

Forest Management and Local People – Illegal Logging, People’s Control and Sustainability, a Case Study at West Java, Indonesia

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Introduction

Deforestation is a serious occurrence in Indonesia. Illegal logging and smuggling have prevailed especially after the economic crisis although reform policies were implemented such as decentralization policies promoted by Act No. 22 on Local Administration, and principle of community involvement in forest management and assurance of transparency in the process of concession insurance stipulated by Act No. 41 of 1999 on Forestry. The failure of sustainable forest management has been the cause of these rampant deforestation and illegal logging (Kato 2005).

These failures of sustainable forest management have been partly brought about by institutional confusion arising in the transition period to new system of governmental decentralization and community involvement in the forest management (Casson 2001, Kartodihardjo 2002). Illegal logging by strong man of local politics and military involvement are common phenomena in Kalimantan (Morishita 2005). This phenomenon is the product of weak law enforcement that was apparent after economic crisis in 1998 (Dudley 2002).

Although the performance of the reform policies has been poor in recent years, the systems of forest management cannot retreat to the centralized and state dominated system which had no or minimal involvement of community in the forest management under the Soeharto regime. Of course there has been important paradigm change from state centered forest management to community based forest management (Nugraha 2005:294).

Here the problem is how communities are involved in the forest management, how the collaborative relations are established between the communities and the state, and how commons are governed by local people? The answers to these can be approached with this question: how can institution concerned with sustainable forest

management be established?

This paper attempts to analyze the case of state forest management in which local people are involved under the social forestry program. Illegal logging was rampant especially after the economic crisis in 1997/8, and conflicts between the state (here National Forestry Corporation-PERHUTANI-) and local people continue until now. Can stakeholders establish institutions that can adjust the interests of the people, the local Government, and National Forest Company? What are real rule both informal and formal, that are recognized by the people and state? What are the stakeholders' strategies that would stabilize and reproduce the institutions? What are the conditions that lead to collaborative and sustainable strategies?

This study attempts to analyze the people's actions from the viewpoint of governing commons because the involvement of local inhabitants in the social forestry program although the state and the National Forestry Corporation control the forest. People can overexploit the forest in an unsustainable way, with illegal logging if they think of short-term interests only, and law enforcement is weak.

On the conditions of governing commons, Ostrom designed principles illustrated by long-enduring Common Pool Resources institutions. She cited seven principles; such as clearly defined boundaries, congruence between appropriation and provision rules and local conditions, and so on (Ostrom 1990: 90). She developed the design of principles by answering the question how a set of principals, faced with a collective-action problem, can solve (1) the problem of supplying a new set of institutions, (2) the problem of making credible commitments, (3) the problem of mutual monitoring (Ostrom 1990:42). These three problems are somewhat similar to the problem of leadership, participation and social control (Mizuno 2001). This study uses these principals relating to the conditions of governing commons.

Chapter 1 describes the research site and system of forest cultivation. Chapter 2 shows the chronology of the social conflicts. Chapter 3 discusses the strategies, and the formal and informal rules. Chapter 4 will discuss on the collaborative and sustainable strategies, and the implications for governing the commons. Chapter 5 will conclude the paper.

Chapter 1. Research site

(1) General picture and Agriculture at Research Village¹

The topographic character of Research Village, which is located in the District of Cianjur, Bojongpicung Sub-district, is that of a hilly and mountainous area. It is part of the Priangan Highlands. The distance that separates it from the center of the Sub-district is about 7 km, and village people must cross over a mountainous pass to get there.

This mountain constitutes a natural barrier for the people outside the village, so migration inflows into the village are small. The population density of 174 persons/km² in the village (including the land controlled by the National Forestry Corporation - Perum Perhutani) or 297 persons/km² (excluding the area controlled by the National Forestry Corporation) in 2001 is relatively small compared to the average population density of 1009 persons/km² in West Java in 2000 (BPS, 2001). The population was 4,384 persons in 2001, whereas the area of the village is 2518.63 hectares. Of that area, 1040.6 ha are covered by forests controlled by the National Forestry Corporation, 878.6 ha are earmarked for highland agriculture and forestry. Rice fields are relatively small, with just 83 ha [Desa Kemang 2001]. In the area controlled by the National Forestry Corporation, social forestry programs have been implemented since 1985, and local people have been able to take part in maintenance and cultivation. In 1996, the National Forestry Corporation integrated the "Forest Village Society Program" (Program Masyarakat Desa Hutan PMDH) and the "Social Forestry Program" (Perhutanan Sosial) into the "Integrated Forest Village Society Program" (Program Masyarakat Desa Hutan Terpadu: PMDHT). Research village was made a model village of PMDHT [Inoue et al. 2000]. The area of the National Forestry Corporation is not maintained and cultivated by the local people of Research Village only. Naturally, it is controlled by the company. Therefore, private highland areas are more important for the villagers' economy.

¹ This chapter is mainly based on Mizuno et al. 2003

In any event, the private highland fields, the forest area and the National Forestry Corporation's area that shape the slopes of the mountains and hills, and wet rice fields that cover the lowlands are the major agricultural areas of the people in the village under survey. Many of the plants in the highlands and the National Forestry Corporation area are subsistence-oriented, but some plants there are highly commercialized. The most important plant in the National Forestry Corporation's area is teak; in the private highland areas, it is banana trees for selling banana leaf, which have been spreading since the second half of the nineties, palm sugar (*Arenna pinnata sp.*), and chilly.

Apart from these agricultural and forestry activities, there are other non-agricultural activities including furniture manufacturing, rice milling, timber trading, grocery stores, the trade of banana leaves, and – also important – is the supply of migrant workers, especially international migrants who work in Saudi Arabia.

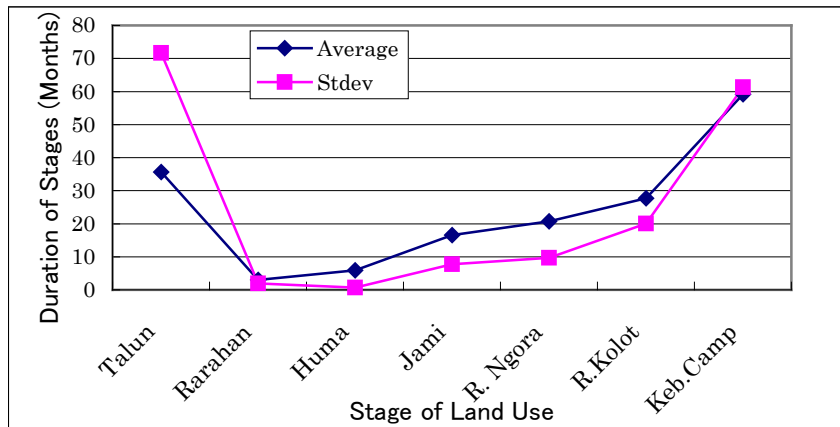
The village consists of 22 hamlets that form part of three sub-villages (*Dusun*). Dusun I, Dusun II and Dusun III have seven, five and ten hamlets respectively. The village lies at an altitude of between 400-800 meters above sea level, and the topography ranges from gently sloping to steep hilly terrain. (Sugiah et al, 2002). Access to the nearest town is not easy. The road providing access to the nearest town was built in 1990s. Before that time, people had to walk to get there.

National forest cooperation assisted some villagers to set up a cooperative in 1997. The cooperation gave some fund under the program of PMDHT for the cooperatives that would succeed to diffuse planting banana trees for banana leaves among the villages. At the end of 1990's and the beginning of 2000's, planting banana tree for selling banana leaves increased rapidly among the villagers, and really felt as a explosion of banana tree for selling banana leaves planting in the surveyed village both at privately owned slop of hills and at the land of National Forest Corporation. People joining social forestry also plant banana trees for selling banana leaves.

(2) Up-land agriculture in Research Village.

People use the slop of mountain and hill as up-land agriculture and forestry. The land use system is quite complicated; however we can find a typical type of land use.

Chart 1. Average duration of up-land farming stage and its stand. Deviation



(Source: Field Survey)

Typically people plant dry rice (*pare huma*) during October and December and will harvest after 6 months. This stage is called *Huma*. Before they plant dry rice, they slash and burn the land. Land that is not cultivated although there are a lot of productive permanent tree is called *Talun*.² This land called *Talun* is slashed and burned so that dry rice can be planted. After slash and burn, the land is prepared for planting dry-rice, for example making pillows in order to avoid soil erosion. Trees for avoiding erosion such as *Caliandra* are planted in this stage. This stage is called *Rarahan*. We can think that once there is huma stage, *Rarahan* stage is necessary to be passed, and last about 2 – 5 months.

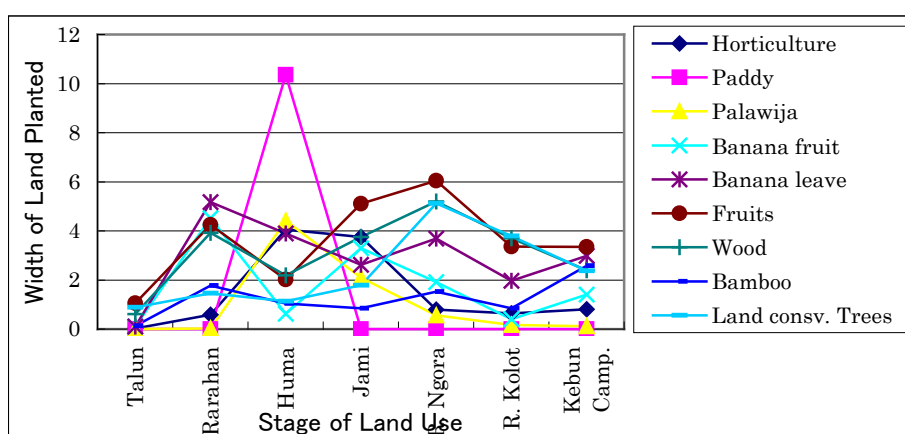
Chart 1 shows the average length of period for each stage of land use, and its standard deviation. This chart is based on the personal interviews with respondents. Respondents answered on the land use system for each plot they used. According Chart 1, average period of land use for *Rarahan* is 3.04 months and standard deviation is 1.9 months.

² For explanation on *Talun* in West Java, see (Tony et al. 1996)

After the harvest of dry rice, people tend to plant secondary crop (*Palawija*, and recently banana trees for leaf harvesting are planted. This stage after the harvest of dry rice is called *Jami*. Periods of *Jami* stage vary a lot from 3 months to 2 –3 years. Its average id 16.6 months and standard deviation is 7.7 months.

Chart 2 shows that kinds of plants used for each stages of land use and its area planted for each kinds of trees per stage of land use (total up-land used by 60 surveyed households is 30.65ha).

Chart 2. Area of trees planted according to the stage of up-land farming



(Source: Field Survey)

Following the *Jami* stage, many kinds of perennial plants are planted and will be productive (including perennial plants that have existed for many years), but maintenance needs not be as intensive as it is at the *Huma* or *Jami* stages. This stage is referred to as *Reuma Ngora*³. Many kinds of perennial trees, such as sugar palm (*Arenna pinnata*), durians (*Durio zibethinus*), *petai*, mango, *rambutan*, *jengkol*, coconut and jackfruit (*Artocarpus heterophylla*) trees are planted and produce. Large numbers of banana trees are planted for their leaves. The *Reuma Ngora* period vary a lot, from 10 months to 3 years. Chart 3 shows the area of trees planted during the *Reuma Ngora* periods. This Chart demonstrates the of wide variation of plants in those stages.

³ For explanation on Reuma in West Java, see (Johan 1992)

After the *Reuma Ngora*, land use will move to the *Reuma Kolot* stage, in which maintenance is more basic. For example, the land may not be touched for several months. However, the land is still being used productively, and perennial trees are productive. The periods of this stage vary more variable. They can vary from 1 to 5 years.

After such productive use, the land is fallowed for a few years, sometimes for ten years or more. This period is called *Talun*. Production of trees and plants is low during this period.

People sometimes prefer to use land as *Kebun Campuran* after it being used as *Jami*. In this kind of land use type, perennial trees, tall annual plants, short annual trees and root plants are mixed. Horticulture, fruits, trees for building materials including bamboo, are planted. *Kebun Campuran* can be translated into "mixed plantations or gardens". This is a productive use of the land, and it lasts for quite a long time, sometimes ten years or more (the average is 59.1 months and the standard deviation is 61.3 months). Banana trees are often planted for both their fruits and their leaves during this period. After the long *Kebun Campuran* period, the *Talun* period starts.

In the area of Perhutani, roughly speaking there are two types of land use. One is the type of social forestry where local people cultivate and maintain the land under the contract with Perhutani, and the other is the system of direct control by the Perhutani in which local people would be sometime be hired as casual labor by the Perhutani.

Under the social forestry system, local people are given the right to cultivate for the land 0.25ha each person. People first fire the land with the way of *rarahan*. At that time, people are obliged to plant teak, Mahoney, cemala or pine trees (*pinus*) as designated by National Forest Corporation. The company supplies the young trees of these plants. Respecting these young trees, people plant *Huma* for one or two seasons, after the planting or at the same time of planting *huma*, banana trees both for fruits and for leaves, cikur, ginger, petai cina, cucumber (*bonteng*), maize (*jagong*), cengek, sometime *jenjeng* trees, durian trees, and peppers and so on. Ten years after these planting, only teak, mahogany, pine trees and durian would be maintained. People

can get harvest all plants for their use except teak, pine tree, and mahogany. Participants of social forestry are obliged to maintain these teak, pine tree and mahogany.

On the other hand, National Forest Corporation plant teak, mahogany and pine tree at direct-controlled land, and local people have no right to use land for their own planting. This system is called Banjar Harian (BH) as local term.

Chapter 2 Chronology

Around a year after the economic crisis in Indonesia, 1999, illegal logging of teak at the forest managed by National Forest Corporation started. Peak of the illegal logging in the research site was in 2000, and afterward the frequency of illegal logging decreased. People believed that most of looter came from Bandung District, but some people of the research village joined the illegal logging, moreover official of National Forest Corporation such as mandors were involved in the illegal logging. Teaks cut illegally were sold to market in Jakarta. Some of the teaks were channeled by a prominent trader in the research village. He had a permit issued by National Forest Corporation to handle teaks, but the volume handled was far larger than the permitted volume of handled teak. He was accused by the National Forest Corporation on the ground that he handled illegally cut teak, and arrested. He was jailed for three months in 2004.

The place illegally logged were many cases occupied by local inhabitants. They started to use the land, especially to plant dry rice or use the land for *huma*. In 2000, the corporation stated to recognize their cultivation with the conditions that they would plant and keep the young trees .

From the end of 1990*s, banana leaf planting increased rapidly. Banana leaf planting had been done by the people of neighboring village since the beginning of 1990's, however the planting in the research village was started in 1998, and defused by the cooperatives the prominent trader mentioned above initiated.

The trader got enough information on the market condition in Jakarta and Bandung, and supplied the banana leaf produced in the village to many market

adjusting the quality and quantity to the markets conditions. With this way the trader realized the relatively high profit ratio, and good producer's prices.

Because of better income incurred from banana leaf selling, banana leaf planting have increased dramatically since the end of 1990's. Banana leaf planting spread into not only private owned slop of mountain/hills but also to the area of National Forestry Corporation.

National Forestry Corporation has permitted the farmer to plant banana trees for fruit with the conditions that banana trees would have distance of 6m x 12m among trees. Actually farmers started to plant banana leaves since the end of 1990's, to this move the corporation decided to prohibit the planting of banana trees for leave harvesting. Although the banning of banana tree for leaves harvesting, the planting have increased rapidly.

In order to prohibit the planting of banana trees for leaves, the corporation consulted with police, army and local government. They deliberated the way to prohibit the farmer to plant banana tree for leaves.

End officers of corporation's administration were mandors. They should face with the farmers who plant the banana trees for leaves harvesting. Because so many banana trees for leaf harvest were planted, they were forced to recognize the planting of banana trees for leaf harvest with conditions that teak would be planted with distance of 1.5 m to nearest banana trees. Sometime people plant banana tress more densely. Some time one banana tree extends its roots, and as much as 6 new trees grow so that teak cannot grow.

One time mandors cut banana trees planted by people that grow within a radius of 1.5 m from the teak. To these actions, local people responded, and cut young teak trees as mach as 200.

Official of National Forest Corporation repeatedly announced that banana trees for leaf harvest should be planted with a distance of 1.5 m from the teak, or the National Forest Corporation announced the banning of banana trees for leaf harvest.

In August 2003, conflict between farmers and mandors brought an accident so that relative of village head of a village near the research site hurt hand of a mandor.

In 2003, National forest corporation started to extend the area of direct management (BH) 71 ha in the block located around the research site, and no more extended the area of social forest. In 2004 National forest corporation extended the area of BH as much as 637ha.

Chapter 3. Rules and Strategies

Here we see the rules valid and invalid in the case of forest management conflict at the research site.

(1) Rule of the forest management

1. Banning of illegal logging

In 1999 and 2000, many people violated the rule, however, afterwards the frequency of illegal logging decreased. Some people said there were no good teak trees more in the region.

Many people said the reason why frequency of illegal logging decreased in 2001, and almost no illegal logging was apparent in 2002 afterwards, because many farmers visit the forest almost everyday in order to plant banana leaf trees, and to harvest banana leaves. They felt strong interest to the forest, because now the forest produces a lot of profit for the farmers, and the farmers intends to protect the forest from the destruction such as illegal logging that bring about the destruction of banana trees also.

For the National Forest Corporation, ironically the illegal planting of banana leaf trees prevented from illegal logging.

National Forest Corporation as well as local government repeatedly announced the banning of illegal logging. This rule is now somewhat maintained not because the rule of law but because the interests of local farmers that they felt to the forest.

2. Rule of social forest system

Social forest system obliged the farmers to keep the rule that the farmers keep the teak tree so that the teak grows well. Before the increase the banana leaf trees planting, farmers sometime kept well, and sometime did not keep well. Usually during the first five years since the farmers join the social forest program, farmers keep teak

trees well because farmers often visit the location, however after five years or more, farmers seldom visit the location, and could not keep the teak trees well.

After the increase of banana leaves planting, farmers often visit the location, so that they keep the teak trees well.

Rule on banana trees for leaf harvest planting made by the company; the banning of banana leaf tree planting is not kept at all, on the other hand, on the rule of banana trees planting effective in the field that farmers are allowed to plant banana leaf trees outside a radius of 1.5 me from teak tree, sometime farmers keep, however they tend to plant banana leaf trees more densely than they are allowed to plant. Officials of National Forest Corporation complained the too dense planting of banana trees that are harmful to teak tress.

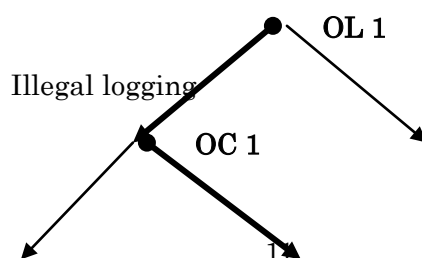
3. Rule of company's direct forest management

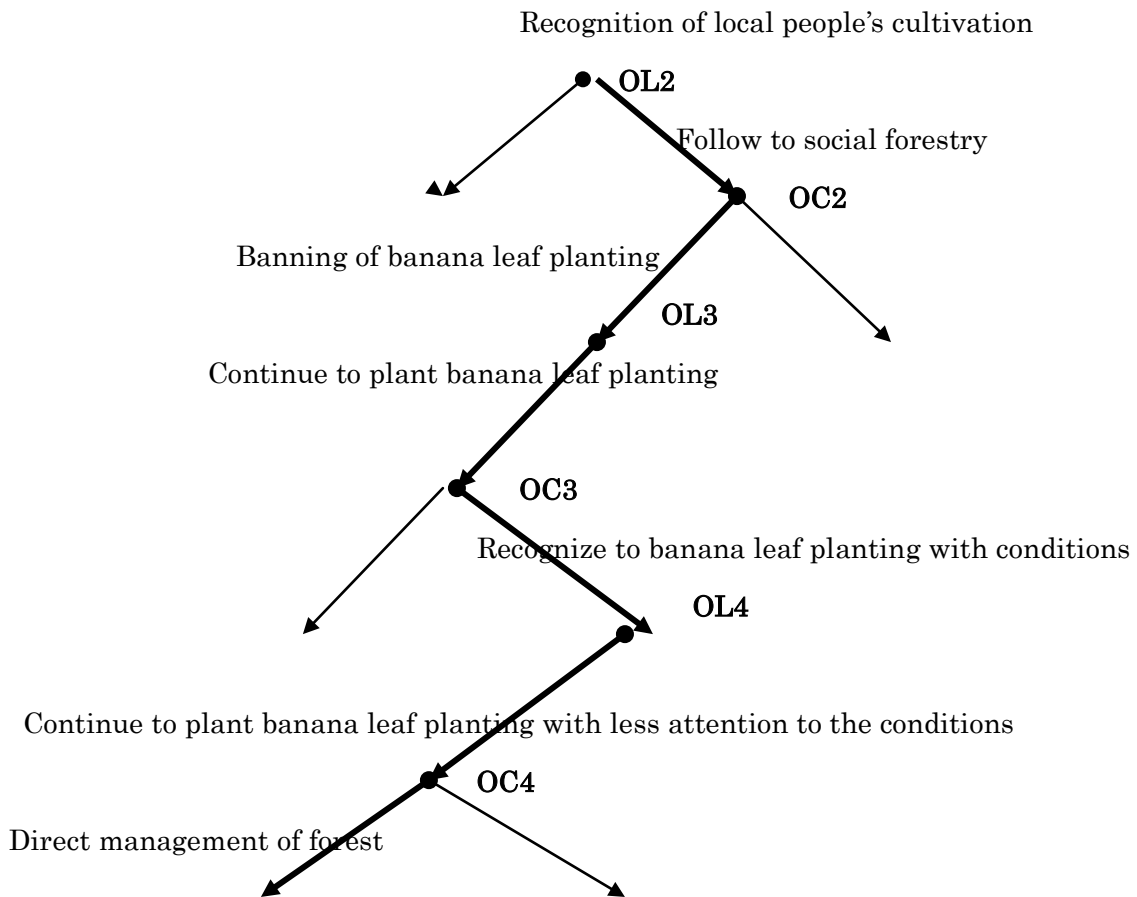
Because the social forest system has not been kept well so that the teak tree production does not increase, the company increased the area of company's direct forest management. For the time being, no conflicts occur relating to the application of this system. However if the area increases and area for social forest decreases, someday the local people could complain, and could lead to new illegal logging because local people could feel that they could not feel the interest from that system.

(2) Strategies adopted by the parties

Chart 3 shows strategies of the company and farmers using game in intensive form. The arrows in each of the diagrams in Chart 3 show the strategy of a player in the negotiations. The Apex of the chart indicates the start of the forest dispute and foot of the chart its end. In each diagram, two arrows point outwards and downwards from a central node. This node is the point at which alternative moves are available to the

Chart 3 Strategies adopted by the parties





(Source) Author's field survey

player. The nodes where the company is required to make a move are shown as OC1, OC2,, and those where the farmers must decide as OL1, OL2... In each of the diagrams in Chart 1, the right-hand downwards arrow represents a collaborative strategy, and the left-hand downwards arrow a hostile one. The arrow drawn in bold lines represent the strategies that were actually chosen by the players in the case study.

As Chart 3 illustrates, the hostile flow starts as indicated by the farmer's strategy of illegal logging. The company responded to this action by giving the right to cultivate the land. Farmers' cultivation of land, especially banana leaf planting protected the forest from further illegal logging. Once the banana leaf planting was banned by the company (OC2), the company compromised with farmers so that

farmers were allowed to plant the banana leaf trees with conditions that banana leaf trees should be planted outside a radius of 1.5 m from young teak trees. Some farmers followed the instruction, however many farmers did not follow the instruction on purpose or without intention not to follow the instruction. Finally the company employed the direct management program that could lead further conflicts.

.Chapter 4, Collaborative and sustainable strategies, and governing the commons

(1) Towards collaborative relation between the parties

Present situation at the research site can not regarded as collaborative and sustainable one, because there are two crucial issues. One is intensified banana leaf planting at the forest with social forest program. This too intensified planting is damaging not only to young teak trees, but also soil there itself, or banana leaf trees themselves. Control to banana leaf tree planting is important issue in the present reseach site.

Another issue is the enlargement of company’s direct management forest. This forest is not involved by the local people without employing local people as casual labors.

Chart 4 is the payoff matrix of national forest management at OC4 and OL 4 in the Chart 3. Chart 4 shows the strategies available at node OL4 for the farmers, and node OC5 for the company. Strategies available to the players at the matrix of chat 2 can be given code according to Chart 5.

Presently both the farmers and the company are taking the hostile strategies. These strategies will lead to (a) short term income maximization, and long term soil fertility declining, and future decrease of social forestry meaning decrease of cultivated land for farmers. Also for company (b) short term increase of teak planting, but

Chart 4. Payoff matrix of forest management dispute National forest at OC4 and OC4

	Company	
	Collaboration	Hostility

Farmers	Collaboration	Banana leaf profit Decrease a little Soil fertility maintained	Teak growth Well 20 % sales of teak will be given to farmers	Decrease of cultivated land	Direct management Increase of teak and sales of teak
	Hostility	Banana leaf profit increase Long term soil fertility decline	Teak growth damaged Soil fertility decline	Banana leaf cultivation intensify, soil fertility decline Decrease of social forestry	Direct management Future illegal logging

Chart 5. Payoff matrix for labor dispute at National forest

		Company			
		Collaboration		Hostility	
Farmers	Collaboration	a1	b1	a3	b3
	Hostility	a2	b2	a4	b4

possible future illegal logging.

Ideally both of the parties will take collaborative strategies so that conflicts will be settled. Farmers will follow the company's compromised instruction; planting banana leaf trees outside a radius of 1.5 m from young teak tree. If the farmers follow the instruction, income of farmers will decrease a little because some intensity of banana leaf trees will decrease. As long as teak trees are planted and kept well, the company can employ the collaborative strategies ($b2 > b4$, $b1 > b3$). Because the farmers

continue to plant banana leaf trees intensively, so the company feels that social forestry sacrifice the company's interests ($b_2 < b_4$, $b_1 < b_3$).

So the key to settle the dispute is that farmers will follow the compromised instruction from the company; that is the farmers will change their strategies from hostile one to cooperative one.

Possible solution to this dispute is the way of sharing profit from teak trees, for example 20 % of teak selling profit will be given to farmers, and 80% of the teak selling will be given to the National Forest Corporation. With that way farmer will be more careful to teak trees keeping, and try not to be destructive to teak trees.

This is good way to keep teak well. Although profit of teak selling for National Forest Corporation will decrease with 20 %, however the number of teak well grown will increase, and teak trees will protected from illegal logging because the farmers will feel more attachment to the trees.

(2) Towards sustainable forestry management at the research site

However there are still serious issues for farmers and forest; that is too intensive banana leaf planting that leads to future soil fertility declining. To that problem, we should remember the traditional pattern of planting at the research site described at chapter 1 of this paper. Traditionally banana trees were planted at the research site, especially at the private owned forestry. No serious soil deterioration was found there.

Banana trees are planted at the stages of *Rarahan*, *Jami*, *Reuma Ngora* and *Reuma Kolot*. As long as banana trees are planted within the *Huma-Talun* system, no serious soil deterioration will occur.

The trader who started to plant banana leaf trees in his plot and showed how profitable the banana leaves were said that as long as the banana leaf trees are planted with the way such as the stage of *Reuma Ngora*, soil fertility will not decline, and also productivity of banana leaf will not decline.

At the stage of *Reuma Ngora* or *Kebun* or *Campuran*, we can find many trees. People can incorporate the banana leaf trees within the system of *Reuma Ngora* or *Kebun Campuran* where actually teaks also can be incorporated.

So we can imagine new system in which teak and banana leaf trees will be incorporated such as *Reuma Ngora* or *Kebun Campuran*. Difference between the traditional system and new system is that frequency of teak and banana leaf trees are far more than the traditional system, however anyway in the concept of traditional *Reuma Ngora* or *Kebun Campuran*.

From the interests of farmers, these incorporation of teak trees as the form of *Reuma Ngora* will bring long term profit although farmers should sacrifice some short term profits. Long term profit will be more valued when the discount rate of the future profit is not too large. If farmers see the importance of long term profit, discount rate of future profit will be reduced, so that farmers can sacrifice part of short term profit. Discount rate will be related to the possibility/certainty of long term cultivation. The more possible/certainly the farmer can cultivate the land, the less the discount rate. From this viewpoint, the spreading the company direct management will increase the future uncertainty of land cultivation for the farmer. Farmer will feel uncertainty, and increase the discount rate. It means that farmer will give priority to short term profit rather than long term profit.

(3) Governing the commons

As we have seen, illegal logging was prevented by people because people often visit the site, and protect the land from illegal logging. Here we can see the participation to the land cultivation, and social control to the illegal logging.

As the term of Ostrum, the problem of supplying a new set of institution was solved by the prominent trader mentioned above. This new institution could solve the issue of illegal logging, however created new issue of too intensive planting of banana leaf trees, and damage to teak trees.

For that matters, as we discussed previously possible solution is that farmers prefer to plant banana leaf trees under the traditional *Huma-Talun* system because farmers value long-term soil fertility and long-term profit rather than short term profit. Teak trees can be thought as trees incorporated within *Huma-Talun* system, so because of their long term profit, farmers prefer to keep teak trees well

rather than damaging teak trees.

Actually this solution is implemented by the prominent trader, and many farmers have imitated the way especially at their privately owned slop of mountain. In order to enhance the consciousness among the farmers, it is effective for National forest corporation to diffuse the information to the farmers with collaboration with the trader. On the problem of social control, one possible solution is that the National Forest Corporation will make agreement with the social forest farmer's group (Kelompok Tani Hutan). Agreement will stipulate that National Forest Corporation will give 20 % of the teak selling to the farmers if teak trees planted by the farmers in the social forest farmer's group are kept well, and grow as planned, for example 80 % of all teak trees planted by the farmers of the group grow well. With this way farmers will care for the teak trees planted by other farmers within the group. Cooperatives can play role to market the products other than banana leaf, with that way farmers will follow the traditional Huma-Talun system more easily.

Cheaper 5, Conclusion

With enactment of Act No. 22 of 1999 on Local Administration, and Act No.41 of 1999 on Forestry, important paradigm change occurred in Indonesia, from state centered forest management during Soeharto regime to community based forest management for the new era. Although idealistic conceptual change of the system was introduced, actually rampant illegal logging and vast deforestation have proceeded especially after economic crisis in 1998.

This paper analyzes the case of state forest management in which local people have been involved under the scheme of social forestry program, however illegal logging was rampant especially after the economic crisis in 1997/8, and conflicts between the state (here National Forestry Corporation-PERHUTANI-) with local people continue until now.

This study analyzes the present conditions in which both the farmers and the company take hostile strategies that can lead to soil fertility declining using the extensive form of game theory, and analysis of rules and strategies.

Illegal logging rampant in 1999 and 2000 ceased in 2001 and 2002 because banana leaf trees planting introduced by prominent trader in the village increased rapidly, so frequent visit of the people to the forest prevented the continuation of illegal logging. However, too intensified banana leaf trees planting caused the damage to teak trees so that National Forest Corporation banned the banana leaf trees planting at the social forest program site. Physical collision between the field officers and local people enforced the corporation to modify the company's policy so that the farmers were allowed with de facto to plant banana leaf trees outside a radius of 1.5 m from teak tree. However this new rule is not kept well by the local people, so the company is employing the company's direct management forest system that in the future leads to possible illegal logging again.

In order to reach to the collaborative strategies by both parties, the corporation should move to collaborative strategy, and teak trees keeping well by the farmers can change the company's strategy to collaborative one. For farmers, a company's policy to share the teak sales with the farmers will promote the farmers to estimate the importance of the teak trees.

In order to reduce the intensity of banana leaf trees planting by the farmers, and with that way soil fertility will be kept, incorporation of banana leaf trees and teak trees in the traditional system of *Huma-Talun* as described at the chapter 1 of this paper is one solution. This incorporation needs the farmer's perception that farmers prefer long-term benefit to short-term benefit. Low discount rate for future benefit enables the farmers to estimate long-term benefit more than the case of high discount rate. From that point, it is important to give the certainty of future cultivation to the farmers. In order to supply the new institutions, the company can take leading role to enhance the consciousness to the long-term benefit with collaboration with the trader who introduced the banana leaf trees planting in this village. Some devise can be thought to enhance the social control among the people, for example an agreement stipulates that National Forest Corporation will give 20 % of the teak selling to the farmers if teak trees planted by the farmers group are kept well, and grow as planned, for example 80 % of all teak trees planted by the farmers of the group grow well.

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