

DEFORESTATION AND CAPITAL ACCUMULATION: LESSONS FROM THE UPPER KERINCI REGION, INDONESIA

ABSTRACT

This study outlines a case where the behaviour of farmers in accumulating capital, rather than their poverty as commonly assumed, results in deforestation. Fieldwork was undertaken in the Upper Kerinci region of the island of Sumatera, Indonesia. A financial analysis of the "net income" streams received by farmers from deforestation is performed. Because forest lands can be "captured" and privatised through clearing, forest clearing and the subsequent agriculture have the capacity to produce high financial returns for farmers as well as to provide adequate capital to finance the next forest clearing. Such a capacity enables landless farmers to become land owners. Forest clearing also enables farmers to own a "long-term maturity bond" in the form of a cinnamon plantation. Poverty precludes poorer farmers from deforestation, and decisions to clear a forest rest mostly with more established farmers. Financial surpluses from outside the forestry and agricultural sectors are also used to finance forest clearing.

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INTRODUCTION

Tropical forests are being deforested at a disturbing rate. According to most recent estimates of the Food and Agricultural Organisation (FAO), deforestation occurred at a rate of 15.4 million hectares year⁻¹, or about 1.2% year⁻¹ between 1981-1990 (1). Worse still, forest extinction by early next century appears to be not unlikely for countries like the Ivory Coast, Paraguay, and Nepal where forests disappear by 5.9, 4.6 and 3.9% year⁻¹, respectively (2). Whilst many recognise that deforestation has multiple causes (3-5), and some causes or mix of causes are regional specific (6), a significant portion of deforestation may be associated with the action of farmers. In Indonesia, for example, smallholders are said to be responsible for 55% of the nation's deforestation rate (7).

It is often assumed that farmers clear a forest because of their poverty. While such an argument may be valid for certain cases, e.g. in the case of shifting cultivation and fuelwood collection in Zaire (8), our report shows that deforestation can depend on the capital accumulation behaviour of richer farmers and holders of capital. Poverty is usually a deterrent to deforestation because the poorest farmers have inadequate capital to finance forest clearing and other associated costs.

METHODS

The study was conducted in the subdistrict of *Gunung Kerinci* (Mount Kerinci) in the Upper Region of the Kerinci-Seblat National Park (KSNP) in 1995. The park is located on the island of Sumatera, Indonesia. Of the subdistrict's 66 villages, three were selected because they have severer deforestation problem than do the other villages (9). The villages are located in the mountainous range of Mount Kerinci, i.e. on the Kayu Aro plateau, with an altitude varying from 1200 to 1500 metres above sea level.

Primary data were collected from interviews with a randomly-selected sample of 55 farmers. The questionnaire includes questions about household characteristics, history of forest clearing and land ownership, ownership of other agricultural capital, farm production and consumption expenditure. Price and trading volume data were collected from farmers' transaction records kept by a major village trader who also happens to be the head of one of the villages surveyed. The records contain information on actual selling price received by each farmer, number of delivery times, the quantity of output sold per delivery, purchase of farm inputs and the amount of each farmer's outstanding loan for the period of October 1994-July 1995. Yield of the main tree crop in the KSNP region, i.e. cinnamon, was estimated by actual measurement of yield obtained from cinnamon trees of 4, 5, 6, 8, 12 and 15 years of age. Estimates for each age group were obtained by taking 2-5 samples of trees. Throughout the field work, a series of observations on *ladangs* (dry-land farming) at the forest frontier were undertaken. These *ladangs* are located about 1800 to 2000 metres above sea level and can only be reached by walking for about 3-4 hours from the villages.

The main tenet of the report is that deforestation occurs because it is financially beneficial for farmers to clear a forest (10). Thus, emphasis will be given to the financial analysis of "net income" streams received by farmers from conversion of forest land into a *ladang*. The term "net

income" refers to the surplus or deficit after investment and operational costs are deducted from revenues. In the financial analysis, no wages are paid to family labour employed in the farm, while the financial cost of land is equal to the total costs of converting a forest land into a *ladang*. For comparative purposes, a simple economic analysis is undertaken. In this case, the shadow price of family labourers is set equal to the prevailing market wages, while that of land to the actual market price of a *ladang*. The Net Present Value (NPV) at a social discount rate of 16% (11) and the Internal Rate of Return (IRR) are computed. The NPV refers to the value today of future net income when discounted at a given discount rate, while the IRR is the discount rate that equates the NPV to zero.

RESULTS AND DISCUSSION

Ladangs and Farmers at the Forest Frontier

The most common farming system found in *ladangs* is multicropping involving cinnamon (*Cinnamomum burmanni*) and annual crops. Cinnamon represents a long-term investment for the farmers while annual crops provide the short term, regular production. Cinnamon trees are generally planted in rows about 4 metres apart, and spaced about 1-2 metres apart along each row. Potato is the most popular type of annual crop planted, with a relatively small amount of scallion and maize. This system of multicropping is practiced until cinnamon trees reach an age of about 6 years. Afterwards, the system will become a monoculture of cinnamon, with a negligible amount of annual crops or bananas grown on the edge.

On the basis of their relation to a *ladang*, farmers can be grouped into: (a) *anak ladang* (tenants),

(b) *anak ladang*/land owner, (c) land owner, and (d) *induk semang* (land owner and capital provider). *Anak ladangs* are operators of a *ladang*. They are usually landless, young (i.e. below 30 years of age) and have limited household capital. With the exception of a few unsuccessful farmers, after several years working as an *anak ladang*, older farmers are usually capable of accumulating adequate capital to own a *ladang*, by way of purchasing an existing *ladang* and/or clearing a nearby forest. In this case the farmers become land owners. They may opt to operate all of the *ladang*(s) if they have adequate family labour, or to let new *anak ladangs* operate some of the *ladang*(s). In the latter case, the farmers become *anak ladangs* and land owners at the same time. Alternatively, they may opt to let new *anak ladangs* operate all of the *ladang*(s), thus becoming purely land owners. *Induk semangs* are on the highest rung of the ladder. They are usually land owners and cash capital providers who often hold a respected position in the village, e.g. as head of the village.

Establishment of a *Ladang* and Property Right Arrangement

According to the Indonesian constitution, forests within the Indonesian jurisdiction belong to the state. In practice, however, traditional tribes consider forests as free, communal assets. Those who clear a forest are entitled to claim ownership to the cleared land.

In the villages surveyed, after clearing a forest the owner usually leaves the land idle for about 1 to 12 months to let the fallen trees dry out. During this "drying period" regrowth of *Imperata cylindrica* or "alang-alang" occurs and covers the land. The length of the drying period, however, depends not only on rainfall intensity but also on the availability of potential *anak ladangs*. This is because the owner is often not endowed with sufficient family labour to

cultivate all the land. Thus, the land is not utilised until an *anak ladang* asks for a contract to sharecrop the land.

Depending on the owner's judgment, the sharecropping contract can be set for a period of as short as one year to about 12-15 years. The contracts usually take on the following forms:

- a. The 1:1 system. This is the most popular system in the villages surveyed. The system entitles *anak ladangs* to keep the income from their annual crops. The owner is to provide cinnamon seedlings, but not a living allowance nor cash for the purchase of farm inputs. Income from cinnamon is divided equally. If however *anak ladangs* have inadequate cash to support themselves and/or to bear the costs of potato farming, they can borrow cash from an *induk semang*. Normally no interest payment is imposed on the borrowing, but *anak ladangs* are obliged to sell their potatoes to the *induk semang*. Loan repayment is directly deducted from the value of output upon delivery.
- b. The 1:2 system. Under this system, in the first three years of the contract the owner supplies *anak ladangs* with about 50 kgs rice month⁻¹, or about 200 kgs per planting season. Income from annual crops is divided equally, while that from cinnamon is distributed as follows: one-third for *anak ladang* and two-third for the owner. The system is rarely adopted because it is financially less attractive for *anak ladang*. The average size of *ladang* operated is about 0.2 hectare, with an average yield of 1867 kgs. Given that potato prices are usually comparable to or higher than those of rice, it is very uneconomical to trade off half of potato production (i.e. 933.5 kgs) and one-sixth of cinnamon output for 200 kgs of rice (13).

After a contract is agreed by both parties, the land is cleared of regrowth. Land owners usually

hire *anak ladang*(s) to do this job. Once land clearing is completed, *anak ladangs* may start cultivating the land. They are free to plant any annual crops, but potato is the most popular one because of its agro-climatic suitability, attractive price and relatively high yields. *Anak ladangs* are also obliged to grow cinnamon during the period of the contract.

For the first 6 years of the contract, *anak ladangs* rely mostly on income from annual crops to support themselves. Between year 4 and 6 about half of the total number of cinnamon trees are cut down to thin the crop. This practice provides additional income for *anak ladang*. Some *anak ladangs* may also earn income from wet-paddy farming and/or from working as paid labourers. After six years, due to shading, no annual crops can be grown in the *ladang*. In this case *anak ladangs* may, subject to owner's approval, harvest some of cinnamon trees to allow enough space to grow annual crops. However, the owner usually opts not to harvest a 6-year old plantation because it produces bark of low quality. If such is the case, *anak ladangs* need to have another contract to operate another *ladang*. As for the land owner, he or she receives no income before cinnamon is harvested. Stages in the establishment of a *ladang* are illustrated by Figures 1a-1d.

Figure 1a A new *ladang* at the forest frontier, with damaged forests shown in the background. The farmer is a new, young, *anak ladang* of 18 years of age. Photographer: D.H. Wibowo.

Figure 1b: Regrowth during the drying period. Photographer: D.H. Wibowo

Figure 1c: A *ladang* after 5 years of plantation, with potato and cinnamon as the main crops. The *ladang* is on sloping land. Photographer: D.H. Wibowo

Figure 1d: A *ladang* after cinnamon trees reach an age of 12 years or more. This could be called a monospice agroforest, with a negligible number of banana and cassava planted on the edge. Photographer: D.H. Wibowo.

The Modes of Capital Accumulation

We observe three different modes of capital accumulation in the villages surveyed. The first two relate to the accumulation of land capital by successful *anak ladangs* and land owners, while the third to the accumulation of capital in the form of cinnamon plantations. To illustrate the first two modes, land ownership history of individuals A and B is presented. Land owner A is an *induk semang* and a potato trader. He began clearing an area of 2 hectares in 1971, but then gradually added another 11 hectares over a period of 21 years (1971-1992). Initially he financed his forest clearing from a financial surplus generated from his trading activity, but in the 1980s and 1990s his cinnamon plantation provided adequate surplus to clear other forests. Land owner B has a different history of forest clearing. He began as an *anak ladang* in mid 1970s and had since accumulated adequate capital from a cinnamon plantation to clear a three-hectare forest in 1986. He cleared another 5 hectares between 1990 to 1993. Both farmers A and B never purchased a *ladang*.

These stories indicate that forest clearing and the subsequent agriculture, i.e. cinnamon and potato farming, have the capacity to generate capital to finance for further forest clearing. This is the first mode of capital accumulation. Using this mode an *anak ladang* is able to move to a higher social status, that is, to become a land owner.

The second mode of capital accumulation is by the use of financial surpluses generated from other sectors, e.g. the trading sector. There are a number of reasons for this. First, the social values held in the region result in greater land ownership giving a higher social status. This motivates farmers to increase their land ownership. Secondly, farmers are attracted by the high financial returns obtained from forest clearing and the subsequent agriculture (See Table 2 for

details). Such high returns are in stark contrast to the limited availability of other financially attractive investments at the village level. Thirdly, farmers feel more of ease with the technical details of forest clearing and the subsequent agriculture than those of other investments.

By clearing a forest, farmers acquire a parcel of land which enables them to invest their time and cash-capital in cinnamon plantation. It takes 4 years before the investment starts producing a financial return, but farmers normally opt not to harvest the plantation for at least another 8 years. Thus, cinnamon serves as a "long-term maturity bond" which will be liquidated after 12 years. The choice of liquidation (or harvesting) timing depends not only on the prevailing prices of cinnamon bark and the age of the plantation, but also on whether or not the farmer is in need of immediate cash for large expenses. The most cited reasons for liquidation are for expenses of land purchase, children's education (e.g. college entry costs), pilgrimage to Mecca and the building of a house.

Who Makes the Decision to Clear a Forest?

Our study indicates that instead of being a cause of deforestation, poverty (or more precisely lack of adequate capital) precludes poor farmers from clearing a forest. Young and poor *anak ladangs* have in fact very limited role in the decision making that leads to forest clearing. The reason is that, first, unless they have adequate family labourers to clear a forest, *anak ladangs* cannot afford the minimum capital required for forest clearing. To clear a hectare of forest costs about Rp 300 000, while the subsequent land clearing adds another Rp 450 000 (14). These costs are far beyond the financial capacity of an *anak ladang*. Secondly, even if they have adequate capital to finance forest clearing (15), *anak ladangs* cannot gain adequate cash to support themselves

during the period between forest clearing and annual crop harvests, termed as the idle-period, which normally takes more than a year.

For these reasons, the decision to clear a forest rests mostly with *induk semangs*, land owners and more established (and older) *anak ladangs*. They are most likely to have adequate capital to finance forest clearing and to support themselves during the idle-period. As Table 1 shows, while all land owners and *induk semangs* had in the past cleared a forest, only a tiny 3% of *anak ladang* (1 respondent) did so (16). The fact that 83% of farmers in the *anak ladang*/land owner group had in the past cleared a forest indicates that while as a young farmer an *anak ladang* is precluded from deforestation, in the later years, after accumulating adequate capital he or she is likely to clear forest land.

Financial Returns from Deforestation

Table 2 presents estimated returns from forest clearing and the subsequent agriculture. Inputs, output and prices data used here are summarised in Appendix 1. Because the average length of the drying period is 9.6 months, while land clearing takes about 2 to 4 weeks, the land is not cultivated until 11 or 12 months after forest clearing is completed. For simplicity, we assume that the agriculture commences on the following year. Thus, if forest clearing occurs at year 0, potato farming and cinnamon plantation will begin at year 1 (17).

In general, the results presented in Table 2 explain why farmers are able to accumulate adequate surplus to finance the next forest clearing. First let us look at the 2nd and 3rd columns of Table 2 which show returns from a hectare of *ladang* if the distribution of income and costs between land owner and *anak ladang* is not taken into account. In financial terms, forest clearing and the

subsequent agriculture produce a high NPV of Rp 14.6 million hectare⁻¹ (=US\$ 6970 ha⁻¹) over 13 years. However, if land price is set at the prevailing market price of Rp 4.63 million ha⁻¹ (US\$ 2205 ha⁻¹) and family labourers are paid wages at the current wage rate, the NPV declines sharply to Rp 5.8 million ha⁻¹ (US\$ 2773 ha⁻¹). This is the economic return of forest clearing and the subsequent agriculture. Despite such a decline, the economic IRR remains very high at 47.4%. These figures indicate that forest clearing and the subsequent agriculture are capable of producing very high financial and economic returns for both land owner and the *anak ladang*.

A clearer picture emerges if the financial returns to land owners and *anak ladangs* are computed separately. Without getting involved directly in cinnamon plantation, a land owner receives a financial return (IRR) of 24.5% or an NPV of Rp 846 191 ha⁻¹ (US\$ 403 ha⁻¹). More importantly, the land owner receives a lump sum of Rp 9.2 million at year 12, which in today's value is equal to Rp 1.3 million. It means that 13 years after the first forest clearing, if the land owner wishes to add his/her land ownership, he or she will have sufficient cash to finance another forest clearing.

As for *anak ladang*, the picture is more interesting. From year 1 to 5 the *anak ladang* obtains an annual net income of Rp 4.0 to 4.3 million ha⁻¹. Because the average size of *ladang* operated by an *anak ladang* is 0.2 ha, this means the *anak ladang* receives a monthly net income of Rp 67 488 to Rp 71 595 (US\$ 32-34 month⁻¹). By rural Indonesian standard, such a level of monthly income is adequate to support a family of 2-3 persons. It explains why *anak ladangs* can rely on potato farming to support themselves. More importantly, as does the land owner, the *anak ladang* receives a lump sum equivalent to Rp 1.3 million in today's value in year 12. It explains why older *anak ladangs* are able to gain adequate capital to finance future forest clearing, and thus, to become land owners.

One possible explanation why forest clearing and the subsequent agriculture produce such high returns is that forest lands are virtually an "open-access resource" and are significantly undervalued. Farmers are able to clear a forest and to claim ownership over the land underneath by investing Rp 750 000 ha⁻¹ (US\$ 357 ha⁻¹), much less than the prevailing price of a *ladang*. Had forest lands been valued properly, forest clearing could have been made financially unattractive for farmers. For example, if land cost is set at Rp 1 731 582 ha⁻¹ (US\$ 825 ha⁻¹) land owners would have received a zero financial NPV at a discounting rate of 16%. It would significantly reduce the incentive for deforestation because land owners are the major decision makers in this process.

CONCLUSION

While in some cases deforestation can be associated with poverty, our study reveals the case where deforestation is caused by those with capital and the desire of wealthier members of the society to accumulate capital. Poverty is a deterrent to deforestation because poorer farmers have inadequate capital to finance forest clearing and to support themselves during the idle-period. The decision to clear a forest rests mostly with more established farmers such as land owners.

Because forest lands are available at a fraction of their true economic worth, forest clearing and the subsequent agriculture are capable of producing high financial returns for farmers. In the early years, net income generated from these activities enables poorer farmers (i.e. *anak ladang*) to support themselves. In the later year, i.e. at the time of cinnamon harvest, a large cash capital is generated. This enables both poorer farmers and land owners to each finance the next round of

forest clearing. The social values held by the society, which result in greater land ownership giving a higher social status, motivate farmers to own a land and to increase their land ownership. In addition to financial surplus from the forestry and agricultural sectors, surpluses generated from other sectors, e.g. the trading sector, are also used to finance forest clearing. For farmers, forest clearing enables them to own a "long-term maturity bond" in the form of a cinnamon plantation.

The policy implication of this study is straightforward. If deforestation is caused by capital accumulation behaviour of villagers, to ease the pressure on forest lands the government may need to, in addition to other measures, stimulate the creation of other financially attractive investments at the village level. This policy should be incorporated into a broader, and integrated, village development program to ensure economic and budgetary efficiencies. The government may also increase the financial costs and risks of illegal deforestation in order to make the activity less beneficial for farmers. Increased fees and/or fines for forest intruders may be considered provided that the government is not plagued by widespread corruption. Revenues generated from these fees and fines may then be used to finance any programs designed to protect a national park, such as improved policing.

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 9. Based on a qualitative assessment by the World Wide Fund for Nature (WWF) which established a research station and a representative office in the Kerinci region in the early 1980s. However, no estimates of deforestation rate, by village, are available.
 10. This premise, however, specifically excludes externalities associated with forest clearing and conservation. Negative externalities such as flood and landslides are likely to be overlooked by farmers as long as they pose no threat to the farmers' daily life. So are environmental bads of regional and global relevance such as biodiversity losses and increased levels of atmospheric carbon dioxide.
 11. Wibowo (12) argues that the "best guess" for the social opportunity cost of capital in Indonesia is at the order of 24%. Given the annual rate of inflation of about 8%, a social discount rate of 16% (in real terms) is then adopted.
 12. Wibowo. 1993. *A Microeconomic Analysis of Health, Safe Water and Sanitation*, unpublished Master of Economics thesis presented to the University of Queensland. Brisbane, Australia. (pp. xv + 281).
 13. If the 1:1 system is adopted, the *anak ladang* would have received one-half of income from cinnamon. By adopting the 1:2 system, the *anak ladang* would only be entitled to one-third of the income. This means a foregone earning of one-sixth of the income.
 14. US\$ 1.00 = 2100 Rupiahs (Rp)
 15. For example, because they opt to clear a small parcel of forest (e.g. 0.1 hectare) which they can afford to finance.
 16. The *anak ladang* used a "loan" from his father-in-law to finance the forest clearing. He considers the land as not his own until he repays the loan.
 17. Potato is cultivated twice a year from year 1 to 5. In year 6, only a season of potato is available because of shading problem.
 18. We wish to acknowledge financial supports provided by the Australian Government's ADCOS scheme. Also, we thank the Centre for International Forestry Research (CIFOR)

for funding the fieldwork. We would also like to thank staff of the KSNP authority and the WWF representative office for their help and assistance.

Table 1. Proportion of farmers who in the past cleared a forest and the average size of forest cleared (... -1995)

Group of farmers a)	Proportion of farmers that cleared forest b)	Average size of forest cleared (hectare) c)	Average size of land owned (hectare) d)
<i>anak ladang</i> (n1= 31, age= 23.4)	3 %	0.01	0.01
<i>anak ladang/land owner</i> (n2= 12, age= 33.6)	83 %	1.27	3.38
Land Owner (n3= 5, age= 48.2)	100 %	5.93	7.96
<i>Induk Semang</i> (n4= 7, age= 45.4)	100 %	8.41	10.50

- Notes: a) Number of respondents = $N = n1+n2+n3+n4 = 55$. The variable "age" represents the average age of the head of household in the group.
- b) It represents the number of respondents in each group who cleared a forest at least once during his/her life divided by the total number of respondents in each group.
- c) The average size of forest cleared by each group of farmers.
- d) Only includes ownership of *ladangs* (dry lands).

Table 2. Estimated returns from forest clearing and the subsequent agriculture (Rp hectare⁻¹)

Year	Total Net Returns		Financial Net Returns to	
	Financial	Economic	Land Owner	Anak Ladang
0	-750 000	-4 630 000	-750 000	0
1	3 843 885	2 643 231	-205 400	4 049 285
2	4 049 285	2 107 978	0	4 049 285
3	4 049 285	2 107 978	0	4 049 285
4	4 360 859	2 403 552	155 787	4 205 072
5	4 542 160	2 584 853	246 438	4 295 722
6	2 817 085	1 740 432	396 221	2 420 864
7	0	-104 000	0	0
8	0	-104 000	0	0
9	0	-104 000	0	0
10	0	-104 000	0	0
11	0	-104 000	0	0
12	18 314 458	18 150 458	9 157 229	9 157 229
NPV at 16%	14 637 740	5 824 234	846 191	13 791 549
IRR	n.a	47.4%	24.5%	n.a

Note: n.a = not applicable

Appendix 1. Inputs, output and prices data

A. Potato Farming (season⁻¹ hectare⁻¹)

Seeds (kgs)	874
Fertilisers (kgs)	
Urea (nitrogen)	257
Phosphate	514
Mix of pesticides and insecticides (unit)	57
Number of delivery times for:	
Fertilisers	15
Output (potato)	129
Family labourers used (days)	221
Hired labourers (days)	62
Output (kgs)	
Large size	7540
Medium size	1594
Small size	468

B. Cinnamon Plantation 1)

Number of initial plants	1956
Survival rate	
Year 1	89%
Year 2	94%
Year 3	96%
Year 4-12	100%
Replanting (number of plants)	
Year 1	98
Thinning (number of plants)	
Year 4	249
Year 5	249
Year 6	332
Harvest (number of plants)	
Year 12	830
Family labourers used (days)	26-79
Hired labourers (days)	0
Output (kgs plant ⁻¹)	
Year 4 (wet bark)	1.07
Year 5 (wet bark)	1.65
Year 6 (wet bark)	1.99
Year 12 (wet bark)	18.40

C. Prices and Wages

Potato seed (Rp kg ⁻¹)	670
Cinnamon seedling (Rp plant ⁻¹)	100
Urea (Rp kg ⁻¹)	290
Phosphate (Rp kg ⁻¹)	450
Mix of pesticides and insecticides (Rp unit ⁻¹)	17 000
Delivery costs (Rp delivery ⁻¹)	
Fertilisers	2250
Output (potato)	5000
Wages (Rp day ⁻¹)	4000
Potato prices 2)	
Large size (Rp kg ⁻¹)	546
Medium size (Rp kg ⁻¹)	375
Small size (Rp kg ⁻¹)	188
Price of cinnamon bark (Rp kg wet bark ⁻¹)	1200
Land acquisition costs	
Forest clearing (Rp ha ⁻¹)	300 000
Land clearing (Rp ha ⁻¹)	450 000
Market price of a <i>ladang</i> (Rp ha ⁻¹)	4 630 000
Exchange rate US\$ 1.00 = Rp 2100	

Notes: 1) No fertilisers, insecticides and pesticides are used in cinnamon plantation

2) Weighted average of prices over the period of October 1994 - July 1995 with

each farmer's sales volume used as the weighing factor.