Ekonomi dan Keuangan Indonesia Volume XLVII Nomor 4, 1999

The Economics of Shifting Cultivation System in Forest Land: Farm-Level Evidence from Sumatra, Indonesia

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Abstract

Makalah ini menguji proses penyesuaian ekonomis bagaimana para peladang berpindah mungkin mengadopsi sistem rotasi bera lahan sebagai sarana untuk meningkatkan produktivitas pertanian secara alamiah atau menerapkan metode budidaya permanen yang lebih intensif sebagai respons terhadap peningkatan upah riil karena perkembangan sistem ekonomi pasar di daerah pedesaan. Survai lapangan dilakukan pada periode Juli-Desember 1997 mengambil lokasi di Kabupaten Bungo Tebo, Propinsi Jambi. Metode analisis yang digunakan adalah pendekatan standar rente lahan (land-rent capture approach) yang didukung oleh simulasi kuantitatif dengan matriks analisis kebijakan (PAM) terhadap beberapa skenario kebijakan ekonomi yang mungkin ditempuh Pemerintah.

Hasil analisis kuantitatif menunjukkan bahwa sistem perladangan berpindah dengan periode bera (fallow period) yang panjang, yaitu lebih dari sepuluh tahun secara ekonomis dan ekologis lebih menguntungkan dibandingkan dengan sistem perladangan bera normal (jangka pendek dan menengah), bahkan dengan sistem pertanian menetap sekalipun. Akan tetapi, persoalannya berkembang menjadi masih mungkinkah sistem bera jangka panjang itu diterapkan mengingat lahan pertanian telah menjadi demikian terbatas karena beberapa faktor ekonomi dan kelembagaan? Periode bera normal lebih banyak merupakan strategi untuk mengamankan hak dan kepemilikan terhadap lahan pertanian (property rights on land) sebelum memulai sistem perkebunan karet lokal dan kayu manis.

Oleh karena itu, fokus kebijakan haruslah didukung dan dilengkapi dengan pengkajian yang mendalam dan perluasan kesempatan berusaha di pedesaan dari luar sektor pertanian (rural non-farm activities). Sektor industri pedesaan, peningkatan sarana dan prasaran pembangunan seperti jaringan jalan, fasilitas pendidikan dan kesehatan adalah beberapa komponen kunci dalam menggerakkan dan mengintegrasikan program pemukiman kembali para perambah hutan dengan sektor lain dalam ekonomi.

Financial supports for this research for the research were provided by the project of Alternatives to Slash-and-Burn (ASB), Indonesia Consortium, through the International Centre for Research in Agroforestry (ICRAF). The author would like to thank the following persons: Scott Pearson, Rick Barichello, Tom Tomich, Agus Hudoyo and conference participants in Vancouver (Canada) and Venice (Italy) for discussion and review of earlier drafts of this paper. Any remaining errors are the author's responsibility.

1. INTRODUCTION

In the literature, shifting cultivation has played a central role in the debate of deforestation. For the case of deforestation in Indonesia, there are essentially two extremes in the on-going debate over the causes of deforestation. On the one hand, deforestation is argued to have been driven by the growing number of shifting cultivation, smallholder production activities (FAO, 1990; World Bank, 1990; Barbier, et al., 1993; and Fraser, 1996) such as in the classical ecology arguments. On the other hand, deforestation has been driven by the government policies and its development, and particularly misdirected policies in the timber sector industry, while also acknowledging the important contribution of shifting cultivation in the forest-cover removal (Dick, 1991; WALHI, 1992; Angelsen, 1995; and Arifin, 1996).

This controversy could be associated with little empirical work about the economic mechanism of shifting cultivation system. Most of the studies that have been published on this issue are case studies of particular communities or regions that provide valuable insights, but do not provide a basis for comparative analysis and economic policy formulation towards the sustainability of forest resource management. The present paper is an attempt to address this gap in empirical knowledge by examining thoroughly the case of shifting cultivation in forest area in Rantau Pandan, Bungo Tebo of Jambi Province, Sumatra-Indonesia.

The objective of this paper is to apply a policy analysis matrix (PAM) on the shifting cultivation system in forest land in Sumatra. The paper examines the economic adjustment process of how shifting cultivators might adopt bush-fallow rotation system as a means to naturally improve agricultural productivity or apply more permanent and intensive land-use systems as a response to increasing real wages and growing market economy in rural area.

The remaining sections of the paper will be organized as follows: Section 2 examines the theoretical arguments on the relationship between shifting cultivation and deforestation. Section 3 develops a conceptual framework for undertaking the study of shifting cultivation system, followed by the description of study sites, field works and data collection of the present study in Section 4. Section 5 analyzes the general features

of the study sites, focusing on the land-use systems found in the study area of Rantau Pandan in Jambi Province, at Sumatra. Section 6 presents the results of micro-level analysis of shifting cultivation, and finally Section 7 exhibits the discussion and implications of the study results.

The paper is organized as follows: Section 2 reviews the literature of shifting cultivation in developing countries. Section 3 develops a conceptual framework for undertaking the study of shifting cultivation system, followed by the description of study sites, field works and data collection of the present study in Section 4. Section 5 analyzes the general features of the study sites, focusing on the land-use systems found in the study area of Rantau Pandan in Jambi Province, at Sumatra. Section 6 presents the results of policy analysis matrix of shifting cultivation, and finally Section 7 exhibits the discussion and implications of the study results.

2. SHIFTING CULTIVATION IN DEVELOPING COUNTRIES

Studies of shifting cultivation in relation to forest-pioneer continuum and to loss of forest cover in Indonesia are not well documented. Weinstock and Sunito (1989) even suggest a distinction between shifting cultivators and forest pioneers. Shifting cultivators are defined as people who practice a from of rotational agriculture with a fallow period, longer than the period of cultivation. Unless faced with population pressure or other constraints, land is used only one to three years and fallowed for a relatively long period. Forest pioneers are defined as people who may utilize slash-and-burn of the existing vegetation but with the primary intention of establishing permanent or semi-permanent agricultural production. They choose primarily cash crops (mostly perennial), although they grow food crops for subsistence purposes.

The growing debate on a continuum of farming systems in Indonesia in terms of policy implication results in two extremes as well. One extreme refers to traditional shifting cultivation's which involve very long fallows and long-term conservation of forest land, as has been practiced by traditional people of Semendoe, Ogan and Melayu in Sumatra, Dayak in Kalimantan, etc. The other extreme refers to forest pioneer cultivation which involve long-term degradation and

deforestation. This extreme often associated with spontaneous transmigration which may also correlates with a government policies to boost regional development in some remote areas. The government position condemns forest pioneer cultivation as environmentally destructive, even it does not differentiate it from traditional shifting cultivation. While the non-governmental organization (NGO) activists insist that if the government is serious about forest conservation, then it must support those traditional farming systems that are consistent with the aim of long-term forest conservation (see Sunderlin and Resosudarmo, 1996).

Empirical estimates show a significant variation in the share of shifting cultivation in deforestation in Indonesia, primarily because of the definition differences of shifting cultivation and the specific (political) purposes of a particular study regarding shifting cultivation practices. The World Bank (1990) estimates that the shifting cultivation for three provinces in 1990 was 14 million hectare in Sumatra, 11 million hectare in Kalimantan and 2 million hectare in Irian Jaya. The total area of 27 million hectare expands at the annual rate of 2 percent, implying deforestation of roughly 500 thousand hectare per year, by far the largest cause of deforestation.

Dick (1991) criticizes the World Bank estimates and suggests that traditional shifting cultivators account for 21 percent of total deforestation, rather than the largest share. The main reason is that many forests being cleared are part of long-standing rotation on clan-lands (*tanah marga*), and the traditional cultivators lack the tools necessary to convert all but the most open primary forest. Then, at the latest report, the World Bank (1994) acknowledges that shifting cultivation may be less damaging than previously thought. A thorough observation on shifting cultivation in Kecamatan Siberida of Riau Province, Sumatra by Angelsen (1995) suggests that simply increasing population is not necessarily the main cause of deforestation. Changing proportion of households practicing swidden accounts for 7 percent of the total forest clearing; the total population of households account for 23 percent of the total; and the average size of swiddens accounts for 7 percent of the total forest clearing.

For Indonesia as a whole, the area of shifting cultivation increases at a rate of 2.9 percent per year in the last decade. The increase occurred

primarily because of a vast increase in the area of rice and secondary food crops (*palawija*) in the upland land. Sumatra and Kalimantan experienced a rapid increase, 9.1 and 4.4 percent per year and upland rice and secondary food crops are extensively grown in these islands. A similar increase is also found in Sulawesi, Bali-Nusa Tenggara and Java which experienced a change in upland cultivation of 1.1, 0.8 and 0.1 percent per year respectively (CBS, various issues). However, these data should be interpreted with cautions. The term shifting cultivation used by the Central Bureau of Statistics (CBS) for the Statistical Yearbook of Indonesia refers to either simply upland cultivation (*ladang*) which might be as a permanent basis or actual shifting cultivation (*huma*). It is very unfortunate that the CBS data available do not provide enough information to distinguish between these categories. Consequently, the term "shifting cultivation" by itself cannot be used specifically to examine the environmental consequences of agricultural operations that shift the land base or use forest fallow to restore fertility. One can assume that in Java, Bali and part of Sumatra, the term "shifting cultivation" will refer to *ladang* but outside these areas it refers to *huma* or the actual shifting cultivation (see Arifin, 1995).

3. FRAMEWORKS AND MEASUREMENTS

The approach of land-rent-capture is generally useful to explain the mechanism of shifting cultivation and deforestation under an open economy argument. However, the approach does not provide a basis for comparative analysis of the profitability of the system compared to other land uses. The comparative analysis becomes so important that the policy formulation could be directed towards searching the alternatives to a more sustainable land-use and forest management. Given that previous studies on shifting cultivation were generally based on the absence of trade and international markets and other types of close economy argument, the present study is relaxing the close-economy assumption and viewing the changes in land-use system as the economy is more opened to international markets and even to government-policies. These policy scenarios are more thoroughly examined and the sensitivity of scenarios are analyzed using the framework of Policy Analysis Matrix (PAM).

The purpose of PAM approach is to measure the impact of government policy on the private profitability of agricultural systems and on efficiency of resource use. In the case of shifting cultivation –as a principal agricultural system– and other land-use system in the study area, the PAM approach is useful to construct accounting matrices of revenues, costs and profits. The PAM is also very useful to investigate further the impact of policy on competitiveness and farm-level profits, the influence of investment policy on economic efficiency and comparative advantage, and the effects of agricultural and research policy on changing technology (see Monke and Pearson, 1989).

Therefore, the determination of profit received by farmers also implies which farmers are currently competitive and how their profits might change if price policies were changed. Also, investment policy to allocate capital budgets could be formulated to increase efficiency and speed the growth of national income. Here, the concept of social profits as a measure of economic efficiency is introduced in the analysis, which is simply the difference between revenues and costs for a system, valued in social prices. Finally, the approach could answer questions on how best to determine the most fruitful directions for the alternatives to raise crop yields and reduce social costs, thereby increasing social profits of the overall land-use systems.

The basic structure of PAM is presented in **Table 1** Profits are shown on the right-hand column and could be calculated by subtracting revenue in the left-hand column with two middle columns of cost. Each PAM normally consists of two cost columns, one for tradable inputs and the other for domestic factors. Intermediate inputs such as fertilizer, pesticide, purchased seed, compound feeds, electricity, transportation and fuels are divided into their tradable input and domestic factor components. The private profitability refers to the observed revenue and costs reflecting actual market prices received or paid by farmers or processors in agricultural system. As mentioned previously, the social profits measure the comparative advantage or the efficiency in the agricultural systems.

Table 1.
Basic Structure of Policy Analysis Matrix

	Revenues	COSTS		Profits
		Tradable Inputs	Domestic Factors	
Private Prices	A	B	C	D
Social Prices	E	F	G	H
Effects of divergences and efficient policy	I	J	K	L

Notes: Private profits : D=A-B-C
Social profits : H=E-F-G
Output transfer : I = A-E
Input transfer: J=B-F
Factor transfer: K=C-G
Net transfer: L=D-H

The second identity in the matrix concerns the differences between private and social valuations of revenues, costs and profits. Recall that social prices correct for the effects of distorting policies, which lead to an inefficient use of resources. However, one needs to distinguish distorting policies with which cause loss of potential income, from efficient policies, which offset the effects of market failures and thus create greater income. Because efficient policies correct divergences, they reduce the differences between private and social valuations (see Monke and Pearson, 1989, p:23). Therefore, an expanded version of the PAM to include additional three rows of the effect of divergences can be seen in the following **Table 2.**

Table 2
Expanded Version of Policy Analysis Matrix

	Revenues	COSTS		Profits
		Tradable Inputs	Domestic Factors	
Private Prices	A	B	C	D
Social Prices	E	F	G	H
Effects of divergences and efficient policy	I	J	K	L
Effects of market failures	M	N	O	P
Effects of distorting policies	Q	R	S	T
Effects of efficient policies	U	V	W	X

Notes: Output transfer: I=A-E, or I=M+Q+U
Input transfer: J=B-F, or J=N+R+V
Factor transfer: K=C-G, or K =O+S+W
Net transfer: L=D-H, or L=P+T+X

A dynamic comparative advantage, inherent within the Policy Analysis Matrix (PAM) approach employed in the present study, could lead to policy formulation on the ability of a land-use system to compete without distorting government policies. This could be strengthened or eroded by changes in economic conditions, because the competitiveness of a land-use system that occurs over time is influenced by three important economic factors: long-run world prices of tradable outputs and inputs, social opportunity costs of domestic factor of production (labor, capital and labor), and production technologies being used. In addition, the provision of modern inputs, rural infrastructure, and non-farm employment in rural areas are important in formulating the alternatives to slash-and-burn in forest area. The use of PAM would tackle these issues and simulate in such a way in accordance with a more opened to international markets of agricultural commodities.

Several variables and their measurements are defined and explained as follows:

- Shifting cultivation is a land-use system involving a form of rotational agriculture with a bush-fallow period, longer than the period of cultivation. The land is used for growing food crop, particularly upland rice for only one to a maximum of three years and fallowed for a relatively long period.
- Forest-pioneer cultivation is a system involving slash-and-burn of the existing forest vegetation but with the primary intention of establishing permanent or semi-permanent agricultural production, primarily cash crops. Forest pioneer cultivation usually involves long-term deforestation and land degradation.
- Deforestation is a process leading to a decline in forest area and destruction of forest ecosystem which cause the forest to loss its function ecologically and economically.
- Intensive land-use system is a cultivation system with more agricultural input and labor per unit of land, and other non-extensive activities of using land resources.
- Agro-forestry is a land-use system which combine a food crop activities and tree crop and wood production at the immediate land.

- Land rent is the surplus or profit to the owner of the land, that is the gross value of production minus all costs of production, except for land, measured in Rupiah.
- Output is an amount of production from particular food and cash crops, reflecting the technological level, soil fertility, measured in kilogram equivalent.
- Farm-gate price is the current or yearly actual price of agricultural production at the farmers' level, measured in Rupiah per Kilogram.
- Agricultural input is the total of non-labor inputs employed in the production process, consisting mainly of traditional and modern inputs, both bio-chemical (seed, fertilizer, pesticide, herbicide, etc.) and mechanical inputs (hand-tractor, etc.), measured normally in the respected input units (kilogram, liter, units, etc.)
- Input price is the farm-gate price of all agricultural inputs, measure in Rupiah.
- Labor input is the total working days spent by both family and hired labor in agricultural production, measured in man-day equivalent.
- Wage rate is the level of actual wages, measured in Rupiah per man-day. In the case of gender segregation in wage rate, necessary adjustment will be made.
- Distance is the duration of travel time from the village center to the field, measured in kilometers and/or walking hours.

4. STUDY SITES AND DATA COLLECTION

The works presented here emerge out of my recent involvement with a broader research project of Alternatives to Slash-and-Burn (ASB) Indonesia Consortium, which was organized by the International Centre for Research in Agroforestry (ICRAF) Indonesia office. Study sites were focused on the regions where the majority of farmers are practicing shifting cultivation system in and around the piedmont area of conservation forest of Kerinci Seblat National Park which is administered by the Subdistrict (Kecamatan) Rantau Pandan, District (Kabupaten) of Bungo Tebo, in the Province of Jambi, Sumatra-Indonesia.

The subdistrict Rantau Pandan is located at the northeastern valley of the very famous Bukit Barisan Mountain in Sumatra. The distance from city center of Muara Bungo, the Capital of Bungo Tebo, is about 31 km, and from Jambi City is about 267 km by a very good quality state road. The study location was selected for a number of reasons. It provides a good example of shifting cultivation in different length of fallow system, of changing forest area to dryland agriculture with rapidly increasing population, and adaptation of more permanent agriculture along with fast improvements in the living standards of the people in the last decades or so. In addition, the district of Bungo Tebo is a primary study region of the project of Alternatives-to Slash-and-Burn (ASB) where ICRAF Indonesia takes a major lead.

The field survey has been undertaken in July of 1997 and focused on collecting information on shifting cultivation activities in the presumably forest area for the 1996-1997 crop season. These data include cropping patterns and activities in crop production, i.e. the use of land, labor, capital and the yield, amount of works and labor calendar spent on on-farm and off-farm, type of off-farm activities, and other physical and socio-economic information.

In addition, the historical aspects of shifting cultivation system were investigated carefully, such as where and how long the farmers cultivate the previous farms before the current site, the length and types of bush fallow, factors affecting the farmers' choice in the previous cropping patterns and the next choice to cultivate, etc.

Secondary and supporting data were collected from a wide range of secondary sources such as Central Bureau and Regional Offices of Statistics, Department of Agriculture, of Forestry, of Public Works, the World Bank, International Centre for Research in Agroforestry (ICRAF), Center for International Forestry Research (CIFOR) related agencies and organizations, and from previous studies of shifting cultivation and deforestation. Time series data on population, labor-force wage level in the region were collected from the Central Bureau of Statistics; yield and cultivated area of particular crops and other resource-based data were obtained from the Department of Agriculture, of Forestry, Environmental Impact Assessment Agency, etc.

The data collected and other related information were analyzed thoroughly using both quantitative and qualitative frameworks. The standard method of land rent calculation for shifting cultivation system will be employed to obtain the economic returns on output after taking into account all costs and related expenses, and in light of the travel cost from the field to village center. Qualitative information such as property rights regimes and institutional factors relating to "the working rules of going concerns" on shifting cultivation practices and social arrangements of labor force will be evaluated using previous studies available information and from the additional interviews with key informants from the village level, district level and the provincial level.

5. GENERAL FEATURES AND LAND-USE SYSTEMS

Based on the information available currently, the Subdistrict of Rantau Pandan consists of 21 villages. The total population of this subdistrict in 1995 are 22,884 (11,084 men and 11,800 women) and the total households are 5,238, most of which are involved in agricultural activities. The area of the whole subdistrict is about 1,278,140 square kilometer, implying that population density of Rantau Pandan is only about 18 per square kilometer (Bungo Tebo Regional Office of Statistics, 1997), which is quite common for an outside-Java standard.

Population growth in Rantau Pandan have increased tremendously in the last decade. Based on the data of national census, the population growth in the period of 1980-90 was 1.42 percent per year. This amount is actually far below the national average of growth, which was 1.97 percent per year. In the period of 1990-1995, the population growth in Rantau Pandan have risen to 1.70 percent per year or about similar to the 1.69 percent growth of national average. This increase could affect the cropping pattern and the length of bush-fallow in the shifting cultivation practices.

Kecamatan Rantau Pandan is located in the piedmont zone, ranging from 100 to 500 meter above sea level (asl). Soils of the area are composed of latosol-litosol complex with fine texture. During the last decade, annual rainfall varied from 1,656 to 2,868 mm where December and January are the wettest and June and July are the driest (van Nordwijk, *et al*. 1995). Typical for this type of soil, the largest part of the area is

dominated by secondary or logged-over forest where large-scale (and notably illegal) logging practices have taken place for years. However, most of the forest area in the southern part or upper portion of Rantau Pandan were claimed as a part of Kerinci Seblat National Park (KNSP). In fact, local people have grown rubber in that forest area long before the government declared the area as a conservation forest. In addition, given the ecological function of rubber, cinnamon and other tree crops around the National Park, the watershed protection functions of the Park may be adequately covered.

Major food crops in Rantau Pandan are upland and lowland rice, corn and soybean. The productivity of these crops is about the average of which in other regions of Sumatra. According to the Official Statistics, the productivity of upland rice in Rantau Pandan is only 1.2 ton/ha, and that of lowland rice and corn is about 4.2 ton/ha and 3.2 ton/ha respectively. While the productivity figure of upland rice is about comparable with that of observed figure in the present study, the official productivity of lowland rice is overestimated by about three degrees of magnitude. Even though the productivity is only 0.8 ton/ha, soybean is becoming more popular among farmers in Rantau Pandan recently and could be prospective in the future.

Major cash crops in Rantau Pandan are rubber, coffee, cassiavera and tall coconut. The area of these crops spread over the subdistrict, reaching more than 14 thousands hectare of rubber, more than 900 hectare of coffee and about 230 and 160 hectare of cassiavera and tall coconut, respectively. As explained above, local people have been accustomed to planting the rubber with local varieties since many years within the forest, particularly for property right purposes. In addition, market information and other pressing factors have caused local farmers in Rantau Pandan to become more alert and allocate their lands to a more prospective cash crops such as cassiavera (cinnamon).

Field observation for this study has focused on two villages in the subdistrict: Muarabuat and Senamat Hulu and some additional information along the road in the village of Laman Panjang. Muarabuat and Senamat Hulu has been known for typical *ladang* land use of Sumatra using a shifting cultivation for upland rice, with bush-fallow system, where more than 60 and 90 percent, respectively of the households in these two villages are involved. The village center of

Muarabuat is located in the main road of the subdistrict, adjacent to the village of Rantau Pandan, the main village or the capital of the subdistrict. The land-use observed in study sites for economic analysis of shifting cultivation system in the lowland Sumatra can be summarized in the following **Table 3.**

Table 3
Land Use Observed and Other Key Variables for the Study Sites

Key Variables / Villages	Muarabuat	Laman Panjang	Senamat Hulu
Land-Use Observed	Shifting Upland Lowland Rice	Lowland Rice	Shifting Upland
Distance to Market (km)	10	14	26
Total Population	696	697	578
Population Density (pop/km)	28	7	6
Total Household	158	171	161
Household practicing shifting cultivation system (%)	60	20	90
Distance to shifting area (in hour walking distance)	1-2	0	2-4

Source: Field Observation and Bungo Tebo Regional Office of Statistics, 1997

As mentioned briefly above, major land-use systems in the subdistrict of Rantau Pandan consists of annual crops for food security purpose and perennial crops for cash income and other purposes. Land-use system for annual crops is mostly shifting cultivation of upland rice (*ladang*) using a bush-fallow rotation system and lowland rice cultivation (*sawah*). Land-use system for perennial crops is mostly local rubber, coffee and cinnamon (*kebun*). The physical boundary between these cash crops land-use system and the (natural and communal) forest is not clearly established because these crops are grown within the forest area. This complex system of land used is sometimes called "jungle rubber" given that the tree crops have been planted for years and no major crop care, except weeding, has been allocated for these trees.

Lowland Rice Fields

Lowland rice fields could represent the most "modern" land-use system in Rantau Pandan, and notably in most places in Sumatra. Even though

the majority of farmers do not have certificate for their land in a formal manner, rice fields could be traded freely in land market, especially those located along the main road. The market price for land ranges between Rp 450,000 to Rp 500,000 per hectare, and tends to increase gradually depending on the market forces. However, the land market for lowland rice field does not take place "normally" since the majority of the land could fall in to "conservation forest status" boundary under the National Park.

As commonly found in the matrilineal system such as in the majority of Minang ethnic in West Sumatra, the lowland rice field is normally inherited by women. Other forms of land transfer include a gift or charity (*tanah wakaf*) for religious purposes, and regular selling and purchasing involving the outsiders. Significant influence of "modernization" has changed the attitude of people of Jambi regarding the rice field. Ten years ago or so, selling the land was considered against the rules of *adat* law because the land was deliberately considered as *"harta berat"*, normally controlled by the communal land system. It implies that the food security of the society was in danger and the sustainability of agricultural system and of the livelihood in the area was in trouble. The complete institutional mechanism of the communal system in land-use allocation would probably an interesting subject for future research in this area.

Average lowland rice farmers in Rantau Pandan normally use local variety of rice (*padi panjang*), under the reason of easier to manage and better in taste. Some farmers have applied modern technology such as fertilizer (Urea) and some new high-yielding variety of rice such as IR-64 and IR-50 (*padi Bimas*). Other modern inputs such as pesticide and herbicide have been known by the farmers in Rantau Pandan, but most farmers do not use them in the 1996/1997 planting season because of unavailability in the surrounding area. The growing period of local variety of lowland rice is about six month, therefore farmers are only able to cultivate their field once a year. Some farmers have grown corn and other secondary food crops at the same field such as soybean.

The average area of rice field-holding in the subdistrict ranges from 0.4 to 2.0 hectares, using mostly their-own family labor. The average yield of rice field in Rantau Pandan is only 1.5 ton/ha, or about one-third lower than the official statistics reported by the local government. This

productivity is also about or below the subsistence level of the society in the subdistrict, while the rate of rice consumption increases steadily due to population growth and increasing income in other sectors of the economy. The "modern" notion of lowland-rice farmers is also shown by the fact that the majority of farmers in fulfill their food need by buying the rice in local market around the sites such as in July and August when the field observation for this study took place. During regular harvest season, the price of milled rice is about Rp 1,000 per kilogram, while during planting season or long-drought such as at the present time, the price of rice could reach as high as Rp 1,400 per kilogram or may be more.

Upland-Rice Shifting Cultivation

The term shifting cultivation used in this study refer to the standard definition developed by the Alternative to Slash-and-Burn (ASB) Indonesia consortium. Shifting cultivation is a land-use system involving a form of rotational agriculture with a bush-fallow period, longer than the period of cultivation. The land, locally known as *ladang*, is used for growing food crop, particularly upland rice, for only one to a maximum of three years and fallowed for a relatively long period. The particular argument for the above definition is that the length of fallow period becomes shorter as population pressures continue.

In the study sites of subdistrict Rantau Pandan, there are is a large amount of communal forest land, more precisely it is shrub land, or locally called *sesap*. These lands have been designated for shifting cultivation, particularly for upland rice, and some presently are left fallow and covered by small trees and bush/shrub. It is not clear whether or not the area of communal forest land, overlap with the state-owned forest land under concession of forest plantation (HTI) or the conservation forest of the Kerinci Seblat National Park, or even with newly developed for oil-palm plantation.

According to the rural standard, this land is relatively fertile, located nearby the village, about 1-2 hour walking distance from the village center. Local people believe that the lands located further from the village center, or about 4-6 hour walking distance, thus it is a natural forest, are more fertile than their present land. In the village of Muarabuat, tenurial security is strongly enforced, in order to maintain the existing *ladang*

system and the availability of rice production, as a part of food security strategy in rural area. About 1,000 hectares of communal forest land have been "preserved" for upland rice field under shifting cultivation practices. No tree crops are allowed in these particular communal land, and shifting cultivation system is managed by the community. Members within the community are free to use it, but those who do not have inherited land get priority. Outsiders have to get permission from the customary leader to use it. Generally, one household is able to cultivate about 1-2 hectares of upland rice per year by shifting cultivation system in the communal land. Bush-fallow rotation ranges between 5-10 years or could be short, medium and long depending on the labor allocation decision among household and on the land availability to support the shifting cultivation system. At present, it is very difficult to employ a long fallow of 20 years or more such as it was commonly found in the last ten or twenty years. Agricultural or rural sector in general has experienced a serious labor shortage since the opportunity cost of labor has increased tremendously in the last decades.

Meanwhile, in the village of Senamat Hulu communal property of forest land under the shifting cultivation system is not strongly enforced. The community can freely buy and sell their land, such it has happened in the last decade or so. Probably, in addition to the communal land, this village has a number of private plots of bush land belong to clans or families. The owners usually plant upland rice for 1-2 seasons and then move to another plot within the bush land. However, there has been some changes in land-use patterns in the last decades after the second rotation of shifting cultivation. The choice of not adapting the bush-fallow system is more open, meaning that farmers could replace the land allocated for shifting cultivation into a more attractive land use system. If the land is suitable for planting rubber or cassiavera, these tree crops are interplanted in the first or second year of cropping.

Most likely, the land-use change from rotational system into a more permanent land-use system takes place in the private and family lands, rather than in the communal forest lands. Once the land-use changes, the land becomes more tradable and the market price for land increase significantly. The market price for the land ranges from about Rp 420,000 per hectare for *sesap* or for upland *ladang* under shifting cultivation and about Rp 2 million per hectare for tree crops such as rubber, cassiavera

and probably for oil-palm plantation. However, interpretation for the land-use change phenomena should be made with caution, given that the present study does not attempt to identify factors affecting the change in a comprehensive way. This should be a leading priority in the future research about land-use change from a traditional shifting cultivation system into more permanent agricultural practices in response of a growing market economy and other external economic forces. In the system where markets exist and all prices, including the wage rate are parametrically given, the decision to increase the area of cultivation and to change to existing land use system are primarily determined by the relative profitability of expected farming practices, including those in the frontier with the expense of natural forest. Also, if labor can be sold or hired at a constant wage, the land-use change and production decisions by a rational and utility-maximizing household can be analyzed by a typical profit-maximizing production behavior. A higher relative price of rubber and cinnamon than that of rice, a better road and transportation infrastructure, and an open-access like tenurial land rights are among important factors contributing to the change.

The recent tendency is an increased tension between the tenurial system of communal forest land or related customary (*adat*) rights on land and a more uniform or centralized "modern" legal system on forest land. According to the Basic Forestry Act of 1967, all forest in Indonesia is state property, while the customary law on land gives usufruct rights to forested land planted with perennials crops after clearance. In the absence of clear boundary between state forest and communal forest land, and due to weak management of communal forest , a large portion of Indonesian forest could fall into an open-access like tenurial land rights. Consequently, the attractiveness of economic profitability of tree crops combined with a property-rights security purpose on forested land have also lead to land-use change into a more permanent cash crop practices in the last decade or so.

The average yield of upland rice in Rantau Pandan is about 1.3 ton/ha, or similar to the official statistics published by the local government. In this study, the following category was used to classification the length of bush-fallow period. A five year fallow or less is considered a short fallow; 5-10 year is medium, and more than ten year is classified as long-bush fallow system. As expected, the yield of long

fallow is higher than that of medium and short fallow. Therefore under existing condition of input use and market price for input and output, the shifting cultivation under long-bush fallow is the most promising for food security purposes. The question is then "is it still possible to adopt the long-fallow system of shifting cultivation given the land is not unlimited anymore and a more permanent land use system is more attractive for the household and has been adapted by some household in the village?" Table 4 shows the performance of shifting cultivation system under different length of fallow.

Table 4
Performance of Shifting Cultivation under Different Length of Fallow System

Important Characteristics	Short Fallow	Shifting Cultivation	
		Medium Fallow	Long Fallow
Input use:			
Seed (kg/ha)	25	25	25
Labor (man-day/ha)	152	167	167
Working Capital (Rp/ha)	140,600	153,600	171,600
Yield (kg/ha)	1,200	1,333	1,800
Profit excluding land (Rp/ha)	596,400	678,000	1,130,400

Notes: At the time of study, one US dollar equals 2,400 Indonesian Rupiah.
Source: Field observation and author's calculation

One should note that a detailed information on long fallow system is difficult to obtained because most of current plots are under a short-fallow system. A seven year bush-fallow could be a maximum possibility that could be materialized by farmers in Rantau Pandan, given the availability of land and other production factors. In the present study, respondents were asked a historical-type of question --but somewhat hypothetical --such as how much the yield were obtained by their parents at the very same land, and what the yield of upland rice would be if the current cultivation in the bush (*sesap*) land took place 15 or 20 years ago, etc. In the future research, a more comprehensive methodology, involving an extensive exploration of available data and documents on particular plots should be employed in order to draw more complete and reliable information on estimated yield of shifting cultivation system.

6. POLICY ANALYSIS MATRIX

Private Profitability

Under the system of shifting cultivation, farmers adopting a short and medium bush fallow receive only Rp 1.4 and 1.6 million gross revenue respectively for one hectare land. This amount is much less than that is received by those adopting a long-fallow system who could obtained at Rp 2.2 million and those under wetland rice. The cost structure among upland shifting cultivation and lowland rice land-use does not differ very much, except for long-fallow shifting cultivation. The cost structure for land preparation differs as much as RP 60,000 because wetland rice system requires a seedbed preparation.

Weeding activities in upland rice take a cost of Rp 100,000 in average, or a Rp 40,000 higher than that in wetland rice. In addition to weed problem, the degree of sensitivity of pest attacks in upland rice shifting cultivation is also higher than that in lowland rice field. Labor allocation for applying the fertilizer does not contribute significantly to the farm cost structure. In the study sites, fertilizer is only used in the lowland rice. It is applied at 15 days after planting/replanting and few days before the period of generative growth or before the rice grain is ready to fill up. Of course this crop-production management is far below the standard or recommended best management practices in rice production. Normally, during the phase of generative growth, NPK fertilizer application is necessary to ensure the growth of grain and to increase the yield.

The cost of other crop care activities, in general, are lower in a more permanent lowland rice cultivation. Crop watching from the pig and the bird is less extensive in the rice field close to housing compound than those located 1-2 hour away from human settlement. Therefore the total cost of farm-production activities in lowland rice field is about Rp 810 thousand, which is lower than all types of different length bush-fallow system. The total cost of short-fallow system is about Rp 844 thousand per hectare, while the cost of medium and long fallow system is Rp 922 and 1,030 thousands, respectively .

The private profitability of different land-use system can be summarized as follows. The profit, excluding land, for lowland rice

cultivation is the higher than that in shifting cultivation, except for long bush-fallow. This is mostly because the yield in lowland rice is 1.5 ton/ha, which is higher than 1.2 ton/ha and 1.3 ton/ha, the yield of short fallow and medium fallow, respectively. However, these yield measurements are lower than the yield of long-bush fallow which is 1.8 ton/ha. Therefore, the profit excluding land of lowland rice is Rp 990 thousand, which is also higher than that of short and medium fallow which are Rp 596 thousand, Rp 678 thousand respectively; but lower than the profit of the long bush fallow system which is Rp 1.1 million.

Table 6
Private Profitability of Lowland Rice and Shifting Cultivation (Rupiah)

Items	Lowland		Shifting Cultivation	
	Rice	Short Fallow	Medium Fallow	Long Fallow
Total Revenue	1,800,000	1,440,000	1,599,600	2,160,000
Total Cost	809,880	843,600	921,600	1,029,600
Land Price	470,000	450,000	420,000	400,000
Profit, excl. land	990,120	596,400	678,000	1,130,400
Net Profit	520,120	146,400	258,000	730,400

Source: Author's calculation

Social Profitability

The concept of social profitability is necessary to compare the profitability of particular land-use with its competitive situation. As explained in the analytical framework in Chapter 3, one way of comparing them is by considering the parity prices at the international markets of input and output and other components affecting farm production process. This mechanism was performed primarily under an assumption that the world market is the most competitive market or where no single country can significantly affect the market behavior.

Three important factors affecting the calculation of social budgets are the world price of commodities imported by Indonesia, i.e. rice and the seed; and the world price of urea, which is exported by Indonesia. The data for this calculation were the average annual data of 1997 from January to July; which were obtained from the World Bank Commodity Price Data (Pink Sheet of July 1997). After some adjustment with freight

and insurance, exchange rate and handling/processing costs, the social price of rice used in this calculation is Rp 570/kg; seed is Rp 943/kg and fertilizer is Rp 457/kg.

The social price for labor was set at Rp 5,000/man-day, as this amount could represent an opportunity cost of labor in the study area of giving up an agricultural activities to obtain different types of job, either on-farm, off-farm or outside the agricultural sector. Under similar circumstances with the situation in the private profitability analysis, the total revenue could be achieved by lowland rice farmers is Rp 836 thousands, which is higher than Rp 684 and Rp 760 thousand, the amount achieved by short and medium fallow shifting cultivators, respectively. This amount is also lower than the revenue from long-fallow system of shifting cultivation, which is slightly above Rp 1 million.

Given that the social cost structure is about the same across four-different of land use system, the positive profit could be achieved by the lowland rice and long bush-fallow under shifting cultivation system. For complete information, please refer to the following **Table 7.**

Table 7
Social Profitability of Lowland Rice and Shifting Cultivation (Rupiah)

Items	Lowland		Shifting Cultivation	
	Rice	Short Fallow	Medium Fallow	Long Fallow
Total Revenue	855,588	684,470	760,332	1,026,705
Total Cost	836,533	889,028	973,778	987,278
Land Price	0	0	0	0
Profit, excl. land	19,054	-204,558	-213,446	39,427
Net Profit	19,054	-204,558	-213,446	39,427

Source: Author's calculation

Effect of Divergence

In the concept of policy analysis matrix, effect of divergence's refers to the policy effects and market failures in all components of production process. In this study, policy effects of tradable outputs and tradable inputs of each land-use system are positive, shown by a higher private value than social value. The positive divergence in tradable output indicate that farmers in Rantau Pandan are receiving more than the social

value for their crop. There is a subsidy on the production process of rice as much as Rp 944 thousand for lowland rice, which is lower than the subsidy for long-fallow shifting cultivation amounting at Rp 1.13 million. The amount of subsidy is still higher than the subsidy for short fallow and medium fallow, respectively of Rp 755 and Rp 839 thousands.

The positive divergence on tradable inputs reflect a taxing effect to farmers for the use of seed and fertilizer. Farmers in Rantau Pandan pay more than the social value of inputs; and these divergence should represent an income to the government. Given that only farmers in the lowland rice land-use system use the fertilizer, the amount of taxing effect on tradable input in lowland rice is Rp 9,227, which is higher than that in upland rice shifting cultivation. An amount of Rp 6,422 tax in upland rice shifting cultivation in all types of bush fallow system is primarily due to the use of paddy seed. Farmers would have received a better value if the government allocate the budget for establishing a seed-multiplication center in the study area.

The higher social cost of labor also reflects the low wage rate in agriculture. Farmers in Rantau Pandan would have received a higher return on labor if they are working outside agricultural sector. The gender issue of labor does not significantly affect the labor-cost structure in the field, because there is no gender segregation in wage rate. Even, the man labor is paid less than the standard if he is performing a woman-job such as weeding, planting, etc. This high social labor cost also causes the negative profits in social value of short-fallow and medium fallow upland shifting cultivation system, reaching as high as Rp 205 and Rp 213 thousands respectively.

Therefore, the patterns of net effects are also the same with the other patterns of production activities, where lowland rice has a higher value than the short and medium fallow, but lower than the long-bush fallow system. A complete version of the tables of Policy Analysis Matrix (PAM) could be in the **Table A-6 Appendix**. The following **Table 8** will present the ratio tables of protection and efficiency for lowland rice and upland shifting cultivation.

Table 8
Ratios of Protection for Lowland Rice and Shifting Cultivation

Land Use System	NPC		EPC	DRC
	Output	Input		
Lowland Rice	2.10	1.29	2.14	0.98
Short Bush-Fallow	2.10	1.27	2.13	1.31
Medium Bush-Fallow	2.10	1.27	2.13	1.29
Long Bush-Fallow	2.10	1.27	2.12	0.96

Notes: NPC is Nominal Protection Coefficient
EPC is Effective Protection Coefficient
DRC is Domestic Resource Cost Coefficient

As can be inferred from previous explanation, the extent of commodity and factor market divergence in the production process of different land-use system could reveal the nominal protection coefficient (NPC). In other words, the comparison between private commodity prices and social commodity prices and the impact of government policy or of market failures that are not corrected by efficient policies. The NPC values both for output and for input are greater than one, respectively 2.10 and 1.29 for lowland rice; and respectively 2.10 and 1.27 for each different length of fallow system of upland rice shifting cultivation. These reflect that market price for the output exceeds the social price, meaning that farmers in Rantau Pandan receive an implicit output subsidy from policies affecting crop prices. However, farmers also being taxed by a very high market prices for inputs, primarily fertilizer and seed.

The positive effect of rice subsidy is also shown by the value of Effective Protection Coefficient (EPC) for all land-use system which are higher than two. As the EPC indicates the combined effects of policies in the tradable commodities markets the floor-price policy on rice could affect the decision made by farmers in the study sites. In this case, the taxing effect of fertilizer and seed could be offset by the output subsidy. This is interesting because Indonesia that has been known for a very protective policy on fertilizer subsidy, in fact, does not employ the subsidy anymore.

Finally, the efficient or the comparative advantage of rice production in four different land-use system is shown by the value of domestic resource cost coefficient (DRC). Shifting cultivation system under short

and medium bush-fallow have a DRC value 1.31 and 1.29 respectively. This indicates that the domestic resources used to produce the rice exceeds its value added in social prices. It also implies that rice production activities in these two land-use system do not represent an efficient use of the resource endowments available in the study sites. The lowland rice and long fallow shifting cultivation of upland rice have a DRC of 0.98 and 0.96, respectively. This implies that both systems have a comparative advantage or an efficient use of resources in rice production process.

NPV-PAM and Sensitivity Analysis

This section is a complementary for the previous analysis on a single-year policy analysis matrix (PAM) on lowland rice and shifting cultivation system. A net present value (NPV) PAM was established in order to examine the profitability and efficiency of particular land-use system within the 25-year cycle. A 20 percent discount rate was set up -- comparable to market interest rate due to economic uncertainty since July of 1997– to calculate the present value of revenue, cost and profit of each land use system.

About similar to the structure of private and social profitability in a single year PAM, lowland rice is more profitable than the short and medium fallow, but less profitable than the long-fallow of shifting cultivation. Based on the ratios of efficiency the in the 25 year cycle, lowland rice system is at the point of domestic comparative advantage; while the long fallow is relatively efficient in using the available resources. Sensitivity analysis of some components in the rice production process results in different policy implication. An increase of exchange rate up to Rp 3,400 for one US dollar results in different characteristics of each land-use system. All four land-use show an efficient domestic resource uses, shown by a DRC lower than one. The increase in exchange rate has sensitively changed all values of NPC for input to be lower than one, implying that the market price for inputs fall below the prices that would result in the absence of policy. The subsidy of tradable inputs for farmers also represent the cost to the government, because of the exchange rate increase.

The impact is also very significant when the exchange rate reach the value of Rp 5,000 for every US dollar. All the components of social value would exceed the those of private value, implying that distorting polices (and notably uncorrected market failures) and in appropriate exchange rate exist in the Indonesian economy. For an open economy model, exchange rate is very sensitive and affect almost all of the economic activities in the country.

7. CONCLUSION AND POLICY IMPLICATIONS

This study has presented the profitability of shifting cultivation system in communal forest area in Jambi Province of Sumatra, Indonesia. The land rent approach has explained the economic adjustment process of how shifting cultivators might adopt different length of bush-fallow rotation system. The results of polucy analysis matrix (PAM) using both single year and multiple-year simulation show that lowland rice is more profitable than the short and medium fallow of the shifting cultivation system but less profitable than the long-fallow of system. Under an open economy argument, farmers are trying to adopt a more permanent and more intensive land-use practices in accordance with the increasing pressure and the existence of market forces and the growing market economy in rural area.

Even though a long fallow shifting cultivation system is also profitable and an indication of domestic resource use efficiency, but probably it is not a wise choice given the pressure on land have increased over time. Since the long bush-fallow system is hardly found in the lowland Sumatra at present time, the policy challenge is then how well-prepared the supporting systems such as transportation infrastructure, irrigation, provision of modern inputs, etc. that could maintain the efficiency and profitability of lowland rice cultivation system? Or this preliminary finding could be taken as another assured indication that farmers adopting an upland shifting cultivation under "normal length" of bush fallow (short and medium) is a pre-requisite to establish the property rights on land under a tree crop or cash crop system such as rubber and cassiavera.

Therefore, provision of modern agricultural inputs such as seeds, fertilizer, and pesticides; quality rural infrastructure, and non-farm

employment generation in rural areas are necessary condition for economically sound policy strategies in the future. In addition, agroforestry systems involving high-yielding variety of rubber and upland rice and management of forest lands by local communities also can be more effective means of sustainable forest-resource management.

8. REFERENCES

Angelsen, Arild 1995. "Shifting Cultivation and Deforestation": *A Study from Sumatra, Indonesia*. World Development Vol. 23 (10). pp: 1713-1729.

Arifin, Bustanul 1993. "A Closer Look at Deforestation in Indonesia". Paper presented at *The Fourth Global Warming International Conference*, April 17 -21 1993, Chicago USA.

Arifin, Bustanul 1995. *The Economics of Land Degradation: A Case Study of Indonesian Upland*. Ph.D. Dissertation. The University of Wisconsin-Madison (USA).

Arifin, Bustanul 1996. *Misconception about Environmental Degradation: Lesson from Deforestation in Indonesia*. Paper presented at the Sixth International Conference on Society and Natural Resource Management at the Pennsylvania State University, May 18-23, 1996.

Arifin, Bustanul 1998. *Does Shifting Cultivation Really Cause Deforestation: The Case of Communal Forest Land in Sumatra* Paper presented at the Seventh Conference of International Association of the Study of Common Property, on June 9-14 of 1998 in Vancouver, Canada.

Arifin, Bustanul. 1998. *The Economics of Shifting Cultivation in Forest Land: Farm-Level Evidence from Sumatra, Indonesia*. Paper presented at the 1998 World Congress of Environmental and Resource Economists, on June 25-27 of 1998 in Venice, Italy.

Boserup, Ester. 1989. *Agricultural Growth and Population Change*, in J. Eatwell, M. Milgate, P. Newman (eds.), Economic Development: *The New Palgrave*. New York: W.W. Norton, 1989, pp: 21-34.

Barbier, Edward B., N. Bockstael, J.C. Burgess and I. Strand. 1993. *The Timber Trade and Tropical Deforestation in Indonesia*. LEEC Paper DP 93-01. London Environmental Economics Center.

Central Bureau of Statistics (CBS). various issues. *Statistical Yearbook of Indonesia*. Jakarta: Central Bureau of Statistics.

Dick, John. 1991. *Forest Land Use, Forest Zonation and Deforestation in Indonesia: A Summary of Existing Information*. Background paper to the UNCED Conference, prepared for the Ministry of Population and the Environment, Jakarta, Indonesia.

Food and Agricultural Organization (FAO). 1990. *Situational and Outlook of the Forestry Sector in Indonesia*, Technical Report of Forestry Studies, Food and Agricultural Organization and Ministry of Forestry, Government of Indonesia, Jakarta.

Fraser, A.I. 1996. *Social, Economic, Political Aspects of Forest Clearance and Land-Use Planning in Indonesia*. Unpublished manuscript.

Gillis, Malcolm. 1988. Indonesia: public policies, resource management, and tropical forest, in Repetto, R. and M. Gillis (eds.) *Public Polices and the Misuse of Forest Resources*. Washington, D.C.: World Resources Institute, pp:10-23.

Monke, Eric and Scott Pearson. 1989. *The Policy Analysis Matrix for Agricultural Development*. Ithaca: Cornell University Press.

Sunderlin, William and Ida Aju Pradnja Resosudarmo 1996. *Rates and Causes of Deforestation in Indonesia: Towards a Resolution of the Ambiguities*. Bogor: CIFOR Occasional Paper No.

Van Noordwijk, *et al.* 1995. *Alternatives to Slash-and-Burn in Indonesia*. Summary Report of Phase 1. Bogor: ICRAF Indonesia.

Weinstock, J.A. and Satyawan Sunito 1989. *Review of Shifting Cultivation in Indonesia*. Jakarta: Directorate General of Forest Utilization, Ministry of Forestry and FAO of the United Nations.

World Commission on Environment and Development (WECD). 1987. *Our Common Future*. Oxford and New York: Oxford University Press.

World Bank 1992. *Development and the Environment, World Development Report 1992*, Washington, D.C.: The World Bank.

World Bank 1994. *Indonesia. Environment and Development: Challenges for the Future*. Washington, D.C.: The World Bank. ■

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