ECONOMIC INCENTIVES FOR COCOA FARMERS TO TEND TIMBER TREES IN SOUTHERN GHANA

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EXECUTIVE SUMMARY

This study, which forms part of the wider DFID Forestry Research Programme study >The Economic Analysis of Stakeholder Incentives in Participatory Forest Management=, focuses on the issue of appropriate incentives for cocoa farmers to look after timber trees in Ghana=s high forest zone. Outside the forest reserves, cocoa farms are the second most important source of timber after natural forest remnants. With the forest reserves under increasing pressure from the industry, the off-reserve resource has an essential buffer role allowing progress to be made towards sustainable management on the reserves.

Currently there is a negative incentive for cocoa farmers to keep timber shade trees as opposed to non-timber shade trees. Since they have no tree tenure rights, the mainly >migrant= farmers get no share in the value of the tree, and have rarely been compensated adequately for damage to their cocoa. Many farmers destroy valuable timber trees to avoid the risk of uncompensated damage. Thus the main objective was to develop a methodology for estimating >fair= incentive payments to encourage the tending of timber trees. The word >fair= implies considering the impacts of such payments on other stakeholders, most obviously the concessionaires who would bear the main burden of paying them.

The research was carried out in Diaso District in the Central Region, an important cocoa growing area in the moist evergreen agro-ecological zone. The initial PRA work established that, at least according to farmer perceptions, there is a generally complementary relationship between timber trees and cocoa production, and that the opportunity costs are relatively low. This implies that it might need only a relatively small incentive payment, as well as full compensation, to persuade cocoa farmers to prefer timber shade trees. The main >input= requiring compensation is farmer knowledge, in what Amanor (1996) calls the farmer=s >root mat and coppice culture=. A vital part of this is being able to differentiate between preferred tree seedlings.

It is essential to separate compensation for losses from >positive incentive payments=. In order to at all appease cocoa farmers, the present official compensation rate per damaged or destroyed cocoa bush needs to be increased by at least 25% according to the calculations here. More importantly the forest law involving farmer-concessionaire agreement on compensation at a post-felling inspection needs to be enforced. A second aspect of compensation is the loss of cocoa production as a result of losing the micro-environmental benefits of the timber tree. A cost-benefit approach was taken here, comparing the returns to cocoa farming in the >with= and >without felling= situation, although it was difficult to obtain the technical parameters necessary for the calculations. These two kinds of compensation, if fully paid, would theoretically make the farmer indifferent to choosing between a timber and non-timber shade tree.

Four incentive payment levels were assessed, in addition to full compensation: the notional plantation replacement cost of a naturally occurring timber tree; 10% of the tree=s value (taken to be stumpage value); 20% of the stumpage value; and 33% of the stumpage value which was equivalent to cocoa farmers= willingness to accept according to a survey we carried out. Calculation of the stumpage value, and assessing the concessionaire-sawmillers= capacity to pay, required developing an economic model of the timber industry. Like the cocoa farm budget, this was based on key informants and secondary data.
The resulting stumpage values and concessionaire profitability were highly dependent on the export price, the costs and the roundwood to sawnwood conversion ratio used. Thus we

developed two models; one using cost and efficiency parameters based on negotiations between the Ministry of Lands and Forestry and industry representatives, and a second using more optimistic, but in out view more realistic (especially considering the trend towards kiln-dried lumber and higher value export products) parameters. Even based on the more pessimistic >baseline profit= calculations, we found that concessionaires could comfortably pay cocoa farmers 10% of the stumpage value of the higher and moderate value or demand timber trees. With the improved profit model calculations, the concessionaires could pay 20%, but probably not the 33% demanded by farmers. For the lower value species, concessionaire profitability was much lower.

Here we argue that there is a strong case for the Forestry Department (FD) to pay farmers 10% of the stumpage value for the lower value species. There are arguably three main reasons for this, apart from the concessionaires= lack of capacity to pay (at least in the pessimistic cost scenario). First, the FD now receives 60% of the off-reserve revenue in recognition of its service or contribution to off-reserve tree or forest management, but the farmers are the *de facto* managers of the resource. Here we calculate the amount of forest revenue accruing to the different stakeholders from the new stumpage charge, and compare it to how much was received previously. A second reason is that this would >soften the pill= for the industry. Third, payments to farmers for keeping lesser used species (LUS) would be a way for FD to pursue one of its stated policy objectives. In addition there might be a case for the FD paying that part of the compensation corresponding to the estimated loss in cocoa yields.

From the point of view of >effectiveness=, paying the farmers 10% of the tree=s stumpage value as well as full compensation, should be enough for them to prefer timber as against non-timber shade trees, because of the low opportunity costs of land, labour and capital. In the short run it may be difficult to introduce a system of farmer incentive payments which will change the distribution of the forest rent, since concessionaires have only just been confronted with more realistic log prices. The FD will need to wait for the new forest fees to bed down, but meanwhile should do everything possible to ensure cocoa farmers at least receive full compensation for damage.

While it is hoped that many will see the logic of the calculatons presented here, they will also be aware of the political and practical difficulties of implementing such a system of incentive payments for cocoa farmers. First, none of the above will happen if farmers are not aware of their rights and do not know the market value of the trees. Some of the cocoa farmers at the stakeholder workshop did not even know the official compensation rate per cocoa bush. This paper can only suggest what might be possible on the basis of some fairly rudimentary economic calculations. It cannot force the attitudinal changes and quality of FD outreach or extension which could make it happen. Strong support of farmer rights by FD field staff is then essential.

As with the other case studies in this series, the methodological objective was to test out a range of economic tools in the analysis of stakeholder incentives in participatory forestry. The smaller than planned research team employed a mix of participatory and traditional economic research tools. By combining PRA methods, a farmer questionnaire, key informant discussions, and secondary data leading to farm budget and cost-benefit analysis, the study was able to develop some basic calculations of possible incentive levels and their impacts on stakeholders. The PRA work focussed on farmer=s perceptions of the value and role of trees on cocoa farms. An attempt was made to quantify the benefits and costs of timber trees on cocoa farms, but the main benefit of this was that it allowed the team to enter into a dialogue with farmers on the issues surrounding incentives, and to appreciate the complexity of the relationship between cocoa and trees.

A cocoa farmer survey was carried out to see if farmers could estimate the effects of tree removal on cocoa production. Some >contingent valuation= (CV) questions were also attempted to elicit farmer valuation of the >indirect use= or micro-environmental benefits (for cocoa) of timber trees. Although some useful data was obtained, the quantitative data was disappointing; farmers gave apparently strategic answers to the CV questions, which exagerated the implied levels of compensation and incentives. A survey was also attempted with the idea of estimating the discount rate; the problem here was how to make the questions relevant to cocoa farming, which is regarded by many as a kind of old age pension, suggesting a low discount rate. This proved a considerable distraction to the research team. Fortunately an earlier World Bank supported study of cocoa farming in Ghana had studied the discount rate question.

These problems forced the study to take short-cut approaches involving simplifying assumptions in the calculations, for example of the impact of removal of a shade tree on cocoa yields. This underlines the point that it is often the lack of reliable data on physical relationships which limits the scope of economic valuation exercises. The combination of key informants and secondary data is a short-cut approach often used by economists, but arguably a cost-effective one given normal project-cycle time frames. There is little doubt that a longer and more thorough piece of research is needed, particularly for assessing the costs and efficiency of the timber industry, and therefore its capacity to pay. Accurate economic data on costs and efficiency in the timber industry, and how these will change in response to fiscal and trade policy changes, is critical for defining a just and effective system of incentives for cocoa farmers.

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ABBREVIATIONS

AAC	Annual Allowable Cut
CFMU	Collaborative Forest Management Unit, Planning Branch of FD, Kumasi
CRIG	Cocoa Research Institute of Ghana
CV	Contingent valuation
FD	Forestry Department
ITTO	International Timber and Trade Organisation
LUS	Lesser used species
MLF	Ministry of Lands and Forestry
NPV	Net Present Value
NTFP	Non-timber forest product
PRA	Participatory rural appraisal
SRA	Social Responsibility Agreement
TEDB	Timber Export Development Board
TUC	Timber Utilization Contract
WTA	Willingness to accept

Note: the Cedi values expressed in this report correspond to an exchange rate of about Cedis 3,800 per pound sterling and Cedis 2,300 per US dollar.

1. INTRODUCTION

1.1 Study context and rationale

Ghana=s supply of timber comes from three main sources: forest reserves, forest fragments outside reserves, and farms outside reserves. In recent years the off-reserve resource has been over-exploited: in 1996, FD records show that 820,000 m^3 roundwood were extracted off-reserve against an Annual Allowable Cut (AAC) of 500,000 m^3. The off-reserve harvest comprised over 70% of the combined on and off-reserve official cut, while a further 5% came from >unknown sources=. Legalised and illegal chainsaw operators also continue to operate, although to a decreasing extent, outside reserves. It is generally estimated by Forest Department (FD) staff that 80% of timber comes from outside the forest reserves.

The concern is that over-exploitation outside the forest reserves will soon result in demand pressures on the forest reserves which will make it difficult to stay within the AAC; therefore maintenance of the off-reserve timber supply is critical for sustainable on-reserve forest management (Kotey et al, 1998). With the assistance of DFID and other donors, FD has made real progress in tackling the problems surrounding the off-reserve resource through the Interim Measures introduced in 1995 and the new Timber Utilization Contract (TUC). The new approach involves innovative forms of collaboration between the stakeholders, especially concessionaires, landowners, communities, farmers and the FD.

FD=s recent off-reserve inventory (FD, undated) shows that, taken together, cocoa farms, food crop farms and fallow land contain more timber trees than the remaining area of natural forest outside the reserves. Cocoa farms are the second most important source (behind natural forests) of timber trees outside the reserves. For natural forest areas, the FD is developing the concept of >Dedicated Forests= in which landowning communities are given full rights to manage and benefit from the resource (Kotey et al, 1998).

At present farmers have no constitutional rights to an economic[1] interest in naturally regenerating trees maintained on their farms (Kotey et al, 1998). The incentive has rather been for farmers to destroy timber trees since concessionaires rarely pay sufficient compensation for damage to cocoa or other crops (Amanor, 1996). It has also been much more attractive for farmers to >sell= timber trees to (mainly illegal) chainsaw operators. Typically farmers are paid one third of the value of the tree in cash or kind (Amanor, 1996).

Recent developments have slightly improved this situation, at least in respect of payment of the damage compensation. The 1995 Interim Measures introduced the >pre-felling inspection= at which farmers are supposed to give permission, in the presence of the FD, for a particular tree to be felled. This was ratified by the Timber Resources Management Act 547. Farmers thus now

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[1] **In this study the term >economic= is used in its everyday sense and does not conform to the narrower cost-benefit analysis use of the term. Thus it refers to marketed financial values, and does not include non-marketed or externality values.**

have the right to refuse permission to concessionaires to fell a timber tree. Also at a >post-felling inspection=, farmers can negotiate fair compensation for crop damage from the concessionaire, and a >certificate of conveyance=, without which the timber is illegal, should not be issued if there are any outstanding disputes. The Interim Measures and its successor, the >Controlled Timber Production Off-Reserve= programme, have had a positive impact in some areas, as documented by Kotey et al (1998), and as farmer education improves, the cases of uncompensated crop damage should decline.

However, it is apparent that fair compensation is still very patchy as not all farmers are aware of their new rights, and there is still some way to go in training District-level FD staff in the new procedures (based on observations from this case study). And farmers still do not have any share in the value of timber trees in spite of being the main decision-makers and managers. This problem was forcibly pointed out in a 1997 FD >Seminar on Sustainable Timber Production from Outside Forest Reserves=. For example, one working group reported: Athe agitation is that the farmers do not get a fair deal when trees are taken from their farms. Does the group have any means to assess what part of royalities is >fair= to be paid to the affected farmer in order that the farmer will protect the trees on his land?@ (FD, 1997, p.30).

1.2 Objectives

In order to provide a more empirical basis for assessing the options for developing positive incentives for cocoa farmers to retain timber trees, and to test out the use of economic tools in the analysis of stakeholder incentives in collaborative approaches to forest management, this study was selected as one of five country case studies in the DFID Forestry Research Programme study entitled >The Economic Analysis of Stakeholder Incentives in Participatory Forest Management (PFM).= The main objective of this is to develop a set of tools or methodological >toolbox= for the economic analysis of PFM for use by donors and project managers throughout the project cycle. The more specific objectives of this research study can be listed as:

X to develop a methodology for estimating >fair= tree-tending incentive payments for cocoa farmers, sufficient to encourage them to maintain timber trees on their cocoa farms;
X to estimate some benchmark figures of possible incentive levels in a cocoa growing region of Ghana;
X to consider alternative payment mechanisms and how these might affect the incentives of other stakeholders.

This information could provide the basis for policy discussions on how to encourage cocoa farmers to keep timber trees, and possibly feed into a Working Group approach to the problems, similar to the process leading to the introduction of the Interim Measures.

1.3 Selection of the study area

The fieldwork was carried out over a four week period in November 1998 in Diaso District which is an important cocoa growing area in the Central Region and forms part of the moist evergreen agro-ecological zone. Diaso District, which is about half way between the towns of Bibiani and Dunkwa, was selected as being a reasonably accessible (two hours drive from Kumasi) and important cocoa growing area. It is also an area where there has been significant recent concessionaire activity on cocoa farms, and where the FD, through an ITTO project to develop the concepts and practise of Timber Utilization Contracts (TUCs) involving collaboration between stakeholders, has made efforts to educate farmers about their recently acquired rights. Since the TUC approach and education of farmer rights are essential ingredients of the new policy for off-reserve forest management, it was decided that it would be more useful to carry out the study in a forward looking context. Background socio-economic information on the area and cocoa farming is presented in Appendix 1.

2. OVERVIEW OF THE METHODOLOGY

2.1 Introduction

The research team found it was necessary to draw on a range of approaches and tools to tackle what proved to be a complex set of issues in a short time. The study involved participatory research appraisal (PRA) methods - or more accurately rapid rural appraisal methods - and more traditional economic tools like a farmer questionnaire, the use of key informants and secondary data to generate farm budgets, and the use of cost-benefit analysis techniques including discounting and sensitivity analysis.

2.2 >Participatory research= excercise

In order to better undestand the issues, and in particular farmer perspectives of timber trees growing on cocoa farms, we first carried out participatory rural appraisal (PRA) type exercises in three communities in Diaso District. The objectives of this were to gain an understanding of the socio-economic basis of cocoa farming, explore farmer attitudes to timber trees, and elicit their perceptions of the physical relationships between cocoa and timber trees. More specifically farmers identified the >good= and >bad= characterisitics of timber trees for cocoa farming, and attempts were made to score the benefits and costs of >good= and >bad= shade trees. More detailed methodology and the results of these exercises are presented in Appendix 1.

2.3 Cocoa farmer questionnaire

The second main research activity was a questionnaire which, as well as providing more general information on timber trees on cocoa farms, attempted to get cocoa farmers to quantify their losses as a result of extraction of the timber tree. This included both the direct damage caused by timber tree extraction, and the loss in cocoa yields and increase in costs (e,g., increased time spent weeding) resulting from the removal of a timber (shade) tree. This was not a statistical sample survey because of the difficulty of identifying farmers with trees recently felled by concessionaires. Many of those interviewed were farmers attending the weekly market in Diaso. As far as we could ascertain, there was no particular farmer type who attended the market. Other farmers were located in areas where recent fellings had taken place. Therefore, while it cannot be claimed that the survey was statistically representative, there is no obvious reason why it should be biased. After a few questionnaires were discarded due to enumerator errors, we were left with 78 observations.

The questionnaire, which is presented in Appendix 8, included several >contingent valuation=

(CV)[2] type questions which were included partly for their methodological interest, but also because sensible answers would have been very useful in the context of this study. For example, one question (19) asked the farmers how much they would be willing to accept as compensation for each cocoa bush suffering a loss of yield after removal of a particular timber tree. This followed a question on the number of cocoa bushes which normally suffered when a shade tree was removed. Effectively these questions sought to place a value on the indirect use or environmental service values of a shade tree for cocoa, and in terms which tried to get the farmer to think about the technical relationship between shade and cocoa yelds. Two further questions (25 and 26) tried to obtain the farmer=s willingness to accept (WTA) compensation (this time in cash terms) for removal of a timber tree over and above damage compensation. It should be noted that cocoa farmers had no problem stating things in cash terms; this is hardly surprising since cocoa production is 100% market orientated.

2.4 Secondary data and key informants for development of cocoa budgets

In order to assess the impact of removal of timber trees on cocoa production, it was necessary to develop farm budgets of cocoa production for three main cocoa varieties. Cocoa production is a complex economic activity, especially in terms of labour inputs over time, and there was insufficient time to design and carry out a reliable random sample survey.

The cocoa budget is based on economic surveys (Okali, 1974, Rourke, 1974), information provided by the Cocoa Services Division (also based on farmer surveys) and discussions with key informant farmers in Diaso District. The information from the key informants was important for modifying the budgets to conform to farmer technology in Diaso District, for yield levels, and for current prices of inputs. In the Okali (1974) study, labour inputs were recorded over an 18 month period on cocoa farms in the Brong Ahafo Region. Although the labour inputs refer to a slightly different agro-ecological zone (moist semi-deciduous forest) it was felt best to use them as being the most reliable study of labour use in cocoa farming available. The cocoa budget is summarised in Appendix 2, with notes on some of the economic assumptions.

2.5 Secondary data and key informant information for calculation of stumpage values of timber and returns to concessionaires

Again there was insufficient time to collect primary data in order to calculate stumpage values and the profitability of timber concessionaires. The calculations were based on data provided by the FD (Head Office), Ministry of Lands and Forestry (a Cabinet Memorandum of April 1998) and from a survey of sawmillers and loggers carried out in 1992 by the International Institute for

[2] The basic idea of the CV approach is that where markets do not exist, they can be constructed or imagined, and that people are capable of expressing their preferences in this hypothetical situation. It is usually used to assess how people value environmental benefits or costs. CV involves asking people what value they would place on a hypothetical change involving a loss or gain in their utility or satisfaction, either in terms of their willingness to pay (WTP) for an improvement, or their willingness to accept (WTA) compensation for loss of a benefit.

the Environment and Development (reported in IIED/FD, 1993). This was supplemented by data from key informant concessionaires and sawmillers in the Kumasi region on some of the key parameters, as for example the proportion of timber exported, merchantable volume per tree, etc., and for differentiating in the economic analysis between logger concessionaires and sawmilling concessionaires.

2.6 Concessionaire and farmer questionnaires on tree >sales=

In a different area (Ofinso District in Ashanti Region), and before the main fieldwork started, farmer and concessionaire questionaires were implemented where it was known that fellings had recently taken place, and it was thought that negotiations had taken place between farmers and concessionaires in which the former were using their right to withhold permission to fell as a means of negotiating a >sale= price. This would have provided a very useful indicator of what might be a fair tree-tending payment for both the farmer and concessionaire. However the negotiations were found to only relate to compensation for damage to crops, rather than additional payments recognising the farmer=s right to withhold permission. There was also no evidence in Diaso District of such negotiations, although Kotey et al (1998) reported incidents of the >sale= of trees by farmers.

2.7 Discount rate survey

It was decided early on in the study that selection of an appropriate discount rate was critical in view of the long-term nature of cocoa farming, and the need for farmers to weigh up compensation or incentive payments at the time of felling in comparison with the loss of a future income stream (resulting from the the tree=s positive effect on cocoa yields). Based on an approach adopted in Zimbabwe (Kundhlande, 1998), we asked cocoa farmers how many roof sheets or bags of cement (according to the farmers= preference) received in the future (one and five years from now) would be equal to ten roof sheets/bags of cement received now. Our first intention was to ask the question in terms of inputs appropriate to cocoa farming - unfortunately none of the few inputs used were appropriate[3]. We also asked tried to cocoa farmers= present time preference in terms of cash rather than kind; in this case it was necessary to get the farmer=s estimate of inflation in order to estimate the real discount rate. The discount rate questionnaire is presented in Appendix 9.

2.8 The discount rate used in this study

The profitability of cocoa farming is very sensitive to the discount rate (see Table 1). We believe that the appropriate discount rate could be very low, since many farmers see cocoa farming as a type of old age pension policy. When they are young they can build it up, and when they are older they can let out the farm to a caretaker farmer on a sharecropping basis and receive one third of the produce. Another factor is the low marketing risk. There is an assured market with the price fixed each year by the Cocoa Board (COCOBOD), and at present cocoa prices are increasing gradually in real terms (due to the rise in world market prices and a gradual reduction

[3]For example, we considered hybrid cocoa seedlings, but (a) after the first year, farmers can obtain seed from seedlings brought in year 1, so they have no future value, and (b) improved seed has technology considerations which would add another distorting dimension to the decision.

in Ghana=s export tax). A World Bank study (Bateman, 1988) of the economics of cocoa farming claims to have studied the discount rate issue, and concluded that a 6% discount rate best represented the cocoa farmers= point of view.

2.9 Stakeholder workshop

A half-day workshop to discuss the results of the study was held at Diaso on 1 December 1998 with 27 representatives of the different stakeholders including concessionaires (2), stool chiefs or their representatives (3), a member of a Traditional Council, members of the District Assembly (2), an employee of the Cocoa Board, an agricultural extension officer, regional FD staff including the District Forestry Officer, and cocoa farmers.

3. COMPENSATION FOR LOSSES

3.1 Introduction

There are a range of possible levels of financial compensation and incentives for cocoa farmers to tend timber trees on their cocoa farms, apart from the possibility of market negotiation between farmers and concessionaires based on the former=s bargaining chip of the right to refuse permission to fell. Here we use the word >compensation= to apply to payments which compensate for losses incurred as a result of removal of the timber tree, and the word >incentive= to refer to payments over and above compensation.

Full compensation for losses resulting from the loss of a shade tree is a necessary but probably not sufficient condition for farmers to maintain timber trees on cocoa farms, although full compensation may be close to being a sufficient condition in view of the complementarity between timber trees and cocoa production. The opportunity cost of keeping a timber shade tree, in terms of the utilisation of land, labour and capital is very low if not negligable.

Discussions with farmers revealed that the labour required to look after and weed round a regenerating seedling (and then sapling) is low and very difficult to calculate since it forms part of a general cleaning exercise. The opportunity cost of land utilised by a timber tree on a cocoa farm may also be surprisingly low. Observations and discussions revealed that some timber trees reported by farmers as being >bad= for cocoa, like *Triplochiton scleroxylon* (wawa) and *Piptadeniastrum africanum* (dahoma), do result in a few less cocoa bushes, but cocoa bushes are generally planted very close to the roots of most trees (suggesting a complementary soil fertility relationship). Except for depreciation on machetes and other cleaning tools, there are no obvious capital inputs required for tending timber trees. The real input of farmers requiring compensation is therefore not land, labour or financial capital but knowledge (part of human capital), especially the skill of being able to recognise a valuable timber tree sapling at the earliest age. Farmer knowledge in managing tree regeneration is a point strongly made by Amanor (1996).

The apparently low opportunity costs of tree tending means that the potential for keeping timber trees should be very high, and the incentive payment above compensation necessary to achieve this may be surprisingly low. Cocoa farmers ought to prefer to keep a timber shade tree over a non-timber shade tree with similar properties as long as keeping the timber tree is not a negative option, and the farmer can see the prospect of at least some positive economic gain over and

above compensation. But as reported by Amanor (1996), cocoa or crop farmers often admit to destroying timber trees by ring barking or burning the stump in order to avoid the risk of uncompensated damage by concessionaires.
Farmers who do not know of their new right of veto are behaving in an economically rational fashion when they select a non-timber shade tree in preference to a timber shade tree. Therefore we place a strong emphasis in this study on the removal of economic disincentives to tree tending by ensuring that farmers are fully compensated. In fact, even direct damage and yield loss compensation is not really full compensation, since it ignores the transaction costs; basically the time and stress involved in negotiating fair compensation with the concessionaire and the local FD Technical Officer, who in the past has often tended to side with the concessionaire and may still be amenable to >tips=.

In a few cases where farmers have understood their right of veto, they have sometimes requested levels of compensation up to a third of the value of the tree, according to one of the concessionaires we talked to in the Diaso area. The concessionaire was then forced to bargain with the farmers to find an acceptable compensation level. On the other hand, it has also been observed that concessionaires expecting farmers to negotiate will wait for the >lean season= before approaching them seeking their consent to fell. At certain times of year they know that economic necessity can drastically reduce the negotiated price. Thus even when farmers know their rights, their poverty may >cheat= them out of a fair deal.

3.2 The baseline cocoa budget

In order to be able to estimate the losses sustained by cocoa farmers, we first need to know the profitability of cocoa farming. The baseline cocoa budget presented in Appendix 2 is for the improved *amazonia* cocoa variety (a cross between the traditional *amelonado* or *>Tettie Quarshie=* variety and varieties from the upper and lower Amazon). The budget was based on secondary data and discussions with key informants. Here we assume a baseline yield of 500 kg per hectare, which Cocoa Services Division considers to be about the national average (Cocoa Services Division, Kumasi, personal communication).

It should be noted that no land cost is imputed here; this is because in this area most land was held by >migrant farmers=[4] on 99 year leases as grants or gifts from stools on the payment of nominal >token payments= and/or annual drinks payments. Budgets were also prepared for *amelonado* and hybrid cocoa varieties, involving different levels of inputs and yields, different cocoa bush densities, and varying longevity of the crop (30 years for hybrid cocoa, 50 years for *amazonia* and *amelonado*, although it appears that farmers continue cropping the latter beyond this).

[4]This term, though commonly used in Ghana is misleading, since all the >migrant= farmers we spoke to had been there for at least 40 years.

There are a large number of variables affecting the economics of cocoa farming, including whether the farmer is a sharecropper (not common in the Diaso area), interactions between the agro-ecological zone and cocoa species, the presence of diseases like Black Pod (see Appendix 6), cocoa bush density, the use of chemical inputs, etc. Any estimate of the returns to cocoa farming should therefore be considered as subject to wide variation; therefore a simple sensitivity analysis was carried out on some of the likely sources of variation: the variety, the discount rate, the cocoa yield or price, and the (opportunity) cost of labour. Table 1 summarises some of the main parameters and the resulting Net Present Value (NPV) per ha.[5]

Table 1. Basic cocoa production parameters and sensitivity analysis of NPV per hectare (based on a 6% discount rate unless otherwise stated)

Basic parameters	*Amelonado variety*	*Amazonia variety*	*Hybrid Amazon variety*
Cocoa peak yield in baseline case: kg/ha	350	500	700
Cocoa price (fixed): Cedis/kg	2250	2250	2250
Cocoa bushes per hectare (final spacing)	1000	800	600
Years of productive cycle	50+	50	30
Labour opportunity cost: Cedis/person day	4000	4000	4000
Net Present Value per hectare	*Cedis 000/ha*	*Cedis 000/ha*	*Cedis 000/ha*
10% discount rate	2481	4740	6119
6% discount rate (baseline)	5439	9448	10500
3% discount rate	10037	17418	16439
20% lower cocoa price or yield	3813	6764	7126
20% higher cocoa price or yield	7065	12133	13874
20% higher cost of labour	4873	8756	9733
20% lower cost of labour	6006	10140	11267

Table 1 shows that while traditional *amelonado* cocoa is much less remunerative than the other varieties, at least according to this data, there is relatively little difference in the profitability of *amazonia* and hybrid cocoa; the latter has higher inputs, and a shorter production cycle which is significant at low discount rates. Table 1 also shows that a 3% difference in the discount rate halves (or doubles) the NPV. The results are also very sensitive to the price of cocoa, which is presently on a gradual upward trend in real terms. The labour opportunity cost is rather less critical. For a sharecropper working under the *abusa* arrangement, in which one third of the produce goes to the landlord, the NPV is approximately halved at these discount rates.

[5]The PRA study revealed that in this old cocoa growing area, in which all >growable= land has been taken up, land rather than labour or capital was usually the scarce or limiting factor of production.

3.3 Damage compensation

The basic level of compensation (A) is for direct damage to cocoa bushes destroyed or damaged in the process of timber extraction, including skidding. Here we compare official damage compensation rates with an estimate of the net present value of cocoa bushes using the baseline cocoa budget. The survey of cocoa farmers revealed an estimated average[6] of 36 cocoa bushes destroyed per felling. This can be compared to Mayers and Kotey=s (1996) estimate of 30 to 50 cocoa bushes. It may even be an underestimate as it is not clear whether the farmer survey response included cocoa bushes destroyed or damaged by skidder trails[7].

A possible basis for compensation is the NPV value of the cocoa bushes damaged or destroyed. With a 6% discount rate, the >average= NPV per *amazonia* cocoa bush was about Cedis 12,000. This compares to the official compensation level of Cedis 9,600 per cooca bush calculated by the Lands Valuation Department.[8] For *amelonado*, the NPV per bush at a 6% discount rate was Cedis 5,400, whereas for hybrid cocoa the NPV was about Cedis 17,500. However it should be noted that since they are much closer together, more *amelonado* bushes will be damaged than *amazonia* or hybrid cocoa bushes. Table 2 presents a range of farmer compensation values per timber tree felled in thousands of Cedis, according to the discount rate and the number of cocoa bushes destroyed or damaged.

Table 2. Possible damage compensation levels per timber tree felled (by cocoa variety and discount rate)

	Amelonado variety	***Amazonia variety***	***Hybrid Amazon variety***
Damage compensation per cocoa bush	*C000/coc.bush*	*C000/coc.bush*	*C000/coc.bush*
10% discount rate	2.5	5.9	10.2
6% discount rate (baseline)	5.4	11.8	17.5
3% discount rate	10	21.8	27.4
Assumed no. cocoa bushes damaged	50	40	30
Damage compensation per timber tree	*C000/tree*	*C000/tree*	*C000/tree*
10% discount rate	125	236	306
6% discount rate (baseline)	270	472	525

[6] Following removal of some very high >outlier= responses which seemed to reflect >tactical= answers.

[7] The importance of damage due to skidder trails was only picked up later in the study - after the farmer survey had been conducted.

[8] We asked Lands Valuation Department in Kumasi for details of how this was calculated. We were told the >investment method= was used but written details were not available.

3% discount rate	500	872	822

The influence of the discount rate is again clear. For *amazonia* cocoa, using a 6% as opposed to a 10% discount rate doubles the compensation, and using a 3% discount rate almost doubles it again. Perhaps unsurprisingly, farmers thought they should be compensated at levels far higher than these figures. In the farmer survey, many said they should receive around Cedis 100,000 per cocoa bush as compensation, and Mayers and Kotey (1996) report a similar figure. This study considers that such demands are exaggerated, but the fact that farmers perceive themselves to be under-compensated (their reaction to the official Cedis 9,600 per cocoa bush is that it is a pittance) is significant, since it is what farmers *perceive to be fair compensation* which will count in the decision to destroy or retain a timber tree. Also a higher compensation payment level would provide an incentive to loggers to take more care, although current >carelessness= may be more linked to the concessionaire=s perception that he can get away with a minimal payment (see below).

On the basis of these calculations we therefore suggest that compensation could be set at Cedis 12,000 ($5.22) per *amazonia* cocoa bush, and to make some allowance for the different values involved, Cedis 10,000 per *Amelonado* bush and Cedis 14,000 per hybrid bush. This would mean a 25% increase in current official compensation rates, and might typically result in a cost of about half a million cedis per felled tree. Where there is sharecropping, payment should be in the same proportion as the product distribution. Any agreed value needs to be tied directly to the cocoa price, which at the time of writing was Cedis 2,250 (close to US$1) per kg. Since this is fixed each year this would be relatively simple.

It might appear from our results that there should be a much higher level of compensation for hybrid cocoa and a much lower level of compensation for *amelonado* in view of the NPV values. But one advantage of a rate of compensation which understates the value differential between the cocoa varieties, is that it would favour systems with more timber trees, and thus higher environmental benefits and potential for the timber industry. This might help counteract the economics of cocoa production which favours a shift towards hybrid varieties with lower shade requirements.

Whatever the compensation rate, there will be no impact if concessionaires are not made to follow the forest law. We found that even in an area in which the FD Planning Branch has made regular visits, correct procedures are not being followed. It appears there is a tendency for some Technical Officers to issue the Conveyance Certificate without consulting the farmer after the felling has taken place. While the law is not implemented, and/or farmers are not fully aware of their rights, the incentive to destroy timber trees will remain high. There may also be some loop-holes in the new forest legislation and procedures which are aimed at fairer compensation. Farmers complained that the damage caused by skidders is often not taken into account. Also we noted that logs are sometimes dragged through a different farm to the one on which the felling took place, and concessionaires say they are not liable for this damage.

3.4 Yield loss compensation

Compensation for destroyed or damaged cocoa bushes is not full compensation, since it does not include *yield loss* suffered by the remaining cocoa bushes as a result of the removal of the shade tree. This type of compensation can also be thought of in terms of the loss of the future stream of benefits derived from the complementarity between the shade tree and cocoa farming.

Our first intention was to obtain information on the likely cocoa yield impacts from the loss of the various different functions of the tree, either from the Cocoa Research Institute of Ghana (CRIG), or the farmers themselves. However we discoverd that (a) the biological relationships are highly complex and subject to great variation according to a number of variables, including the type of timber tree, and (b) there is a paucity of scientific data which might provide a basis for developing a model of the yield impacts from shade tree removal. Table 3, which is based on the literature and our PRA discussions, represents an attempt to summarise the complexities of the interaction between shade trees, whether timber or non-timber trees, and cocoa (see also Appendices 1 and 6).

Table 3. Advantages and disadvantages of shade trees for cocoa

Factor	*Advantages of shade trees: negative effects on cocoa from removal of tree*	*Disadvantages of shade trees: positive effects on cocoa from removal of tree*
Competition/ soil fertility/ space	loss of micro-climate benefits, resulting in higher soil and air temperatures, less protection from wind and loss of nutrient recycling benefits	provides space to plant more cocoa bushes if large buttress and/or spreading roots, and reduces competition for soil moisture and nutrients
Shade / sunlight	increased mineral nutrient requirements of cocoa due to greater photosynthesis/ growth/transpiration rates; build up of capsids (see below); die-back problems due to too much direct sunlight	faster growth of cocoa due to increased photosynthesis
Diseases and pests	build up of capsids, which feed on cocoa shoots and cause defoliation, and mealybugs which can carry swollen shoot disease; viral die-back problems	reduction or elimination of fungal and especially blackpod disease; some trees are wild hosts to diseases/vectors (e.g., ceiba to swollen-shoot disease); shade removal may also reduce rodent populations
Weeds and parasitic plants	increase in time spent weeding and removing mosses and parasitic plants including climbers and >mistletoe=	
NTFPs	loss of firewood and any NTFPs (e.g., kapok, gum, medicinal plants)	
Falling branches		reduced risk of damage to cocoa/people from falling branches, or even treefall

The economic loss to the cocoa farmer as a result of reduced yield from cocoa bushes was estimated by using a standard cost-benefit analysis (CBA) approach: comparison of the >with project= (or here *with felling*) and the >without project= (*without felling*) benefit flow. Table 4 shows the >with= versus >without felling= calculation. In this case, the per cocoa bush calculation is less useful since it would not be practical to estimate the number of cocoa bushes affected on a felling-by-felling basis; we therefore suggest a flat-rate compensation per felled tree regardless of the timber tree species.

In spite of this complexity, there is sufficient evidence to suggest that at least in an area like Diaso where Black Pod disease is not as big a threat as in some areas, removal of a shade tree is likely to cause some fall in cocoa production, at least until the farmer can nurture a replacement tree to restore adequate shade. This can take from five to ten years, depending on whether it is a coppicing tree. Based on the farmer survey and the PRA exercises, in Table 4 we therefore crudely assume a one-third lower yield of cocoa for five years after removal of the shade tree, and that cocoa yields would be gradually restored to pre-felling levels by the tenth year after felling.

Another vital calculation is the number of cocoa bushes affected by each shade tree. Field measurements indicated that between typically 40 to 80 cocoa bushes are shaded by a mature crown. However many of these cocoa bushes will have been damaged or destroyed in the felling, and thus have already been taken into account by the calculation of direct damage compensation. Based on farmer estimates in the survey, and in the absence of more empirical data, we assume a further 35 *amazonia* cocoa bushes would suffer yield loss as a result of removal of the tree.

There is less variation according to the discount rate because the calculation is only over a ten year period. With a 6% discount rate the yield loss estimation came to C111,000. This calculation suggests that reasonable compensation might therefore be C100,000 (US$48) per felled tree, regardless of the cocoa variety (for the same reasons stated in 3.3). Again this would need to be linked to the cocoa price.

We also attempted to estimate the yield loss effect through a CV-type question in the cocoa farmer survey. Farmers who had timber trees felled on their farms were asked how many kg of cocoa they would be willing to accept as compensation for each cocoa bush suffering from reduced production following removal of a shading timber tree. The question was asked >in kind= in the hope that this would get farmers to focus on the shade/yield relationship. However many farmers found it difficult to respond in kg of cocoa, and preferred to state a cash figure. Both the responses in cash and kind were very high, resulting in a value of over Cedis 100,000 per cocoa bush - about ten times the value of the bush according to our calculations. This was probably caused by >strategic voting= (i.e., high responses in the hope that these might influence actual payments in the future). Perhaps surprisingly, the estimates in kind were higher than in cash.

3.5 Full compensation for removal of a timber tree

Table 5 combines the damage and yield loss estimates. The resulting full compensation figure depends on how many cocoa bushes are damaged, and therefore cannot be fixed per timber tree. For the remaining calculations we take as a baseline the figure of Cedis 580,000 (about US$250) per timber tree felled.

Table 5. Calculation of full compensation for removal of a timber tree

	Amelonado variety Cedis	*Amazonia variety Cedis*	*Hybrid variety Cedis*
Damage loss per timber tree (from Table 3)	500000	480000	420000
Yield loss per timber tree (Table 4)	100000	100000	100000
Full compensation loss per timber tree	600000	580000	520000

4. INCENTIVES FOR TIMBER TREE TENDING

4.1 The issue of tree tenure

So far in this analysis we have only looked at >compensation= for losses. As yet there is still no positive encouragement to farmers to keep a timber as opposed to a non-timber shade tree. Most analysts support at least partial ownership of the trees by farmers as the most desirable outcome. For example, Amanor (1996:184) expresses the need to develop Aan ethical framework of rights and ownership that reflects the labour and knowledge invested in the management of forests@ pointing out that Aan invented tradition of ownership[9] by chiefs does not promote rational management of forest resources@. A CIFOR/UNEP commissioned study also recommended Aa review of the present land, tree and forest tenure systems as well as the forest and timber laws to give right of ownership of trees to farmers who have the customary or statutory legal farming rights over any piece of land@ (Ofosu-Asiedu et al, 1995:43), and CFMU (1995) predict that Ain the very long run, virtually all trees off-reserve will be planted or nursed and full ownership can move to the cultivator.@

While Kotey et al (1998) observe that a return to the pre-colonial tree tenure position is unlikely, they point out that farmers provide a service in off-reserve areas and should get a share of the revenue. We agree that a degree of ownership and a share of the revenue is desirable on both efficiency and equity grounds: farmers provide a service at least as important as the FD (which currently receives 54% of log royalties outside forest reserves for its management function) as regards management of the resource, and are the principal *de facto* resource managers, but at least for the purpose of this study must consider full tree tenure as unlikely[10].

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[9]This point is explained by Mayers & Kotey (1996:12): AAcross the tropical high forest zone, the general >customary law= position is that >assets= found on the land, not the result of identifiable labour, belong to the whole community and are held in trust and administered by the traditional authority (traditional councils and their sub-components - the stool chiefs. The colonial system sought to provide a revenue base for the stool, and effectively changed the nature of the chief from the representative of collectivity to an individual with ownership rights.@

[10]Full tree tenure to farmers would logically result in negotiated sale prices and compensation determined on a market basis involving competition between buyers and sellers. But it is difficult to see how full tree tenure to farmers could be reconciled with the current or indeed any concession system. There is also the equity issue of how to compensate landowners for timber trees growing at the beginning of the lease. Clearly this requires much more analysis.

4.2 Four incentive payment options

Leaving aside the option of full tree tenure for the present, we present here four possible options for incentive payment levels to farmers:

1. Full compensation plus a payment based on the estimated plantation-grown replacement cost of naturally regenerated trees.

2. 10% of >the value= of the tree, with this being interpreted as 10% of the stumpage value of the tree plus full compensation.

3. 20% of the stumpage value plus full compensation.

4. 33% of the stumpage value, which is taken as the farmers= willingness to accept value, plus full compensation.

A rationale for (1) is that if farmers do not tend timber trees and/or deny concessionaires access to them, given the limited AAC from the forest reserves, the timber would have to be grown on a plantation (leaving aside the issue of which indigenous tree varieties could be grown in a plantation). Also we might think of this payment as a means of encouraging a more tree-intensive land use system with its commensurate environmental benefits to society. There might therefore be scope for payment by a party other than the concessionaire. Another basis might have been a payment based on the opportunity cost value of the resources devoted by the farmer to tree tending. However this is not appropriate due to the largely complementary (as opposed to competitive) relationship of timber trees with cocoa farming[11].

4.3 Full compensation plus plantation-grown replacement cost of naturally regenerating timber trees

The plantation cost was based on an economic study of teak plantation costs conducted in 1993 (ODA/EC, 1993). Appendix 3 shows the present value of the costs of production, including land, for a hectare of teak yielding 240 m^3 standing volume per ha, including poles, over a 30 year period. Taking the gross volume cumulative yield of 240 m^3, the cost was estimated at Cedis 7,291 per m^3 with a 10% discount rate, and Cedis 8,126 per m^3 with a 6% discount rate. We therefore take Cedis 8,000 ($3.48) per m^3 as a very crude estimate (given the difference between teak and most natural forest management timber species) of a naturally regenerating tree=s replacement cost.

Typically timber trees on cocoa farms have 15 m^3 to 20 m^3 merchantable timber, although the most common species found on cocoa farms (see Appendix 1), Ceiba petandra, Triplochiton scleroxylon (wawa) and Milicia excelsa (odum) are often much bigger than this, and often exceed 30 m^3 merchantable timber according to concessionaires in the Diaso region. Official tree

[11]This comment is made in spite of the distinction made in the PRA excercise between >good= and >bad= trees for cocoa. In fact the conclusion is rather that all trees on cocoa farms, up to a certain density, are >good= to a degree, but some are much better than others. This is supported by the observation that farmers do not usually remove a strategically placed >bad= tree.

volumes used by the Ministry of Lands and Forestry for the purpose of estimating tree stumpage values are as follows (for the trees most commonly found on cocoa farms):

Ceiba petandra = 28.2 m^3;
Milicia excelsa (odum) = 17.9 m^3;
Triplochiton scleroxylon (wawa) = 21.2 m^3;
Terminalia ivorensis (emire) = 13.6 m^3;
Khaya spp. (mahogany) = 18 m^3;
Terminalia superba (ofram) = 14.3 m^3;
Celtis mildbraedii (esa) = 9.8 m^3.

This would result in an incentive of Cedis 160,000 per timber tree assuming 20 m^3 merchantable timber per tree and Cedis 120,000 per tree assuming 15 m^3 merchantable timber. Added to full compensation (*Amazonia* variety), the total payment would be Cedis 700,000-740,000 (about US$300-320) per timber tree, dependent on the number of cocoa bushes damaged. It should be noted that this incentive payment, being cost-based, would not vary by species.

4.4 Payments based on a proportion of the stumpage value of the timber trees

Farmer=s willingness to accept value

In order to consider what share of the value of the tree might be an effective incentive, we started by considering how much farmers would be >willing to accept= for having looked after the timber tree, aside from compensation. We therefore asked a sample of 78 cocoa farmers what they would be willing to accept if in the future it became possible to pay them a proportion of >the value of the tree=. The question was asked in the >referendum= style, i.e., asking firstly if farmers would accept 5% of the value of the tree, then 10%, etc., until a yes answer was given. If they answered no to 50%, then they were asked what proportion they would accept. The >mean= answer came to 37%, with the most popular groupings being 41-50% and 21-30%. This was similar to Amanor=s (1996, p.129) results from a similar survey. As pointed out by Amanor (1996), one third of the timber tree value seems to have a special significance. It is the amount normally agreed on with chainsaw operators. Therefore we take 33% as the farmer=s willingness to accept (WTA) payment.

Table 6. Willingness to accept payment as a proportion of the >value= of the tree

% of tree=s >value=	*Cocoa farmer survey % farmers (n=78)*
less than 10	8
11-20	13
21-30	27
31-40	17
41-50	29
more than 50	6

Calculating the stumpage value

We interpret the >value= of the tree to be the stumpage value since this is the standing value of the timber. The stumpage value can be defined as the residual value of timber after subtracting all the costs of harvesting and transport and a working profit margin from the FOB log price (see Grut et al, 1991 and Richards, 1995). It is important to note that it is calculated *before* deducting forest fees and can be specifically defined for Ghana as follows:

> Log value (roundwood equivalent of FOB air-dried lumber price assuming 37% conversion efficiency)
> *less*
> logging costs
> transport to port
> port handling, bank and documentation charges
> 3% export levy
> reasonable profit margin (20% over costs).

Normally the export levy is not deducted when calculating the stumpage value since it is a fiscal transfer. However in this case we deducted the 3% export levy because it represented a payment for services by two institutions: the Forest Products Inspections Bureau (FPIB) and the Timber Export Development Board (TEDB). Since it appears that logs processed for the local market have a very low profit margin (according to concessionaires it is only the export rejects which go to the local market), the FOB stumpage value is multiplied by the assumed proportion of roundwood exported in some processed form. This results in what we call here the >adjusted stumpage value=.

Table 7 summarises the stumpage value calculations in the baseline and >improved profit= situations, and the four possible incentive payment levels under consideration, and Appendix 4 shows the full calculations. The FOB export values are taken from issues of the Tropical Timbers (1998/1999) information newsletter, and represent a six month average (October 1998 to March 1999) of the FAS air-dried lumber ex-Takoradi D-Mark prices. *Milicia excelsa* (*odum*) was used to represent the higher demand or value species, *Terminalis ivorensis* (*emire*) to represent the moderate value species, and *Triplochiton scleroxylon* (*wawa*) the lower value species. It is realised that *wawa* is listed in the Ministry of Lands and Forestry (MLF) moderate demand species category for forest fees, rather than the lower demand species category. However none of the lower demand species were listed in the Tropical Timbers list, and it is observed from FOB prices supplied by FD (Keith Dolman, pers. comm.) that *wawa* had one of the lowest FOB values in the moderate demand category, and was lower than several species in the low demand category (*Celtis mildbraedii (esa)*, *Nesogordiana papaverifera (danta)* and *Pterygota macrocarpa (kyere)*). Another very important but low value species in the MLF moderate demand category was *Ceiba petandra*, possibly the most abundant timber tree found on cocoa farms. In the interpretation of the calculations here, both *wawa* and *ceiba* should be treated as low value species.

The prices used here are *lower* in terms of D-Marks per cubic metre than the 1998 annual average or for the second half of 1998, reflecting a fall in the value of most aid-dried timber species during the last year, and can therefore be considered to be on the conservative side. It should be noted that interest on capital is included in the logging and processing costs. A very conservative conversion rate of 37% was used, and in the baseline calculation other costs provided by the timber industry were used. Using the >baseline profit= parameters and costs presented in Appendix 4, the stumpage value came to Cedis 240,000/m^3 ($104) for high demand or value species, Cedis 149,000/m^3 ($65) for moderate demand species, and Cedis 38,000/m^3 ($17) for lower demand species.

Table 7. Summary of possible compensation and incentive payments to farmers in thousands of cedis per timber tree (15-20 m^3 merchantable timber)

	High value species Cedis 000	*Moderate value species Cedis 000*	*Low value species Cedis 000*
Baseline profit adjusted stumpage value per m^3	240	149	38
Improved profit adjusted stumpage value per m^3	399	275	122
Baseline profit adjusted stumpage value per tree	3,594-4,791	2,239-2,985	576-768
Improved profit adjusted stumpage value per tree	5,392-7,188	3,710-4,979	1,644-2,193
BASELINE PROFIT MODEL: PAYMENTS TO FARMERS			
1. Full compensation plus replacement cost	700-740	700-740	700-740
2. 10% stumpage value plus full compensation	979-1,113	829-912	644-665
3. 20% stumpage value plus full compensation	1,379-1,645	1,078-1,244	708-751
4. 33% stumpage value plus full compensation	1,778-2,177	1,326-1,575	772-836
IMPROVED PROFIT MODEL: PAYMENTS TO FARMERS			
1. Full compensation plus replacement cost	700-740	700-740	700-740
2. 10% stumpage value plus full compensation	1,179-1,379	992-1,130	763-824
3. 20% stumpage value plus full compensation	1,778-2,178	1,404-1,679	945-1,067
4. 33% stumpage value plus full compensation	2,377-2,976	1,806-2,229	1,128-1,311

However, we believe that the cost and efficiency assumptions in the baseline profit case may be over-conservative[12]. If profitability is as tight as the industry argues, and the price of their logs has been sharply increased due to the new stumpage charges, then it is to be expected that (a) less efficient millers will go out of production, and (b) those that remain will be forced to improve the efficiency of their operations. This could improve the conversion rate to at least 45%. Other fiscal or trade policy incentives[13] could be introduced in the coming years to improve efficiency and reduce over-capacity (and thus excess demand on the resource) in the sawmilling industry. The timber prices in the calculations also reflect a period in which they have been depressed due to the Asian crisis (Tropical Timbers, March 1999). In addition kiln-dried lumber and >added-value= export products like veneer, are more profitable. In 1998, the kiln-dried lumber export price commanded a price premium of up to 20% above air-dried lumber (which fell in volume by 17%) and also avoided the air-dried lumber tax. Export volumes of sliced and rotary veneer

[12]The Ministry calculations were made in order to assess the likely impact of the new stumpage charges on concessionaire returns. The forest industry was naturally concerned that their costs would not be underestimated.

[13]For example, if the log export ban were lifted and replaced by auctioning of log export quotas as suggested by Karsenty (1998), local lumber would become much more valuable and provide a further stimulus to processing efficiency; but this scenario is not considered here.

increased by 7% and 45% respectively in 1998, and the TEDB expect this trend to continue in 1999 (Tropical Timbers, March 1999).

Therefore Appendix 4 shows a second >improved profit= calculation assuming 20% lower cost levels[14] than in the baseline calculation and a 45% conversion rate. This resulted in stumpage values of Cedis 399,000/m^3 (\$173) for high value species, Cedis 275,000/m^3 (\$120) for moderate value species, and Cedis 122,000/m^3 (\$53) for lower value species. These values compare to an overall stumpage value (all timber species) of \$98 per m^3 calculated on the basis of 1991 prices and costs (Richards, 1995). One obvious problem of any incentive payment system based on the stumpage value would be how to estimate the stumpage value at any point in time. In Appendix 7 we provide one suggestion for a short-cut approach to estimating stumpage values at any point in time.

5. CAPACITY TO PAY: IMPACTS ON A RANGE OF STAKEHOLDERS

This section considers the capacity to pay the proposed compensation and incentive payments, and specifically tries to answer the questions: Who can pay? What would be a fair amount to pay? How can the incentive payment burden be shared between the stakeholders? What would be the impacts of incentive payments on other stakeholders?

5.1 Timber concessionaires

The concessionaire, provided he has a sawmill[15], has been the main recipient of the forest rent in Ghana (Richards, 1995), although profit margins will fall sharply with the new stumpage charges[16]. The concessionaire clearly has to be responsible for the direct damage compensation

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[14] The effect of assuming a 20% increase in prices, or of a 10% increase in prices combined with a 10% fall in costs, would be the same in terms of concessionaire profitability but different for the stumpage value.

[15] Here we examine only concessionaires with sawmills, as past analysis (e.g. IIED, 1993) show that loggers without mills operate with very small profit margins and are unlikely to be able to make incentive payments, and possibly not even compensation payments, to farmers. This is because with the log export ban, domestic log prices may only be a third of export prices (based on logger sale prices reported in Kumasi). Secondly we understand there is a policy preference towards vertical integration, and that loggers are to be phased out.

[16] 20% of the FOB roundwood equivalent (based on a conversion rate of 37%) value for high demand species, 10% for moderate demand species and 5% for low demand species.

as this will provide a strong incentive for greater care in logging. The concessionaire may also be the only stakeholder with the potential to make incentive payments based on a proportion of the stumpage value.

In order to assess the impact of any of the incentive payment levels on concessionaires, we first need to calculate the existing economic incentives. The economic analysis presented in Appendix 4 is based largely on data from calculations made by the Ministry of Lands and Forestry and FD, Accra. Much of this data was originally supplied by representatives of the forest industry. We have supplemented this data with information collected from concessionaires in Kumasi. We have assumed that 90% goes for export, since we were told by all the concessionaires interviewed (four) that only export rejects find their way onto the local market: they try and export everything they can in view of the large price differential[17]. The calculations reinforce this view; even in the >improved profit= scenario and for higher value species, there was a negative return to concessionaires for anything sold on the domestic market. In fact there appears to be a strong disincentive to supply the home market and probably only export rejects, as well as timber supplied by low cost operators like chainsaw loggers and bush-millers which finds its way onto the domestic market.

In Appendix 4 the logger-miller concessionaire=s profitability is estimated for both situations (export and domestic lumber), net of all costs including forest fees, and a weighted mean >return on investment= calculated. The return on investment is equal to net revenue or profit as a percentage of total cost. Appendix 5 shows the impact of the four incentive payment levels (plus full compensation) on concessionaire profitability in both the baseline profit and improved profit scenarios. Table 8 summarises the returns on investment with the four incentive payment levels in both profit scenarios, and also considers the possibility of a further 20% fall in the price of timber.

The first observation is that in most cases the profitability is double with the improved profit calculations. This shows just how important the cost and efficiency parameters are. It implies there is a need for an independent and statistically sound economic survey of costs in the industry. One way of interpreting the figures in Table 8 is to consider the higher and lower figures as a range within which the real return should lie. Thus we can observe that for the high and medium value species the industry appears to have a comfortable capacity to pay 10% of stumpage value, and possibly up to 20%, but 33% of stumpage value plus full compensation would probably be excessive.

But for the lower value species, even with the improved profit calculations, it would be difficult for the industry to make payments to farmers. It is interesting to note that the baseline calculations imply that the concessionaire-sawmillers are making a loss on the lower value species, even assuming 90% of the harvested volume finds its way onto the export market. Thus we can expect interest in the lower value species to dry up with the new stumpage charges. If

[17] We understand that one reason for the lower export proportion assumed in the Ministry of Lands and Forestry calculations is because of the policy to phase out air-dried lumber and introduce kiln dried lumber. However kiln-dried lumber will attract higher export prices, and there will be strong incentives for industry to invest in the technology, especially if and when air-dried lumber exports are banned. Therefore if a lower export percentage is assumed, higher FOB prices would be justified in the calculations.

millers continue to show a strong interest in the lower demand species with the new stumpage charges, it will show that the improved profit model is closer to reality.

Table 8. Return on investment to concessionaires with proposed incentives for a 15-20 m^3 tree and sensitivity analysis (20% lower export prices)

	High value species		*Moderate value species*		*Low value species*	
	Baseline profit % return	*Improved profit % return*	*Baseline profit % return*	*Improved profit % return*	*Baseline profit % return*	*Improved profit % return*
Baseline (no payments)	43	75	39	73	0	33
1. Full compensation +	28-32	60-64	20-24	54-59	(22)-(16)	36385
2. 10% + full compensation	23-26	51-54	17-21	47-51	(19)-(15)	36501
3. 20% + full compensation	15-18	39-42	36478	36-40	(21)-(16)	36312
4. 33% + full compensation	36439	27-30	36376	25-29	(23)-(18)	(4)-0
Return on investment assuming 20% lower FOB prices						
Baseline (no payments)	24	54	16	47	-18	9
1. Full compensation +	36502	39-42	(2)-1	28-32	(39)-(35)	(15)-(10)
2. 10% + full compensation	36408	31-35	(3)-(1)	23-27	(36)-(31)	(14)-(9)
3. 20% + full compensation	36221	22-25	(7)-(3)	15-19	(36)-(32)	(18)-(13)
4. 33% + full compensation	(6)-(3)	36508	(11)-(8)	36470	(36)-(32)	(21)-(17)

Just as the calculations are highly sensitive to the cost and efficiency parameters, they are also sensitive to timber prices. Here we consider the possibility of a further 20% reduction in timber prices, noting the recent fall in Ghana=s real export prices of air-dried timber[18]. Assuming the pessimistic cost and efficiency parameters in the baseline profit model, this would mean only high value species would be attractive to exploit, and concessionaires would not even be able to pay minimal incentives to farmers even for these. This is not a realistic assumption, since if the costs are as high as the >baseline profit= model suggests, a large fall in export prices would force concessionaires either to become more efficient or they would be likely to go out of business or invest their capital elsewhere. In the case of the >improved profit= model, except for the low values species, the return on investment would still be sufficient for the concessionaires to pay 10% of the stumpage value to farmers plus full compensation; this would still leave them with a 31-35% and 23-27% return on investment for high and moderate value species respectively.

One conclusion from this analysis is that the level of payment and who can pay it depends partly on the value category of the timber species. For the high and moderate value species there appears to be a good case for the concessionaire to pay 10% of the stumpage value (plus full compensation) to the cocoa farmers, as in even the baseline profit scenario, concessionaires

[18] In the 12 months from May 1998 to April 1999, air-dried *odum* lumber fell by 6.4%, *emire* by 6.6% and *wawa* by an alarming 21%.

would still be assured of a reasonable profit. For the lower value species, we need to consider the possibility of other stakeholders making the incentive payment.

5.2 Beneficiaries of revenue payments

Apart from the concessionaires, the other stakeholders who could contribute to farmer payments are the recipients of forest revenue flows. These stakeholders would logically want to see more timber trees being kept for concessionaires. Thus the landowning stool, the Traditional Council, the District Assembly and the FD all have a vested interest in timber trees on cocoa farms. Table 9 examines how these stakeholders= financial interests have changed with the switch from log royalties to the new stumpage charges, again considering a 15-20 m^3 tree.

This calculation shows firstly the large increase in forest revenue received by the FD for its off-reserve management services, both as a result of the increase in forest fees and the increased percentage distribution from 10% to 60%. Even for the low value species, FD stands to receive over Cedis 100,000 per tree, while for the higher value species it will usually receive over a million Cedis. This represents an increase in revenue of about 9000% for the higher value species, 4000% for the moderate value species and 1500% for the lower value species. For the other stakeholders, the percentage increase is about 600% for the higher value species, 200% for the moderate value species and only 15% for the lower value species. The absolute increase in revenue is too small for them to take an increased interest in the resource.

Had these stakeholders maintained the same percentage shares as with the old system, there would have been a strong case for them to contribute to farmer incentive payments. An opportunity has arguably been missed in the new revenue distribution for the landowning stools and traditional councils to strengthen a mutually advantageous relationship with cocoa farmers to maintain timber trees.

When the possibility that these stakeholders might contribute to farmer incentive payments was discussed in the stakeholder workshop, it met with furious debate. But clearly the stakeholders were considering the meagre amounts they have received under the old royalty distribution system; these were in fact considerably less than Table 9 implies, due to under-collection. Another problem with these stakeholders contributing to farmer incentives would be that, based on the evidence of the stakeholder workshop, farmers would have little confidence that the money would be handed over.

Some observers have suggested that the new Social Responsibility Agreement (SRA) might be a possible mechanism for providing incentive payments. However these payments, set at 2% of the stumpage charge, come to only Cedis 30-40 thousand ($13-17) per tree for the higher demand species, and much less for other species. The other obvious problem with the SRA is that its distribution is a matter of consultation with the community, when what is needed is a mechanism to compensate individual farmers.

Table 9. Changes in the distribution of forest revenue between recipient stakeholders

	% distribution between stakeholders	*High value species C000/tree*	*Moderate value species C000/tree*	*Low value species C000/tree*
1. Old forest fees basis: revenue per timber tree 1/				
Forestry Department	10%	10-13	8-11	7-9
Administrator of Stool Lands	9%	9-12	8-10	6-8
District Assembly	44.55%	43-58	37-50	31-41
Landowning stool	20.25%	20-26	17-23	14-19
Traditional council	16.2%	16-21	14-18	11-15
TOTAL (log royalty per tree)	100%	97-130	84-112	69-92
2. New forest fees basis: revenue per timber tree 2/				
Forestry Department	60%	912-1,216	347-463	107-143
Administrator of Stool Lands	4%	61-81	23-31	7-10
District Assembly	19.8%	301-401	115-153	35-47
Landowning stool	9%	137-182	52-69	16-21
Traditional council	7.2%	109-146	42-56	13-17
TOTAL (stumpage charge per tree)	100%	1,519-2,026	579-772	179-238
3. Net increase in revenue per timber tree (percentage increase)				
Forestry Department		902-1,203 (9152%)	339-452 (4163%)	100-134 (1463%)
Administrator of Stool Lands		52-69 (593%)	16-21 (206%)	1-2 (15%)
District Assembly		257-343 (593%)	77-103 (206%)	5-6 (15%)
Landowning stool		117-156 (593%)	35-47 (206%)	2-3 (15%)
Traditional council		94-125 (593%)	28-37 (206%)	2 (15%)
TOTAL		1,422-1,896 (1462%)	495-660 (589%)	110-146 (159%)

1/ 10% of the revenue was paid to FD, and 10% of the remainder to the Administrator of Stool Lands. The residual was then divided between the District Assembly (55%), the landowning stool (25%) and the traditional council (20%).
2/ 60% paid to the FD, with the residual divided in the same proportions.

5.3 Conclusion: who should pay?

Given the redistribution and absolute increase in forest revenue, we think there is a strong case for the FD making a payment to cocoa farmers who are the *de facto* managers and custodians of the resource. Apart from the cocoa farmers, the FD is the stakeholder who will lose out most if the trees are not there in the first place. The case is particularly strong for the lower value species, both in view of the lower capacity of the concessionaire to pay and FD=s policy to encourage >lesser used species= (LUS)[19]. It appears that the FD could pay 10% of the stumpage value assuming the baseline profit parameters, leaving the concessionaire to pay compensation. The FD could also consider paying the cocoa >yield loss= share of the compensation using revenue derived from the higher value species and applying the principle of cross-subsidisation to encourage LUS.

If the >improved profit= model is more accurate, then 10% of the stumpage value or $164-219 (see Table 7) could be too high for the FD to pay from the forest revenue received from the low value species. However Table 8 reveals that with the >improved profit= model the concessionaire could still have a 8-12% profit margin on lower value species after paying 10% of the stumpage value plus full compensation. Therefore a smaller FD contribution in terms of its share of the forest revenue should be possible in the >improved profit= scenario, for example by dividing the burden of farmer payments equally between the two stakeholders.

In order to sweeten the pill for the timber industry and provide a clear signal to cocoa farmers, we argue that the FD could pay the average >yield loss= compensation payment of Cedis 100,000 per tree, which should be set at its dollar equivalent (US$50 would appear to be a reasonable figure). Farmers could view this payment as an initial incentive for them to give permission to fell. Then, according to our calculations, concessionaires could reasonably pay 10% of the stumpage value plus damage compensation for the higher and moderate value species. For the lower value species, FD could pay 10% of the stumpage value, as well as the cocoa yield loss compensation in the baseline profit scenario, and share the cost equally with the concessionaire in the improved profit scenario.

While 10% of the stumpage value is well short of cocoa farmers= stated willingness to pay, it should be enough to persuade them to prefer timber tree shade trees over non-timber tree shade trees. This is because of the biological complementarity and low opportunity costs of tending timber trees. However >equity= in the distribution of the forest rent is another matter. If the improved profit model is more realistic, then the calculations suggest that there is a continuing transfer from the public to the private sector (even with the new stumpage charge) which needs to be addressed by additional efforts at rent recovery by the government..

5.4 Other findings from the stakeholder workshop

Among the other insights gained from the stakeholder workshop were:

$ the main concern of farmers continues to be non or under-payment of damage compensation

[19] We recognise that species like ceiba and wawa are not LUS, and in fact are major export species. FD support for these species, if necessary, would have to be based on more commercial criteria.

by concessionaires as well as felling without consent;

- X many if not most farmers (even in an area which has received regular visits by FD due to the ITTO project) did not understand the procedures of pre and post-inspection felling, and that a Conveyance Certificate would not be issued if the farmer lodged a complaint about the level of compensation on offer from the concessionaire;
- X serious crop damage often occurs after skidding; therefore the post-felling inspection should occur after skidding, and allow sufficient time for farmers to register a complaint;
- X most farmers did not know the official damage compensation rate of C9,600 per tree set by Lands Valuation Department;
- X one third of the >value= of the tree was regarded by most participants as a fair payment to farmers (it should be pointed out that stool chiefs, members of District Assemblies, etc. are also cocoa farmers, so such a majority view was unsurprising);
- X farmers would prefer the trees to be extracted by chainsaw operators working within laid-down rules since they have more confidence that compensation will be paid, hauling damage is minimised and the remaining sawdust serves as a >good fertilizer=.

6. SOME METHODOLOGICAL OBSERVATIONS

6.1 Attempts at >quantitative PRA=

The main benefit of the PRA exercise was that it enabled the researchers to learn how farmers perceived the benefits and costs of shade trees on cocoa farms and to discuss some of the underlying biological and socio-economic issues, rather than from the attempts at quantification which proved of limited usefulness. It was therefore an effective entry point for researchers with a limited prior understanding of the issues. The researchers were also made aware of the considerable sacrifice made by the cocoa farmers to attend these meetings, and therefore felt obliged to make some financial compensation in recognition of the farmers= opportunity costs.

6.2 Survey of cocoa farmers

The cocoa farmer questionaire was generally disappointing. The responses by farmers to questions on the damages and yield loss as a result of removal of the cocoa trees were probably strategic; the implied levels of compensation were exaggerated. The strategic responses were perhaps understandable given the negligable compensation cocoa farmers have received in the past. Questions aimed at a better understanding of the relationship between the timber trees and cocoa production were also disappointing; they were unrealistic in expecting farmers to be able to assess the impact of the loss of a timber tree on cocoa yields. It should be pointed out that they were only asked such questions because of the paucity of research or empirical data on this relationship in spite of the long history of cocoa research in Ghana. The contingency valuation type questions and responses have already been discussed. Some of the questions in the survey provided useful information for the economic analysis, but only when outlier answers had been removed. Clearly there was a problem of subjectivity on the part of the analyst in deciding where the cut-off point should lie in terms of deciding what was an unrealistically high (or sometimes low) response.

6.3 Discount rate survey

The discount rate survey did not prove useful. We were unable to identify an input into cocoa farming which allowed respondents to trade present values off against future values in cocoa farming. We therefore used examples from outside cocoa farming which gave us a very high discount rate (over 100%) reflecting short-term income earning possibilities, high real interest rates charged by informal credit sources, high annual farming risks, etc. In spite of repeated explanations, many of the respondents found it difficult to understand the abstract nature of the question, and some who did appear to understand did not take it seriously. It proved a considerable distraction to the research team, and showed how difficult it is to introduce methodological experimentation into a study with specific policy goals.

7. CONCLUSIONS

7.1 Compensation and incentives for cocoa farmers

The present strong disincentive for cocoa farmers to maintain valuable timber trees on their farms, since they are not compensated properly for damage and yield losses resulting from removal of the tree, represents a major threat to sustainable forest management in Ghana, since continuing erosion of the off-reserve resource is causing excess demand pressures on the reserves. While the opportunity costs of keeping timber trees do not seem to be significant for cocoa farmers, and therefore do not provide a basis for estimating incentive payments, we argue that the main >input= requiring compensation is farmer knowledge or human capital. This study indicates that it is important to separate out the issue of compensation from positive incentive payments. In order to at all appease cocoa farmers, the present official compensation rate per cocoa bush needs to be increased by at least 25% according to the calculations here. Even then farmers are unlikely to be satisfied until an incentive is introduced which will make them prefer a timber tree to a non-timber tree with similar shade tree characteristics.

In the short-term it may be difficult to introduce a new incentives scheme which changes the distribution of the forest rent in the way proposed here since, after a long period during which concessionaires have obtained their timber at minimal prices (by comparative international standards), the timber industry has only just been confronted with more realistic prices. The FD or new Forest Service will need to wait for the new stumpage fees to bed down, but meanwhile should do everything in their power to ensure cocoa farmers at least receive full compensation for damage and yield loss.

Although farmers would like to be paid one-third of the >value= of the tree, our calculations showed that, assuming the >pessimistic= economic model, this is unrealistically high in comparison with concessionaires= capacity to pay. But even based on the pessimistic calculations, which ignores the trend towards higher value export products, there is a strong case for concessionaires to pay farmers10% of the stumpage value for the high and moderate value timber trees. There are arguably three main reasons for suggesting that FD pay for the lower value species (although this might not be possible if the >improved profit= calculations are closer to reality[20], for the simple reason that the stumpage values would be much higher) apart

[20] If profit margins are as thin as the industry claims, the new stumpage charges will cause sawmillers to become more efficient or they will not stay in business.

from the low capacity of concessionaires to pay.

First, the FD now receives 60% of the off-reserve revenue in recognition of its service or contribution to off-reserve tree or forest management. Due mainly to the system of land and tree tenure, the farmers who select the seedlings and look after the growing saplings do not receive any economic benefit. Yet they are the *de facto* managers of the resource. It would therefore seem equitable as well as expedient for the FD to pay farmers a proportion of this service payment. The second reason is that if concessionaires see that the FD is prepared to shoulder part of the burden of the compensation or incentive payments, this will greatly >soften the pill=. Third, payments of farmers for keeping LUS would be a way that the FD can pursue this policy objective, and concessionaires= profit margins may be too low to make an incentive payment for the lower value species. We also argue that the FD could pay the farmers for that part of the compensation related to the estimated loss in cocoa yields, regardless of the value category of the tree species. A problem picked up in the cocoa farmer survey is that in terms of administrative arrangements farmers would much much prefer to receive payments from the FD rather than the concessionaire. A mechanism probably needs to be found whereby the latter pays the FD, which then remunerates the farmers.

Some observers may think that 10% of the stumpage value is too low a proportion of the value of the timber to pay the farmers. However the complementarity of timber trees and cocoa, and the low opportunity costs of land, labour and capital, imply that it would be enough for them to prefer timber shade trees over non-timber shade trees, and would therefore be effective, if not necessarily equitable. Farmer discussions showed that they are often reluctant to get rid of a strategically placed timber tree, especially if it coppices, even though they fear the uncompensated damages from extraction. In fact the more important issue could be the confidence the farmers have that they will be properly compensated for any damage caused and this should be the first priority. But this study argues that full compensation (even if a payment is made for the cocoa yield loss) would not be sufficient incentive for farmers to prefer timber trees.

Accurate economic data on costs and efficiency in the timber industry, and how these will change in response to fiscal and trade policy changes, is critical for defining a just and effective system of providing cocoa farmers with incentives for tree tending. Economic capacity is needed in the MLF to monitor the profitability of the timber industry in response to sectoral policy[21] and extra-sectoral change, and for regular calculation of the stumpage value (apart from the need for economic analysis in policy setting more generally).

While it is hoped that many will see the logic of the calculatons presented here, they will also be aware of the political and practical difficulties of implementing such a system of incentive payments for cocoa farmers. First, none of the above will happen if farmers are not aware of their rights and if the FD (or Forest Service) is unable to change the traditional allegiancies associated with another kind of incentive system. This paper can only suggest what might be possible on the basis of some fairly rudimentary economic calculations. It cannot force the attitudinal changes

[21] Clearly economic capacity is needed to define effective sectoral policies in the first place, for example by tracing through the impacts of policy change on the incentives of the range of stakeholders (see IIED/FD, 1993)

and quality of FD outreach or extension which could make it happen. Information for farmers is crucial both on their legal rights and on the value of the trees (e.g., the prevailing stumpage values of timber trees commonly found on cocoa farms). Some of the cocoa farmers at the stakeholder workshop did not even know the official compensation rate per damaged cocoa bush. Strong support of FD field staff for these rights is then essential.

Finally a comment is necessary about the geographical scope of this study. First, the profitability of cocoa farming, and the relationship with shade trees, varies considerably from area to area. More importantly, in terms of the calculations necessary, the stumpage value of timber is highly dependent on location and transport costs. Thus while 10% of stumpage value as an incentive payment to cocoa farmers may prove a workable policy, the calculations need to be checked in other areas to ensure that concessionaires would have capacity to pay. The 10% proportion of stumpage value could also apply to timber trees on other farmland, but compensation might be different (possibly zero on farmland, and variable according to the crop type damaged). Thus the methodology here could be applied to all situations of timber trees on farmland, and should be considerably simpler than with cocoa farms.

7.2 Methodological conclusions

This study used a combination of participatory and more traditional research tools like farmer questionnires, farm budgeting and cost-benefit analysis, for analysing a complex set of issues in a short time. Through a combination of methods we were able to come up with some fairly rudimentary calculations which at least provide a basis for discussion of the issues. We think that the methodology for estimating possible compesation and incentive levels, and for deciding who should pay for them, represent a useful basis for later calculations.

However the data should be treated with caution; the basis for some of the calculations is rather weak, at some points resembling the short-term consultant=s >back-of-the-envelope= approach, and placing a heavy reliance on secondary data sources. The recourse to short-cut data collection and analysis methods was partly since the research team was not as strong or inter-disciplinary as planned, as well as due to the time constraint; one of the main proposed collaborators, Dr Kojo Amanor, was forced to drop out of the study due to sickness. We were also only able to obtain the services of a local economist for 10 days split into three separate periods, making it difficult to incorporate him effectively into the study. The lack of scientific or empirical data on the physical relationships also meant we had to make simplifying assumptions. This underlines the point that it is more often the physical data which constrains economic exercises rather than the problem of how to value things, which so occupies the economics literature (Davies & Richards, 1998).

More specifically, while the >quantitative= results of the PRA exercises were of limited value, the PRA work proved an ideal way for the research team to get a better understanding of the effects of shade trees on cocoa production, and to enter into a dialogue with the farmers on the issues. The cocoa farmer survey was a mixed success; some useful data was obtained, but the attempt to get farmers to place sensible values on losses from the removal of timber trees was unsuccessful. The CV-type questions provided some insights but suffered from strategic responses. The discount rate survey proved particularly disappointing; this was less a reflection of the methodology based on Kundhlande (1998) and related more to the problem of how to relate the exercise to cocoa farming. We were fortunate that a 1988 World Bank study went into the question of discount rates in cocoa farming.

Some of the more traditional approaches to collecting and analysing economic data, like the combination of key informants and secondary data to derive the budgets for cocoa farming and concessionaire returns, were possibly >cost-effective= but were in need of verification or triangulation. These methods will always be used by economists when there are time/budgetry constraints since they are expedient. In order to move to a more refined approach to analysing economic incentives, it is clear (based also on the other case studies in this research programme) that a considerably longer time frame is needed at the project design stage or through the process project approach.

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