PROCESSING AND UTILISATION OF TREES ON FARMLANDS AND LOGGING RESIDUES THROUGH COLLABORATION WITH LOCAL COMMUNITIES

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IMPACT ASSESSMENT ON THE USE OF LOGOSOL (IMPROVED CHAINSAW) FACILITIES ON FARMLANDS AND RURAL LIVELIHOODS

REPORT

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Abstract

The assessment of capacities of the machine operators and operational supervisors was based on visual observation of their activities and the administration of questionnaire. The visual observation was undertaken by two technical staff on the activities of the machine operators. The results obtained were rated as Grade 1 (exceptionally good operators) to Grade 3 (fair). Again, a prepared questionnaire for the assessment of field staff was administered to the project field operators (machine operators and supervisors). The questionnaire administered were all answered and returned for analysis. The environmental impact assessment was conducted at the six project sites (Twifo-Kyebi, Japa, Abesewa Gyaaman, Ankasie, Dominase and Nsabrekwa) in the Central and Western Regions of Ghana. Three indicators that were considered in the study through the survey conducted included the land/milling areas disturbed by the improved chainsaw milling and conventional logging activities, quantities of residue generation by the improved milling on log basis and the effect on agricultural crops by the improved milling. Conventional logged areas at Bowie Forest reserve, Wassa Akropong were included to compare results. In each of the six communities, field assessment was conducted in the farmlands of the beneficiaries whose trees had been felled and processed into lumber. Measurements (width at 3 different points and length) were made at each operated area where a tree was felled and processed to estimate the total area disturbed. Dimensions of butt and top logs as well as other utilizable portions that were left behind were also taken to determine the volume of residues. Agricultural crops destroyed were counted and recorded. In six and 12 months after operation visits were made again to observe the situation at the operated farmlands by considering the rate of growth of some food crops and regeneration of the vegetation including the types of wood species. For the impact assessment of livelihoods, 88 people were interviewed using questionnaires in 4 villages involving-three in the Western and one in the Central regions before the intervention of the project. Three years after the intervention of the project 72 people were interviewed in the same villages in the same forest districts, which were the project areas. The major findings of the assessment of the field operators are that the majority of the machine operators could assemble, disassemble and operate the logosol machines independently. Machine operators have had the desire to use logosol facilities than the chainsaw freehand milling but the quantity of lumber produced in a day was said to be higher with the freehand method. Lumber produced with logosol machines were of equivalent quality as that of sawmill, hence of better quality than chainsaw milled lumber. Repairers of chainsaw machines were capable of repairing the logosol system hence no special group of people are required for their maintenance and servicing. Minor repairs could be taken up by most of the operators and availability of spare parts for the logosol facilities on the Ghanaian market was highlighted. The use of logosol facilities discouraged illegal lumbering as it is with ordinary chainsaw for freehand milling. Generally the level of co-operation by four of the beneficiary communities was estimated to be higher (80% - 95% rating). The study has also revealed that in-situ processing of trees on non-reserved forests using logosol (improved chainsaw milling) facilities could be managed sustainably with communities' involvement. Improvement has been made on the log recovery over that from sawmills and illegal milling hence lumber obtainable being higher. Yield from crops on farmlands could be

increased due to increase in planting area, avoidance of shadows on crops and enrichment of soil with sawdust generated on farmlands. Indiscriminate burning and felling of trees on farmlands by farmers to protect their crops will be minimized. Areas disturbed after in-situ processing and conventional logging have been estimated and that area disturbed by conventional logging is much more than that by logosol milling. About 54% of the species extracted were made up of lesser-used timber species that are of economic value. The average butt diameters of trees felled ranged from 0.583m to 1.062m. On livelihood impact, the most important contribution is in the area of social, human and physical assets status of participating community members. This is derived from the project through revenue generated from the processing of the trees on farmlands and logging residues that has been distributed to community members. Other community members also benefited from the project through earnings from services delivery in the form of lumber carrying, lumber sales or marketing. For crisis that communities go through, the report has identified irregular and poor rainfall pattern leading to drought, excessive rainfall leading to flooding and damaging of crops by the wind. This brings about poor production of food that leads to food shortages, illnesses and funerals among communities. The ways community members cope with these crisis are the sale of trees possibly due to the presence of illegal chainsaw operators, sale of food products at reduced prices to attend to the crisis. Sustained education and assurance of forest communities that have been done in this project that they can benefit directly from timber trees on their farmlands in future can let them stop or minimise the sale of trees on their farmlands to the illegal chainsaw operators. However, this should be backed by changing the laws governing the access of trees on farmlands in favour of communities. Interventions in these forest communities would make meaningful impact if they are designed to target the general conditions of living of these community members. They would again bring significant relief to the communities if they also target these short term crisis that communities go through and the way they cope, particularly sale of farmland trees and food products at reduced prices. This therefore points out the importance of processing trees on farmland. Although, its impact on the livelihood of community members may not be so significant, it shows one way through which livelihood of the forest communities could be improved and at the same time ensures sustainable management of the forest resources. That is if due to the benefits that communities members enjoy from the project, they become committed to the growth and protection of trees on their farmlands.

PROCESSING OF TREES ON FARMLANDS WITH LOGOSOL FACILITIES: ASSESSMENT OF CAPACITIES OF MACHINE OPERATORS AND SUPERVISORS

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PROCESSING OF TREES ON FARMLANDS WITH LOGOSOL FACILITIES: ASSESSMENT OF CAPACITIES OF MACHINE OPERATORS AND SUPERVISORS

Introduction

Under an ITTO project PD 431/06 Rev 1 (I) on processing and utilisation of trees on farmlands and logging residues through collaboration with local communities, seventeen members from six local communities in the Central and Western regions were trained in the use of logosol timber milling machine. This machine is a portable and improved chainsaw type, whose finishing is equivalent to that of a conventional type. These operators and supervisors were grouped into three and operated in the farmlands of six communities. A maximum of two trees were felled and processed in-situ into lumber for sale and the income generated was shared according to a formulae that the communities had agreed upon.

In order to train others in future for the sustainability of the project, participants needed to be assessed for their competence to enable the project management team to make some recommendations at the end of the project.

Methods

The assessment of capacities of the machine operators and operational supervisors was based on visual observation of their activities and the administration of a questionnaire. The visual observation was undertaken by two technical staff on the activities of the machine operators only. This was undertaken for one week per month for six months. The results obtained, as shown in Table 1, were discussed by the team and rated. Grade 1 was for those operators whose performance was exceptionally good; Grade 2 –good and grade 3 - fair. Again, a prepared questionnaire for the assessment of field staff was administered to the project field operators (machine operators and supervisors) in February/March 2010. They were assisted in answering the questionnaire by interpreting them in the language that was best understood by the operators. Seventeen copies of the questionnaire administered were all answered and returned. The results generated are summarised in Table 2. Figure 1 is one group of operators being given some technical instructions while an ITTO representative, Mrs. Celestine Ntsare-Okwo, looks on and Figure 2 shows two operators exhibiting their skills on logosol lumbering.

Fig 1: Milling techniques being given to some operators

Fig 2: Operators lumbering with timberjig

Results and discussion

The activities that were selected for observation were those that can lead to generation of logging residues when they are disregarded. Observation made by technical people on tree felling techniques was that 50% paid attention to all felling techniques while the rest ignored some of them. For instance, paths of escape for the operator were not made while those who made them were wrongly sited. Brushing around trees was done instead of making proper clearing. Again, felling notch (undercut) and felling cut (back cut) were wrongly done and therefore caused barber’s chair and or sloven as shown in Figure 2. In cross-cutting a few operators started wrongly which could lead to kick-back and some cross-cuts surfaces were not smooth. Of the seven techniques observed, cross-cutting was the activity that recorded the highest grade 1 score of 84%, which means that the operators were exceptionally good. 79% of the operators strictly adhered to milling strategies which enabled them to mill faster with high lumber accuracy. Some operators were unable to identify the cutting edge of saw chains and hence were sharpening the back edge of saw chains. This is possibly could increase the production cost of lumber. The confidence level of four operators was low, as they could not handle the machine to suit the direction/angle of cut. Therefore, thick and thin lumber pieces were produced thereby recording a lower grade. Maintaining the air filter is very important and hence needs to be inspected, cleaned and replaced when necessary, but this was not properly observed by the operators in general. Only about 21% of the operators were very serious with the filter maintenance while 36% ignored it until the machine indicated signs of faulty filter. On the average, ten operators (71%) were technically good and undertook the observed techniques/activities seriously and with ease.

Table 1: Grading of 14 logosol operators on the basis of visual observation of their activities

Activity	Grade 1	Grade 2	Grade 3
Tree felling techniques	7	5	2
Cross – cutting techniques	12	2	-
Milling techniques	11	1	2
Confidence in machine handling	10	3	1
Accuracy in logosol lumbering	9	2	3
Sharpening of saw chain	10	2	2
Maintenance of air filter	3	6	5


Fig 2: Poor felling techniques resulted in barber's chair/sloven

Table 2 shows the summary results of the questionnaire that was administered to the seventeen field operators. The views of only the machine operators were highly considered for the asterisked (*) questions.

The frequency of machine breakdown was quite low as 76% of the field operators answered in affirmative and it was added that if maintenance precautions are not observed the tendency for the machine breaking down will be higher. For the 17 field operators, 10 could undertake minor repairs and servicing of the Bigmill system while 4 said the machine is complex and delicate, hence specialists (machine repairers) should be allowed to take up any repairs (Table 2). This indicates the availability of qualified repairers who can take care of the machines when major faults are developed, which was confirmed by 76% of the respondents.

Table 2: Summary results of questionnaire administered to field operators

Questionnaire	Frequency	
	Yes	**No**
Can you assemble, disassemble and operate the logosol machines independently? *	12	2
Is it safe and easy to fill machine with fuel while engine is running? *	8	6
Do you prefer using the logosol machines for milling than the chainsaw? *	13	1
Does it produce more lumber than chainsaw milling in a day? *	13	1
Is the quality of lumber generated by logosol better than chainsaw milling (CSM) ?	17	0
Is the degree of vibration of the logosol machine lower than the CSM? *	14	0
Is it easy to maintain / service the logosol facilities?	13	4
Will you be able to make minor repairs ?	10	7
Does the machine breakdown so frequently ?	13	4
Are you able to use personal protective equipment ?	5	12
Do you use the scabbard ?	4	13
Is it easy to move around in the forest with logosol facilities ?	15	2
Are the spare parts for the logosol facilities availability ?	16	1
Are you adhering to the proper fuel mix ? *	9	5
Do you regularly correct the chainsaw chain tension ? *	6	8
Has there been some casualties since the commencement of the project?	17	0
Will you be able to train people to use the logosol facilities? *	11	3
Has the local community been co-operative?	15	2
Is logosol machines convenient to use for illegal lumbering activity	0	17

* The views of only machine operators were considered

Although the risk of injury in using the logosol facilities was rated very low, 57% of the population was fuelling the machines with the engine running – very risky indeed. Vibration was rated lower than the freehand milling because the logosol attachments have added extra weight to the chainsaw and that some of the vibrations are dissipated without getting transferred to the human body. Market was said to be available for logosol products, willingness of farmers to nurture trees on farms is high, and majority of the operators (79%) had the capacity to train others. This is a very good result since their services will be needed in future to train others in some parts of Ghana. 86% of the operators could use the facilities independently while 21% will need some kind of assistance. The cutter chain is sharp enough to cause injury even when it is not being driven. The scabbard covers the chain when the saw is in storage or being transported. It also protects the chain from damage, for instance blunting by contact with concrete floors but this was poorly practised as only 23% of the field operators patronized it. The saw chain has to be correctly tensioned at all times. Incorrect saw chain tension is the cause of most saw chain and chain saw guide bar problems. A new chain saw chain quickly stretches and therefore needs to be adjusted after even a few minutes of use. Surprisingly less than 50% of the operators were doing that. With use of personal protective equipment, about 29% was confortable in using them while the major reason for the remaining 71% was that they found it difficult to work with. The degree of proper fuel mix was quite good as 64 % of the machine operators gave the correct ratio of engine oil to petrol and were able to state some of the problems to be caused should the proportion be changed.

The results indicate that most of the operators (93%) had developed interest in using the logosol machines (Table 2). Some of their major reasons were that the machines were environmentally friendly, comparatively lumber recovery was better than freehand (chainsaw) milling and that lumber quality was comparable to that of conventional milling but the number of lumber pieces obtained in a day was said to be lower with logosol machines, difficult to use the facilities for illegal operations, spare parts for the logosol facilities were available in Ghana. The level of co-operation exhibited by each of the local communities was rated by the field operators, which ranged from 45% (Twifo-Kyebi) to 95% (Abesewa Gyaaman)

Conclusion

In conclusion, the summary of the findings of the assessment of the field operators are that :

- Majority of the machine operators could assemble, disassemble and operate the logosol machines independently
- Machine operators have had the desire to use logosol facilities than the chainsaw freehand milling but the quantity of lumber produced in a day was said to be higher with the freehand method. Lumber produced with logosol machines used were of equivalent quality as that of sawmill, hence of better quality than chainsaw milled lumber
- Logosol system generated minimal vibration than the chainsaw milling (CSM)
- Repairers of chainsaw machines were capable of repairing the logosol system hence no special group of people are required for their maintenance and servicing. Minor repairs could be taken up by most of the operators and availability of spare parts for the logosol facilities on the Ghanaian market was highlighted. Even though the rate of machines breakdown was lower it would depend on the degree of adherence of safety precautional measures and servicing and or maintenance schedules
- The use of personal protective equipment was not enforced during the study hence most of the operators did not develop the habit of using them
- Safety method of transporting the chainsaw machines was not strictly complied. Some techniques in tree felling and log processing into lumber were not implemented by some of the operators
- The use of logosol facilities could not encourage illegal lumbering as it is with ordinary chainsaw for freehand milling and
- Generally the level of co-operation by four of the beneficiary communities (Dominase – 80%, Ankasie – 85%, Nsabrekwa – 90% and Abesewa Gyaaman – 95%) was estimated to be higher.

Recommendations

- Intensive training on safety precautional measures, servicing and maintenance schedules of the logosol machines or any other improved chainsaw milling (new) machines need to be introduced.
- Major techniques in the use of any improved chainsaw milling (new) should also be fully covered.

ENVIRONMENTAL IMPACT ASSESSMENT ON FARMLANDS: PROCESSING OF TREES ON FARMLANDS INTO LUMBER USING IMPROVED CHAINSAW (LOGOSOL) FACILITIES IN SOME COMMUNITIES OF GHANA

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Introduction

Illegal logging, which includes illegal chainsaw logging, has raised global concerns. This global forestry issue came to the fore at the World Bank/IMF meeting in Singapore in September 2006 where a platform was created to bring together legislators of the group member countries and key timber producing ones including Ghana, Brazil, Cameroon, etc. (Tacconi, 2007).

In Ghana, felling of trees and in-situ processing of logs into lumber, which are chainsaw milling activities, constitute the major item on the illegal logging agenda. The activity has been described to be environmentally unfriendly. This notion has over clouded the positive aspect of the chainsaw milling operation. Hence the use of chainsaw to convert trees to lumber has generated a lot of debate. Although the practice has been banned over a decade ago it is widespread despite measures put in place by government to enforce the ban. Enforcement has not been effective leading to proliferation of the practice at levels that threatens sustainability of Ghana's forest resources.

According to Damnyag and Darko-Obiri (2009), chainsaw lumber production is one stage of the process and the lumber is mostly produced by the chainsaw operators. These operators arrange for the timber trees for processing from farmlands, forest reserves and plantation. For the farmland trees, operators get the trees from the farmers and community elders through payment of small sums of money or freely without the knowledge of the farmer.

According to Asamoah Adam and Duah-Gyamfi (2009), the impact could be assessed based on the on the mode of operation, which is dependent on the choice of tree to be felled in terms of species, size, and location and felling and sawing techniques to be adopted in relation to minimization of felling damage, quality of lumber, recovery and residue generation. These consequently affect the sustainability of resource either positively or negatively. Since the ban has become a problem, it is imperative that alternative means of operation that will minimize the negative aspect is established to sustain employment, revenue generation and lumber availability on the market. Introducing an improved chainsaw milling facilities therefore requires an assessment of their environmental impact with respect to damage to agricultural crops, residue generation and milling area disturbed (both logosol and conventional milling).

Methods

The environmental impact assessment was conducted at the six project sites (Twifo-Kyebi, Japa, Abesewa Gyaaman, Ankasie, Dominase and Nsabrekwa) in the Central and Western Regions of Ghana. Three indicators that were considered in the study through the survey conducted included the land/milling areas disturbed by the improved chainsaw milling and conventional logging, quantities of residue generation by improved milling on log basis and the effect on agricultural crops by the improved milling. The operators were not told of any subsequent study that would follow after their operational activities, hence were given the freedom to work normally. Conventional logged areas at Bowie Forest reserve, Wassa Akropong were included to compare results.

In each of the six communities, field assessment was conducted in the farmlands of the beneficiaries whose trees had been felled and processed into lumber. Measurements (width at 3 different points and length) were made at each operated area where a tree was felled and processed to estimate the total area disturbed. Dimensions of butt and top logs as well as other utilizable portions that were left behind were also taken to determine the volume of residues. Agricultural crops destroyed were counted and recorded. In six and 12 months after operation of an area visits were made again to observe the situation at the operated farmlands. The materials used in taking data included measuring tapes, note book and pens/pencils. The data was then analyzed using Mirosoft Excel and where appropriate tables were also employed.

Results and discussion

The results have been presented into three forms as milling area disturbed, residue generation and effect on agricultural crops.

Milling area disturbed (both logosol and conventional milling)

The milling area, in this case, is defined as the maximum land area disturbed when a tree is felled, cross-cut and milled or transported whereby there is evidence of damage to plants / agricultural crops and disturbance to the soil.

Table 1 shows the mean dimensions and area disturbed around a tree after logosol milling on farmlands at six communities and conventional logging in Bowie Forest Reserve (Figures 1A &1B). The mean width of the area disturbed by logosol (on site processing) and conventional logging were 4.98m (0.57*) and 3.45m (0.78*) respectively with a mean length of 25.35m (2.13*) and 96.01m (3.98*) in that order.

Table 1: Dimensions of areas disturbed during logosol milling and conventional logging of some trees

Statistics	Mean width (m)		Mean length (m)		Mean area (m^2)	
	Logosol lumbering	Conventional logging	Logosol lumbering	Conventional logging	Logosol lumbering	Conventional logging
Average	4.98	3.45	25.35	96.01	129.83	331.25
Standard deviation	0.57	0.78	2.13	3.98	20.19	23.47
Minimum	3.70	2.80	17.65	31.50	65.31	88.20
Maximum	6.60	4.11	40.00	160.53	264.00	659.78

**** Standard deviation***

These indicate that the width of the area disturbed with logosol facilities (improved chainsaw milling) was wider than that by conventional method but the mean length disturbed by conventional logging was higher. This is because with the conventional logging approach, trees felled were cross-cut and skidded away through skid trails to logging yards as shown in Figures 1B & 2. With the in-situ milling facilities, the human activities involved after felling (cross-cutting, milling and stacking of lumber) opened up the area more laterally than lengthwise as operators worked within the utilizable length of a tree. Again, farmers' paths were used for carting lumber generated on farmlands to the nearest road side. The mean disturbed areas were estimated as 129.83 m^2 (20.19*) and 331.25 m^2 (23.45*) for the logosol milling and conventional logging respectively with minimum and maximum areas ranging between 65.31-264 m^2 and 88.20-659.78 m^2 in the same order.

Fig 1A: Disturbed area after logosol milling

Fig 1B: Disturbed areas after conventional logging

Photos: F.W.Owusu, CSIR-FORIG

Fig 2: Loading bay in a concession (Photos: F.W.Owusu, CSIR-FORIG)

Residue generation

At each of the six study areas, dimensions of every bole and logs were taken. Microsoft Excel was used to analyse the results from which the minimum, maximum and mean butt diameters including the volume of every bole/tree were estimated, hence the volume of residue generated (Tables 2 and 3). This was compared with that by conventional method as reported by Adam *et al* (1994).

The minimum and maximum butt diameters of trees felled from each of the communities is shown in Table 2. In this case trees from Ankasie were generally bigger than the rest while Abesewa Gyaaman recorded the smallest. The minimum and maximum average diameters of trees felled in the six communities ranged between 0.4m (Essia) and 1.63m (Ofram) with the average butt diameter of each tree in a community being 0.818m.

Table 2: Butt diameters of boles of tree species extracted from six local communities

S/no	Local Community	Minimum Diameter (m)	Maximum dameter (m)	Average diameter (m)
	Twifo – Kyebi	0.42	0.955	0.655
	Japa	0.605	1.25	0.838
	Nsabrekwa	0.615	1.13	0.889
	Dominase	0.49	1.63	0.88
	Ankasie	0.755	1.341	1.062
	Abesewa Gyaaman	0.4	1.03	0.583

Table 3, which shows the log yield and logging residue generated indicates that trees on farmlands are composed more of lesser-used timber species (LUS) than primary species (PS), which are getting extinct and are of high demand. This is good news because extracting such LUS species will enhance their promotion and may not affect the sustainability of non-forest reserves.

The percentages log yield for the 13 timber species varied from 70.4% to 94.5%. The species that recorded the lowest and highest log yields were Mohogany and Avodire respectively. The mean log yield per tree/bole is estimated as 80.1% with a residue generation of 19.9%. This is an improvement upon the average logging recovery of 76% estimated by Adam *et al* (1994) for conventional logging. Considering the fact that logs taken to the mill have up to 60% milling recovery of log volume, then the harvestable bole volume will be 48.1% with the logosol mill as against 45.6% obtainable by sawmills and 45% by freehand chainsaw milling.

Table 3: Timber species extracted with percentage log yield and residue generated

Species Local name	Scientific name	Classification of species	% mean log yield	% mean residues
Wawa / Obeche	*Triplochiton scleroxylon*	Primary	83.4	16.6
Dahoma	*Piptadenia africana*	LUS	84.6	15.4
Edinam	*Entandrophragma angolense*	Primary	77.8	22.2
Danta	*Nesogordonia papaverifera*	LUS	76.1	23.9
Avodire	*Terreanthus africanus*	LUS	94.5	5.5
Essia	*Petersianthus macrocarpus*	LUS	79.8	20.3
Ofram	*Terminalia superba*	LUS	79.5	20.5
Emire	*Terminalia ivorensis*	LUS	77.5	22.5
Mahogany	*Entandrophragma utile*	Primary	70.4	29.6
Cedar	*Entandrophragma candollei*	Primary	89.0	11.0
Sapele	*Entandrophragma cylindricum*	Primary	78.6	21.4
Odum / Iroko	*Milicia excelsa*	Primary	75.5	24.5
Awiemfosamina		LUS	87.4	12.6

Fig 3A: Residue by conventional logging. (Photos: F.W.Owusu, CSIR-FORIG)

1 **2** **3**

Fig 3B: Extracting residue for processing with logosol machines (Photos: F.W.Owusu, CSIR-FORIG)

The 76% of average logging recovery by sawmills means that an average logging residue of 24% is generated as against 19.9% generated by logosol milling facilities. This could be confirmed photographs shown in Figures 3A and 3B, which represent the situation on the field. As big and long logs are left to rot in the forest bed after conventional logging (figure 3A), the improved chainsaw (logosol) milling machine seeks to process both the butt and top portions of trees felled (Figure3B-1&2) to obtain usable lumber (Figure 3B-3), which increases the lumber yield. This makes the forest bed free to enhance regeneration or creates cropping area for farmers.

Effect on Agricultural Crops

During the field study it was observed operators embarked on directional felling. An interview with some of the operators revealed that there was no sense in destroying farmers' crops since they were operating legally, hence directional felling technique was employed (Figure 4).

Fig. 4 Directional felling technique to minimize destruction of crops

The second observation was that damage to crops was minimal and in some cases (especially during the rainy season) within 2-3 months after operation crops had sprouted. Again, in a situation where a tree had been uprooted or felled by a farmer and or field operators, a sizeable land area was created after processing the bole to enable the farmer plant more crops (Figure 5). These views were also expressed by the farmers who had had trees felled and lumbered on their farms. It was added that crops at boundary lines where trees had been felled were also doing well as seen from Figure 6. This could be attributed to the shadows of trees that are cast on crops around the boundary lines. Also the sawdust generated added some nutrients to the soil making it richer than other areas even on the same farmland. A farmer who later agreed that his trees be felled also revealed that the operators were co-operative and caring as against his prejudiced mind of wickedness. These, in addition to their share of the lumber generated from their farmlands were enough education for them to stop indiscriminate burning and felling of trees on their farmlands just to leave them to rot in order to avoid conventional logging or illegal chainsaw milling onto their farmlands.

Fig 5: Planting area created for more crops to be planted

Fig 6:Crops doing well on farmslands where lumbering has taken place

Again, some of the farmers (both beneficiaries and non-beneficiaries of the project) had a change of mind to plant commercial trees on their farms in order to benefit from what the future holds for the farmers in the rural communities. Some of the operators in an informal discussion said “the project has helped us redeem our image because it had created a good working relation between us and the farmers (communities)”. Some wood species, especially lesser-used and lesser-known timber species, were observed to have regenerated.

Conclusion

The study has reaveled that in-situ processing of trees on non-reserved forests using logosol (improved chainsaw milling) facilities could be managed sustainably with communities’ involvement.

There is an improvement on the log recovery over that from sawmills and illegal milling hence lumber obtainable being higher. Yield from crops on farmlands could be increased to increase in planting area, avoidance of shadows on crops and enrichment of soil with sawdust generated on farmlands.

Indiscriminate burning and felling of trees on farmlands by farmers to protect their crops will be minimized if not eradicated.

Areas disturbed after in-situ processing and conventional logging have been estimated and that area disturbed by conventional logging is much more than that by logosol milling.

About 54% of the species extracted were made up of lesser-used timber species that are of economic value. The average butt diameters of trees felled ranged from 0.583m to 1.062m.

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IMPACT OF ON-FARM TREES REVENUES ON RURAL LIVELIHOODS IN TWO FOREST DISTRICTS OF GHANA

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Introduction

The benefits trees offer to farmers include food, medicine, timber, fuel wood and commodities, as well as fodder and shelter for livestock and fertilizer to boost crop yields and enrich soils (Mongabay.com, 2009). In Ghana one of the most important direct benefits from trees is timber. It ranks only behind gold, tourism and cocoa in export earnings and a key provider of income for government, industry, and workers. In 1994 timber exports contributed 18 percent to total external earnings of Ghana. In 1990, the overall contribution of the forestry sector to GDP was 5.1 %. In 1995, timber exports alone contributed US$ 230 million which was 11 % total of export earnings (FAO, 1997).

However these benefits are under threat owning particularly to the high level of deforestation and forest degradation due to a number of factors. Notable among these is illegal logging that takes place both in the state forest reserves and on the farmlands or outside reserve areas. Studies have found that forest loss and degradation are not the only reasons why many poor households in sub Saharan Africa face declining access to forest resources (Oksanen *et al*, 2002). These studies have observed that local communities, poor households and women have lost access to forest resources as a result of the elite groups obtaining a greater share of the existing resource (Anold, 1991; Scoones *et a*l., 1992; Shepherd *et al*., 1991; Wachiira, 1987). Logging and mining companies often displace traditional forest owners (Ribot, 2000; World Rainforest Movement, 2002, a, b, d; World Rainforest Movement, 2001). Also government policies frequently favour these groups with concessions, licenses and permits whilst denying similar rights to poorer local inhabitants (Ribot, 2000; World Rainforest Movement, 2002, a, b, d; World Rainforest Movement, 2001).

The causes for the decline of forest resources, particularly timber to local communities in Ghana are not different. Whilst it is recognized that government revenues from timber exports, taxes and levies are used for the overall development of the economy which indirectly impact on rural communities livelihood, the other direct benefits that are supposed to get to the local communities are the stumpage revenue earned from the extraction of timber. According to Forestry Commission, (2009), the office of Administrator of Stool Lands (OASL) and Forestry Commission (FC) are responsible for the management of the Forest proceeds on behalf of stool / landowners. The FC manages the Forest and collects revenue by way of stumpage and the OASL ensures that the stool / landowners are fairly treated in the context of the prevailing disbursement laws. For the management of the forest on behalf of the Government and the Stool/Landowners, the

Forestry Commission is authorized to retain some percentage of the stumpage fees. It is provided in the constitution that the net revenue accruing from Stumpage/Rent after providing for FC's management fees of 50% and 10% for the OASL shall be deemed as 100% and to be distributed as follows; 25% to Stool; 55% to District Assembly and 20% to Traditional Council (Owusu *et al*., 2008). This stumpage revenue is expected to be the direct benefits to local communities and is expected to get to them through the district assembly and the traditional council development activities. However, most of these benefits do not flow regularly to these local communities. Even if it gets to them, they get it in the form of public goods which make it difficult for them to perceive it as the benefit coming from their trees. As result of these, local communities do not adequately protect timber trees on their farmlands and others tend to condone illegal chainsaw operators to harvest these trees against the law.

The present ITTO project on processing trees on farmlands and logging residues with local community's collaboration is intended to address this problem. It intends to make local communities benefit directly from trees on their farmlands with the ultimate aim of encouraging them to protect the trees so that the desired overall benefits of trees on farmlands can flow to them in the long run. This study reports on the impacts of the processing, utilization and marketing of lumber and lumber products from this project on the livelihood of the participating local communities. The aim is provide information to support forest policy decisions in enabling local communities derive benefits directly from timber trees on farmlands that will motivate them to nurture and protect trees on their farmlands.

Methods

Study area

This study was conducted in Dunkwa forest district in the Central Region and Asankragwa forest district in the Western Region. Before the intervention of the project 88 people were interviewed in 4 villages involving-three in the Western and one in the Central (Table 1). Three years after the intervention of the project 72 people were interviewed in the same villages in the same forest districts, which were the project areas.

Table 1: Distribution of number of people surveyed in communities in the project areas

	Name of Forest District			
	Before		After	
Community	No. of people in Dunkwa	No. of people in Asankragwa	No. of people in Dunkwa	No. of people in Asankragwa
Japa	44	0	12	0
Nsabrakwa	0	2	0	17
Ankaasie	0	10	0	25
Dominase	0	9	0	14

Total	67	21	16	56

Conceptual framework on livelihood

In order to assess the impact of the revenue from processing trees on farmlands on livelihoods, a livelihood systems model adapted from Soussan *et al*., (2001), as shown in Figure 1, was used. Carney, (1998) presents a definition of livelihoods based on the work of Robert Chambers and Gordon Conway and quoted in Prakash *et al*., (2003) as:

"A livelihood comprises the capabilities, assets (including both material and social resources) and activities required for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and maintain or enhance its capabilities and assets both now and in the future, while not undermining the natural resource base" (Carney, 1998, p. 4).

Based on this definition, the framework for analysing the impact of timber revenue on the livelihood of the participating communities is depicted in Figure 1.

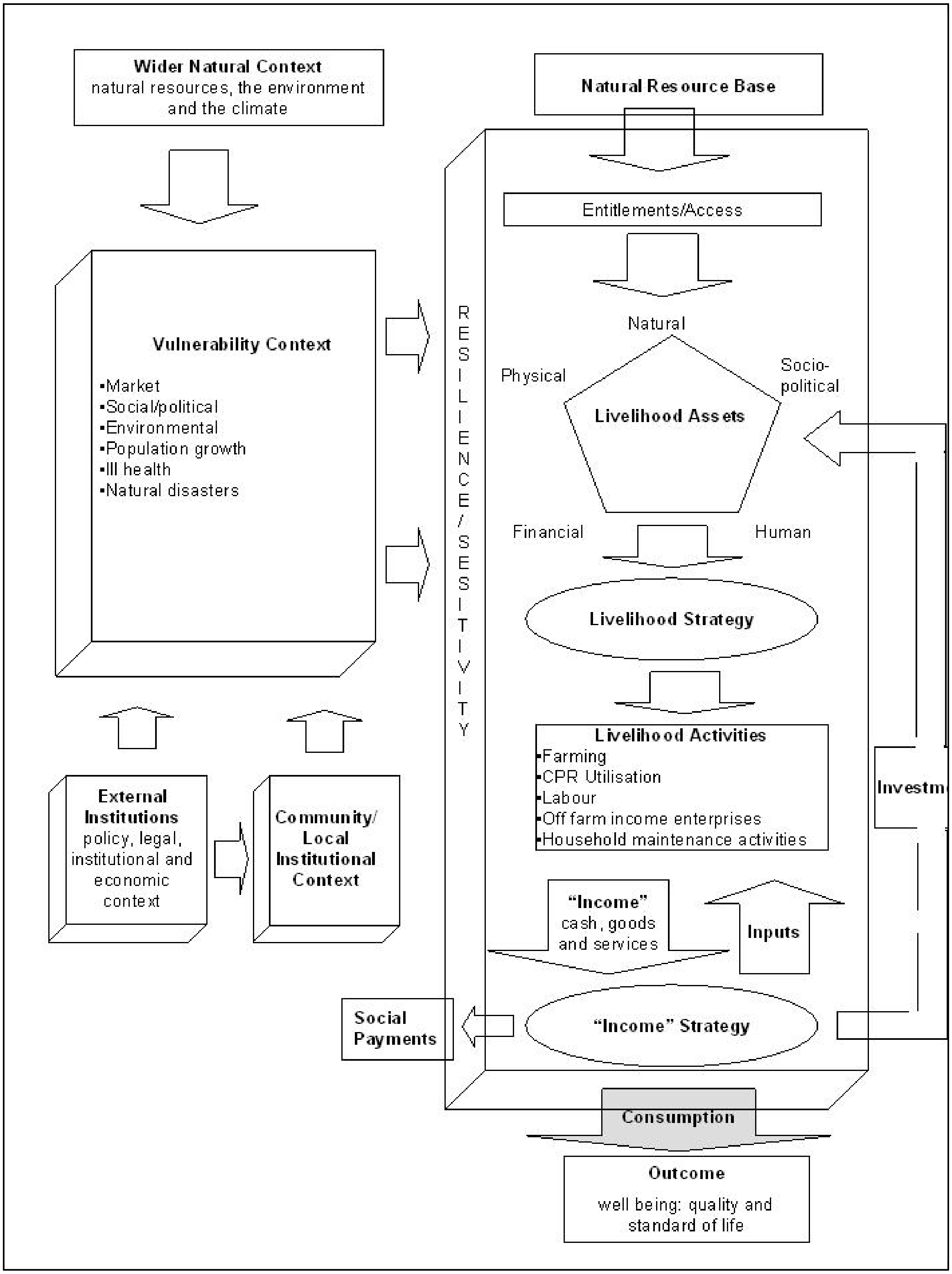

Figure 1: Livelihood Systems model (Soussan *et al.*, 2001)

Construction of indicators of livelihood improvement

The five livelihood indicators have been adopted for the measurement of the impact of this project. Variables for these have been constructed using the survey results. The constructed variables include:

Physical capital: This is measured as the percentage of the total household respondents in the survey indicating that they have the basic household assets such as farm implements, jewellery, transport, cooking utensils and clothing among others. It is anticipated that with the implementation of this project, where lumber is sold and the revenue distributed to community members, they could increase or acquire these basic physical assets to make life worth living.

Natural capital: This is measured as the average number of timber trees age 2 years and above possessed by household respondents on their farmlands in each community. It is expected that with the execution of this project, where community members begin to see the tangible benefits they stand to gain from these timber trees on their farmlands, they will be more careful and interested in maintaining and protecting these trees on their farmlands. Over time the number of trees per the survey participants will increase.

Financial capital: Is measured as the average income earned from forestry activities in a year by the household members that are surveyed. With this project, household members earn income directly either by engaging in the project through carrying of lumber or having trees processed on their farmlands.

Human capital: Is measured as the average annual expenditure on education by household members that are interviewed. It is also expected that with the income communities members earn from the project, many more will be able to spend more on the education of their children in the form of the secular training and learning of trade.

Social capital: Is measured as the average annual expenditure on social and religious activities by household members. It is hypothesised that, at these gathering, communities' members form their networks and connections that assist them to improve their livelihood. Therefore with the money earned from the project, many more of them will be able to pay their church dues, harvest levies, association dues, 'susu' deposit savings and funeral donations and therefore strengthen their ties with their various social groups.

Data collection

Questionnaire was designed to collect baseline livelihood information on the communities' participation in the project. This was done in the early part of the project in February and March 2007. Reconnaissance visits were first made to these communities. At these visits themes or open ended questions were discussed with the community members. From these a closed ended questionnaire was designed and pretested and the full scale survey of the communities conducted. This was done to provide the baseline livelihood information upon which the projects intervention in the area of livelihood impact is measured using results of the survey of the same sample units in February and

March 2010, three years after the project's intervention. The questionnaire focused on the livelihood activities of communities' members, household characteristics and their coping strategies following crisis in the previous years. The distribution of the number of people interviewed across the two forest districts are indicated in Table 1.

Data analysis

Descriptive statistics including means, percentages and frequency tables were used to analyse the data. For the livelihood measure, radar diagrams and principal component analysis were used upon the construction of the livelihood indicators from the data. The analyses were made separately on village basis and then the combination of all the villages using spread sheet in excel.

Results and discussion

Household characteristics

For the 81 individual respondents before the intervention of the project, mean household size was 5, which is slightly higher than the mean national household size of 4. However the standard deviation of 3 clearly point out a wide variation of the household size around the mean. It is not surprising that the minimum household size was one and the maximum was 14. On distribution of the sample by gender, more males were interviewed than females as indicated in Table 2. Similar patterns were observed, before and after the project intervention.

Table 2: Distribution of respondents by gender across the different target communities under the project

	Gender of respondent			
	Before		**After**	
Community	No of Male(%)	Female(%)	No. Of Male(%)	Female(%)
Japa	77	23	92	8
Nsabrakwa	100	0	88	12
Ankaasie	80	20	76	24
Dominase	100	0	93	7

Access to facilities in communities

On availability and access to basic facilities that contribute to the livelihoods, Japa community seems to be better off in terms of water supply, as 62% of them have access to water from the bore holes, while only 42% of all the 85 respondents have access to this source of water. As indicated in Table 3, 55% of the respondents depend on hand dug wells and rivers for their water supply. This implies interventions to improve the water supply in these communities might be useful to them.

Table 3: Number of respondents (%) indicating type of water supply accessible in the community

	Number of respondents(%) indicating type of water supply							
	Before				After			
Community	River (%)	Hand dug well (%)	Bore hole (%)	Pipe borne(%)	River(%)	Hand dug well(%)	Bore hole(%)	Pipe borne(%)
Japa	18	14	66	2	25	8	58	9
Nsabrakwa	50	0	50	0	17	12	53	18
Ankaasie	10	60	30	0	0	12	44	44
Dominase	22	78	0	0	0	8	21	71

The situation of solid waste disposal is typical of most rural communities in the country where the free range disposal is prevalent in most northern parts of the country and the pit latrines in the southern part. It is not surprising that majority of respondents make use of this type of solid waste disposal compared to only a few who have access to the improved KVIP system (Table 4). While before the project, 60% of respondents used the free range (open) solid waste disposal, three years after the project intervention, fewer (20%) people now used this type of facility as against 76% that used the pit in Ankaase community.

Table 4: Number of respondents indicating type of solid waste accessible in the community

	Number of people (%) indicating type of solid waste disposable available							
	Before				After			
Community	Pit	Water closet(water sealed)	Open	KVIP	Pit	Sanitary/ring-slab	Water closet(water sealed)	Open
Japa	68	2	0	30	33	17	8	42
Nsabrakwa	100	0	0	0	94	0	0	6
Ankaasie	40	0	60	0	76	4	0	20
Dominase	100	0	0	0	36	21	0	43

Access to electricity seems better. Most households have access to electricity as indicated in Table 5. Nsabrakwa community seems to be worst off before the project, but has slightly improved three years after the intervention of the project, as 12% of respondents managed to have access to electricity. This might be due to the rural electrification drive embarked on in the country. The results show that some level of development is taking place in these communities.

Table 5: Access to electricity in communities

	Is there electricity in the house			
	Before		**After**	
Community	Yes(%)	No(%)	Yes(%)	No(%)
Japa	80	20	92	8
Nsabrakwa	0	100	12	88
Ankaasie	90	10	88	12
Dominase	78	22	86	14

Housing facilities for communities

The houses the communities live in are mainly the mud bricks houses. Over 94% of respondents in all communities lived in such accommodation before the intervention of the project; while cement block houses were barely 2% as indicated in Table 6. There seems to be improvement, three years after the implementation of the project. As indicated in Table 6, many more respondents now live in cement block houses than before.

Table 6: Access to housing facilities for communities-nature of wall

	Number of respondents (%) indicating type of residential main house (wall)								
	Before				After				
Community	Brick	Cement block	Bamboo	Wood	Brick	Cement block	Bamboo	Wood	Straw
Japa	94	2	2	2	50	42	0	8	0
Nsabrakwa	100	0	0	0	41	6	6	35	12
Ankaasie	100	0	0	0	56	32	4	8	0
Dominase	100	0	0	0	57	36	0	7	0

The roofs and floors of the houses of these community members appear better. Majority of respondents are able to acquire iron sheets (zinc) to put over their roofs particularly three years after the intervention of the project. While in Nsabrekwa community, no respondent had iron sheet roof before the intervention of the project, 77% of respondent are able to roof their houses with iron sheets, three years after the intervention of the project

Table 7: Access to housing facilities for communities-nature of roof

	Type of residential main house(Roof)			
	Before (%)		**After (%)**	
Community	Zinc	Bamboo	Zinc	Bamboo
Japa	98	2	92	8
Nsabrakwa	0	100	77	23
Ankaasie	100	0	64	36
Dominase	78	22	79	21

In the case of the floors of the houses in which these communities' members live in, majority of them are able to afford cement for flooring their rooms, while few community people still use ordinary mud for their floors (Table 8). There appears to be improvement three years after the intervention of the project, as many more respondents used cement floors compared to the mud floors (Table 8)

Table 8: Access to housing facilities for communities-nature of floor

	Number of respondents (%) indicating type of residential main house(Floor)					
	Before			After		
Community	Tiles	Mud	Cemented floor	Mud	Cemented floor	Clay
Japa	0	3	97	8	58	34
Nsabrakwa	0	50	50	12	53	35
Ankaasie	0	0	100	0	88	12
Dominase	0	22	78	0	69	31

Livelihood activities of communities

Primary occupation of the community members show that they are mainly engaged in agriculture for their livelihood in both districts (Table 9). The large dependence on agriculture by these communities' members for their livelihood indicates the importance of forest resources, particularly the on-farm trees.

Table 9: Primary occupation of household members in communities

Primary occupation	Before % total respondents (N=86)	After % of total respondents (N=71)
Agriculture	238.4	204.2
Unemployed	2.4	1.4
Agricuture labour	4.7	1.4
Blacksmith,Cobbler,Carpenter,Sewing etc	23.3	53.5
Salaried worker	4.7	5.6
Petty business	10.5	11.3
Business	7	1.4
Handicraft	2.3	7
Student	201.2	260.6
Private/government service	1.2	-
NGO worker	1.2	5.6

Levels of impact of on-farm tree revenue on community's livelihood

The initial assets levels of the household respondents are indicated in Figure 1 for the different communities. In Figure 1, the value for the natural capital for the Nsabrekwa community members could not be found and that makes the bar to be zero. In all the four communities, the natural assets involving average number of timber trees owned by communities' members is the lowest of all the five livelihood indicators (Figure 1). This might be as a result of their lack of awareness of these trees due to their perception that they do not get much benefit from them. Among the five livelihood indicators in all the communities, the financial assets indicator appears to be the highest. This might be driven by earnings from cocoa, which most of these communities' members are engaged in. For this indicator shown in Figure 1, Nsabrekwa community leads.

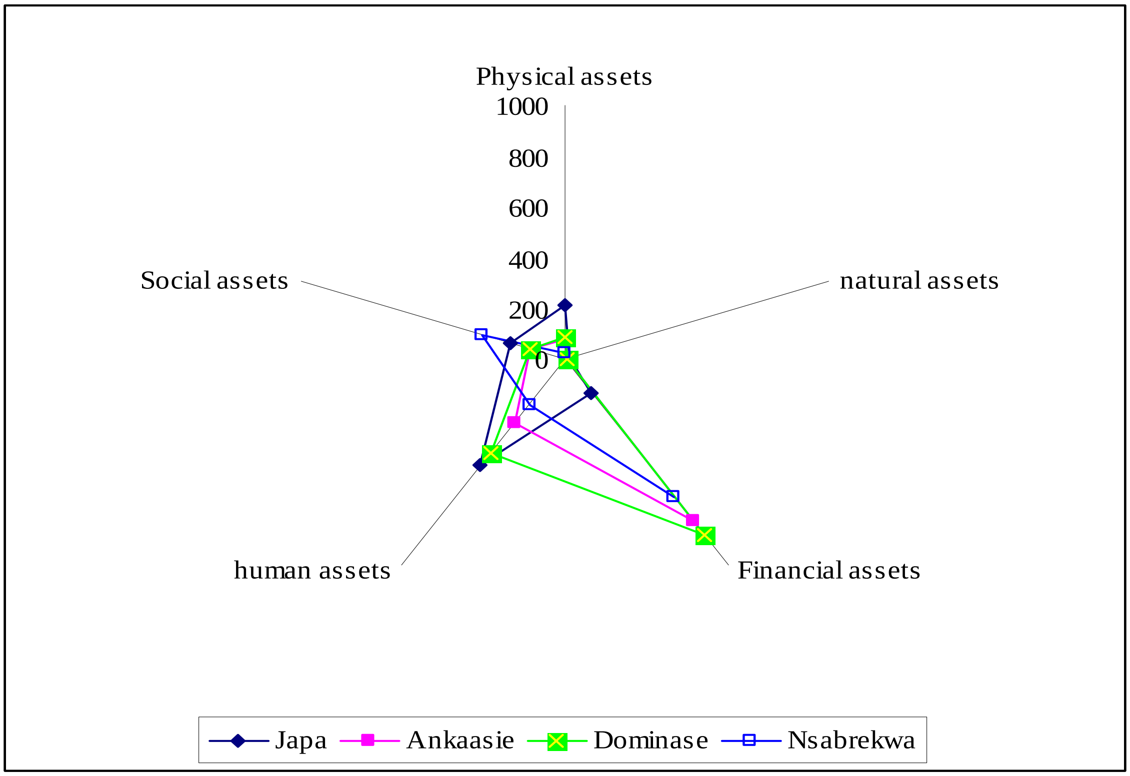

Figure 2A: Initial levels of livelihood assets possession in the 4 communities

The performance of the livelihood indicators before and after the intervention of the project is indicated in Figure 2 for the four project communities. There appears to be improvement in the physical assets status of the household respondents in Ankaase, Dominase, and Nsabrekwa communities. The social and human capital status has, however, improved for these four communities (Figure 2). Contrary to expectations, the financial capital status of respondents has rather declined, three years after the project intervention. The cause for this could be attributed to the lack of proper data collection on this key variable. Some amount of physical cash was distributed to participating community members. Other community members also earned some money directly and indirectly from the project, and these monetary benefits appear not to have reflected on this indicator. The improvement in these livelihood indicators, could not be entirely attributed to the project interventions, but can be concluded that, it has contributed to it, though minimally. Possibly a more significant contribution could be made if the intervention of the project is sustained for a longer period of time than these initial three years.

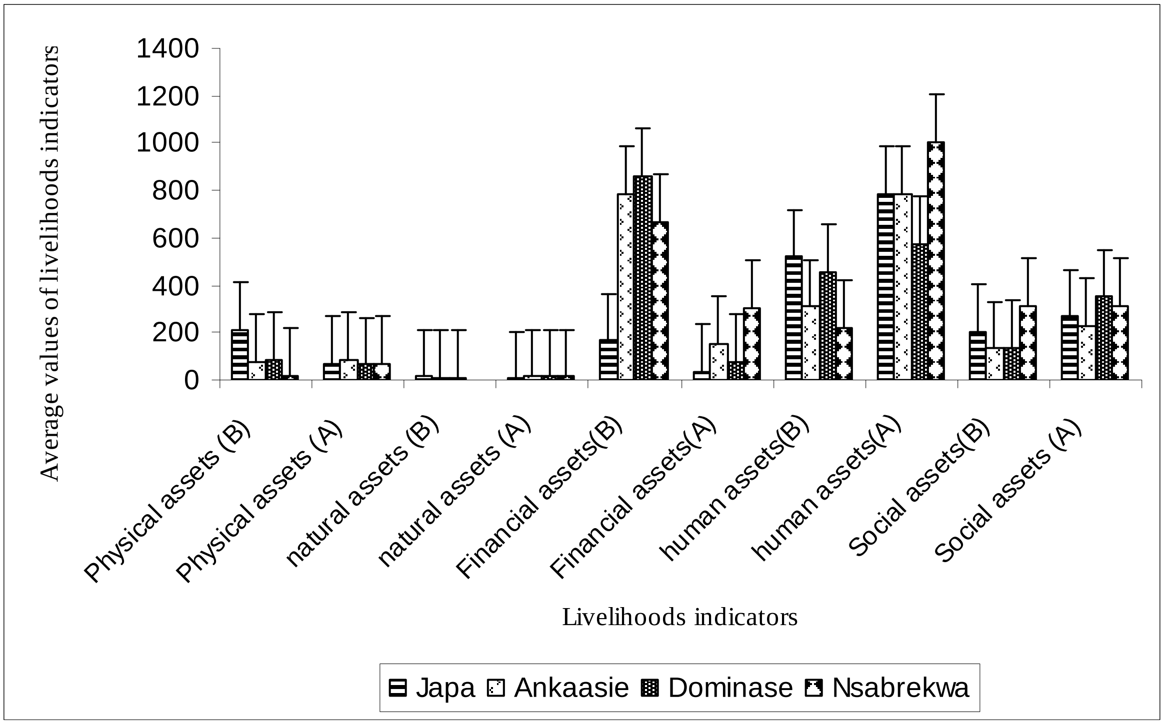

Figure 2B: Assets levels of household respondents in 4 communities before (B) and 3 years after (A) project intervention

Mitigative effect of on-farm tree processing on community's crisis status

The crisis households have been through is indicated in Figure 3 before and after the intervention of the project. These include a wide range of problems among these communities in the forest areas. Key among them is illness, poor food production, food shortage and loss of household members and funerals. As shown, these crises cover all aspect of life including financial, social, natural, human, and physical. Some of these crisis are natural and possibly beyond the direct control of communities. For instance, drought, excessive rainfall, and wind damage to crops are crisis that appear to go beyond the control of members. These are the indicators that have rather increased beyond the base year level three years after the project intervention. For the remaining indicators, there seems to be no significant decline in these crisis levels that community members encounter. All these have negative impact on the livelihood of these community members and point at the trouble forest community members go through. It also points to the fact that short, long term, as well as multi sectorial interventions might be required to improve the livelihood of these forest community members.

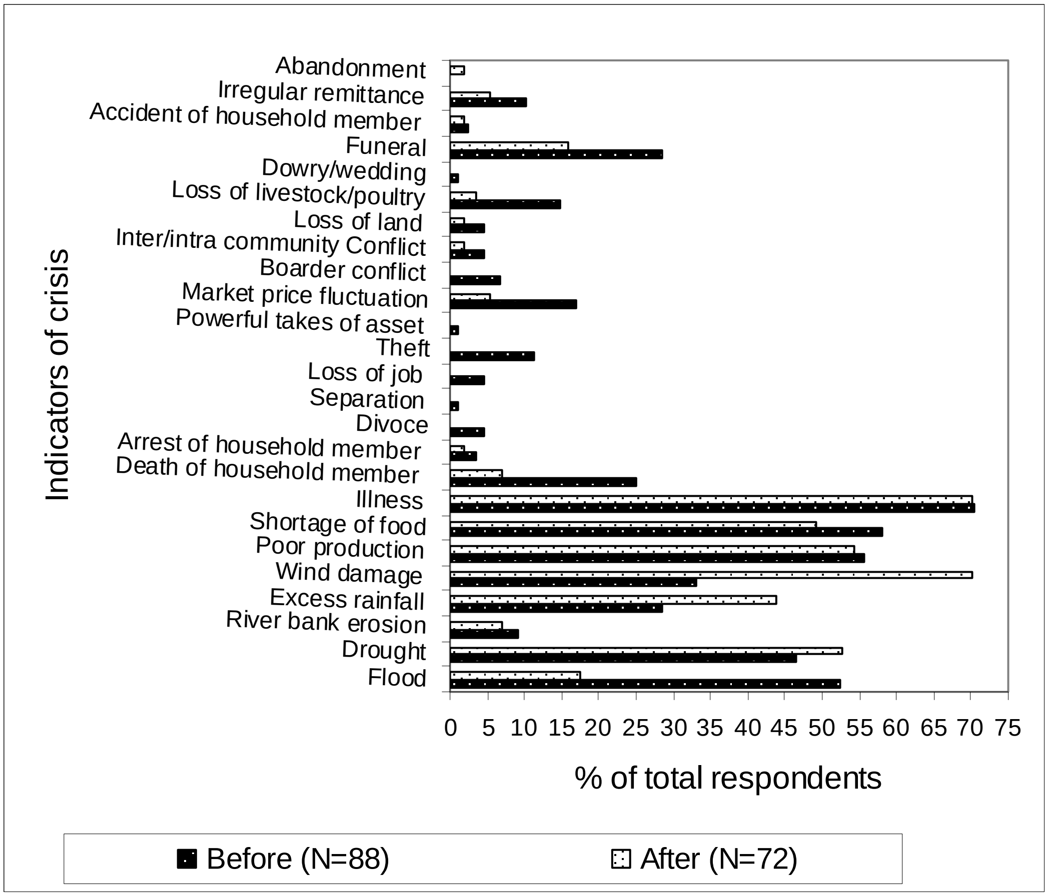

Figure 3: Crisis communities experienced in the course of the year before and after project

Indication of community coping strategies with crisis

In the event of crisis, community members have their own way they go about to cope with the crisis. These coping strategies include loan from neighbors or relatives, adjustment of meals, sale of agricultural produce at reduced prices and sale of trees. This later action possibly is the sale of timber trees on their farmlands to the illegal chainsaw operators in order to get out of the crisis (Figure 4). Three years after the project intervention this strategy did not seem to have reduced significantly as compared to the baseline level, pointing out that community members still resort to sale of trees on their farmlands to get out of crisis situation. Though the project has shown how community members can benefit directly from trees on their farmlands, once the laws and rules governing access to these trees have not changed in their favour, it appears these community members still harbour the fear of non benefit from timber on their farmlands, hence their continuous sale of trees to the illegal chainsaw operators.

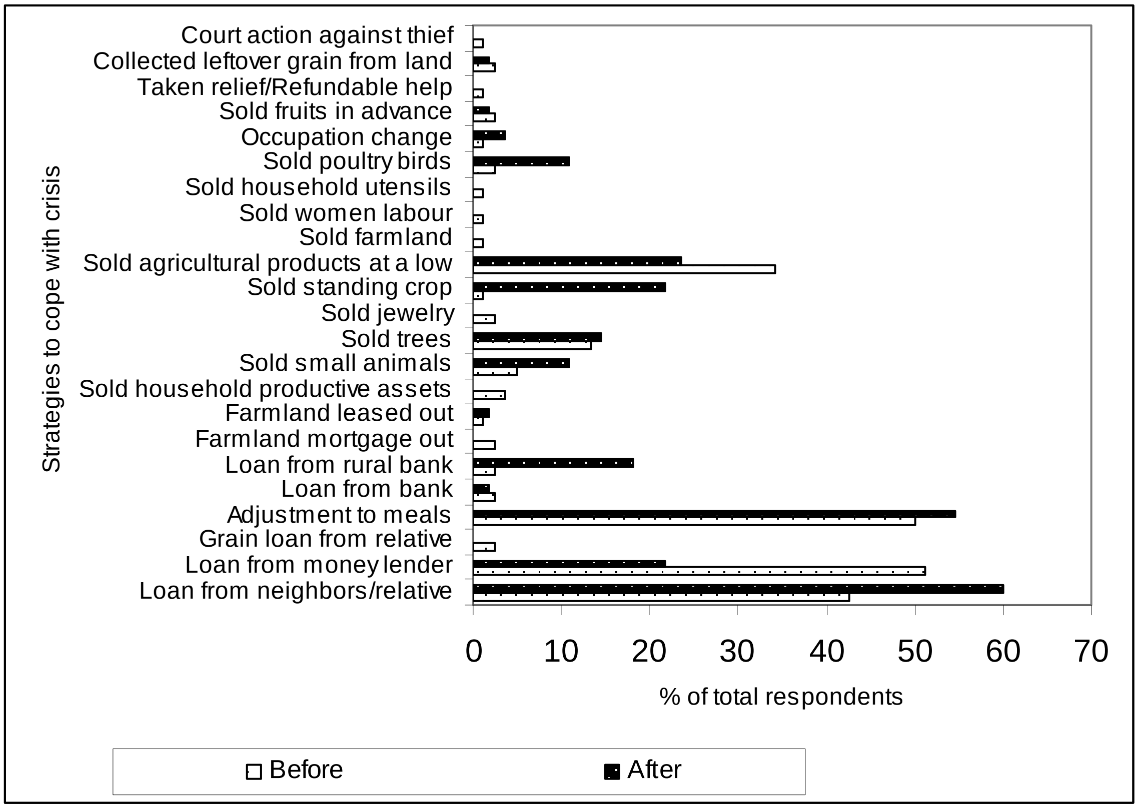

Figure 4: Community coping strategies with crisis before and after project intervention

Conclusion and policy implications

Understanding the living conditions of local community members is the starting point for providing the relevant interventions that will improve their living condition and ease the pressure on the environment and also make them committed to its management. This report has provided important information on how the processing of farmland trees impact on the livelihood and living conditions of community members in the project area and for that matter the forest areas. The most important contribution is in the area of social, human and physical assets status of participating community members. This is derived from the project through revenue generated from the processing of the trees on farmlands and logging residues that has been distributed to community members. Other community members also benefited from the project through earnings from services delivery in the form of lumber carrying, lumber sales or marketing, etc.

For crisis that communities go through, the report has identified irregular and poor rainfall pattern leading to drought, excessive rainfall leading to flooding and damaging of crops by the wind. This brings about poor production of food that leads to food shortages, illnesses and funerals among communities. The ways community members cope with these crisis are the sale of trees possibly due to the presence of illegal chainsaw operators, sale of food products at reduced prices to attend to the crisis. The sale of trees to illegal chainsaw operators did not seem to have reduced drastically in the target communities three years through the project. This may be due to fears among community members about their inability to benefit directly from timber trees on their farmlands due to the laws governing the access of such trees; though the project has shown them the way they can directly benefit from trees on their farmlands. Sustained education and assurance of forest communities that have been done in this project that they can benefit directly from timber trees on their farmlands in future can let them stop or minimise the sale of trees on their farmlands to the illegal chainsaw operators. However, this should be backed changing the laws governing the access of trees on farmlands in favour of communities.

In general, interventions in these forest communities would make meaningful impact if they are designed to target the general conditions of living of these community members. They would again bring significant relief to the communities if they also target these short term crisis that communities go through and the way they cope, particularly sale of farmland trees and sale of food products at reduced prices. This therefore point out the importance of processing trees on farmland. Although, its impact on the livelihood of community members may not be so significant, it shows one way through which livelihood of the forest communities could be improved and at the same time ensures sustainable management of the forest resources. That is if due to the benefits that communities members enjoy from the project, they become committed to the growth and protection of trees on their farmlands.

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