DRAFT REPORT

Analyses of potential livelihood outcomes, farming practices and conflicts in natural resource use under a REDD+ implementation in Ghana

1.0 Introduction

Reducing emissions from deforestation and forest degradation (REDD+) mechanism is one important international effort to mitigate climate change effects (Agrawal et al. 2011). REDD+ mechanism entails a set of processes and measures through which financial incentives are to be offered to tropical forest countries for demonstrable reductions in GHG emissions from deforestation (the conversion of forested to non-forested land), forest degradation (reductions in forest quality, particularly with respect to its capacity to store carbon), and to address the role of conservation, sustainable management of forest and the enhancement of forest carbon stocks in these countries (Agrawal et al. 2011; UNFCCC, 2010). REDD+ mechanism is likely to affect the livelihood of poor people (IEED 2011) since most of them dependent on forest (FAO, 2011)

Whereas REDD+ incentives aim to support forest conservation and help to secure services provided by forests in addition to carbon storage and sequestration, potential social impacts, risks, conflicts and required changes in farming practices should also be recognized. Potential negative impacts arising from REDD+ implementation could include, displacement of land use pressures to other parts, interference with tenure rights of the poor or loss of biodiversity arising from plantation forestry and conflicts. If REDD+ would be effective in mitigating climate change, the potential positive and negative impacts (Bell et al. 2012) need to be identified. Governments and other actors implementing REDD+ policies and activities should therefore be informed about these possible outcomes and so that they could use that evidence to revise and improve the policies (Agrawal et al. 2011).

The need to clearly understand these potential positive and negative effects in order to help in the development of feasible REDDS + strategies for Ghana have been highlightedinthe Readiness preparedness proposal (R-PP) and the (R-PIN) documents (Bamfo, 2010; 2008). Some of the issues requiring the necessary attention include, i) reform of tree tenure regime in order to revitalize forest resources outside the official state reserves; ii) under developed technologies in agriculture, particular the smallholder sector; iii) agricultural expansion and fuel wood harvesting, charcoal production, illegal logging, wildfire and biomass burning; and avoiding negative social implications that might arise from REDD+ implementation due to issues such as effects on food prices, limited market access to rural poor, etc. However, the identification of these issues on the ground, including the perception of farm households on such issues are yet to be fully understood

With this background information on the need for economic and social implication of REDD+ implementation, to be clearly understood in advance, it is important such potential impacts on local communities and their economies are evaluated to aid the understanding. These potential impacts could includeimpacts on the well-being of people who live and work in the REDD + project areas; the required changes in farming practices (e.g. farmland intensification, agro forestry etc) and likely conflicts in the natural resource use. Evaluating these local welfare impacts and changes in farming practices and conflicts in natural resources use are critical for

understanding the broader social implications and long-term political feasibility of REDD+. More importantly, project developers, donors and relevant certifying bodies such as the Climate, Community & Biodiversity Standards (CCBS), Voluntary Carbon Standard (VCS), and Plan vivo (PV) will need to know the outcomes of their projects and what tradeoffs between conservation and livelihoods are associated with those outcomes.

This work posits that the success or failure of REDD+, at any scale, depends on the possibility of designing interventions that do not harm local populations, and at best lead to favorable joint outcomes of reduced net carbon emissions and improved rural livelihoods. This work is a report onactivity 2.1 of the ITTO project RED-PD 093/12 Rev. 3 (F)-Advancing REDD+ in Ghana: Preparation of REDD+ Pilot Schemes in off-Reserve Forests and Agroforests**.**

The aim is to understand the potential implications of REDD+ implementation for livelihood, required changes in farming practices and conflicts in natural resource use at the forest or farm level in Ghana using six project communities as a case study. The purpose is also to provide information on farmers' perception about REDD+ with an aim to contribute to Ghana's REDD+ strategy designs and formulations

2.0 Theoretical background

The analysis in this work is based on the following theoretical concepts- the livelihood framework, cost benefit analysis, auction theory and conservation contracts and the framework for identifying potential forest conflicts under REDD+ implementation

2.1 Livelihood framework

A livelihood comprises the capabilities, assets and activities needed for a means of living (http://practicalaction.org/livelihoods-4). It is sustainable when it is able to cope with and recover from shocks and stresses, enhance its capabilities and assets and provide sustainable opportunities for the next generation. The sustainable livelihoods approach considers vulnerabilities as the main factor that shapes how people make their living.The level of vulnerability of an individual or community is determined by how weak or strong their livelihoods are, what occupational activities they are engaged in, the range of assets they have access to for pursuing their livelihood strategies and the strength and support of the social networks and institutions that they are part of or which have influence over them (Figure 1)

One important factor that influences the choice and strengths of the livelihoods that people pursue is the range of resources or assets that people are able to access and use.Certain components of these assets required to make a living can be classified under five main groups as follows.

- Natural (N) - soil, water, forest, environmental assets, etc
- Financial-sources of income, assets which can be traded or sold, savings, financial services
- Physical(P) - houses, schools, clinics, roads, ploughs, producer goods accessible by community, etc
- Human (H) - health, skills, education, knowledge, confidence etc
- Social (S) - family links, groups, support networks, leadership, influences over political decisions, conflict (Figure 1)

In Figure 1, the sustainable livelihoods framework indicates the different aspects of peoples' vulnerability and point out the social, political and economic structures and processes which influence vulnerability.From this sustainable livelihoods framework the social (S), Human (H), Natural (N), Financial (F) and Physical (P) assets indicators and copying strategies were employed in the design of checklist of issues for the focus group discussion with farmers in the study communities (Figure 1)

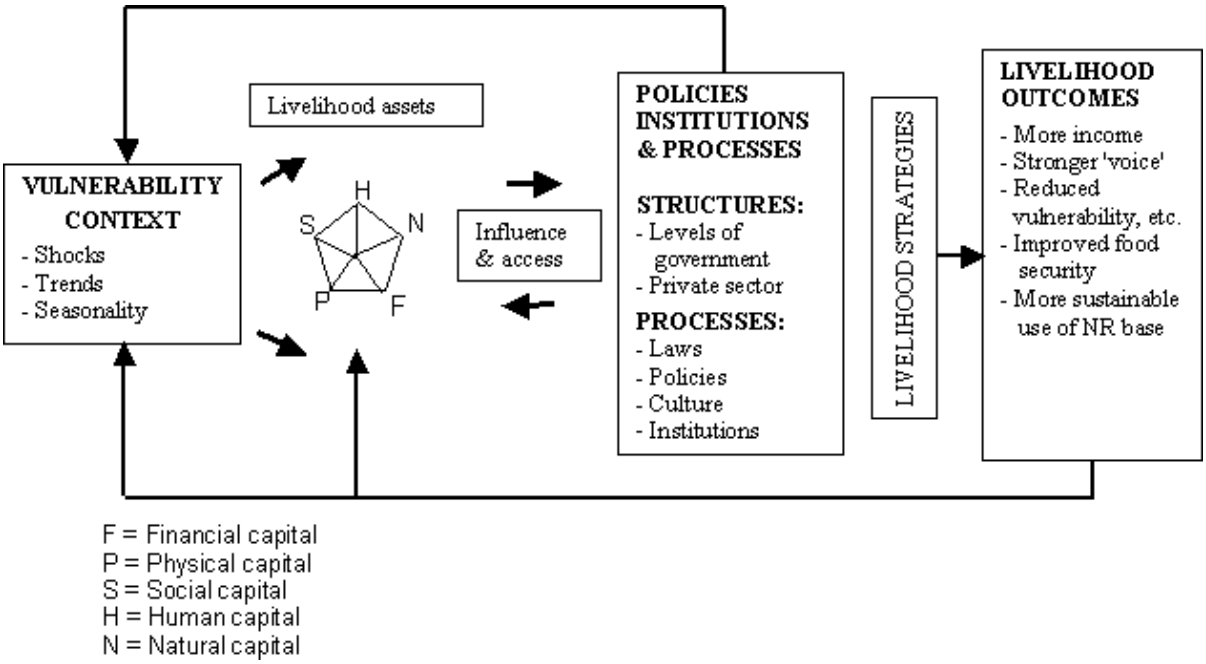

Figure 1: Sustainable livelihood framework (DFID, FAO 2000)

2.2 Cost-Benefit analysis

Cost-benefit analysis (CBA) involves the totaling up of equivalent money value of the benefits and costs of a project to its target beneficiaries. The purpose of this summation is to arrive at a conclusion on the desirability of the project. In order to get to this conclusion, all aspect of the project, positive and negative, must be expressed in terms of common units, which is most conveniently in money. These benefits and costs are not only expressed in terms of money value, they are also expressed in terms of money value at given point in time. This is done to avoid differences in value of money at different points in time due to inflationary effects. In the application of CBA in this work, only benefits and costs data on farming of farmers was considered. Historical data on such activities as well as future ones were not considered. Other land uses data of farmers were not also considered basically due to budgetary and time constraints in procuring such data

2.3 Auction theory and conservation contracts on farmlands

According to Macfee and McMillan (1986), auction is a market institution with clear set of rules for determining resource allocation and prices on the basis of bids from participants in the

market. Awarding contracts using competitive bidding is a method frequently used to obtain goods and services that do not have a well-established market (Latacz-Lohmann and Van der Hamvoort, 1997). In the award process, the buyer announces a contract for the procurement of a specified item and calls for bids from potential market participants. This auction process has long been used in government procurement contracting. For instance, the U.S. Department of Agriculture uses this process to award conservation (land retirement) contracts on competitive bidding basis (Latacz-Lohmann and Van der Hamvoort, 1997). Aside applying auctions in the conservation contracting in land retirement; it can also be applied in the management of environmental goods and services on private agricultural/farm lands. In doing this, farmers who are the sellers of these environmental goods and services on their farmlands, would be made to indicate in their bids the amount of incentive payment (or the percentage cost-share) required to adopt the conservation practice in question (Latacz-Lohmann and Van der Hamvoort, 1997). It is important to point out the application of auction theory in conservation contract is feasible based on two reasons. That is, i) the item being traded, provision of an environmental good/service on farmlands, is a public-type non market good with no standard value; ii) information asymmetry is present in the process where farmers are much knowledgeable than the conservation experts, how participation in the program would affect their production plans and profits. This is one theoretical advantage of auctions since it enables participating farmers to manage uncertainty about the value of the environmental good/object being sold or purchased.

2.4 Framework for identifying potential conflicts under REDD+ implementation

This framework is a preliminary predictive one built to identify possible sources of impairment that may result in conflict over management of forests and natural resources under REDD+(Patel et al. 2013). It is developed from literature, mainly on Glasl's definition of conflict (199) that is further developed by Yasmi and Colfer (2010), as a situation in which one actor or group impairs the activities of another because of different perceptions, emotions and interests. Based on Yasmi et al. (2012) categorization of potential sources of impairment as: underlying (e.g. contested and overlapping claims of tenure) and direct (e.g. loss of access by communities), the analytical framework in question was developed consisting of nine possible sources of impairment as the possible sources of conflict in REDD+ implementation. The nine conflict sources include; a) access and use restriction, b) benefit distribution, c) competing demands, d) conflict management capacity, e) leadership, f) legal and policy frameworks, g) participation and information, h)quality of resources, and j) tenure security.

The focus of the framework is on sub-national potential conflict, and based on internal issues (e.g. decision making within the community), and external levels (e.g. laws and regulations regarding community rights). The developed analytical framework was tested in three REDD + pilot project sites in Nepal. The sources of conflict that this framework was used to detect in these REDD+ pilot sites were issues related to benefit sharing that have been the main drivers of conflict prior to REDD+. Although, this frame work has some limitations in its scope and precision, it is useful for policy makers and practitioners involved in REDD+ strategy designs.

3.0 Methodology

3.1 Study area

The study was conducted in three administrative districts in three communities each. These districts and the communities included AowinSuaman (Adonikrom and New Yakasi) in the Western region, Asikuam-OdobenBrakwa (Bedum and Brakwa) in the Central region and Kintampo North Municipal (Dawadawa no 1 & 2,Attakura and Tahirukura) also in the BrongAhafo region (Table 1 and figure 1). Communities in the BrongAhafo region are in the drier part (forest savannah transition zone), while the remaining study communities arein the wetter (high forest zone) partof Ghana.

Table 1: Communities and number of farm households engaged in the interview

Community	Aowin Suaman district in Western region	Asikuam-OdobenBrakwa district in Central region	Kintampo North Municipal district in BrongAhafo region
Adonikrom	38	0	0
Attakura	0	0	23
Bedum	0	33	0
Brakwa	0	45	0
Dawadawa No. 1	0	0	3
Dawadawa No. 2	0	0	35
New Yakasi	37	0	0
TahiruAkuraa	0	0	18
Total	76	78	79

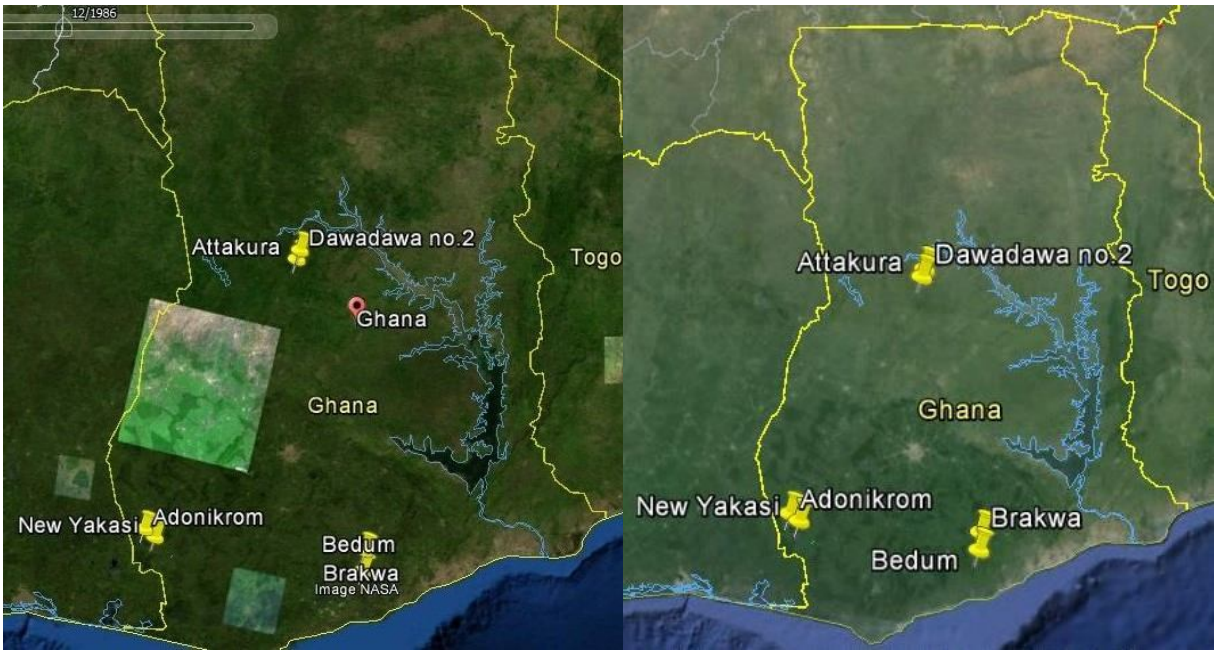

Figure 2: Map of Ghana (1986/left and 2013/right) showing the study communities in the three districts

3.2 Questionnaire design, sampling and data collection

Individual interview questionnaire wasprepared from literature and pretested in one community in the study site. For this questionnaire, the sample units were the farm households in two communities each in the three district study sites. Selection of these farm households was based on the household heads. The housing units were systematically identified and household heads randomly selected for the face-to- face individual interview in May 2013. With the focus group discussion that was also employed, a check list of issues to be discussed was first prepared from literature documents. On site in the study communities in the target districts, household heads were organized into groups (see Table 2) for the discussion on the issues. The group responses were then recorded on sheet of paper according to the check list. For the auction data collection, a hypothetical REDD + intervention that involves inclusion of at least 20 trees on farmer's land was constructed. These lands included an acre ofcash crops, perennial crops and fallow land. Farmers who are land owners were identified in the study communities to participate in this auction exercise. In doing this exercise these groups of farmers were made to indicate their bids on these types of their land uses individually three times in a sealed envelop

Table 2: Focus group discussion information collection schedule

Categories/activities for focus group discussions	Aowin-Suaman district	Asikuma-Odoben-Brakwa District	Kintampo north district
Average time for one group discussion	2.5 hours	1.5 hours	1.5 hours
Gender	Male - 5 Female - 2	Male - 8 Female - 3	Male - 10 Female - 5
Number of focus groups per district	4	4	3
Number of persons in each focus group	8	11	16

3.3 Data analysis

Quantitative and qualitative research data were collected in order to address the research problem identified in this work. While the quantitative data was collected through questionnaire surveys, the qualitative data was collect in focus group discussions (Table 1). The surveys questionnaires were analyzed using frequency, graphs, averages on issues that community respondents were asked. These issues were socio economic characteristics, farming and livelihood activities, land use practices, perception on land use types that are low carbon emitting, likely effect on farmers for adoption of such land use types. Other issues discussed and information collected on them was revenues and cost information from the farm households farming activities. Information on how much (in monetary terms) these farm households would auctioned out portions of their farmlands for potential REDD+ intervention was also asked. Farmer-land owners were made to indicate a bid for an acre of farmlands to be committed for these REDD+ conservation activities.The bids information was averaged for three rounds for each farmer and plotted as line graphs of average bids values against the individual farmers. Other descriptive statistics involving means were obtained from the data and t test statistics performed to compare the bids among farmers in the different study communities in the three districts. The information collected in the focus group discussions were analyzedby identifying themes and clustering them

under the assets categories indicated in the livelihood framework (figure 1) and the framework for conflict identification.

4.0Results

4.1 Land uses and management practices among farmers

Land use practices

Land use practices in the study communities are varied. While charcoal production is dominant in the communitiesin the drierareas in the Kintampo North Municipal District, sand winning is dominant in the Central region communities and settlement expansion and road construction in the Western Region communities (Table 3)

Table 3: Prevailing land use practices in communities in the study districts (numbers and percent of respondents)

Prevailing land use in the study communities	Aowinsuaman in numbers(%) of respondents	AsikumaOdobengBrakwa in numbers (%) of respondents	Kintampo North Municipal in numbers (%) of respondents	Total number of respondents
Building	22(63)	7(20)	6(17)	35
Road construction	9(90)	1(10)	0(0)	10
Food crop (Plantain)	1(33.3)	2(67)	0(0)	3
Sand winning	1(8.3)	11(92)	0(0)	12
Charcoal production	2(3.3)	0(0)	59(97)	61
Animal rearing	1(25)	0(0)	3(75)	4

Land management practices

Among farmers in the study communities, soil and nutrient management in Aowin suaman districts appears to be prevalent while use of synthetic fertilizer is prevalent among farmers in the study communities in the Kintampo North Municipal district. It is among farmers in communities in the Asikuma Odobeng Brakwa district that the use of pest and disease control as a form of land use management appears to be prevalent (Table 3)

Table 3: Prevailing land use managementin communities in the study districts (number and percent of respondents).

Current land use management	Aowinsuaman in count (%) of respondents	AsikumaOdobengBrakwa in count (%) of respondents	Kintampo North Municipal in count (%) of respondents	TOTAL

Soil and nutrient management methods and practices that increases organic nutrient inputs, retention and use	48(57)	4(5)	33(39)	85
Use synthetic fertilizer	68(41.2)	26(16)	71(43.0)	165
Pest and disease control	66(41)	69(43)	27(17)	162
Harvesting, processing and supply chain	10(40.0)	2(8.0)	13(52.0)	25
Regular weeding	0(.0)	27(68)	13(33)	40

4.2 Analyzes of revenue of farmers from existing farming practices

The areas in respect of which farmers' revenue from existing farming practice is analyzed are the gross revenue, net revenue and the inputs use.

4.2.1 Analyses of gross revenue of farmers from existing farming practices

The analyses of the gross revenue of farmers from their agricultural lands, excluding the inputs cost, show a dominance of cocoa production (cash crop) in the wet zone; andrice and yam (food crop) production in the dry zone in study areas (Table 5 and 6).

Table 5: Quantities of leading crops produced and the corresponding gross revenue obtainedby farmers in the study communities in the three districts

	First farming season					Second farming season				
District/crop	Farmers(no)	Quantities produced			TR(¢)	Farmers	Quantities produced			TR(¢)
		Bags	Kg	Metric tons			Bags	Kg	Metric tons	
Aowin/cocoa	73	3535	226240	226.24	741852	71	1042.75	66736	66.74	222328
Asikuma/cocoa	74	821	52544	52.54	164857	52	219.5	14048	14.05	42291
Kintampo/Rice	41	1057	86264	86.3	87942					
Kintampo/yam	40	*86602	216505	216.5	433010					

*Yam is in pieces/Numbers. One bag of paddy rice = 82Kg, 100 tubers of yam=250Kg (MDA, 2010)

Average cocoa revenue (gross) per farmer in the Aowin-Suaman district (study communities) is GH¢10162 in the first farming season andGH¢3131 in the second farming, while it is GH¢2228 and GH¢813 in both seasons respectively in the Asikuma-Odobeng Brakwa district, study communities. For the food crops among the study communities in the Kintampo North districts, average revenue per farmer is GH¢10825 for yam, and GH¢2145 for rice. These are only for one

season, because these crops are not cultivated in the two seasons due to dry nature of this area (Table 6)

Table 6: Gross revenue analysis of cash and food crops of farmers in the study communities in the three districts

Asikuma	1st farming season					2nd farming season				
Crop	Plot area (acres)	farmer (number)	Total revenue(¢)	Average revenue/ farmer(¢)	Average revenue/ acre	plot area (acre)	Farmer (number)	Total revenue(¢)	Average revenue/ farmer	Average revenue/acre
Cocoa	537	74	164857	2228	307	414	52	42291	813	102
Cassava	53.97	21	7483.98	356	139	46.5	17	2120	125	46
Maize	6.8	4	1365	341	201	49	5	930.6	186	19
Plantain	7	4	28028	7007	4004	380	3	4096	1366	11
Palm	4	2	120	60	30					
Kintampo		1st farming season				2nd farming season				
Maize	86	25	20956	838	245	28	8	7969	996	285
Cassava	4	2	340	170	85					
Yam	204	40	433010	10825	2123					
Rice	192.5	41	87942	2145	457					
Pepper	5	3	27367	9122.4	5473					
Ground nut	16	9	7590	843	474					
Beans	13.5	7	7518.4	1074	557	9	2	237	118	26
Okro	1.5	2	306.4	153.2	204					
Aowin-suaman		1st farming season				2nd farming season				
Cocoa	1210	73	741852	10162	613	1217	71	222328	3131	183

As it appears (Fig 3), gross total revenue farmers obtained in a year involving all crops cultivated is generally higher in the study communities in the Aowin-Suaman district, although only cocoa farming revenue was included in the computation. Revenue from communities in the Kintampo North Municipal district follows and those obtained in communities in the Asikuma-Odobeng Brakwa appears to be the least.

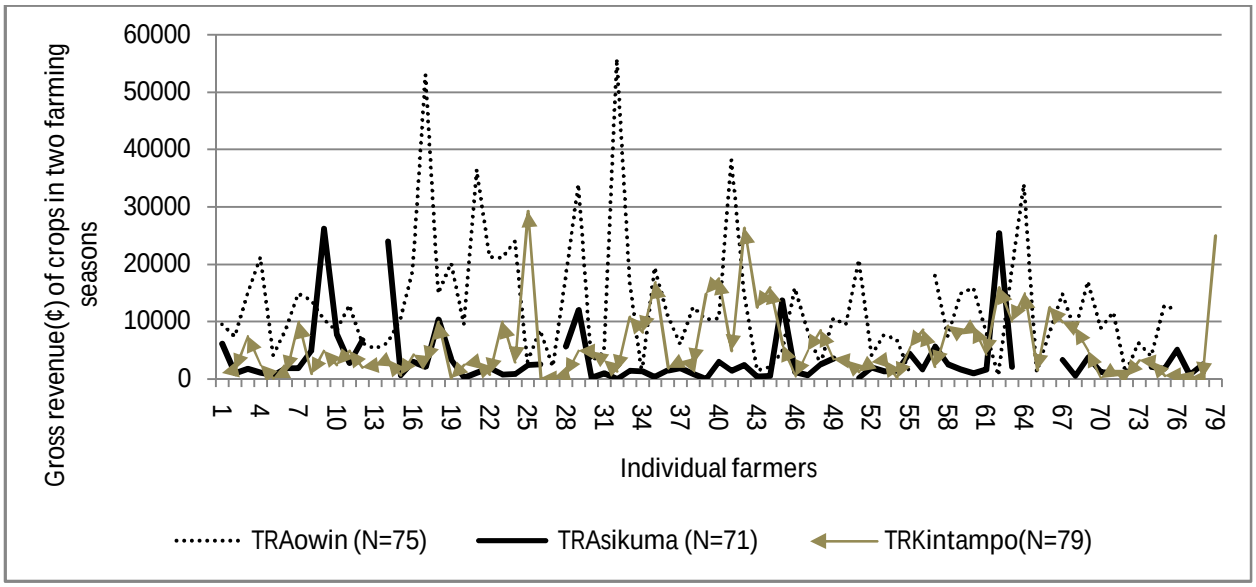

Figure 3: Gross total revenue of individual farmers in the study communities in three districts for two farming seasons

The dominance of gross revenue earnings of farmers in communities in the Aowin-Suaman district appears confirmed with the highest average revenue (i.e. total gross revenue /farmer) of GH¢12855.73, followed by GH¢5830.44 in Kintampo communities and the least, GH¢3539.32 in the Asikuma-Odobeng Brakwa communities. The large standard deviation values in Aowin-Suaman and Kintampo communities probably is an indication that these gross revenues in these communities are not evenly distributed among the farmers (Table 7)

Table 7: Descriptive statistics of gross revenue of farmers for two farming seasons in the study communities in the three districts

District	Farmers (no.)	Min(GH¢)	Max(GH¢)	Average (GH¢)	Standard deviation
Aowin	75	636	55756	12855.73	10720.94
Asikuma	71	3.2	26252.35	3539.32	5285.7
Kintampo	79	177.6	29287.6	5830.44	6224.18

4.2.2 Analyses of inputs of farmers in existing farming practices

Labour inputs appear the highest cost element in the farming activities of farmers in all the study communities in the three districts. The next higher cost element is fertilizer both NPK and UREA, but appears dominant among farmers in communities in the Kintampo North Municipal district as many more farmers report the use of these (Table 8). The use of pesticides appears higher than that of Herbicides among farmers in all the study communities (Table 8).

Table 8: Costs of inputs used in the food and cash crop production in the 1st and 2nd farming seasons by farmers in the study communities in the 3 districts

District/Season	Hired labour(¢)	farmers (no.)	Fertilizer (NPK) (¢)	farmers (no.)	Fertilizer (UREA) (¢)	Farmers (no.)	Herbicide(¢)	farmers (no.)	Pesticide(¢)	farmers (no.)
Aowin/	36416	71	102225.1	70	5014.2	9	7800	33	25723.	76
1st	4088	25							18.38	1
	3235	19								
	2408	14								
Asikuma/	51414	62	18112.32	25		?	4819.2	43	9961.96	57
1st	24754	31				?	902.4	23	514.64	9
	7461	14				?	182.4			
	1354	3								
Kintampo/	88608	72	9160.33	40	2342.4	12	8745.6	56	533.02	6
1st	41432.	59	7554.70	35	768.6	5	4838.4	50	183.1	3
	27814	40	4178.76	25	329.4	2	2371.2			
	8427	13	1338.03	8	73.2	1	547.2			
Aowin/	13694	44	6710.71	12		?	278.4	4	6524.9	41
2nd	2884	22								
	2132	17								
	1931	14								
Asikuma/	239299	40	1844.15	9		?	854.4	20	2536.44	25
2nd	9405	17				?	201.6	8	73.52	2
	3526	8								
	451	1								
Kintampo/	5843.64	7	370.53	2	329.6	1	633.6	5	110.28	2
2nd	100.32	1	329.36	1	205.85	1	115.2	1		
	150.48	1								
	100.32	1								

4.2.3 Analyses of net revenue of farmers from existing farming practices

The net revenue (total overall revenue minus total overall cost) appears highest among farmers in communities in Aowin (Fig 4). The least net revenue value is recorded in Asikuma-Odobeng Brakwa, with an average net revenue value of GH¢1273.59 compared to the highest value of GH¢11469.92 (Aowin) and GH¢3079.45 (Kintampo). Again, the high standard deviation value of 11260.33 point to an uneven net revenue distribution in Aowin compared to a likely even net revenue distribution among farmers in Kintampo North Municipal District communities with the lowest standard deviation value of 1051.97 (Table 10).

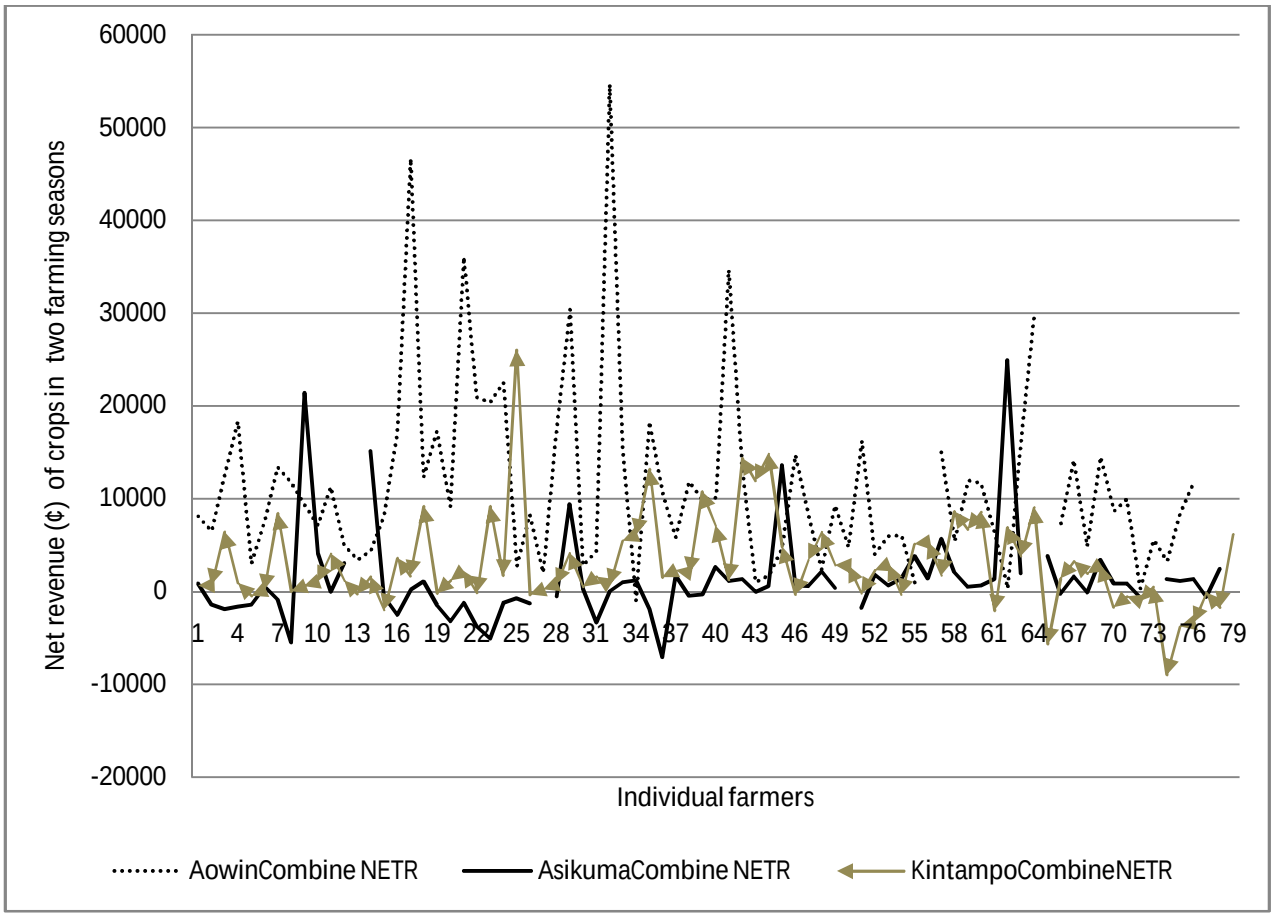

Figure 4: Net revenue of individual farmers in the study communities in the three districts for two farming seasons

Table 10: Descriptive statistics of net revenue of farmers in the study communities in the three districts

District	Farmers(no)	Min(GH¢)	Max(GH¢)	Average(GH¢)	Standard deviation (GH¢)
Aowin	74	-1003.21	54668.84	11469.92	11260.33
Asikuma	73	-7105.12	24882.82	1273.59	3062.96
Kintampo	79	-8975.7	26022.98	3079.45	1051.97

4.3 Analyses of farmers' bids (GH¢) for potential conservation contracts on farmlands

Individual farmers' bids for potential REDD+ intervention on cash crop farmlands appears highest compared to those in the perennial and fallow lands in the Kintampo north municipal and Aowin-Suaman communities (Figure 5). In the Asikuma-Odobeng Brakwa communities, the highest bid is in the fallow lands. Comparing the bids for the cash crop lands, Aowin-Suaman communities minimum and maximum bids are GH¢367 and GH¢70000, Kintampo North

Municipal communities is GH¢600 and GH¢50000, and the Asikuma-Odobeng-Brakwa communities is GH¢50 andGH¢367. For the perennial crop lands, the minimum and maximum bids are GH¢1700 and GH¢15000;GH¢233 and GH¢36660; and GH¢50 andGH¢ 233 in Kintampo, Aowin and Asikuma-Odobeng study communities respectively. On the fallow lands, the minimum and the maximum bids are GH¢100 andGH¢1667, and GH¢167 and GH¢10000, GH¢50 and GH¢1500 in the same communities in the study districts respectively (Figure 5)

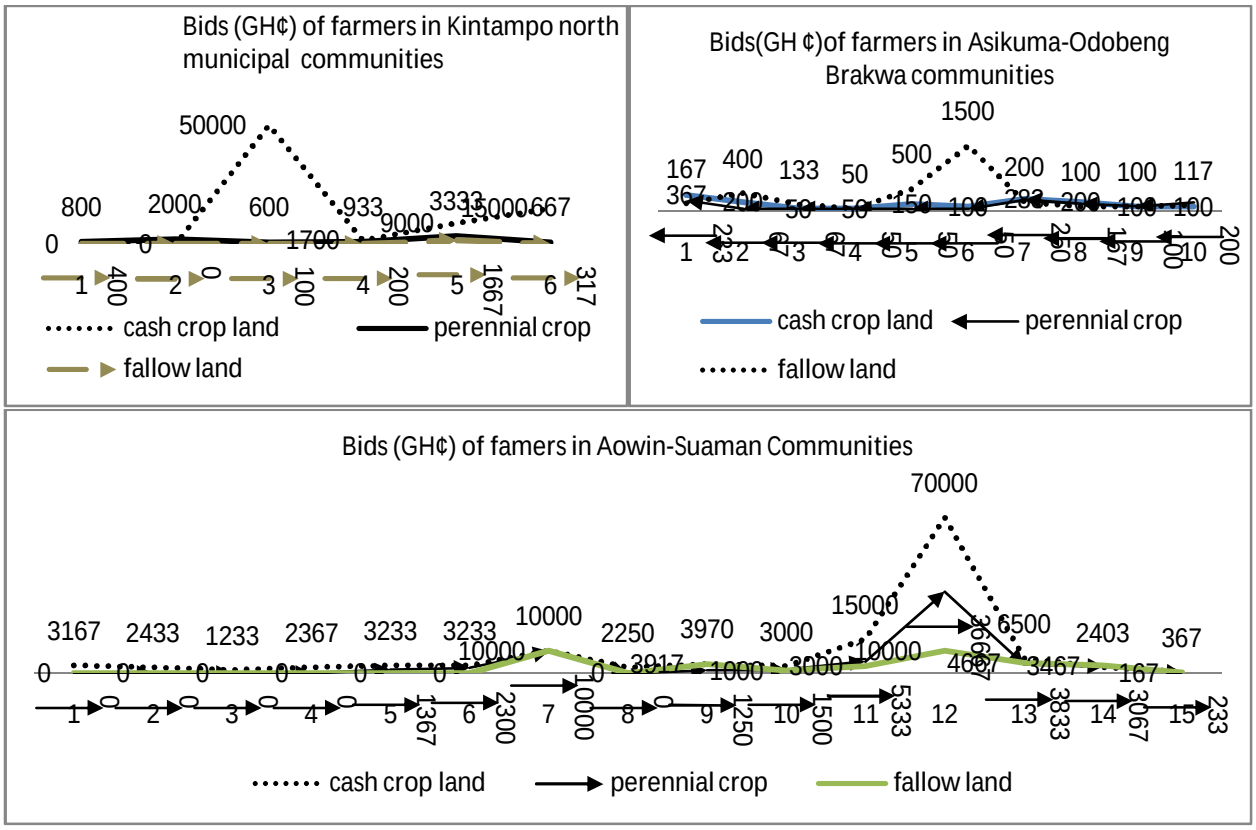

Figure 5: Individual farmer bid price (average of 3 rounds) for an acre of cash, perennial and fallow lands in the Kintampo north municipal, Asikuma-Odobeng Brakwa and Aowin-Suaman study districts

For the overall bids (average per farmer) among farmers in each of the study districts, Kintampo North Municipal communities record the highest mean bid of GH¢12616.67 for the cash crop farmland. In the same category, in the Asikuma-OdobengBrakwa district, the mean value is GH¢160 and it is the lowest, because the mean value in Aowin-Suaman is GH¢ 9199.24 (Table 11). The mean bid for the perennial crop land is also higher than that of the fallow lands in two study districts-Kintampo and Aowin-Suaman. In the Asikuma-Odobeng Brakwa, mean bid for the fallow land is the highest, followed by that of the cash crop farmland and the perennial crop land which is the least (Table 11). The mean bid values between the study districts are not significantly different, except that of perennial crop lands between Kintampo north and Aowin-Suaman ($t_{(14)} = -3.77$, $p = 0.002$) (Table 11)

Table 11: Average bid price of farmers for REDD+ intervention on an acre of cash, perennial and fallow land in communities in the study districts

Categories where bits were offered by farmers	Aowin		Asikuma		Kintampo		T test statistics for pairs of communities in the three study districts-AS, AOB and KN
	Mean (GH¢)	*N	Mean (GH¢)	*N	Mean (GH¢)	*N	
Cash crop (average bid for 3 rounds)	9199.21	14	160	10	12616.67	6	*(AS: AOB), t(22)=1.59, p=0.13 (AS:KN); t(18)= -0.38, p=0.71 (*KN:AOB); t(14)=-2.10, p=0.55
perennial crops (average bid for 3 rounds)	4665.5	14	123.4	10	1388.83	6	(AS:*AOB); t(22)=1.48, p=0.15 (AS:KN); t(18)=0.82, p=0.42 (KN:AOB); t(14)=-3.77, p=0.002
Fallow land (average bit for 3 rounds)	2575.07	14	326.7	10	447.33	6	(AS:AOB); t(22) =1.97, p=0.62 (AS:KN); t(18)=1.43, p=1.71 (KN:AOB); t(14)= -0.46, p=0.65

*AS is Aowin-Suaman district, *KN is Kintampo North Municipal district and *AOB is Asikuma-Odobeng Brakwa
*N is the number respondents

4.4Analyses of potential effect ofREDD+ implementation on livelihood

4.4.1 Livelihood activities of farmers in communities in study districts

While the livelihood activities vary from district to district, cash crop and food crop farming appear common for all communities in the study districts. However, some livelihood activities are peculiar to some directs. For instance, while charcoal production is highly practiced in the Kintampo north municipal, activity of purchasing clerk is prevalent in Aowin-Suaman and Asikuma-Odobeng Brakwa study communities.

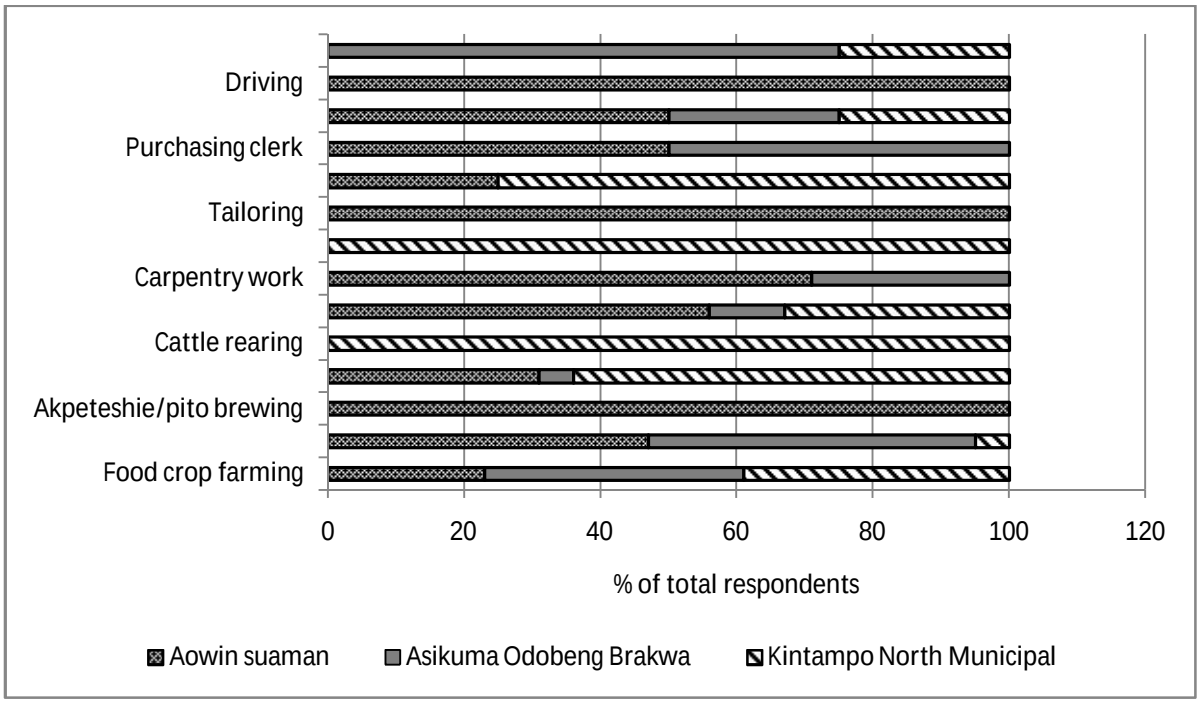

Figure 2: Livelihood activities in communities in the study districts

4.4.2 Farmers' perception on low carbon emitting land use practices and impacts on livelihood

Farmers in the study communities perceive conservation agriculture as the key land use practices that is low carbon emitting. This is followed by agroforestry. Among these farmers, the most important potential effects of the adoption of conservation agriculture on their livelihood activities (Figure 2) are reduction of quantities of food and cash crops produce (Table 4).

Table 4:Effects of conservation agricultural practices adoption on livelihood in communities in the study districts (number and percent of total respondents).

Impact on livelihood on adoption of lowcarbon emitting	Aowin suaman number(%) of respondents	AsikumaOdobengBrakwa(number (%) of respondents)	Kintampo North Municipal(number (%) of respondents)	TOTAL
Reduction of quantities of food crop produce	23(18.4)	42(34)	60(48.0)	125
Reduction in cash crop production	57(51)	54(48.2)	1(.9)	112
Tree planting reduces sunshine for cocoa	7(100.0)	0(.0)	0(.0)	7
Increase yield	1(20.0)	2(40.0)	2(40.0)	5
no effect	0(.0)	0(.0)	11(100.0)	11

4.4.3 Potential effect of REDD+ implementation on livelihood

Capital assets famers obtain from engaging in different livelihood activities

Capital asset is defined to include, human, social, financial, natural and physical (Figure 2). Through the different livelihood farmers acquire these assets and utilize them in order to improve their living standards depending the quantity and quality of these assets. The types of assets farm households possess are the basics and are almost the same in all the study communities (Table 12).

Farmers' perception of potential favourable and negative effects on livelihood

For all the five livelihood indicators, there is potential favorable effect on each of them from the REDD+ implementation in all the study communities (Table 13). In the social capital assets category, enhanced social relationship is expected by farmers in all the study communities, while under the financial asset category, increased savings are expected that are likely to result from increase in financial institutions (Table 13). On the potential negative effect, reduction in food and cash production is expected. Also expected is increase in crop pests and diseases (Table 14).

Farmers' perception on potential conflicts in natural resource use

Likely conflicts to arise with use of natural resource are the felling of trees grown under REDD+ implementation and in the process damage food crops particularly in the Kintampo North Municipal

communities. Others are use of agricultural lands for crops production, instead of planting trees for more carbon, presence of trees on farmlands that are likely to attract loggers leading to destruction of food crops (Table 14), and confront loggers and reduce trees on farmlands

Table 12: Type of capital assets farmers obtain/derive from engaging in different livelihood activities.

	Aowin-Suaman district		Asikuma-Odoben-Brakwa		Kintampo north Municipal district	
Type of capital assets	Units/quantity/tally	Remark/totals	Units/quantity/ tally	Remark/totals	Units/quantity /tally	Remark/totals
Social	Farmers Association: Abrabɔpa, Adɔyɛkuo, Nyamebɛkyerɛ, Church group, Drivers association	Poor social relationship, networks, associational and institutional linkages resulting from few number of organizations		Help one another in times of need; and in agriculture innovation adoption	Rice farmer Association Yam farmer Association Maize farmer Association	These organizations do not function effectively
Natural	Land, Own trees, Livestock, Housing plots	Most of these natural assets are used for agricultural purposes.	Land, Own trees, Livestock		Land, Livestock	Most of these natural assets are used for agricultural purposes
Human	Education Health	Most of them are engaged in farming activities and have low level of education and low level of health centres	Education Health		Education Health	Most farmers are engaged in farming activities and have low level of education and low level of health centres
Physical	House, Phone, TV, Car	Farmers have less physical assets to make life worth living for them	Houses, car Shops, motor bike Furniture, electrical gadgets		House, Phone, Bicycle	Inadequate physical assets to enhance effective and efficient work processes
Financial	Savings, Remittances	Low level of income has resulted in low level of personal savings. With this a few number of financial institutions are available in the community	Savings, Income from remittances		No credit union No income from remittances	They have low level of financial assets resulting in low level of savings and investment

Table 13: Indicate the potential positive effect of REDD+ Implementation on your capital acquisition.

Type of Capital Assets	Nature of impact in Aowin Suaman district	Nature of impact in Asikuma-Odobeng-Brakwa	Nature of impact in Kintampo north municipal district
Social	➢ It will help increase available funds to cater for oneself and family ➢ It will increase household expenditure for gifts and transfers and reduce household income from remittances ➢ Quality social relationships, networks, associational and institutional linkages as a result of forming various organizations within the community	➢ We will be able to afford new innovations from Agriculture extension officers. ➢ Helping each other in time of needs(funeral and during sickness)	➢ Increase income and reduce burden ➢ We will form groups from the project andtogether we can afford equipment for our work (tractor) and other farm implements.
Natural	➢ Increase in the price of land. ➢ Increase in soil nutrients thereby increasing crop production ➢ There will be proper waste disposal minimizing diseases such as cholera ➢ Increase level of water bodies such as rivers ➢ Help maintain our forest reserve ➢ Increase in farming activities thereby minimizing other livelihood activities ➢ High security of household plots ➢ Increase in poor waste disposal	➢ Timber, rainfall, good air, non-timber forest produce and fertile land for our farming	➢ Help maintain our forest reserve ➢ Increase in soil nutrients thereby increasing crop production ➢ Small patches of land to be available for livestock ➢ There will also be proper waste disposal minimizing diseases ➢ High rainfall resulting in increased level of water bodies such as rivers.
Human	➢ Primary school net enrolment falls during rainy season. ➢ Positive primary school net enrolment and completion rates and also increase in literacy rate since more infrastructures will be established ➢ Reduce morbidity and mortality rates	➢ Enough money to take care of our children's education and health.	➢ There will be positive primary school net enrolment and completion rates since more infrastructures will be established and will result in high literacy rate ➢ Reduce mortality rate of the youth thereby creating more labour
Physical	➢ Possession of more items that enhances income. ➢ Possession of more personal consumption items ➢ Access to infrastructure and utilities	➢ Possession of more items that enhances income. ➢ Possession of more personal consumption items	➢ Possession of more items that enhances income. ➢ Provision of facilities and infrastructure in the community.

		➢ Access to infrastructure and utilities	
Financial	➢ Reduction in the rate of borrowing but then increasing the rate of lending. ➢ Creation of more financial institutions will result in high level of savings and investment	➢ We will have enough money to save and even invest in other areas such as livestock and trading.	➢ Creation of more financial institutions will result in high level of savings and investment and also increase in other financial assets

Table 14: Indicate the potential negative effect of REDD+ Implementation on your capital acquisition

Aowin Suamandistrict	Asikuma-Odoben-Brakwa district	Kintampo north municipal district
➢ Reduction in quantities of output, both cash crops and food crops ➢ Increase in the general price of land ➢ Primary school net enrolment will fall due to high rainfall ➢ Increase diseases that affect cocoa. E.g. black pods ➢ Increase in social vices ➢ Litigation and bad moral practices, i.e. lack of respect ➢ Increase in population thus increasing demand and all things being equal price rises due to pressure on facilities ➢ Improper waste disposal ➢ A greater portion of land will be used for agricultural purposes	➢ Some of the trees will uproot and branches will break and destroy crops (there will be high wind through effect). ➢ The presence of trees will attract loggers who will cut the trees and destroy our crops. ➢ Over shading by the trees will reduce crop yield ➢ Increase in crop pest and diseases as some trees tend to serve as habitat for crop pest and diseases	➢ Reduce production of both food crops and cash crops: thus will result in high prices of food crops ➢ In the long run, we can't use the land for any other purpose other than planting of trees. ➢ Over shading by the trees will reduce crop yield ➢ Trees will uproot and branches will break and destroy crops ➢ The charcoal burners will cut the trees and destroy our crops.

4.4.5 Strategies to minimize potential negative effects of REDD+ implementation and enhance livelihood

Important strategies to overcome potential negative effects of REDD + implementation are woodlot establishment for charcoal and fuel wood production in, planting of shade tolerant crop varieties and non-shady trees on farmlands ((Table 15)

Table 15: Indicate ways potential negative effects of REDD+ Implementation could be minimized to improve your capital base and enhance your livelihood.

Aowin-Suaman district	Asikuma-Odoben-Brakwa	Kintampo north municipal district
➢ The trees that would be planted should not be in a way that will negatively affect crop production. ➢ The trees should also not be shady ➢ Rules and regulations governing the community should be heightened ➢ Policies should be formulated and implemented on the basis of distribution of REDD+ benefits (money) to households. ➢ Educate community before and after implementation ➢ Money delivered to households should be in both cash and kind	➢ Timber contractors, government, landowners and farmers have to come to agreement before trees are cut from cocoa farms to avoid conflict. ➢ Timber laws governing forest have to be strengthened and enforced. ➢ Trees on cocoa farms will be reduced to the minimum recommended number as has been advised by agriculture extension agents. ➢ Only tree species which do not break or uproot easily will be nurtured or planted on farms. ➢ We will not tolerate timber on our cocoa farms to avoid destruction by loggers. ➢ Planting of shade tolerant crop species. ➢ Planting or nurturing of wind resistant trees on farmlands to avoid uprooting trees and breaking of branches to destroy crops. ➢ Involvement of land owners and farmers on allocation of trees on their farm to timber contractor. ➢ Nurturing or planting the recommended number of trees on farm land. ➢ Removal of pest harbouring trees from the farm.	➢ Demarcate specific portion of land for the REDD+ activities ➢ Locate land for a group of people to grow the trees ➢ We will minimize number of trees on our farms to have optimum yield for our crops, thus the project can compensate us substantially. ➢ Wood lot will be established for charcoal and fuel wood production.

Coping strategies with potential negative effect of REDD+ implementation on livelihood

ASIKUMA-ODOBEN-BRAKWA

Trees are said to belong to government and as such timber contractors and government do not seek landowners and farmers consent before logging forgetting that the farmer too has his or her crop which will definitely be affected either by the falling tree, the absence of shade on the crops or both. So there is the need for the government to involve both farmers and land owners in decision making concerning allocation of timber species on cocoa farms to timber concessionaires for them to compensate farmers and land owners accordingly to avoid confrontation and conflict between the two parties.

The cocoa variety we are going now does not strive well under heavy shade, and by leaving more trees during the project, the over shading will promote fungus growth which will definitely reduce the yield of the cocoa. Therefore, if new variety cocoa which is shade tolerant can be introduced it will help us to leave more trees and get optimum yield at the same time. More so, tree species which does not provide more shade can be introduced, so that we will plant them in our farms.

Most times land owners sell the trees to loggers without consulting us the farmers thinking that the trees belong to them. The loggers cut the trees and destroy some crops in the process. This compels the farmers to kill the trees on farms. So we suggest that landowners, farmers and loggers have to be contacted before logging permit is issued to a concessionaire to avoid conflict and destruction of trees on farm land. Sometimes both the farmer and the landowner know nothing about the allocation of their farm to concessionaire which results in conflict.

Confront loggers and reduce number of trees on farmlands

If the REDD+ implementation starts and we find some problem in it, we will use the money available to trade and enter into any lucrative job that will be available. But as at now we can't tell because all that we know is farming, and it has been our livelihood since we met our fathers. But the youth instead of relying on farming can go into animal rearing and other alternative livelihood activity like aquaculture.

KINTAMPO NORTH DISTRICT

Most of the crops we are growing are light demanders (yam, groundnuts, rice maize, cassava and cowpea) so leaving or planting more trees on that same piece of land will reduce the crop yield, there is therefore the need for us to leave just few trees on the field or if we leave more trees on these farmlands, we have to be adequately compensated for yield lost.

We will establish wood lots for the charcoal and fuel production to avoid cutting down of the few indigenous tree species in our farms (off-reserve). This will create wealth and employment to the youth who engage in the charcoal production.

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