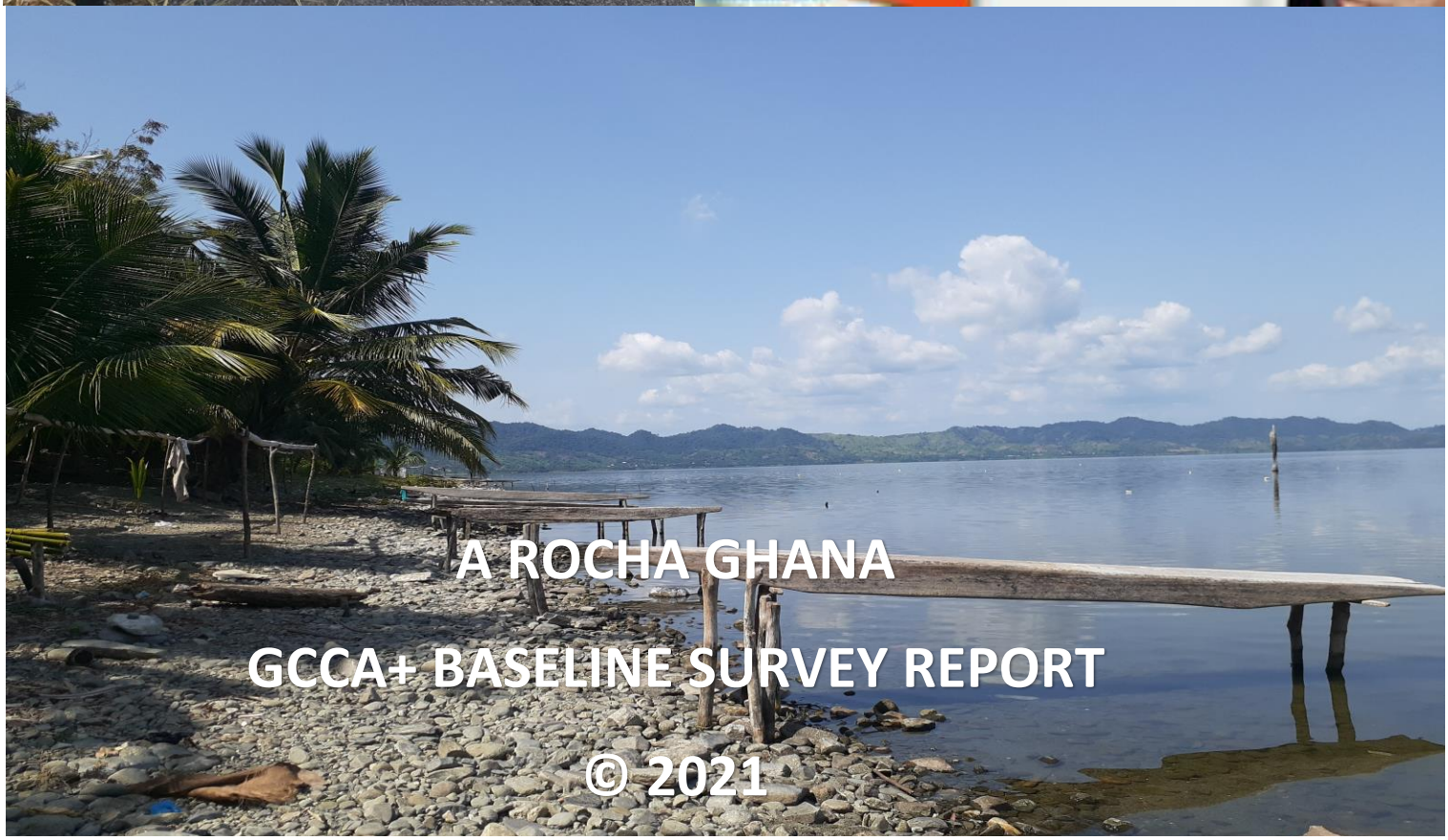
SECURING CLIMATE CHANGE RESILIENCE AND MITIGATION BY BUILDING SELF-RELIANT SMALLHOLDER FARMERS WITHIN THE LAKE BOSUMTWE LANDSCAPE

BASELINE SURVEY REPORT



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GCCA+ BASELINE SURVEY REPORT

Executive Summary of Baseline

The project titled "Securing Climate Change Resilience and Mitigation by building Self-reliant Smallholder Farmers within the Lake Bosumtwe Landscape" is a 20-month project funded by the European Union through Expertise France and GCCA+ is being implemented in eight communities (Adwafo, Abaase, Detieso, Esaase, Duase, Amakom, Adjaman and Atafram) from two District Assemblies (Bosomtwe and Bosome Freho) of Ashanti Region, Ghana. The project will develop and pilot a resilience framework for local action planning capacities and methodologies to increase climate change resilience through joint learning, planning and testing by stakeholders in demonstration sites in the Lake Bosomtwe catchment**.**

To monitor the project progress and achievement during the regular project monitoring, mid-term review, and final evaluation in the future, the Project Baseline is significantly required. Accordingly, a baseline study was commissioned. The project baseline had three phases: One focused on farmers (on household level), the second phase focused on the supporting actors (District Agriculture and Extension Officers, District Planning Officers and Rural Development Officers), and the final phase focused on reviews of relevant documents.

The survey applied a participatory rural appraisal method by applying a questionnaire that consisted of different major parts: 1) basic profile of the respondents, 2) experience with climate change adaptation and mitigation technologies as well as agro-ecological farming technologies , 3) Direct effect on food/farm production/food security, 4) Information on Climate and Agricultural information and support 5) Climate change adaptation skills and knowledge, etc.

The Baseline work was scheduled for a period of 3 weeks but was extended to 4 weeks due to on-field related issues. The following are some of the important highlighs from the survey:

- This baseline survey interviewed about 80 smallholder farmers, 12 experts (District Agriculture and Extension officers, Rural Development Officers and District Planning officers) and reviewed a host of relevant documents (Medium term development plans and Agriculture reports)

- Of the Smallholder Farmers in the target villages interviewed, 65 % were solely into crop farming, 1% strictly indulging in livestock farming and 34% involved in both crop and animal farming.

- With the crops grown, plantain was the most dominant as 95% of individuals had it on their farms, followed by cassava which had 85% while 59% and 61% of farmers had cocoa and cocoyam on their farms.

- Related to soil fertility, 91% indicated that, they had detected changes in the fertility of the soil with the remaining 9% indicating that they have not observed any significant changes. With the impact of the changes, 93% were observed to be significant negative impacts while the remaining 7% were positive impacts.

- Interaction with extension officer: 49% had no interaction with an extension officer, 23% interacted twice or twice, 18% had more than 4 times interaction whiles 10% had a one-time interaction in the last planting season.

- In terms of the planting season, 97% of respondents claimed to have observed changes whereas 3% no changes whatsoever. The general observation revolved around changes in rainfall pattern with the main focus being delayed rains and reduced times in rainfall.

- 100% of the respondents claim to have observed changes in temperature. Generally high or hot temperatures which intend withered most of the crops constituted the major observation of the respondents.

- Crop performance against pest: 93% of respondents said to have observed some form of changes in the performance of crops against pests. The complains were usually focused on high pest incidence and how these pests were hindering the successful growth of crops.

- Respondents claim the top soil of most of the farm lands have eroded and thus resulting in a reduction of their fertility. Also most of the lands have hardened due to high temperatures which has reduced the moisture of the lands.

- Due to the reduction in crop and animal yield which serves as the major livelihood for these farmers, the farmers generally do not get enough funds to properly cater for their households. This has led to a cycle of poverty as they are not able to make purchases towards their farming activities.

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1. INTRODUCTION AND BACKGROUND

Ghana like other developing West Africa Countries is facing high impacts of climate change on development goals, especially those concerning poverty reduction, exclusion and inequality. This situation demands both private agencies and government to integrate requirements for climate resilience, risk management into existing farming planning processes in a comprehensive and sustained manner. Given the capacity gaps and lack of understanding of climate change impacts and adaptation needs and planning, particularly by smallholder farmers in the Lake Bosomtwe Catchment, this project seeks to address the gaps by "Supporting farmers in the Lake Bosomtwe Landscape to become self-reliant in securing climate change resilience and mitigation". The project will develop and pilot a resilience framework for local action planning capacities and methodologies to increase climate change resilience through joint learning, planning and testing by stakeholders in demonstration sites in the Lake Bosomtwe catchment. The specific project objectives are:

- Farmers in the Lake Bosomtwe Landscape are building the Climate Change Adaptation and Mitigation (CCAM) capacities of their farms by making their own evidence-based farm decisions and implementing ecological CCAM practices.

- Adoption of Participatory Integrated Climate Services for Agriculture and Climate Change Adaptation and Mitigation (PICSA/CCAM) practices has increased by testing, sharing and implementing recommendations to improve their effectiveness.

- State & non-state actors in Ghana & West Africa that provide support and advice to farmers are sharing the identified successful practices for farm-level CCAM.

To give the Project Implementation Team the needed baseline information of the existing situation of the project communities and identified beneficiaries, this baseline study was carried out.

The baseline gathered data especially on:

- Current challenges experienced at the household and individual farmer level related to farming, food security and climate change
- Target smallholder farmers' current household food security (e.g. No. of food insecure months)

- Farmers' ideas and views on how they can best be supported
- Current sources and means of access to information (on both weather/climate and farming practices)
- Current practices used by smallholder farmers, including use of:
    - Traditional indigenous techniques and/or farmers' own innovations, in particular when used to address identified climate change challenges
    - Any agroecological practices (some may overlap with the above point, e.g. crop residue left on/in soils)
- Any prior training in ecological farming techniques (farmers and others identified for training as Climate Resilience Trainers)
- District Agricultural Extension Officers' (DAEO) knowledge and sharing of ecological farm practices
- Level of integration of ecological farm practices into local government and civil society/NGO strategies and actions plans.

Findings and insights from this study provides useful knowledge on the dynamics to further inform extension, projects and up-scaling. The results from this study are valid for the population in the project pilot site and may be generalized to similar areas in the two districts and other districts in the country, which are characterized by smallholder farming system and small land sizes. The baseline considers wider policy, institutional and social structures and processes that may affect adoption. In addition, the assessment also provides farmers' perceptions on initial benefits of those practices in terms of agricultural production, livelihoods diversification, overall resilience to climatic risks and household food security

2.0 METHODOLOGY AND CONDUCT OF THE STUDY

2.1 The Study Area

The baseline study was carried out in selected lake fringe communities from two District Assemblies (Bosomtwe and Bosome Freho).

Bosomtwe District

The Bosomtwe District, is located at the central part of the Ashanti Region and lies within latitudes 6° 24' South and 6° 43' North and longitudes 1° 15' East and 1° 46' West. It is bounded on the north by Kumasi Metropolitan Assembly, on the east by Ejisu - Juaben Municipal, on the south by Bekwai Municipal and Bosome - Freho District, and on the west by Atwima - Kwanwoma District. The district has a land size of about 422.5 sq km with a density of 147.8 persons per sq km. The 2010 housing and population censusing confirmed a population of 93,910 with male population representing 47.7 percent and that of the female population representing 52.3 percent. The District also has a more rural population (65,535) than urban population (28,375). The District is primarily rural (69.7%).

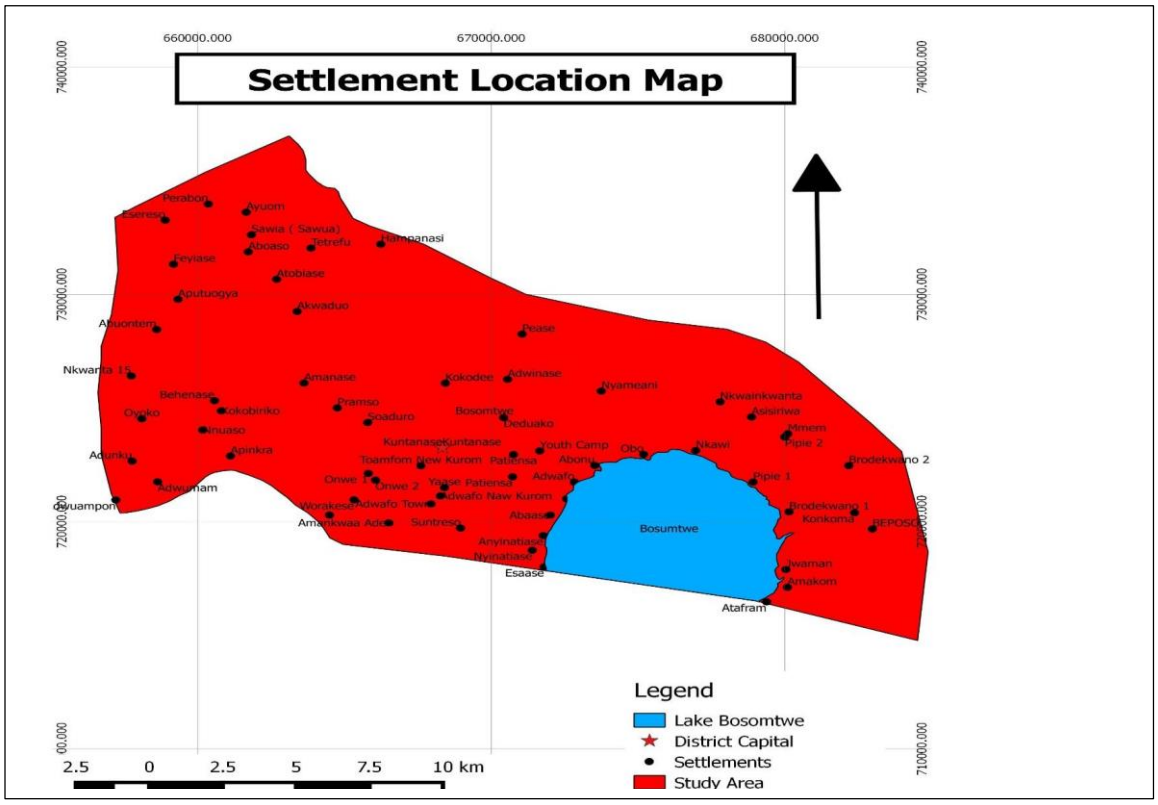


Figure 1 : Settlement Location map of Bosomtwe District

Bosome Freho District

The Bosome Freho District is located in the south eastern part of Ashanti Region and shares boundaries with Bekwai Municipal and Adansi North District to the West, Ejisu Juaben and Bosomtwe Districts to the North, Asante Akim South to the East and Akyimansa and Adansi South to the South. The District lies within Latitude 6° 00'N and 6° 26'N and Longitudes 1° 00 W and 1˚30 W. It covers a total land area of about 630 sq. km. According to the 2010 Population and Housing Census Report, the population of the District is 60,397.

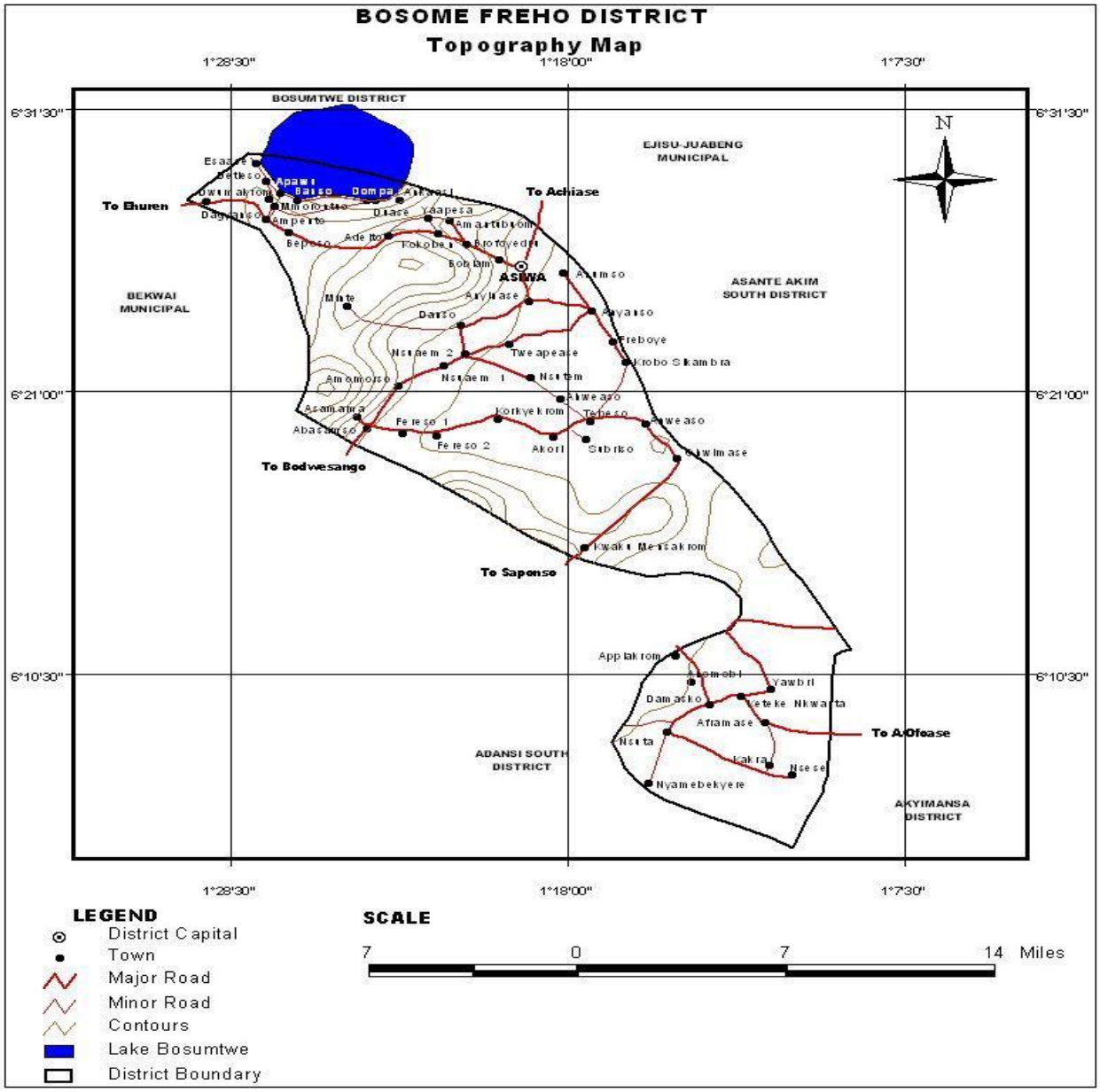


Figure 2 : Settlement Location map of Bosomtwe District

Data were collected from eight communities, which constitute the project area. These communities are (for Bosomtwe: Adwafo, Abaase, Amakom, Adjaman, Atafram , For Bosome Freho: Detieso, Esaase, Duase). See figure 1 for Map of the Study area

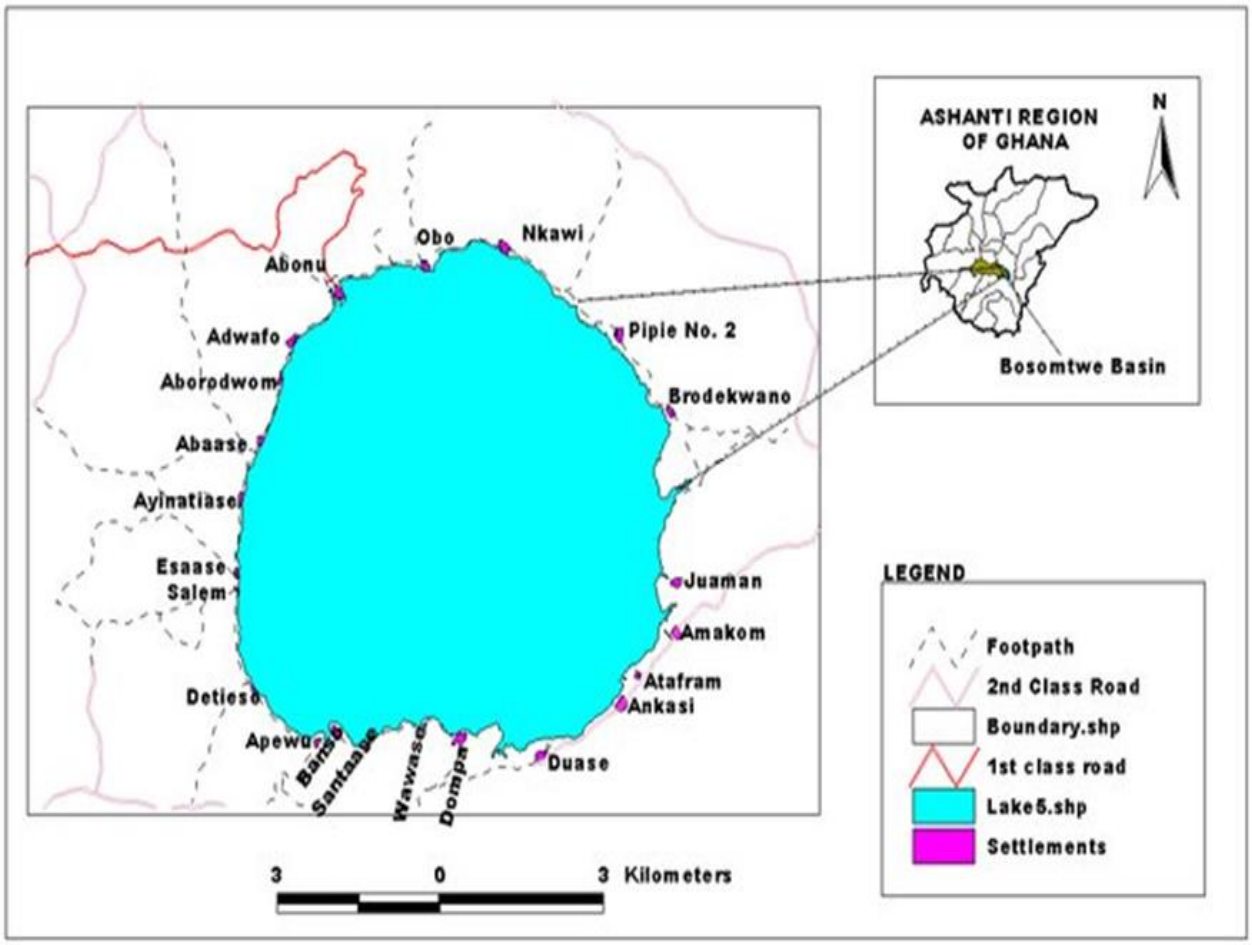


Figure 3 : Lake Bosomtwe with surrounding communities

2.2 Survey sampling procedure

Through a defined criterion, 80 smallholder farmers were selected by project implementers at the farm level (10 from each of the eight communities) as project beneficiaries. A feedback Focus group discussion for farmers was carried out, one on one interviews were conducted for selected officers numbering 12 from the two district assemblies (comprising District Agriculture and Extension officers, District planning officers and Rural development officers). This sampling

frame of project participants constituted the population representative sample drawn for the purpose of this baseline study.

2.3 Data collection process

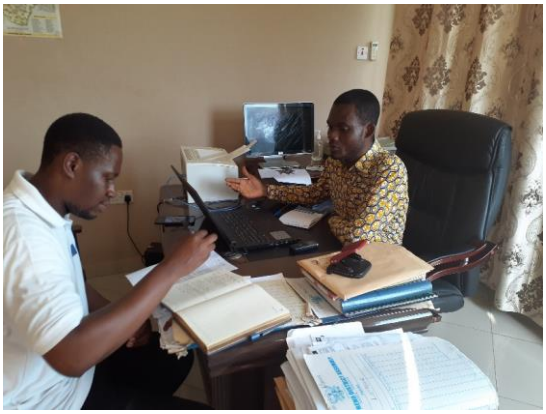
Smallholder farmers survey data were collected using a structured questionnaire. The questionnaire asked about: 1) Smallholder farmer information (demographics) 2) farm characteristics, 3) Cropping systems, 4) Soil Status, 5) Smallholder farmers access to Agricultural information systems and support, and contribution to their work 6) GMet information etc. (See Annex 6.1)

Prior to actual data collection, a team of five enumerators were trained in questionnaire administration, translation and recording of geo-referenced responses. The enumerators also participated in pre-testing of the questionnaire and shared their initial experiences with translation. The team leader and enumerators went through each of the questionnaires filled during pre-test and clarified issues that were unclear.

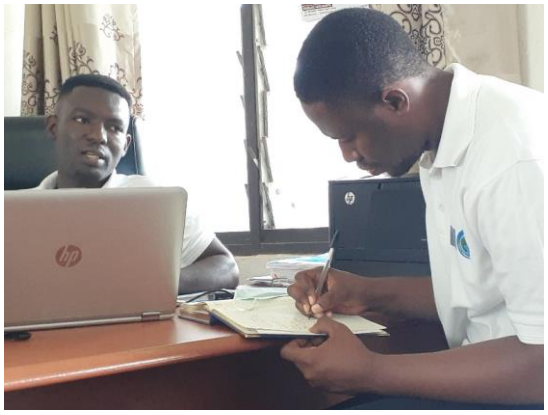
Enumerators were given names of Smallholder farmers and paired for ease of coordination of visits to homesteads. A total of 80 Smallholder farmers were interviewed using a structured questionnaire.

2.4 Interviews and Focus group discussions

A total of 12 officers (Six each) from the two district assemblies (comprising District Agriculture and Extension officers, District planning officers and Rural development officers) were interviewed. District Medium term development plans of the two districts were also reviewed. Focus group discussions were conducted in parallel with the household interviews. At the meeting, the team leader explained the objective of the group discussions and highlighted the broad themes for deliberations. The team leader also directed the discussions, guided by a set of questions in the relevant checklists. Further probing was done to focus the deliberations and generate comprehensive information. Deliberate efforts were made for the discussions to be as interactive and participatory as possible by encouraging contributions from all participants. Both the team leader and project staff documented all deliberated issues. Data were collected in field notebooks and flip charts.



Interviews with District Agric Extension Officers from Bosomtwe



Interviews with District Executive Planning and Development Officers

Interviews with farmers from participating communities

Interviews with farmers from participating communities

Focus Group Discussions at Adwafo Community

Focus Group Discussions at Abaase Community

All collected data from household interviews were first entered in Ms Excel for easier data coding and then exported to R-package software for analysis. Qualitative responses were grouped into common themes and coded in Ms Excel. Basic data cleaning and processing as recommended preceded statistical analysis based on descriptive procedures in R-package software. Analysis of interviews and FGD information involved summarising responses in MS Word. Main results from the household survey and FGDs are presented as below.

3.0 RESULTS

This section describes farmers' characteristics and their cropping systems, then, presents findings to each critical baseline question. Finally, the expert interview results close the section.

3.1 Participants

In total 80 Smallholder farmers were interviewed with 58% of the individuals interviewed being males as against 42% females. 55% of the individuals interviewed were between the ages of 25-54, 36 % also between the ages of 55 – 64. 89% had received some form of formal education education with primary school being the dorminant level. 91% were married as against 8% that were single. 65 % were solely into crop farming, 1% strictly indulging in livestock farming and 34% involved in both crop and animal farming.

3.2 Cropping Systems

Most farmers have multiple farms and employed different farming systems on these farms. Crop rotation was less implemented as 2% of the population admitted to using that with 93% practicing mixed cropping and 21% practicing mono cropping. With the crops grown, plantain was the most dominant as 95% of individuals had it on their farms, followed by cassava which had 85% while 59% and 61% of farmers had cocoa and cocoyam on their farms.

3.3 Soil Fertility Status

91% indicated that, they had detected changes in the fertility of the soil with the remaining 9% indicating that they have not observed any significant changes. With the impact of the changes, 93% were observed to be significant negative impacts while the remaining 7% were positive impacts. Among the positive impacts were improved soil fertility and water retention which were observed at Adwafo and Atafram. 55% of the negative impacts was observed to relate to soil erosion, 74% relating to lack of adequate soil moisture for crop growth and 81% relating to loss of soil fertility.

3.4. Smallholder farmers access to Agricultural information systems and support and contribution to their work

In terms of access: 60% of respondents have direct access to some form of agricultural information with the rest resorting to indigenous knowledge and knowledge from other farmers. The source of Information: 44% of respondents who have access to some form of agriculture information has the source being radio, 40% from District Agricultural Extension Officers (DAEO'S), 13% from TV and 3% from Research Institutes. Supporting NGOs that farmers have interacted with are A Rocha Ghana (16%), Raha (8%) and CREMA (4%). Please, Where are these %s adding up

Extension Officers: 11% of the respondents failed to give response concerning their access to extension officers. 38% claim to have no access to extension officers whiles 51% claim to have access to an extension officer.

Interaction with extension officer: 49% had no interaction with an extension officer, 23% interacted twice or twice, 18% had more than 4 times interaction whiles 10% had a one-time interaction in the last planting season.

Services received: 43% of respondents claim to have received education from extension officers on Pest and disease control management, 30% also received education on planting patterns,18% on weeding control management, 4% on climate mitigation and adaptation management and 6% on water management.

GMET info: 56% of respondents have access to GMET information (specifically those from radio related to the region and country as a whole).

Frequency of GMET: For respondents who gets access to GMET information, 75% get weekly access to information, 2% gets information monthly and 23% gets access to information quarterly.

3.5 Climate Change

Table 1: Perceived Changes in some Climate and Agricultural variables within the Lake Bosomtwe catchment

Aspect	% Yes	% No	Key Remarks
Climate Change Awareness	79	14	7% of the farmers failed to give their response
Planting season	97	3	The general observation revolved around changes in rainfall pattern
Wind	82	12	Strong, and intense winds which in tend uproots most crops and hot winds
Temperature	100	0	Farmers said, high or hot temperatures withered most of their crops
Rainfall	100	0	Rainfall are erratic, inconsistent pattern in amount and intensity
Crop performance (Disease and pest)	93	7	Pests are hindering the successful growth of crops
Crop yield	92	8	These changes revolved around a reduction in the quantity of yield
Livestock health	42	58	General concerns was that, livestock are easily attacked by diseases
Livestock yield	50	50	The changes alternated between no significant changes in yield and low yields

Table 2: Classification of Nature of Climate Change/Natural Phenomena by Smallholder farmers in the Lake Bosomtwe landscape

Nature of climate change or Natural phenomena	Intensity of impact	Frequency (out of 80 respondents)	Percentage (%)	Total
Flooding before end of growing or harvest season of crops	H	8	10	
	M	8	10	
	L	24	30	
	N	40	50	100
Drought after planting of crops	H	48	60	
	M	28	35	
	L	4	5	
	N	0	0	100
Prolonged rainfall during wet season	H	12	15	
	M	36	45	
	L	16	20	
	N	16	20	100
Prolonged drought during dry season	H	36	45	
	M	20	25	
	L	20	25	
	N	4	5	100
Pest and diseases during wet season	H	56	70	
	M	16	20	
	L	6	7.5	
	N	2	2.5	100
Pest and diseases during dry season	H	4	5	
	M	22	27.5	
	L	16	20	
	N	38	47.5	100
Erosion	H	32	40	
	M	24	30	
	L	14	17.5	
	N	10	12.5	100
Strong winds that cause lodging	H	36	45	
	M	28	35	
	L	16	20	
	N	0	0	100

Table 3: Perceived knowledge, practice and interest of Smallholder farmers on CSA Technologies/Practices in the Lake Bosomtwe landscape

CSA Technologies/Practices	Percentage (%) Farmers who have Knowledge of CSA practices	Percentage (%) Farmers who are practicing the CSA	Percentage (%) Farmers who are interested in CSA practices
Crop Rotation	62.5	31.25	100
Stress/Climate tolerant seed and planting materials	32.5	32.5	100
Intercropping	97.5	85	87.5
Leguminous cover crops (cowpea, groundnut, soyabean, mucona)	100	7.5	86.25
Mulching	100	75	97.5
Composting	6.25	1.25	100
Crop's livestock mixture	62.5	62.5	62.5
Zero/low tillage	50	0	62.5
Agroforestry	75	3.75	100
ICT-based agro-met services (PICSA)	6.25	0	85
Irrigation schedules (canals)	97.5	0	8.75
Improved water management	18.75	0	18.75
Biological and natural pest control (Push-Pull pest control)	2.5	0	97.5
Charcoal/Biochar	5	0	87.5
No use of chemicals (weedicides, pesticides, fertilizers)	73.75	5	86.25
Crop residue management	87.5	85	87.5
Average Percentage (%)	**54.8**	**24.3**	**79.2**

3.6: Climate-smart agriculture mainstreaming in local development plans (Review of Medium-term development plan and other district documents, interview with 12 experts at the two District Assemblies)

Overall, the Medium-term Development Plans (MTDPs) of the two Districts (Bosomtwe and Bosome Freho) reviewed had weak mainstreaming of Climate Smart Agriculture. They scored low on the climate trends indicator as the plans provided basic to no reliable evidence of past, present, and future climate information.

Generally, the reports and plan narratives depict awareness of climate change and its impacts. Reviews and interview generally collaborated that, the effect of climate change on agriculture which is the mainstay of the people in the Lake Bosomtwe catchment is enormous leading to a high reduction of yields across major crops cultivated. In addition to this are the annual occurrence of diseases such as fall army worm in the two districts.

The absence of climate data in the two Medium Term Development Plans (MTDPs) is problematic, as reliable data is critical for understanding the location, extent, and severity of climate change impacts to inform appropriate strategies in building adaptive and resilience capacities of the agriculture sector both in the present and for the future.

Additional reasons for CSA mainstreaming challenges at the local level in the two districts include poor stakeholder collaboration and coordination, inadequate financing, and a knowledge gap between climate change information, research and policy.

4. DISCUSSION

Findings and insights from this study provides useful knowledge on the dynamics to further inform extension, projects and up-scaling. The results from this study are valid for the population in the project pilot site and may be generalized to similar areas in the two districts and other districts in the country, which are characterized by smallholder farming system and small land sizes.

The results show a unique pattern in age distribution in the sampled smallholder farmers, revealing that there are more prime working age (55% aged between 25-54) and mature working age (36% aged between 55-64) of people involved in farming. The high level of involvement of youths in agriculture could be because they find no other alternatives to agriculture in the catchment. Even though most farmers indicated unattractiveness of agriculture (low yields, low income etc.), they asserted that, they have no choice but to do it for survival.

Results on the educational status of the sampled farmers reveal that they were exposed, on the average, to a primary level of education (89%). Educational status is found to have a statistically significant and positive influence on the level of adoption of CSA practices as well as positively affecting climate change adaptation. Accordingly, with an average primary level education in the catchment, smallholder farmers are better placed to learn and share on new technologies to positively impact on their agriculture activities. A better level of literacy could be an added advantage in mainstreaming innovations and practices, particularly CSA among the farmers in the area. Farmers' literacy is expected to enhance their capacity to obtain, process and utilize information relevant to adaptation, adoption and management of agricultural practices. Additionally, farmers' education could enhance the productivity of agricultural extension services, as educated farmers could be more receptive to and productive with new agricultural innovations or practices. The above notwithstanding, Wekesa et al. argued that educated farmers would opt out of a CSA package if it does not offer risk reduction measures which could protect their investment against the risks of climate change.

The results on cropping systems shows a considerable number of the sampled smallholder farmers having multiple farms and employing different farming systems on their farms. Mixed cropping (the most dominant in the landscape) involves planting two or more plants simultaneously on the same field. Since crops ripen during different seasons, planting more than one saves space and also provides a wealth of environmental benefits including maintaining a balance of input, soil nutrients; weed, disease, insect pest suppression; resistance to climate extremes (wet, dry); an increase in overall productivity, and management of scarce land resources to its maximum potential. What is critical for this farming system is the ability to choose crops in a way such that no plant compete for resources such as sunlight, nutrient, water, root pattern and crop duration- a situation that was discussed as being an issue for farmers. For most farmers, they are practicing what they have learnt from their ancestors and if there is any proven technology that can increase their yield and income, they will wholeheartedly adopt.

For Climate Change and Agricultural information; Better understanding and management of climate variability will help smallholder farmers to cope with climate change. Decreasing the vulnerability of agriculture to natural climate variability through a more informed choice of policies, practices and technologies will, in many cases, reduce the long-term vulnerability of this

system to climate change. The agricultural sector within the Lake Bosomtwe needs accurate, reliable and timely weather and climate information for daily tactical decisions and long-term planning. The national and regional context information mainly received through the radio, tv etc. is not context specific thus not making farmers get real time local specific information for farm level planning. This is affecting gains in their farming practices. Seasonal climate outlooks are increasingly important tools for decisions such as what crops to plant and when to plant them and whether to sell livestock in the event of a looming drought. On a longer-term basis historical climate records, agricultural data and future climate scenarios will be needed for big decisions such as the purchase of land, the design of farming schemes and, the switch to more drought-resistant seeds or crops, or the introduction of systems to prevent or mitigate adverse conditions.

The Department of Agriculture is currently fully devolved to the district level but its ability to offer timely advice to smallholder farmers in the Lake Catchment is affected by resource constraints. There is therefore a need to strengthen the existing agricultural extension services and build the capacity of extension workers particularly on promising climate-smart agricultural practices. Resource constraints affect service delivery in many public institutions, however the innovative farmer trainer approach that will be tested and promoted in this pilot project activities has the potential to improve efficiency and effectiveness of extension delivery system. When properly integrated into the mainstream extension delivery system, the farmer trainers approach would ensure sustainability and scaling-out of climate-smart activities in this and other areas.

For CSA technologies/practices: In general, farmers have an average knowledge on the various CSA practices in agriculture, and an even lesser adoption of CSA practices. It is seen from the survey that although there were a number of practices farmers had knowledge on, they were not practicing and even more interesting was their interest in the practice.

Notably, although there was a high percentage of farmers having knowledge on crop rotation, even fewer practiced it amidst the fact that all the farmers were interested in this. Another instance is the knowledge on irrigation schemes in which a whooping majority of farmers (97.5%) knew about it. In spite of their knowledge, none of these farmers are into this practice and few of them (8.75%) are interested in it. This could be attributed to the complexity and cost of the said technology. Although farmers have knowledge in it as a CSA measure, they are reluctant in practicing it due to the cost involved.

Furthermore, practices such as ICT-based agro-met services, Biological and Natural Pest Control, Charcoal/ Biochar were relatively unknown to farmers, thus, was reflected in their adoption (0%). This is to be expected as most farmer education schemes on crop protection and nutrient amendments were mainly focused on inorganic and chemical solutions. In spite of this, farmers showed great interest in these practices, making it a potential for training farmers in these technologies.

Composting also is a huge potential since farmers had lesser knowledge in them, and even lesser people were practicing, although all the farmers showed interest in that technology.

Farmers are at the forefronts in the effects and control of climate change in agriculture, and farmers at Lake Bosomtwe are no exception. With the exception of livestock yield in which there was a

split, majority of farmers acknowledge there was changes in the climate and agricultural variables in the catchment. Notably among the responses was the change in temperature and rainfall which received a unanimous response from the farmers in affirmation of there being changes over the period. Farmers agreed that there has been a change in temperature, affecting crop growth. This is due to the increase in temperature that tends to wither the plants. Further, the major complaint about rainfall was its erratic and inconsistent nature in pattern and rainfall amount.

Furthermore, most farmers agreed there has been changes in planting season (97%), which generally was due to changes in the rainfall pattern. Crop performance and crop yield were seen to have witnessed some changes (93% and 92% respectively). This was mostly attributed to the high increase in the occurrence of pests and diseases, which has been one of the main effects of climate change in agriculture. Due to the incidence of pest and diseases, coupled with irregular rainfall pattern, crop yields have been tremendously affected.

For Nature of Climate Change/Natural Phenomena: Due to climate change, the farmers were able to rate the intensity of the impact on their activities. Most farmers agreed that the impact of drought after planting (60%), pest and diseases in the wet season (70%), erosion (40%) and strong winds (45%) have been highly intensified as a result of climate change. Farmers can highly relate to the increase in the impact of drought after planting due to irregular rainfall patterns, making it difficult for farmers to determine the best planting time.

The growth cycle of pests and some disease-causing pathogens previously were managed by the planting time and growth cycle of plants. However, due to irregular rainfall and high temperature as a result of climate change, the natural means of pest and disease control by managing the cycle of the crops has been disrupted. This has led to an increase in the effect of these on crop growth and yield, thereby affecting farmer profit.

For CSA Mainstreaming in MTDPs; strengths, gaps, and weaknesses: From the analysis, CSA mainstreaming in MTDPs remains a challenge. Mainstreaming in the MTDPs was rather weak. Despite the calls for CSA mainstreaming in local development plans, the findings illustrate this has not adequately materialized in the Bosomtwe and Bosome Freho Districts of Ghana, where CSA is essential to climate adaptation for the agriculture sector. Generally, the experts interviewed as well as reports reviewed demonstrated strength concerning awareness of climate change impacts but provided little evidence of the climate trends that undergird their awareness of climate change impacts. For instance, the spatio-temporal dimensions of climate change in the MTDPs were absent, although such relevant geographic information and contextual climate realities of people and places over time and across environmentally dependent sectors and livelihoods are vital for promoting targeted CSA.

Whereas the MTDPs problematized crop production and forest management, issues such as sustainable/green value change, water/river, and land management that critically support and enhance agriculture productivity and production had low connections to climate change in the MTDPs. This weakness is rather critical since their poor management can derail efforts to promote CSA in crop and livestock production, especially for the lake catchment. The limited attention to fishing and aquaculture in the MTDPs is another major weakness. Yet, given the appropriate

technology and investments, the catchment can utilize fishing and aquaculture as a potential to provide alternative livelihoods, especially for households with fishing as main livelihood stream.

A careful examination of the goals, objectives, and strategies in the MTDPs shows they were adopted directly from the medium-term national development policy framework— An Agenda for Jobs: Creating Prosperity and Equal Opportunity for All (First Step) 2018–2021—without localization. For instance, all plans adopted the national goal of "Safeguard the natural environment and ensure a resilient built environment" verbatim (NDPC 2017, p. 144). Again, the only national strategy with direct use of climate-smart agriculture—"Promote and document improved, climate- smart, indigenous agricultural knowledge" (NDPC 2017, p. 188)—was adopted verbatim in all MTDPs. Here, awareness about climate change has not resulted in effective localization in the MTDPs. The limited contextualization and alignment of agriculture goals with local problems and climate realities can render strategies and projects ineffective when addressing climate change impacts on agriculture. Again, this raises concerns for localization.

Another mainstreaming weakness is a lack of clear identification of climate finance opportunities for CSA projects in the MTDPs. This lack of clarity in sourcing climate funds demonstrates a lack of innovation in attracting alternative funding opportunities by local authorities to address climate change impacts on the agriculture sector. Secondly, the omission of climate financing in MTDPs demonstrates the overreliance on central government transfers. This overreliance can be detrimental to CSA initiatives in the two districts due to the twin challenges of inadequate funds—owing to competing local projects—and endemic delays in the transfer of statutory funds from central to local governments that plague local development in Ghana (Yeboah and Obeng-Odoom 2010, p. 89). Additionally, the lack of mention of climate finance in the plans can be attributed to an absence of clarity on how climate finance opportunities can be accessed by local authorities in Ghana.

Overall, a reconsideration of climate adaptation planning processes must reflect the context-specific realities of the two districts. With its unique climate vulnerabilities, CSA can contribute to its climate adaptation and resilience. With the high level of awareness of climate change, the development of capacity (i.e., human and financial) for planning is critical if CSA is to be effectively and efficiently mainstreamed into local development plans. For this reason, new institutional arrangements that come with funding opportunities and robust human resource capacity are necessary for mainstreaming adaptation measures such as CSA into development planning processes in the two districts.

5. CONCLUSIONS AND RECOMMENDATIONS

The methodology used during the baseline is typically described as Rapid or Participatory Rural Appraisal (RRA, PRA). However, before surveying some documents related to agriculture and forestry and other reports were collected and reviewed. Eight villages in 2 districts (Bosomtwe and Bosome Freho) were selected as target for the project. The surveying started at Bosomtwe district with 5 target villages and completed with 3 targeted villages in Bosome Freho District. The number of respondent are 80 Smallholder farmers and 12 experts from two District Assemblies.

The Smallholder farmers in the target villages of the project depend on crops cultivation, fishing, domestic livestock raising, etc, as main source of livelihood and income. According to the farmer's interview as well as reports review, most farming fields of farmers in the target villages suffers from seasonal erosion and drought. Besides pest and diseases during the wet and dry season are also a part problem of farmers and affected their crops and livestock production. Seasonal erosion and drought, poor soil fertility, erratic rainfall and high temperatures have affected farmer's production. So knowledge or technical skill on crops cultivation of farmers is necessary.

However, to ensure that many farmers are empowered to benefit more from the improved agricultural practices, and to enhance landscape level agro-ecological integrity, this study recommends that the District Agricultural extension continue the work in locations of the pilot site as well as beyond. This could be achieved by increasing and motivating farmer trainers to train more groups, supporting them with seeds to establish demonstration plots in their farms and organizing for additional field days and learning tours for farmer groups to build their capacity on CSA practices at the to be established demonstration sites.

To overcome some of the constraints to adaptation, adoption of CCAM practices and Agro-ecological technologies at the local level, as suggested by farmers themselves, there is a need for them to embrace collective action to mobilize resources through cost-sharing and group credit access. Effective partnerships and collaboration with other interested organizations is another avenue that can generate substantial synergy to accelerate the adaptation and adoption rate of the to-be promoted CSA practices in the study area. For instance, systematic collaboration with organizations such as Community Resources Management Area (CREMA) on promotion of tree nursery establishment, Council for Scientific and Industrial Research (CSIR) on improved CSA technologies and practices would increase prospects of these practices being adapted and/or adopted by a majority of famers.

It is of importance that, CSA mainstreaming guidelines for preparing MTDPs should point local authorities to resources on climate assessment and information systems, CSA principles and techniques, climate finance opportunities, and also build the capacity of MMDAs to utilize these resources when preparing their MTDPs.

Finally, as recommended by farmer trainers, deliberate arrangements are required to support farmer-to-farmer dissemination of promising improved practices. A reward mechanism requiring that non-participating farmers be periodically allowed to visit model demonstration farms maintained by participating farmers, will ensure that those farmers who are not necessarily in groups are also adopting climate-smart agricultural practices. This way the adoption of CSA

practices will get entrenched and more economic and environmental benefits realized by many farmers.

6.0. ANNEX

6.1. Sample Questionnaires used in the survey process, analysis and interpretation of data

Questionnaire for Recruited Farmers

Community…… Name……

1.Marital status? Married [ ],

2. Educational level? No formal education [ ], Primary [ ], Secondary [ ], Tertiary [ ],

3. Age? 0-14 [ ], 15-24 [ ], 25-54 [ ], 55-64 [ ], 65 and above [ ]

4. How long has your household been in this community? Less than 4 years [ ], 5-10years [ ],

More than 10 years [ ]

5. What is your role in the household? Head [ ], Spouse [ ], Son [ ], Daughter [ ], Other [ ].

6. What is the total number of people in this household? ……..{ Men=…., Women=……..,
Children=…….}

7. What is your major occupation? Farming [ ], Fishing [ ], Mixed (Farming & fishing [ ] other [
]……

8. How long have you been farming? Less than 4 years [ ], 5-10 years [ ], More than 10 [ ]

9. What is your farm size? Less than 1 acre [ ], 1-5 acres [ ], 6-10 [ ], More than 10 [ ]

10. What is the main livelihood source of your household? Crop farming only [ ], Livestock only [ ],
Crops and animals [ ], other (specify)……

11. If crops only, how many types of crops do you often grow per year (each season)……
(Names:……..)

12. What cropping system(s) do you practice on your plot(s)? Sole/mono cropping [ ], Crop Rotation [ ],
Intercropping (Mixed) [ ] Other (specify)…….

13. During the past five years, how fertile was/were your farmland? Not fertile [ ], Fertile [ ]

Very fertile [ ]

14. In general, do you think that the fertility level of your plots changed over the past five years

Yes [ ], No [ ]

15. If yes, has the change been positive or negative? Positive [ ], Negative [ ]

16. What positive changes occurred? Soil fertility improved [ ], Water retention increased [ ],
Higher amount of soil cover crops [ ], other (specify)……

17. What negative changes did you experience on your plots in the past five years? Soil erosion [ ], Loss
of Soil fertility [ ], Lack of adequate soil moisture for crop growth [ ], Other (specify) ……..

18. Do you have access to regular agricultural information in this community? Yes [ ],No[ ]

19. What is your main source of agricultural information? Radio [ ], TV [ ], DAES [ ], Research institutes [ ], NGOs (state names)……

20. Do you have access to an extension agent in this community? Yes [ ], No [ ]

21. In the past cropping season, how many times did you interact with an extension agent in this community? 1 only [ ], 2-3 [ ], 4 and above [ ]

22. In the past cropping season, what main service(s) did your household obtain from extension agents in this community? Planting patterns [ ], Water mgt [ ], Weeding control mgt [ ], Pest and Disease control mgt [ ], Climate Mitigation and adaptation mgt [ ], Other (specify) ……..

23. How do you rate the quality of agricultural information you received in the past two years?

Ineffective [ ], Effective [ ], Very effective [ ].

24. Do you pay for agricultural information services? Yes [ ], No [ ].

25. If yes, do you motivate the agents? In what form ……..and how frequent

26. Have you heard of Climate Change? Yes [ ], No [ ].

27. Have you perceived any changes in the past 5-10 years in climate. Please consider the following:

Aspect	Changes
Planting season Yes [ ], No [ ]	
Wind Yes [ ], No [ ]	
Temperature Yes [ ], No [ ]	
Rainfall Yes [ ], No [ ]	
Crop performance (Disease and pest) Yes [ ], No [ ]	
Crop yield Yes [ ], No [ ]	
Livestock health Yes [ ], No [ ]	
Livestock yield Yes [ ], No [ ].	

28. Important Climate events in the catchment with year

a. ……. Year……

b. ……Year……

29. Impact of changes in the catchment (Address Landscape, Use of water, Economy, Social structure)

Landscape ……

Use of Water…….

Economy……...

Social Structure……

30. Do you think climate change is affecting your farming activities? Yes [ ], No [ ]

31. Which of the following are the three most prevalent climate change issues on your farm. it's more difficult to know when to plant crops now [ ], The rains are heavier and destroy crops and wash the soil away [ ]; The rains do not last long enough but we cannot irrigate, so the crops do not mature and yield well [ ]; Crop pests are increasing [ ]; others (specify)……..

- How are you dealing with low rainfall?.....
- How are you dealing with high temperature?.....
- How are you dealing with crop yield?.....
- How are you dealing with increasing pest?.....
- Where did you learn these skills?.....

32. Do you have direct access to GMET for weather and climate information and forecast?

Yes [ ], No [ ]

33. How often do you receive this information? Weekly [ ], Monthly [ ], Quarterly [ ], other (Specify)……..

CSA Technologies/Practices	Farmers who have Knowledge of CSA practices	Farmers who are practicing the CSA	Farmers who are interested in CSA practices
Crop Rotation			
Stress/Climate tolerant seed and planting materials			
Intercropping			
Leguminous cover crops (cowpea, groundnut, soyabean, mucona)			
Mulching			
Composting			
Crop's livestock mixture			
Zero/low tillage			
Agroforestry			
ICT-based agro-met services (PICSA)			
Irrigation schedules (canals)			
Improved water management			
Biological and natural pest control (Push-Pull pest control)			
Charcoal/Biochar			
No use of chemicals (weedicides, pesticides, fertilizers)			
Crop residue management			

Nature of climate change or Natural phenomena	Intensity of impact	Farmer Classification (out of 80 respondents)
Flooding before end of growing or harvest season of crops	H	
	M	
	L	
	N	
Drought after planting of crops	H	
	M	
	L	
	N	
Prolonged rainfall during wet season	H	
	M	
	L	
	N	
Prolonged drought during dry season	H	
	M	
	L	
	N	
Pest and diseases during wet season	H	
	M	
	L	
	N	
Pest and diseases during dry season	H	
	M	
	L	
	N	
Erosion	H	
	M	
	L	
	N	
Strong winds that cause lodging	H	
	M	
	L	
	N	

District Agricultural Extension Officers and any others identified for training as Climate Resilience Trainers

Name of officer……

District/ Community……..

Designation of officer……..

Date of interview…….

Baseline Questions

1. What is your knowledge of climate change?
2. Do you ever discuss climate change with farmers to learn about the challenges they are facing?
3. Do you ever discuss other on-farm challenges with farmers, besides those related only to climate change? What are they?
4. Do you share any information with farmers about climate change? If yes, what sort of information do you share, and how do you share it?
5. Do you ever provide farmers with weather or climate information, such as warnings of extreme weather or likely dates for the onset of rains, that would help them make on-farm decisions? (e.g. timing to plant seeds, or decisions over crop types to plant, etc)
6. Do you share techniques with farmers aimed at addressing the climate change impacts that they are experiencing? What are those techniques?
7. Do you ever find out about other on-farm and off-farm (post-harvest, marketing) challenges they are facing? If yes, what are the main challenges they tell you about?
8. what do you do to help them?
9. What other techniques or information do you share with farmers?
10. Do you know some ecological beneficial farming techniques and practices?

a. Which of these do you know about?
b. Do you/your organisation ever demonstrate these environmental techniques to farmers?

11. Have you ever received training in any innovations to address challenges that farmers are experiencing? If yes, what was the source of training? Will you kindly talk about them a little?
12. Do you share your training experience with the farmers? If yes which one have they are practicing? If no, what are the reasons why farmers are not adapting it?
13. Do you/your organisation provide chemicals or other inputs to farmers and advise on their use? What are the chemicals and the other inputs?
14. Have you ever heard of PICSA? i.e. Participatory Integrated Climate Services for Agriculture? If yes, can you kindly share what you know about it?
15. Are you interested in receiving training in the ecological friendly farming techniques?
16. The project will train you to become trainers in PICSA and environmentally friendly farming practices and then train farmers in these skills (you will be Climate Resilience Trainers, CRTs). This is to build farmers' capacities and self-reliance for improving farm food security and building farm resilience to climate change through the use of environmentally friendly farming techniques. Do you feel confident you can learn these practices and share them with farmers through trainings and Farmer Field Schools?
17. How has the District integrated Climate-Smart Agriculture (CSA) into their Medium Term Development Plan (MTDP)?
18. What are some of the challenges associated with mainstreaming CSA into the MTDP?

District Assemblies

Name of officer……
District/ Community……..
Designation of officer……..
Date of interview…….

Baseline Questions

1. The project is about helping farmers to build self-reliance in farm decision-making, build the resilience of their farms to the impacts of climate change, and improve farm productivity. Overall, this aims to strengthen household and community food security. What do you know about climate change? (causes and consequences)
2. What is the role does the District Assembly play in supporting farmers?
3. How do you help farmers cope with changing weather and climate?
4. How do you help farmers cope with other challenges on their farms and off-farm. Do you provide any advice to farmers? If yes, what is the advice on and how do you share it?
5. Do you provide any inputs/facilities to farmers? If yes, what type?
6. Do you provide any training for farmers? If yes:

a. What do you train them in?
b. Do you ever train in environmentally friendly farming techniques?

7. Do you ever learn from the farmers about their traditional techniques or their own innovations for coping with on-farm challenges? If yes, do you share them more widely with other farmers?

Do you ever provide any weather or climate information to farmers? If yes, how do you share the information with them?

8. How many times in a planting season do you share this information?
9. Do you ever provide any facilities for farmers? If yes, what type of things?
10. Do you know about environmentally friendly farming techniques? If yes, do you ever advise and train farmers to use these techniques?
11. Does your MTDP incorporate issues of climate change and techniques for environmentally friendly farming? If yes, what are these?
12. Does your MTDP Action Plan include any activities to help farmers address climate change or to implement environmentally friendly farming techniques? If yes, what are these?
13. What are some of the challenges associated with mainstreaming CSA into the MTDP?

6.2. List of Tables

6.3. List of Figures