustainable land management and the environment in forest zones. The main incentive for local communities to manage land more sustainably is the expectation of secure land rights on state forestland, through which livelihood and incomes are realized. If the current condition of the forest is degraded, it is more advantageous, in economic and environmental terms, to allow local communities manage or to rehabilitate the degraded forestland. Community forestry policy (*Hutan kemasyarakatan or HKM*) may be considered as a vehicle in giving more secure land rights to local communities.

If local communities are successful in managing the land more sustainably, it results in a better environment that benefits global society. Most local communities who

provide environmental services are poor people and, in fairness, those people need to obtain compensation or rewards. In this case study we have seen how securing land tenure may be used as a reward for poor upland farmers.

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