



RESEARCH PROGRAM ON
**Climate Change,
Agriculture and
Food Security**



CCAFS midline synthesis report - Ghana (GH0108)

CGIAR Research Program on Climate Change,
Agriculture and Food Security (CCAFS)

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1. Introduction

The CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) CCAFS program is a strategic ten-year partnership between the CGIAR and the Earth System Science Partnership to help the developing world overcome the threats posed by a changing climate to achieve food security, enhance livelihoods and improve environmental management. It brings together the world's best strategic research in the fields of agricultural science, development, climate science and earth systems science to identify and address the most important interactions, synergies and tradeoffs between climate change, agriculture and food security. As a collective effort, the CCAFS program aims to become a hub that facilitates action across multiple CGIAR centers and research programs, as well as involving farmers, policy makers, donors and other stakeholders. Their knowledge and needs will be integrated into the tools and approaches that the CCAFS' program develops.

The CCAFS program is working in five regions including South Asia, East Africa and West Africa, Latin America and South-East Asia (more information about CCAFS sites is available on our website <http://ccafs.cgiar.org/where-we-work>). When CCAFS began in 2011, baseline surveys were carried out in 21 research sites across 17 countries within the five regions. The surveys were conducted using standardized baseline tools in each site. The baseline effort consists of three components: a household survey, a village study and an organizational survey.

The household baseline survey was conducted using a quantitative questionnaire on basic indicators of welfare, information sources, livelihood/agriculture/natural resource management strategies, needs and uses of climate and agricultural-related information and current risk management, mitigation and adaptation practices. The village baseline survey (VBS) was conducted using a participatory approach consisting of a whole community meeting and focus group discussions with men and women.

In Ghana, CCAFS partners implemented the village baseline studies and organizational baseline surveys in one out of the seven villages within each CCAFS site where the household survey was implemented. The plan was to assess these villages in roughly 5 years, and again in 10 years, to monitor what changes have occurred since the baseline was carried out.

Seven years after the implementation of the baseline studies, the CCAFS program carried out surveys again in Lawra-Jirapa, Ghana as a test case to help assess whether a midline assessment in other sites is worth the substantial investment that will be needed. The same tools were used with a few improvements to ensure comparability with the data collected in 2011. The aim is twofold: (1) to get an idea of how quickly and easily the three levels of surveys can be conducted a second time around; (2) to try to determine if there has been significant change that is worth tracking in other sites.

The goal of CCAFS midline surveys was to assess what kinds of changes have occurred and whether these changes are helping villages adapt to, and mitigate, climate change. It also provided information at the village level about some basic indicators of natural resource utilization, organizational landscapes, information networks for weather and agricultural information, as well as mitigation baseline information, which can be compared across sites and monitored over time.

The CCAFS midline surveys included three components: household, village and organizational surveys. The household midline survey revisited the original 140 households from the CCAFS baseline survey to the extent possible. The village midline survey was conducted in Doggoh village while the organizational midline survey was conducted with the main organizations drawn from the village midline survey.

Following the midline surveys, a workshop was organized in Jirapa on 2 July 2019 to feed back some of the preliminary results from the baseline and midline surveys. The workshop was attended by 46 people, more than half of whom were farmers from 7 villages of the CCAFS site; two village chiefs attended, along with members of the Lawra and Jirapa Fire Service and representatives from the Department of Agriculture (MOFA), the Council for Scientific and Industrial Research (CSIR) - Savanna Agricultural Research Institute (SARI) and Animal Research Institute (ARI), Ghana Met, Esoko (an agricultural information messaging service), Ghana's Northern Development Authority, the University of Development Studies (UDS) Wa, the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), the International Livestock Research Institute (ILRI) and CCAFS. Participants' comments have been collected to support findings from the midline surveys.

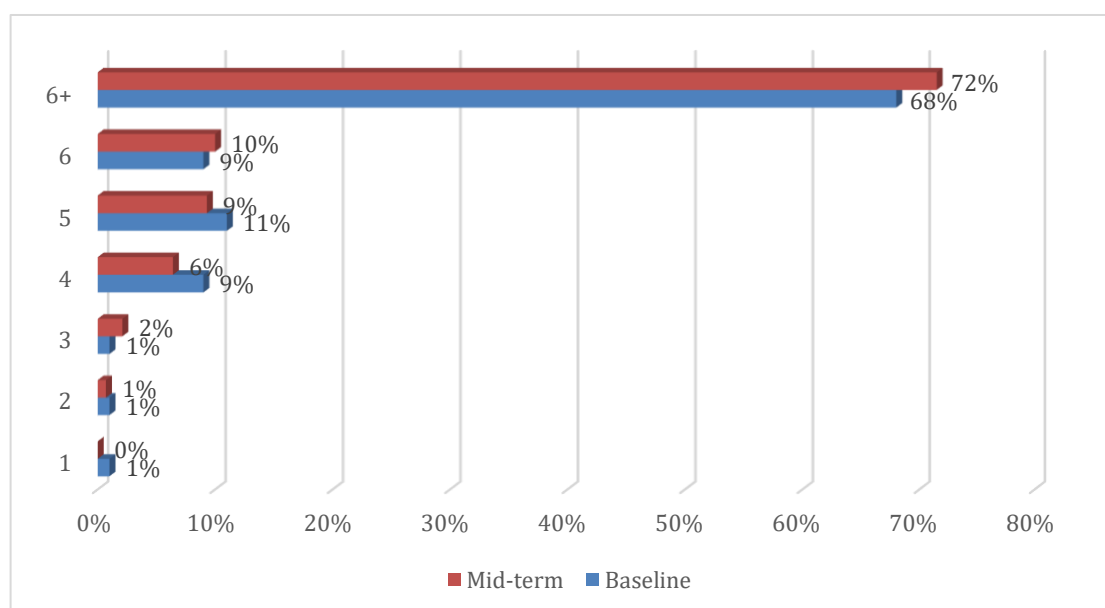
This report provides a synthesis of the changes at the household, village and organizational levels emphasizing major indicators on the changes.

2. Demographic changes

2.1. Household size

In 2018, the average size of households in the communities where CCAFS operates was found to be relatively big. The proportion of households with more than 6 members increased from 68% in 2011 to 72% in 2018. According to the communities, the improvement of farm productivity owing from CCAFS activities contributed to increasing the food security and incomes of households. The improvement of the livelihoods conditions has triggered a bit of population growth within the households. This has contributed to reducing the migration of young men out of the region.

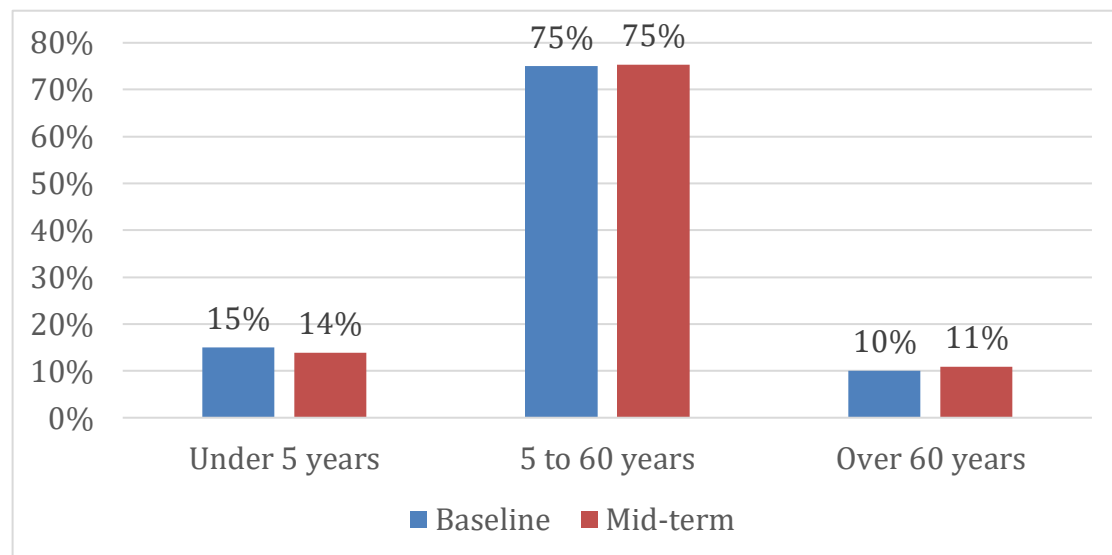
Figure 1. Number of people in the household



2.2. Household age categories (% of people under 5, between 5-60, over 60)

The household age categories recorded no changes since the baseline surveys. The 60+ category and the 5-60 years categories changed only from 10 to 10.88% and from 75 to 75.28% of the population respectively while the age category under 5 years reduced from 15 to 13.83%. This could be due to lowering birth rates or the return of aged migrants due to the improvement in farm productivity since the baseline.

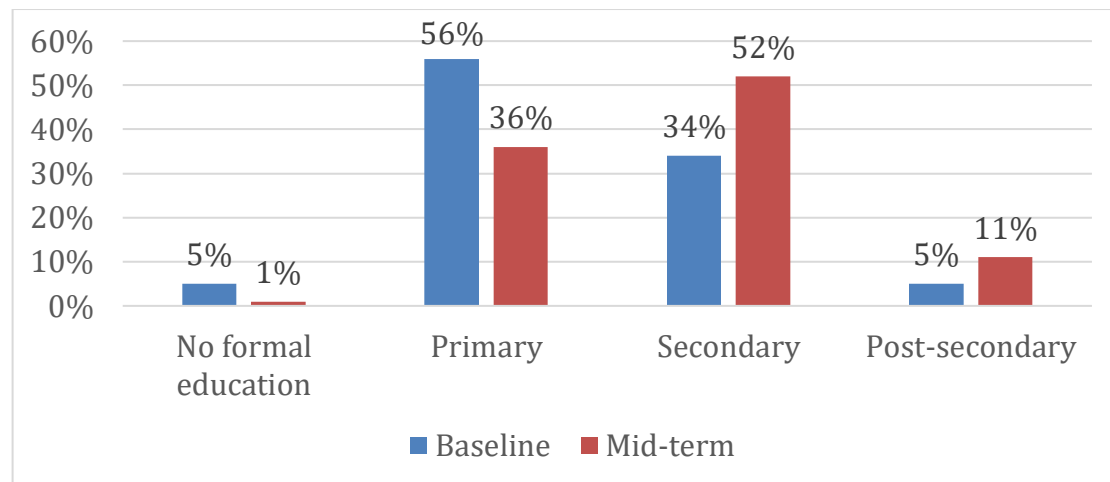
Figure 2. Household age categories (percentage of people under 5, between 5-60, over 60), change from 2011 (baseline) to 2018 (mid-term)



2.3. Highest level of education by any household member

The level of education has been improving since the last baseline study. People with post-secondary education increased from 5% of the population in 2011 to 11% in 2018 while secondary school graduates now stand at 52% up from 34% in 2011. Currently, it is just 1% of the population who has no education. This change was due to many factors including change in the education system, change in people's perception regarding education and change in household income. The government of Ghana has developed efforts to improve the education system in rural areas through building new infrastructure including schools but also helping people go to university. People are seeing more opportunities and value in education since the baselines. They have found that it is hard to get casual jobs if they are illiterate. Education is key and will increasingly be important. Also, CCAFS interventions provided more incomes, which has led to households having more cash for school fees.

Figure 3. Highest level of education by any household member, change from 2011 (baseline) to 2018 (mid-term)



2.4. Ratio of female-headed households

In 2011, only 4% of households were headed by women. This ratio increased by 5.3% to reach 9.3% in 2018. This could be explained by the death of some male household heads leaving families in charge by women.

3. Changes in farming practices and drivers of changes in resources

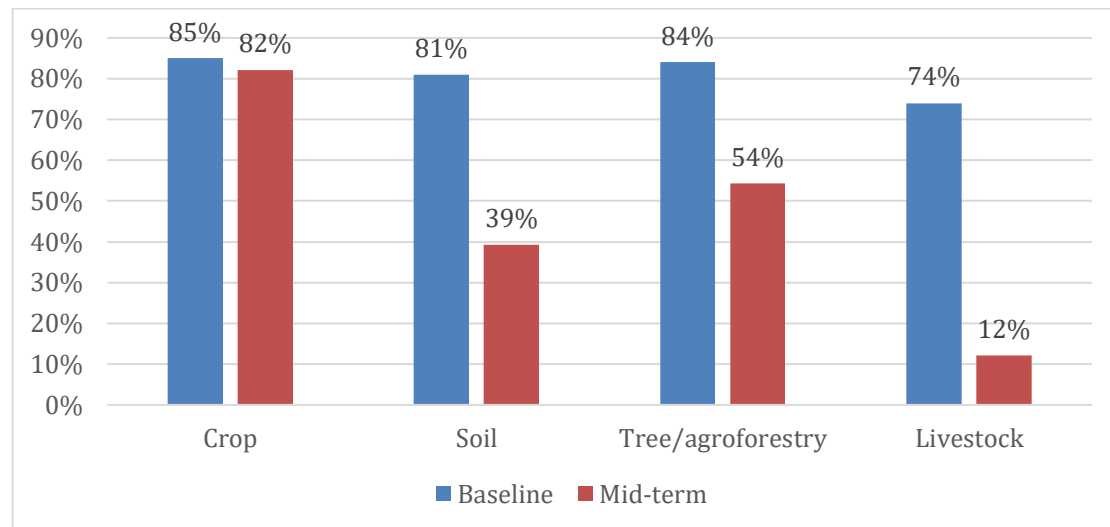
3.1. Percentage of households introducing 3 changes or more

The ratio of households that reported making changes related to crops is different between the baseline and the midline surveys. The current number of households that reported making changes related to soil, tree/agroforestry and livestock practices since the baseline is very low compared to the baseline period, when households reported on changes they had made in the previous 10 years. Only 12.1% of households had made changes in their livestock practices against 74% in 2011.

The decrease of this number could be explained by the behavioral change in farming system and also by the opportunity for innovation. Since the intervention of CCAFS in 2011, people have been sensitized and capacitated for the selection of best-bet agricultural options. This led to an informed and rational choice of technologies and practices by farmers. Some of the new technologies are very expensive (e.g., new varieties, agrochemicals). This means that people

need to stick to what they know and can do. The new technologies are addressing the current needs of farmers so that they do not need to try a lot of practices.

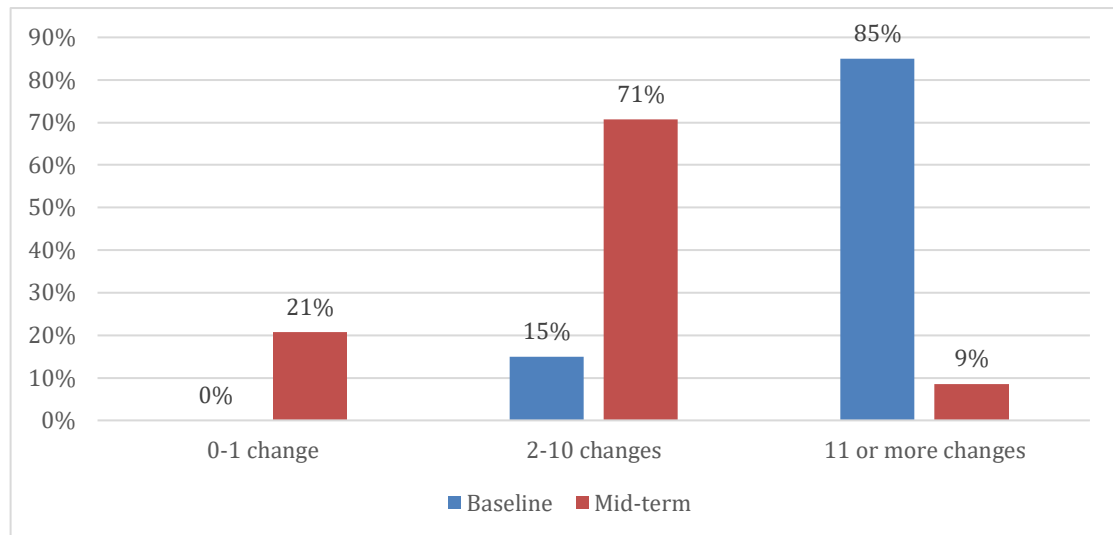
Figure 4. Percentage of households introducing 3 changes or more, change from 2011 (baseline) to 2018 (mid-term)



3.2. Adaptation index

The adaptation index shows that 21% of households reported zero or only one change in agricultural practices (compared to 0% at baseline). At least 71% of the households now record 2 or more changes to their agricultural practices since 2011. This indicates that households were moving from high adaptation level to medium and low adaptation levels. This reduction in number could be explained by the opportunity for innovation and by the behavioral change in farming systems as noted above. People are more and more focused on a limited number of technologies and practices (less innovative) that they found successful in terms of production.

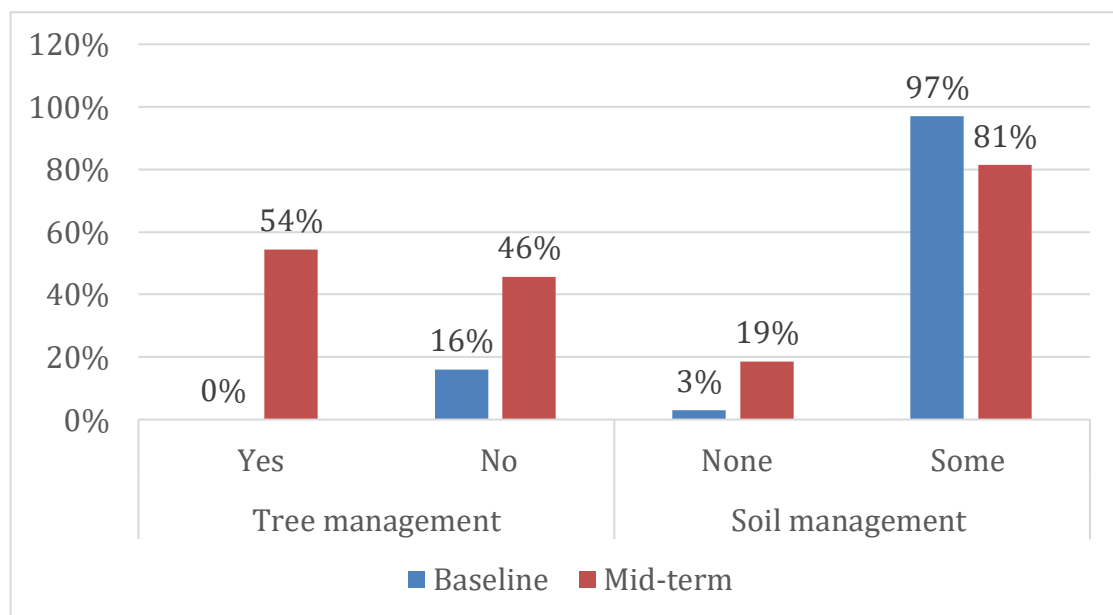
Figure 5. Adaptation index, change from 2011 (baseline) to 2018 (mid-term)



3.3. Mitigation index

Households recognize the threats of climate change and have been introducing one or two mitigation measures across the study area. More than half of households have planted one or more trees around their house area to improve the greenery in the landscape and/or produce fruits to improve nutritional security for household members. Figure 6 indicates a decrease of households involved in mitigation practices.

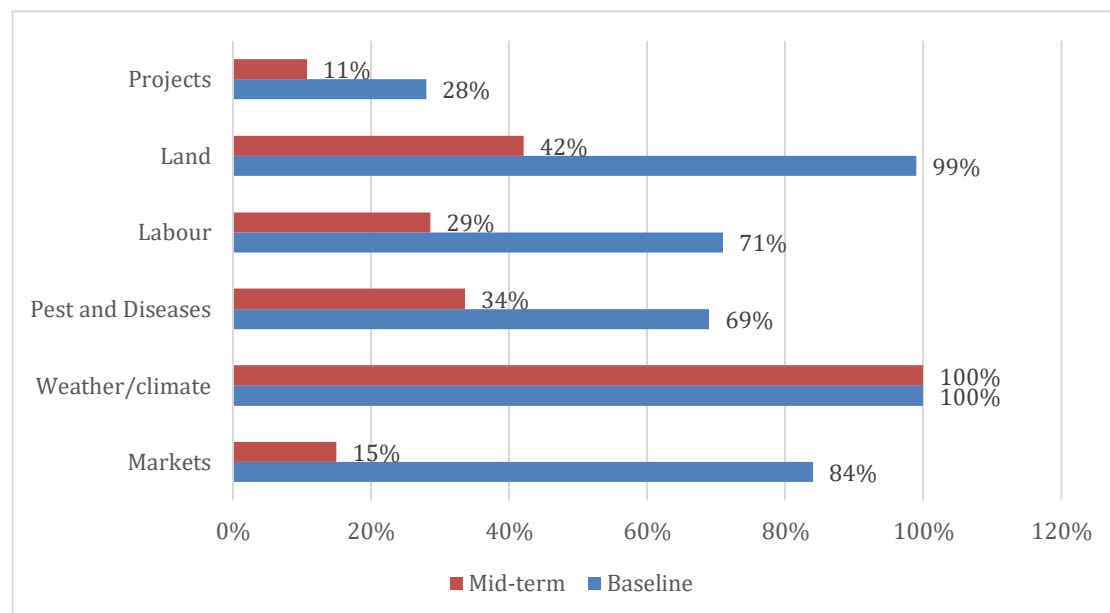
Figure 6. Mitigation index, change from 2011 (baseline) to 2018 (mid-term)



3.4. Drivers of changes to crop agriculture and land management with the percentage of households reporting each driver

During the baseline, 100% of households reported having made crop-related changes because of weather/climate constraints and the soil constraints. In 2018, climate is still 100% a driver of changes to crop, agriculture and land management in the Lawra-Jirapa site of Ghana. This means that the issue of climate change and variability is still current in the area and CCAFS should continue this work in order to strengthen the adaptive capacity of farmers vis-a-vis climate change. The other factors including market, land, labour, project, etc., were much less important as drivers of change to crop, agriculture and management in 2018 compared to 2011. However, Esoko and MOFA provided training to farmers in the CCAFS communities on how to sell their products, and where they can sell what at which time. The improvement of the access to market information contributed to changes in the selection of crops to grow with focus on maize.

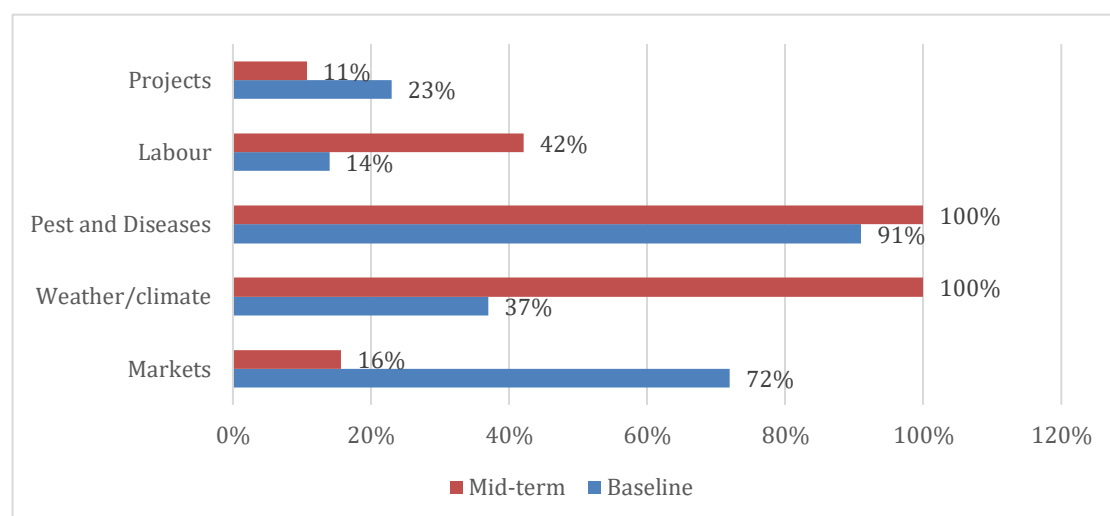
Figure 7. Drivers of changes to crop agriculture and land management with the percentage of households reporting each driver, change from 2011 (baseline) to 2018 (mid-term)



3.5. Drivers of changes to livestock production with the percentage of households reporting each driver

During the baseline, the top three main drivers for livestock-related changes were pests/diseases (91%); markets (72%) and weather/climate (37%). During the midline, livestock-related changes were made 100% because of weather/climate constraints and pests/diseases. Weather/climate and pests/diseases are becoming the most important drivers for livestock practice changes in Lawra-Jirapa. CCAFS should strengthen its ongoing activities on goat production in the site, but also introduce new activities related to animal health.

Figure 8. Drivers of changes to livestock production with the percentage of households reporting each driver, change from 2011 (baseline) to 2018 (mid-term)



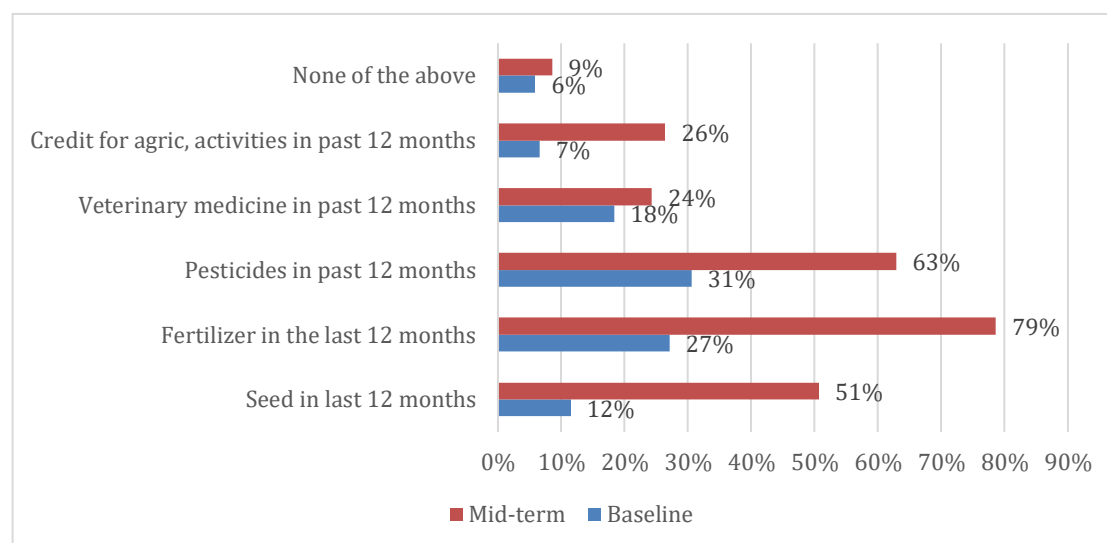
3.6. Changes in use of inputs and credit

When asked about the use of inputs on their farm in 2018, the percentage of households that reported using inputs increased for all the type of inputs (Figure 9). About 63% of the households reported using purchased inputs (pesticides). Fertilizer is also used and has been reported by 79% of the households and 50% used improved seed. It appears clearly that households have made more changes in inputs use at the midline compared to the baseline. Half of the households reported to use improved seed in 2018 against only 11% in 2011.

The increase of inputs is due to the change in cultivation pattern, but also to the new opportunities for inputs markets. The introduction of maize cultivation and the adoption of new varieties requires more fertilizer. The reduction of land size per household (because of population growth) reduced the possibility of crop rotations and require more nutrient inputs.

All these reasons could explain the increase of the fertilizers use from 27% in 2011 to 79% in 2018.

Figure 9. Use of inputs and credit, change from 2011 (baseline) to 2018 (mid-term)



3.7. Changes in drivers of change in the community

This information has been collected at community level through the focus group discussion. Table 1 shows that the population growth, deforestation and soil degradation, rainfall change, and government initiatives were the common drivers of change at the community level during both surveys (baseline and midline). Practices such as production of charcoal for fuel, bush burning for land cultivation, increase of livestock and the religious beliefs reported during the baseline as drivers of change at community level were no longer reported as drivers of change in 2018. In fact, CCAFS contributed to reduce some of these practices (including charcoal burning/fuel and forest fire/bush burning) within the research site through sensitization during the past 7 years. The infrastructure has been reported as a new driver of change in the community. New features since the last baseline survey included the Royal Cosy Lodge (locally referred to as ‘Dubai’), a new clinic building, new housing and school infrastructure amongst others. For instance, the Royal Cosy Lodge has created jobs in construction for most young people from Jirapa district.

Table 1. Drivers of change in the community, change from 2011 (baseline) to 2018 (mid-term)

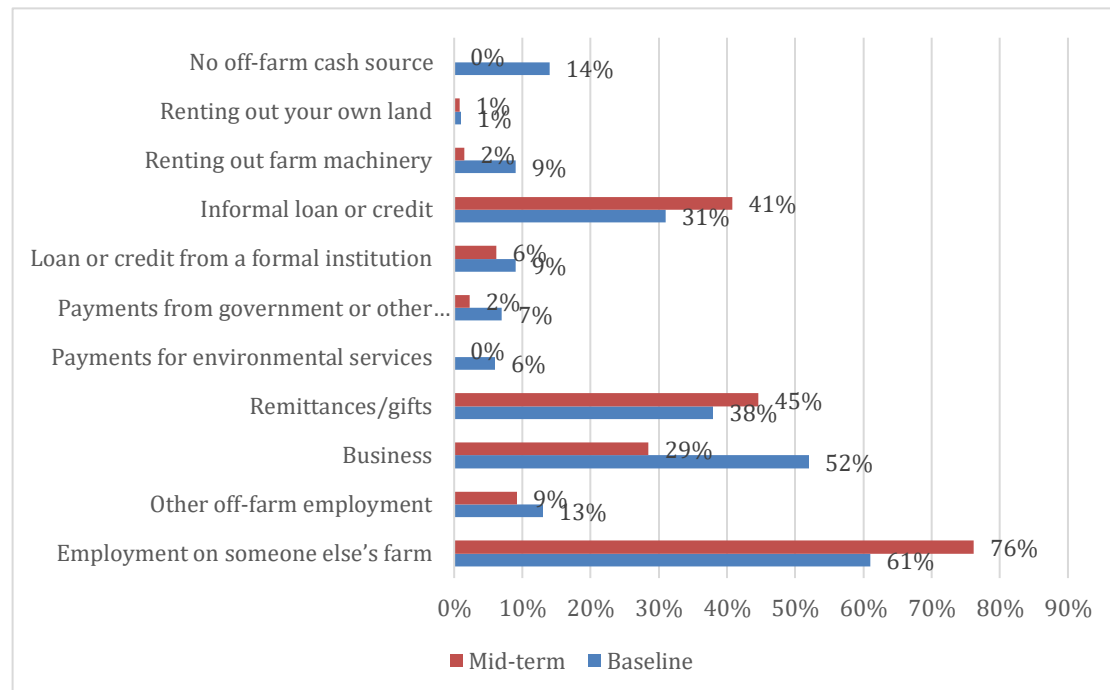
Drivers	Baseline	Mid-term
Population Growth	X	X
Deforestation	X	X
Soil degradation/Erosion	X	X
Rainfall Changes	X	X
Charcoal Burning/Fuel	X	
Government	X	X
Forest Fire/Bush burning	X	
Spiritual/Cultural/Religious	X	
Increase in livestock	X	
Infrastructure		X

4. Livelihood diversification

4.1. Changes in sources of cash income

Figure 10 shows the different sources of cash income in the households surveyed in 2011 and 2018. Employment on someone else's farm (61%) and business (52%) were the main sources of cash income in 2011. During the midlines, employment on someone else's farm (76%), remittances and gifts (45%) and informal loan/credit (41%) have become the most important sources of income for households. The diversity of off-farm income seems to be reduced during the midline. No household received any income from payments for environmental services and other source in 2018. Less than 1% of farmers have received income from renting out farm machinery in 2018. However, all the households reported receiving cash income from different sources in the past 12 months as opposed to during the baseline, when 14% of households reported not receiving cash from any off-farm sources during the previous 12 months.

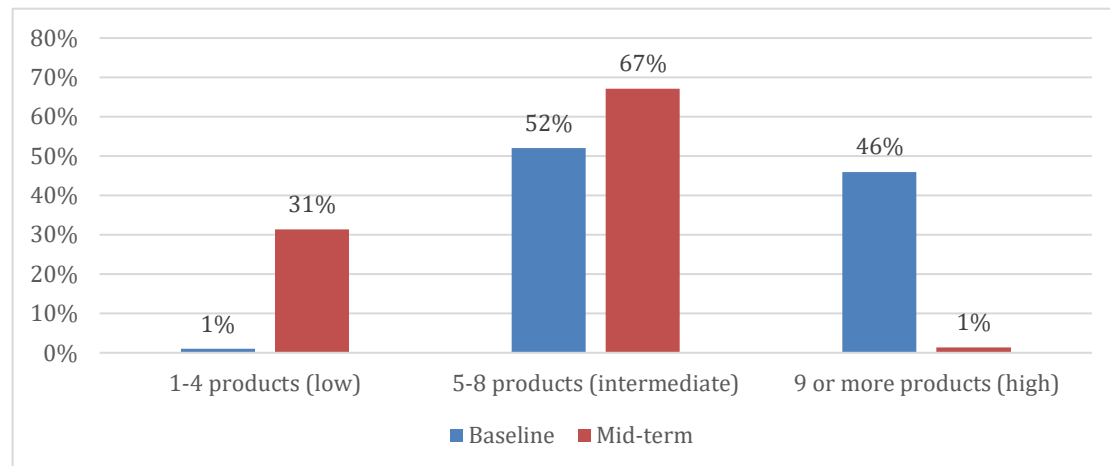
Figure 10. Sources of cash income other than own farm, change from 2011 (baseline) to 2018 (mid-term)



4.2. Product diversification index

In the research site of Lawra-Jirapa, agricultural production is highly diversified among farms. The household surveys show that approximately 98 and 68% of the households surveyed produced more than 5 products in 2011 and 2018 respectively. Product diversification has recorded changes since 2011 albeit still revolving around products from the immediate environment. The proportion of high producers (more than 9 products) decreased from 46% in 2011 to 1.4% in 2018. During the same time the proportion of intermediate and low producers increased from 52% to 67% and 1 to 31% respectively.

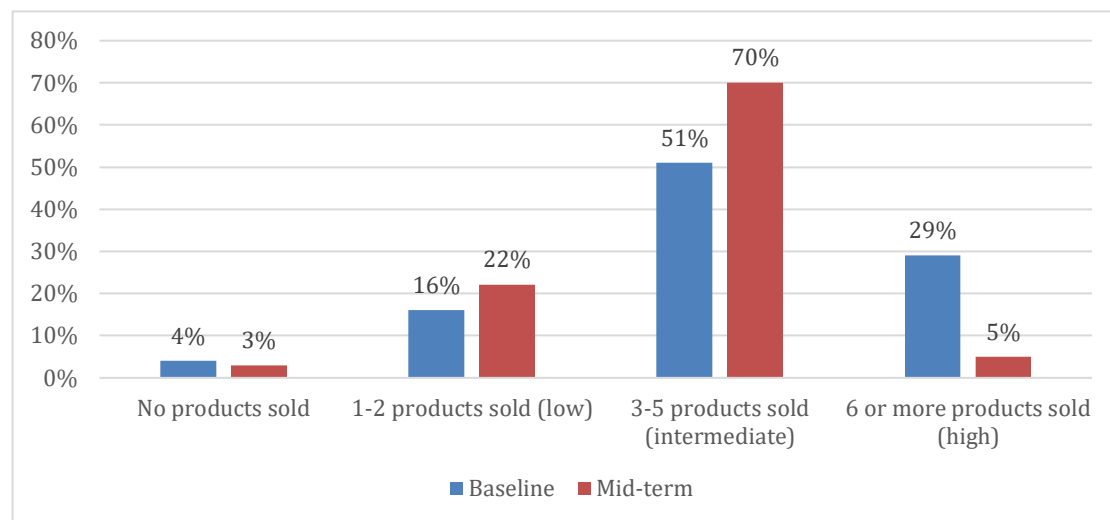
Figure 11. Product diversification index, change from 2011 (baseline) to 2018 (mid-term)



4.3. Selling/commercialization diversification index

An immediate livelihood sustenance indicator is income. Part of the income was found to be coming from the agricultural products produced and sold by households. Most households (about 50% in 2011 and 70% in 2018) are currently intermediate sellers, meaning they commercialize between 3-5 products. The proportion of households recorded as having a high commercialization rank of selling 6 or more products decreased from 29% in 2011 to 5% in 2018. Households are moving towards commercial production (less focus on subsistence) to increase incomes. Farmers are listening more to market signals. According to them, there was a lot of production risk in agriculture in 2011. With CCAFS interventions, that risk has been substantially reduced, allowing some level of increased specialization (or less diversification). Farmers also consider their costs of production as well and limit the number of crops that they can invest in. At some stage, diversification will reduce risk but it may limit what they can really achieve in terms of income from the farm.

Figure 12. Selling diversification index, change from 2011 (baseline) to 2018 (mid-term)



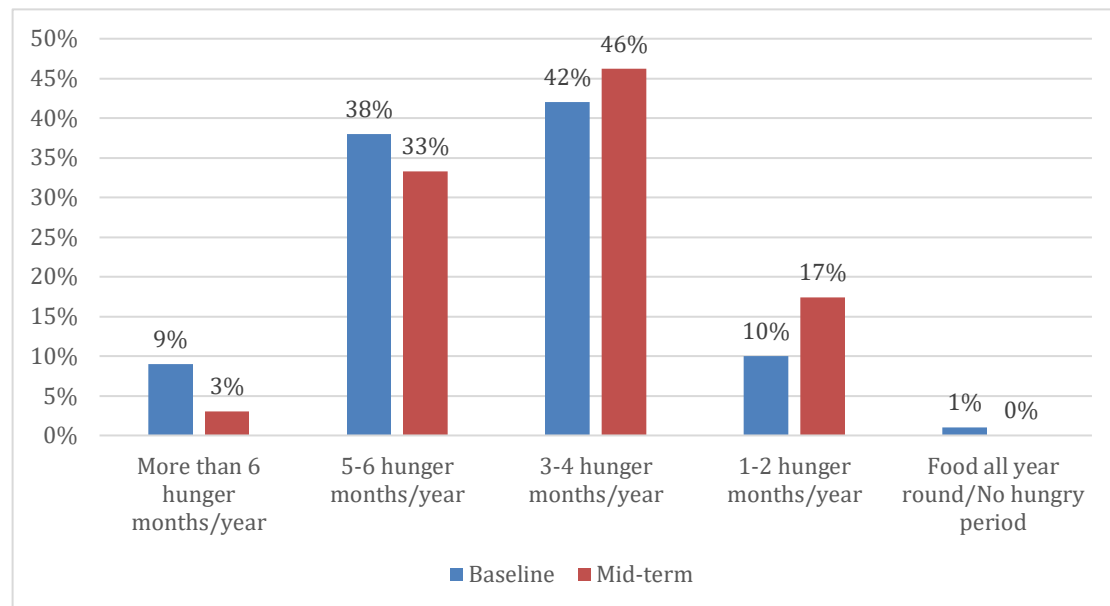
5. Food security

5.1. Food security index

The index shows that food availability, access and quality affect almost all households surveyed by varying lengths of time. It appears that food security generally improved between the baseline and the midline periods. The proportion of households experiencing 5 or more hunger months a year decreased from 47% in 2011 to 36% in 2018. At the same time, and as a result of fewer households in the most extreme category, the proportion of households with 3-4 hunger months and 1-2 hunger months were increased by 4.2 and 7.4% respectively.

According to the community members, new technologies and practices are leading to increased yields. Feeding patterns of the household have also changed with education. The households are told by development projects and NGOs to feed the kids well. This contributed also to increased food intake.

Figure 13. Percentage of households experiencing hunger months, change from 2011 (baseline) to 2018 (mid-term)



5.2. Number of organizations working on food security in the community

This information comes from the village exercise, in which focus group discussions were held with men and women separately to ask about organizations working on food security issues in the community. In 2018, the men’s group identified 10 organizations addressing food security in the village while the women’s group identified 11. Respectively, 9 and 12 organizations were identified as working on food security during the baselines.

5.3. Areas of food security work of organizations (availability, access, utilization)

The analysis of the organizational landscape showed that there have been a number of organizations that were present during the village baseline survey and are currently no longer operating in the area. These included ADRA, Agriculture group and Techno service for men and Timedonbaea, Enye group, Tentaabaerebo group, FARM plus, and Non formal education for women. At the same time, there are a number of new organizations that were not present at the time the village baseline survey took place. These included SADA, AZUMAH RESOURCES, FORESTRY COMMISSION, ACDEP, CCAFS, GHS, GES, Mother-to-mother support group, and Youth group for women.

CCAFS was mentioned as one of the new organizations, and participants reported that its activities are directly responding to some of the community needs. CCAFS trains farmers on good planting techniques including planting in lines, mixed cropping, composting and tie ridging amongst others. CCAFS is also supporting the planting of trees such as moringa, mango and other fruit trees to improve the landscape. FIC is another organization that currently operates in Doggoh but was not present during the baseline surveys. Meanwhile, some organizations that were present during the village baseline survey but currently do not operate in the community include ProNet North, SADA, Sung taa Nuntaa, School for Life and Agamal. The participants indicated that most of the organizations have now folded up and left the community. The number of organizations working in food security are reported in Table 2.

Table 2. Organizations working in food security reported according to gender, change from 2011 (baseline) to 2018 (mid-term)

Food security dimension	Baseline		Mid-term	
	Men's group	Women's group	Men's group	Women's group
Availability	7/9	2/12	5/10	6/11
Access	5/9	9/12	5/10	3/11
Utilisation	0/9	0/12	5/10	2/11

6. Collective action on natural resource management

The collective action around natural resources have not really changed since the baseline. The trees are managed through traditional systems that do not allow members to cut down fruit bearing trees particularly the shea tree (*Vitellaria paradoxa*). Agricultural productivity is low due to poor soils and unreliable rainfall during the months of drought, and the years of crop failure are many. Hence, the fruits from the trees supplement the food requirements of the community. There is a difference in the management of trees that fall on community owned land (open access) and those that fall on individually owned land (controlled access). There is ready market for wood fuel in the towns such as Jirapa, which is putting pressure on the tree population. The absence of alternative sources of income increases the risks of the trees being cut for sale. The community, however, has not yet come up with mechanisms to regulate cutting down trees to sell as fuel wood. The reported environmental benefits of the trees

include the improvement of soil fertility and the provision of shade and fresh air. The region is subject to very strong winds called the “Harmattan.” Trees provide a windbreak, especially during the Harmattan. According to the farmers, trees are also associated with “attracting” rain. One significant dimension is the increasing involvement of female household members in tree nursery management and planting of fruit tree and fuel wood species on the degraded landscapes. This opens pointers to collective action for maximizing impact.

The farming system practiced by the community involves cultivation of land between trees. They maintain the natural trees and introduce other trees of economic value such as mangoes. Some of the natural trees like the shea nut trees and the *dawa-dawa* are retained for their fruits while others like *Acacia albida* are retained to improve soil fertility.

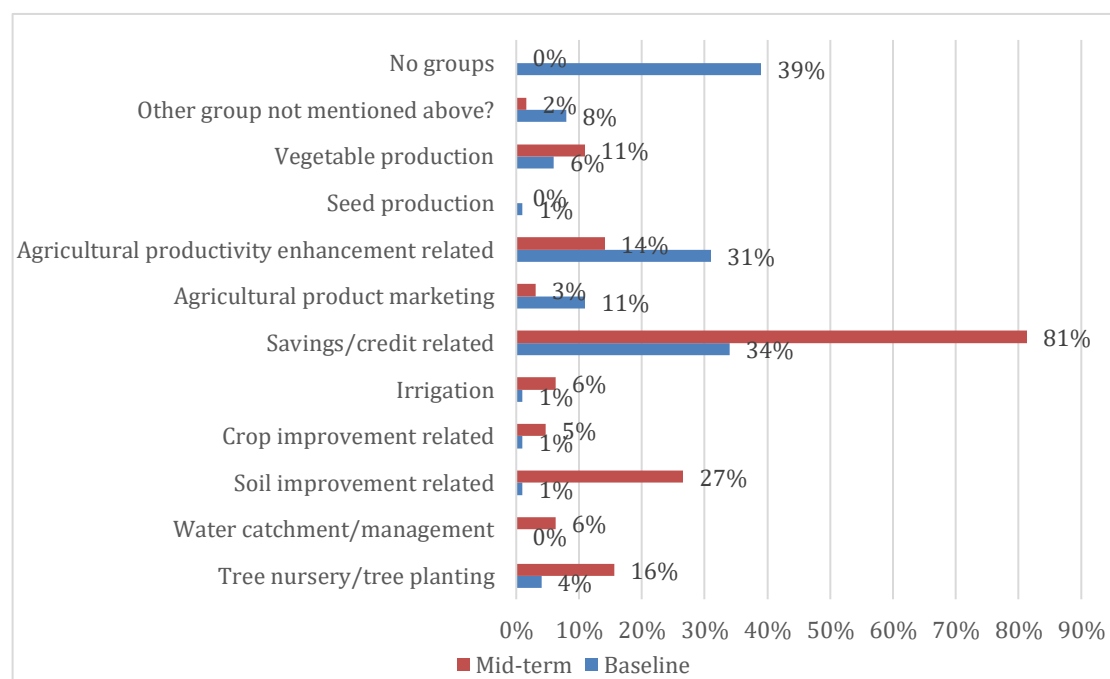
Farmland/cultivated fields are located around the scattered settlements and outskirts of the village. The community grows a variety of crops such as maize, groundnuts, cowpeas, rice, bambara nuts, sorghum, and yam and also keep livestock. All land is owned and managed by the community, which allocates plots to community members for use. Farmland is therefore given in usufruct and not purchased. All members of the community have land that they cultivate. In spite of everyone having land to cultivate, and cultivating many crops in their plots, community members did not grow enough food to meet their needs. The situation is changing with interventions such as the application of climate-smart agricultural techniques and practices. Since the baseline surveys, CCAFS has tested more than ten climate-smart agriculture options with the communities of Doggoh and Bompari including crop rotation maize/cowpea, intercropping, improved varieties of crop, integrated nutrient management, mulching, home garden diversification, no/reduced tillage, organic fertilizer, tree planting, water harvesting (earth bund, planting pits and tied ridges) and climate information use. Farmers in these communities can only produce enough food to feed themselves for three months a year and must seek food from other sources for the remaining nine months of the year. The average land productivity is low due to poor soil fertility and the little, unreliable rainfall received in the region. Members rely on remittances from their grown children who go to the South to seek employment.

7. Organizational membership

7.1. Households belonging to various groups

All the households belonged to groups during the midline survey. The proportion of household heads belonging to some groups such as nursery/tree planting group, soil improvement related, savings/credit related, vegetable production and agricultural productivity enhancement related groups increased considerably. Currently 81% of households are members of a savings/credit related group. According to the communities, the groups are very important as sources of credit and as sources of new knowledge. Access to credit is difficult if you are alone, but it is easier in a group. The NGOs also prefer to work with groups to work with higher numbers of people.

Figure 14. Percentage of households belonging to various groups, change from 2011 (baseline) to 2018 (mid-term)

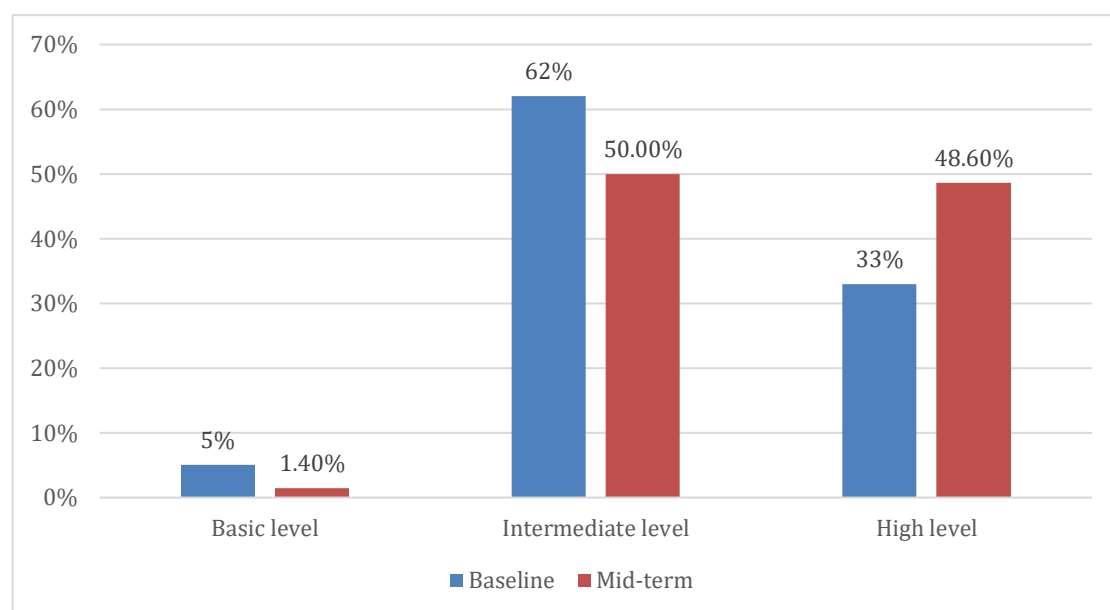


8. Asset ownership

8.1. Households with assets by level (basic, intermediate, high)

From 2011 to 2018, there is a noticeable improvement of the household asset portfolio. The proportion of households at basic level and intermediate level of asset ownership were reduced from 5% to 1.4% and 62% to 50% respectively. The proportion of household in the high level of assets was increased from 33 to 48.6%.

Figure 15. Percentage of households with assets by level (basic, intermediate, high), change from 2011 (baseline) to 2018 (mid-term)



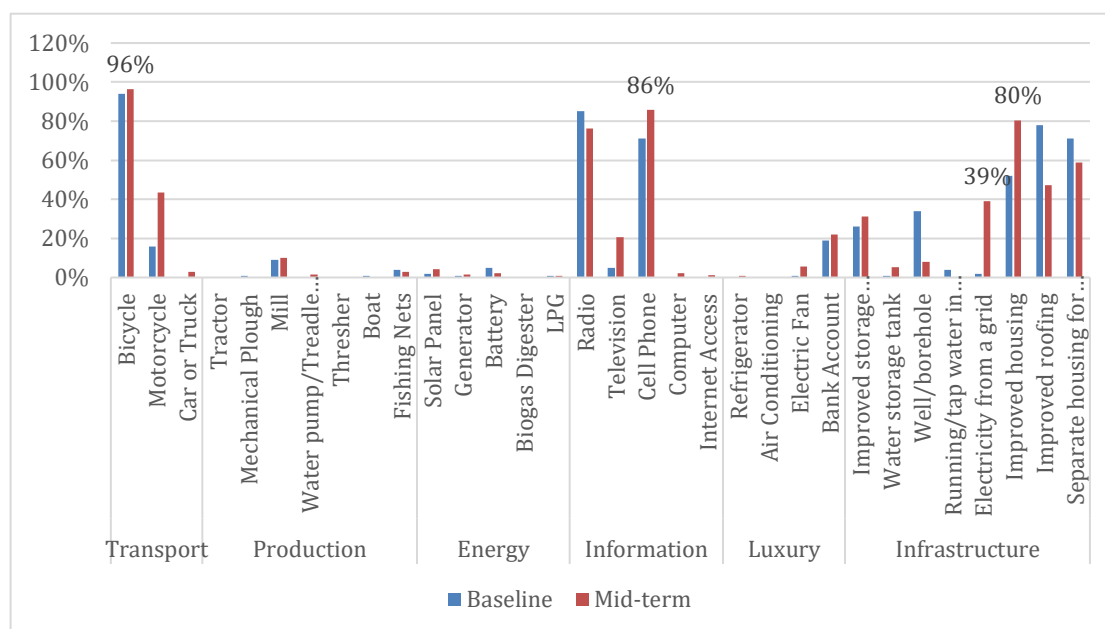
8.2. Household ownership by asset category (transport, production, energy, information, luxury, infrastructure)

The household survey data showed that the asset base has increased. During the midline, a few household members (3%) were found to now own tricycles which are used to carry farm produce and also service transportation needs to neighboring market centers. More people have now a motorcycle (43.6%). There was no change in terms of production assets and energy facility ownership. Concerning the information, we noticed an increase of household members with cell phones and televisions. To benefit from weather forecasts communicated in the research area through the Esoko company and Ghana meteorological service, farmers need a radio and a mobile phone. This contributed to the increase in mobile phone and radio ownership in the villages.

Regarding the luxury assets, 4.7 and 3.10% more household own an electric fan and a bank account respectively. The proportions of households with electricity from a grid and improved housing structures increased by 37 and 27% respectively in 2018. The Government of Ghana has invested in rural electrification contributing to improve the access of communities to grid electricity. This strategy was used by some politicians also to get a political base in every community.

According to the community members, the increase of the farmer asset base was due to more production and more income from farming activities, allowing people to use the surpluses to buy assets. The income from the illegal small-scale mining of gold has also contributed substantially to improve the asset base of households. In addition, to keep a social standing, people were investing in improved assets base (i.e. block house or getting a zinc roof, solar panels, etc.).

Figure 16. Percentage of household ownership by asset category (transport, production, energy, information, luxury, infrastructure), change from 2011 (baseline) to 2018 (mid-term)



9. Information access

The baseline site analysis report described networks of how people access and share information within the community. The midline study investigated if these networks have changed.

9.1. Networks of information for men and women

Table 4 presents the networks of information as identified during the baseline study. Currently, the type of information community members require includes time for land preparation, weather information, storage protocols, market information and guidelines to seed selection. The people continue to source these pieces of information from family and friends, neighbors, organizations, radio and observation. Table 4 shows that recently, farmers are able to call through the mobile phones to the Esoko call centre to access information such as time of planting, fertilizer application, weather forecast in different local Ghanaian languages as well as text alerts. Some community members also report that they are also able to source important information from members of the CCAFS project who come to work in the community.

Table 4. Networks of information as identified during baseline study (0=not identified, 1=identified)

Source of information	Topic (men)				Topic (women)			Total
	Market information	Rainfall	Planting time	Farm inputs (seeds & fertilizer)	Land preparation	Manure application	Weather information	
Family	0	0	1	1	0	0	0	2
Friends	1	0	1	1	1	1	1	6
Neighbor	1	0	0	0	0	0	1	2
Organizations	1	1	1	1	1	1	1	7
Radio	1	1	1	0	1	1	1	6
Observation	0	1	0	0	1	0	1	3

Table 5. Changes in the sources of information for different topics (type of information) as mentioned by men and women

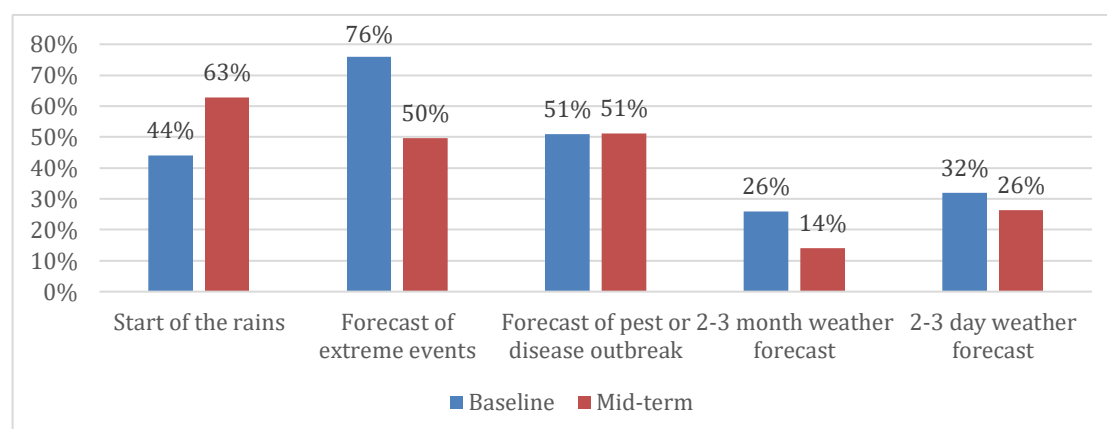
Gender/Type of information	New source of information that has become available	Sources of information that are no longer used
Men		
Time for planting & fertilizer application	Phone call and text messages (Esoko), radio	Cloud movements
Market information	Phone call and text messages (Esoko) and observation	Information van announcements
Start of rains	Phone call and text messages (Esoko), Indigenous local knowledge (ILK)	Particular insect movements
Drought period	Radio	Some particular birds and insects migrating
Women		
Weather information	Esoko (mobile phone calls and text alerts)	Particular bird sound and animal movements
Post-harvest storage information	none	Storage
Marketing	Radio, Esoko, neighbors	Information vans
Seed selection	CCAFS workers	n/a

New types of information were required during the midlines. They were related to drought period, input supply information, sources of small loan support and post-harvest storage information for men and use of chemicals, access to fertilizer, elimination of fall armyworm and market for shea butter and moringa soap for women.

9.2. Households receiving weather-related information

Currently, most households receive information related to the start of the rainfall compared to the time of the baseline. However, the households receiving the 2-3-day weather forecast were supposed to increase given the efforts developed by CCAFS and partners (Esoko; MOFA and Ghana Met service) to diffuse weather information in Northern Ghana.

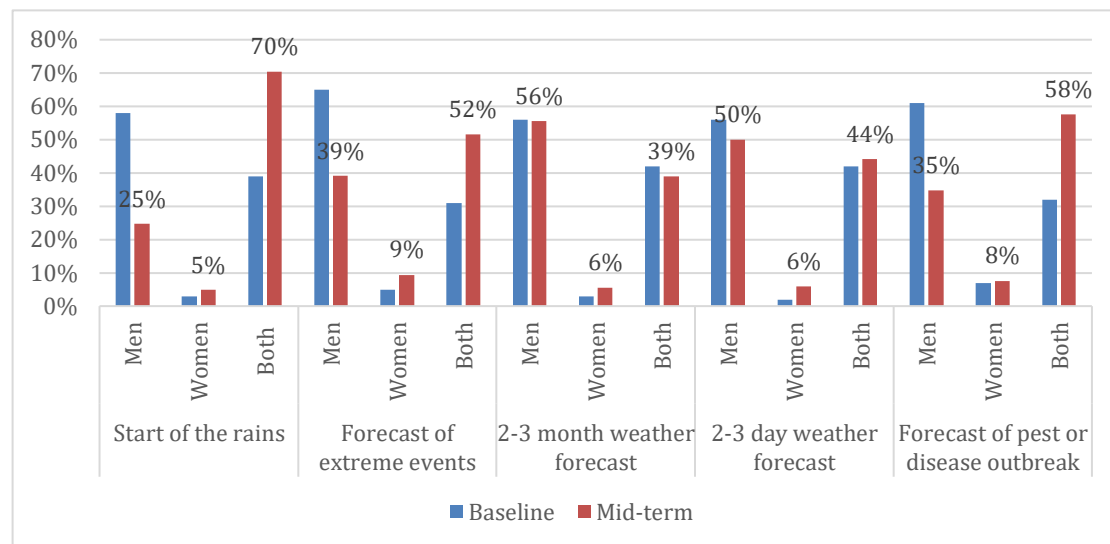
Figure 17. Percentage of households receiving weather-related information, change from 2011 (baseline) to 2018 (mid-term)



9.3. Households members receiving information

During the baseline, the information was mostly received by men. During the midline it is now received by both men and women. We can notice an improvement in women's access to information related to weather and climate forecasts in the research site of Lawra-Jirapa.

Figure 18. Percentage of household members receiving weather-related information, change from 2011 (baseline) to 2018 (mid-term)



10. Conclusion

The objective of the CCAFS midline surveys was to assess what kinds of changes have occurred and whether these changes are helping the households and villages adapt to and mitigate climate change. It also provided information at the village level about some basic indicators of natural resource utilization, organizational landscapes, and information networks for weather and agricultural information, which can be compared across sites and monitored over time.

The synthesis of midlines surveys showed that:

- The demographic characteristics of households were changed with an increase in household size and an improvement of education level of household members.
- The adaptation and mitigation indexes have recorded changes with a decrease of the number of farmers using adaptation and mitigation practices.
- The main drivers of change for livestock and crop production were changed even though the weather/climate remained at 100% and was the most important driver of changes.
- The use of inputs and credit were increased considerably with more households using fertilizers, pesticides and seed.
- The proportions of high producers and high sellers of products were reduced.

- The food security status was improved with more than half of the households experiencing less than 4 hunger months a year. CSA practices including tied ridging, crop rotation, and improved seed varieties promoted through CCAFS activities are improving crop yield outputs contributing to improving the food security status.
- The household asset portfolios were improved with about 49% of households in the high level of assets.
- The community resources are improving as more trees have since been planted in the settlement area and reduced indiscriminate felling of trees as well as banning of small-scale gold mining have contributed to improved vegetation cover.
- The organizational landscape has recorded some changes since the village baseline exercise with new organizations such as CCAFS, SADA, MoFA, ProNet North and Forestry Commission (reported by men) and GHS, Pogfaabargone, CCAFS, ACDEP and Mother-to-mother support group (reported by women) which are working in food security, natural resource management, infrastructure, and agriculture.
- The information networks were improved with the appearance of new sources of information including mobile phones, radio, and Esoko which are providing the community with information on agriculture (rainfall, time of planting and/or fertilizer applications as well as market information for farm inputs and agricultural produce).

Overall, there is satisfactory progress towards building a natural resource management regime to contribute to food security in the face of climate and ecosystem changes.

The midlines surveys were useful to generate some indicators at household level including adaptation, mitigation, intensification, diversification and food security indices that allow to track the change in behavior within the research site. Data from the midline surveys could help to understand processes, effects of interventions, and dynamic nature of climate impacts and adaptations in the study area. For example, they could be used as a secondary data for future impact assessment of the research to find out whether observed changes in the area can be attributable to CCAFS interventions.