What climate services do farmers and pastoralists need in Tanzania?

Working Paper No. 110

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

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Working Paper

CGIAR

RESEARCH PROGRAM ON
Climate Change, Agriculture and Food Security

CCAFS

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Baseline study for the GFCS Adaptation Programme in Africa

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Correct citation:
Coulibaly Y. J., G. Kundhlande, N. Amosi, Tall A., Kaur H., Hansen J., 2015. What climate services do farmers and pastoralists need in Tanzania? Baseline study for the GFCS Adaptation Program in Africa. CCAFS Working Paper no. 110. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Copenhagen, Denmark. Available online at: www.ccafs.cgiar.org

Titles in this Working Paper series aim to disseminate interim climate change, agriculture and food security research and practices and stimulate feedback from the scientific community.

This document is published by the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS), which is a strategic partnership of the CGIAR and the Earth System Science Partnership (ESSP). CCAFS is supported by the CGIAR Fund, the Danish International Development Agency (DANIDA), the Government of Australia (ACIAR), Irish Aid, Environment Canada, Ministry of Foreign Affairs for the Netherlands, Swiss Agency for Development and Cooperation (SDC), Instituto de Investigação Científica Tropical (IICT), UK Aid, and the European Union (EU). The Program is carried out with technical support from the International Fund for Agricultural Development (IFAD).

The Global Framework for Climate Services (GFCS) is an international partnership seeking to harness scientific advances and improve the availability, accuracy and use of climate information which will help society cope with climate change and hazards such as droughts and floods. It brings together researchers and providers of weather and climate services, as well as a wide range of users from the agriculture, food security, water management, health and disaster management sectors - and many others. The GFCS Adaptation Programme in Africa is the first national, multi-sector implementation project under the GFCS. It aims to increase the resilience of people most vulnerable to the impacts of weather and climate-related events through the development, implementation and evaluation of a joint program for the target countries, Tanzania and Malawi. The program will help build integrated frameworks within countries and will support existing initiatives to improve the provision and use of climate services for food security, nutrition and health as well as disaster risk reduction. The GFCS Adaptation Programme in Africa is funded by a grant from the Norwegian Agency for Development Cooperation (NORAD), and is implemented with technical support from the World Meteorological Organization (WMO).

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Abstract

This report presents final findings from the baseline data collection exercise conducted for Global Framework for Climate Services (GFCS) Adaptation Programme in Africa. The GFCS programme, having a focus on agriculture, food security, heath and disaster risk reduction, is implemented in Tanzania and Malawi. Under the auspices of this GFCS project, the CGIAR research program on Climate Change, Agriculture and Food Security (CCAFS) is responsible to support baseline data collection and monitoring and evaluation (M&E) to evaluate climate services for farmers and pastoralists in Tanzania. The purpose of this report is to inform national partners on farmers' current access and needs for climate information services.

Communities of agro-pastoralists and pastoralists interviewed have little access to climate information, which is generally not associated with agricultural advice. To increase the relevance and communication of climate information in their communities, respondents have recommended training of local extension agents and traditional leaders on the concepts of climate information, having site specific information and using local languages and brochures. The forecasts of greatest interest include start of the rain and expected amount of rainfall over the season. Preferred formats cited by men are radio messages, visits from extension agents while women selected voice message on cell phones and villages communicators. Messengers suggested for radio presenters, local extension agents and village leaders highly recommended by women.

Keywords

Climate services; baseline survey; monitoring & evaluation; Tanzania; Africa; gender equity.

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Acknowledgements

This study was commissioned and overseen by the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS); and conducted by World Agroforestry Center, under the auspices and with financial support of the Global Framework for Climate Services (GFCS) Adaptation Programme in Africa.

We would also like to thank the following experts for their inputs, efforts, and support for the baseline survey: Henry Neufeldt, John Gathenya, , Anthony Kimaro, Mathew Mpanda, Juvenal Kisanga (WFP Tanzania) and Renatus Mkaruka (Red Cross Tanzania).

Contents

Acronyms

GFCS	Global Framework for Climate Services
WFP	World Food Programme
CCAFS	CGIAR Research Program on Climate Change and Food Security
CGIAR	Consortium of International Agricultural Research Centers
SMS	Short Message Service
ICRAF	International Centre for Research in Agroforestry
ADMARC	Agricultural Development and Marketing Corporation

Introduction

Agriculture plays a critical role in the livelihood of smallholder farmers in Tanzania as in many developing countries. Farmers rely on rainfed agriculture for their daily subsistence and for income generation. Increased climate variability poses great challenges to farming activities and leaves farmers very vulnerable to the impact of weather and climate fluctuations. Thus, improving climate information and advisory services is recognized as a strategy that could help farmers to deal with the weather and climate uncertainty and thereby improve their decision making on crop management. Climate information provides useful knowledge that contributes to the adoption of new technologies, improved inputs and new cultivation practices (Msangi et al. 2006). Resultantly, there would be reduced risk and vulnerability to changing climate and enhanced crop productivity and food security. Hence, access to timely, accurate, reliable climate information and agricultural advice presents opportunities for reducing vulnerability and becoming more resilient to climate change.

To respond to this major challenge of increased climate variability, the international community established the Global Framework for Climate Services (GFCS) to promote operational climate services at the national and regional levels. This intergovernmental partnership is supported by the United Nations and other international organizations, and coordinated by WMO. The Adaptation Program in Africa, which targets Tanzania and Malawi, is the first multi-agency initiative to be implemented under GFCS. It is a 3-year project, funded by the Government of Norway, that aims to strengthen capacity both to develop and use climate services and combines cutting-edge science with traditional knowledge. The Adaptation Program in Africa is a joint effort of WMO, CCAFS, the Centre for International Climate and Environmental Research – Oslo (CICERO); the Chr. Michelsen Institute (CMI); the International Federation of Red Cross and Red Crescent Societies (IFRC) through the Tanzanian and Malawian Red Cross; the World Food Programme (WFP); and the World Health Organization (WHO).

CCAFS-led activities in the GFCS Adaptation Program in Africa include the implementation of research-based Monitoring and Evaluation regarding the access, use and needs of climate services by end users (farmers, pastoralists). A first step in this process was an implementation of a baseline survey that collected detailed information on the current situation of climate services accessed and used by farmers and pastoralists. This information provides benchmark indicators against which progress and performance of the project will be measured.

This report presents a synthesis of the findings of the key benchmark indicators regarding the access, use and availability of climate information services in Tanzania. Malawi is covered in a separate report. The results shed light on what kinds of information farmers and pastoralists need, and in what formats. This baseline information will be used to compare against data after the implementation of the program activities, in order to evaluate the impact of climate services on the livelihood of the rural communities targeted.

Survey Instruments

The survey instruments developed for the baseline include both a structured individual household questionnaire and a key informant interview guide. Both instruments were derived from pilot CCAFS baseline tools to measure the value of climate services for farmers, to which GFCS partners contributed questions and specific input to adapt the survey to the country context and needs of the GFCS project. The protocol instruments have been tested and validated in several CCAFS research sites in West Africa (Kaffrine in Senegal), East Africa (Nyando in Kenya) and South Asia (India) (Tall et al., 2014). These efforts have resulted in an effective context driven tool kit to evaluate climate services across countries. The toolkit encompasses a pre-assessment survey to understand background contextual issues related to the usefulness of climate information services and guidelines for monitoring and evaluation of climate service projects. The baseline survey instruments have been adapted and implemented in Tanzania and Malawi for the purpose of this baseline exercise.

The data collected from the survey instruments are used to develop a set of indicators on access, needs and use of climate services that will be monitored during the project implementation in order to assess changes in the beneficiaries' livelihoods as a result of the project. The individual household questionnaire focuses on 6 sets of indicators: household assets and risk to agricultural productivity, the general sources of information on agriculture,

the specific sources of information on climate, the use of climate information and the perceived impacts, gendered access to climate information and finally, impact of climate service use on crop/livestock production and food security.

The key informant interview guide was more concise since it aims to complement the information generated from the individual households' interviews. Indicators from this guide include community risks, sources of information on climate and agriculture, communication of climate information, gender and access to climate information.

Prior to the administration of the survey instruments in the target districts, the tools were tested in a pilot village, named Segesa in the district of Kisarawe, 60 km from Dar Es Salam. The goal of this pre-testing was to check the relevance of the questions to the context of the survey, ensure a very good understanding of the survey tools and key concepts by the enumerator team.

Site Selection

A stratified random sampling design including village experiments (to receive the program) and controls (to serve as comparison) was used for the individual household data collection process. Key informants interviews involved a purposive sampling design. The stratified sampling design involved a three-stage selection process. First, districts were selected in the same sites where the GFCS project partners, mainly the Tanzania National Red Cross Society, and the World Food Programme (WFP), operate and plan interventions and climate service delivery between 2014 and 2016. Red Cross and WFP are planning activities in the districts of Kiteto but in Longido only WFP has targeted activities. Following the choice of districts, villages were then selected randomly from the list of villages where these partners plan to implement the GFCS project activities. Finally, in each village, households were randomly selected from a list provided by village leaders, together with local development workers of partner organisations. In addition to the selection of villages where partners have planned their activities, control villages where no GFCS activities are expected to take place between 2014-16 were also selected to serve as a comparison group. The control groups were selected from villages with similar vulnerability status, agro-ecology, socio-economic setting as the target experimental villages, but outside the range of influence of project activities to avoid information leakages. Selection of experimental and control villages will allow us to

use a quasi-experimental approach when evaluating the project's effectiveness and impact for local farmers and pastoralists at the end of the project. Data were collected in 17 villages (9 experimental and 8 control) and on 340 individual households (25% female headed) using a structured questionnaire.

Populations sampled in each district have been weighted according to their total population figures. The population in Kiteto is almost twice that of Longido, thus the largest sample of households surveyed has been attributed to Kiteto.

In addition to the individual households, 42 informants were also interviewed using semi-structured interview guide. Key informants interviews are deemed necessary to triangulate information obtained at the household levels but also to obtain general background information, constraints encountered in agriculture and risk management.

Table 1. Summary of sampling sites and respondents.

	Number of		
District	**Villages**	**Households**	**Key informants**
Kiteto	11	220	26
Longido	6	120	13
Total	*17*	*340*	*39*

Survey Implementation

To implement the survey, ICRAF entered a partnership with ICRAF's office in Tanzania, WFP, Red Cross and district officers. ICRAF's Tanzania office has extensive experience conducting farm household surveys, and helped recruit experienced enumerators and assisted in the training and the supervision of the enumerators' team during the field survey.

The training of the enumerators took place at ICRAF's office in Dar Es Salam in the month of September 2014. The training covered explanation of the purpose of the study, in-depth review of the baseline survey tools, pre-testing of the questionnaires and de-briefing sessions to improve the tools and sharpen the ability of the enumerators to administer the questions.

The implementation of the survey took place from September to October 2014. The survey team comprised 10 enumerators, and two supervisors including the ICRAF field technician and the agricultural economists from ICRAF.

Administrative protocols for entering districts were facilitated by the partners WFP and Red Cross. Then, upon arrival in these districts, the field team completed the formalities by meeting with the district officers of partner organisations to explain the purpose of the survey, discussed selection of control villages (sites where no GFCS activities will be carried out over the course of the project) and ask to be introduced to local leaders in communities where the survey will take place, and to government agricultural extension officer responsible for the area in which the survey took place. After obtaining permission to interview households from the Group Village Headman and the Village Headman, the enumerators proceeded to conduct the household survey. The survey team also sought help of a local person in each village to guide the enumerators to the households in the village, ensure that only households falling within the selected villages were interviewed and help with translation issues if needed.

Results

Agro-ecological Zones and Climate in Surveyed Districts

Kiteto and Longido are the target districts in Tanzania under GFCS implementation activities to be undertaken by various partners like WFP, Red Cross and TMA. The district of Kiteto lies in Manyara Region and has three major agro-ecological zones, namely the rift valley highlands, the semi-arid midlands, and the bushed Maasai steppe.

The rift valley highlands are characterized by moderately high rainfall with annual rainfall that ranges between 800 mm and 1000 mm per annum. This is the zone of reasonably reliable rainfall. Temperatures vary between 20°C and 25°C. The semi-arid midlands are depicted by elevated to flat areas in low altitudes. This area experiences moderately low rainfall, which averages 450 to 700 mm. per annum with short duration. The rainfall regime is not reliable.

The bush Maasai steppe is an arid grassed plain mixed with bushes. Livestock density is high while that of human is low. Rainfall is short and unpredictable ranging from 350mm to 400mm per annum.

Kiteto district is characterized by a marked dry and wet season. The climate of the Region can be described as dry type savannah climate with a dry season of 6 to 7 months and a rainy season of 5 to 6 months. The district receives an average rainfall between 450 mm and 1,200

mm per year, with two rain seasons. The short rain begins in October and ends in December while the long rain season starts in February and ends in May.

Longido district is part of the Maasailand and is characterized as semiarid area. Low levels of rainfall, averaging 300–600 mm/year with high spatial and temporal variability are recorded in most regions of the district. This has restricted agriculture to a limited area of land, primarily on the higher western slopes of Kilimanjaro and along a few seasonal watercourses. Rainfall is highly unpredictable with periodic drought and animal diseases. Longido was impacted by several droughts in 2000, 2006 and 2009. The 2009 drought was the worse one and led to food shortage, water scarcity and large migration of herders to other areas.

The district is bounded by well-known conservation areas: Ngorongoro Conservation Area to the west, Kilimanjaro and Arusha National Parks to the east and south, and Amboseli National Park just across the Kenyan border to the north.

Primary Livelihood Activity

Over 80% of rural households interviewed in Kiteto are crop farmers (60%) and agro pastoralists (33%) involved in both crop production and livestock keeping (Table 2). In Longido, majority of farmers surveyed are pure pastoralists (53%). A lower proportion of respondents are engaged in agro-pastoralism (32%). Extensive pastoral production with herd mobility is used as a primary strategy to cope with rainfall uncertainty. Livestock is kept for several uses including income generation from sales of milk, meat, skin, draught power and manure. Level of education in Kiteto and Longido are comparable. Primary school education is the highest level of education of half of the respondents.

Households' Agricultural Production

Table 3 presents the main farm produced (crops and livestock) of the households interviewed in Kiteto and Longido. Maize, beans, sunflower and pigeon peas are the main crops cultivated by the respondents in Kiteto and Longido. Maize is the leading crop with a share of 53% and 59% among all the crops grown in Kiteto and Longido respectively. Sunflower (22%) and pigeon peas (11%) are the second and third most important crops cultivated in Kiteto while beans (34%) is the second largest crop grown in Longido. These crops are cultivated under rain-fed conditions on a medium scale in Kiteto with an average area varying between 6 to 13 acres and on a small scale in Longido with average area ranging from 1 to 3 acres. Livestock

farming comprised chiefly cattle, dairy cows, goats and sheep with goats and cattle representing the largest livestock shares kept.

Table 2. Socio-economic characteristics of individual households, CCAFS survey.

	Kiteto	Longido
Level of Education (percentage of households)		
None	45.7	35.3
Primary School	47.9	50.4
Secondary School	3.7	5.9
Post-secondary	0.9	0
Other	1.8	8.4
Primary Livelihood Activity (percentage of households)		
Farmer	56.6	15.1
Agro-Pastoralist	33.3	31.9
Pastoralist	9.1	52.9
Trade	0.9	0

Table 3. Main crops produced and areas cultivated, CCAFS baseline survey

Crops	Kiteto		Longido		Livestock	Kiteto	Longido
	Share grown (%)	Area (acre)	Share grown (%)	Area (acres)		Share kept (%)	Share kept (%)
Maize	57	10	62	3	Cattle	34	34
Beans	8	6	37	3	Dairy cows	10	8
Sunflower	24	13	1	1	Goat	39	37
Pigeon peas	12	12	0	0	Sheep	17	21

Key informant types

Most of the key informants interviewed in Kiteto were traditional leaders (50%) and agricultural extension officers (15%) (Table 4). In Longido, respondents were mainly village leaders (54%) and Ward Executive Officers (23%).

Table 4. Socio-Demographic characteristics of key informants, CCAFS baseline survey.

Respondent Role in Community/Organization (% of households)	Kiteto	Longido
Agricultural and livestock officer	15	8
Division officer	0	8
Mosque/Pastor leader	8	0
Secretary of political party (CCM)	4	0
Teacher	8	8
Traditional leader	8	0
Village leader	50	54
Ward Executive Officer (WEO)	8	23

Household asset ownership

Figure 1 shows respondents' ownership of communication assets disaggregated by gender. The main communication assets owned by the households interviewed are radio and cell phones. Cell phone is the most common communication asset owned by 79% and 86% of male household heads interviewed in Kiteto and Longido, respectively. Female household head do own cell phones (58% in Kiteto and 82% in Longido) but to a lesser extent than men. About 60% of the male respondents, and 50% of female households heads, own radio.

Figure 1. Households' communication asset ownership by district, CCAFS baseline survey.

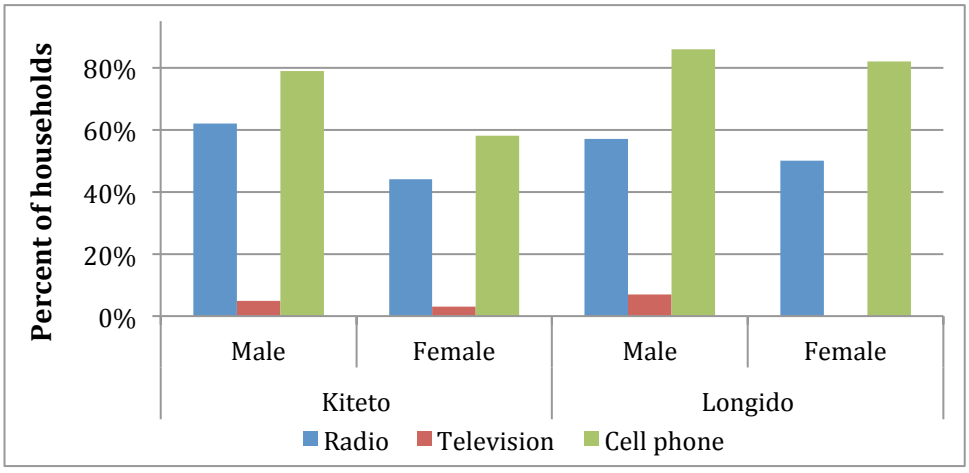
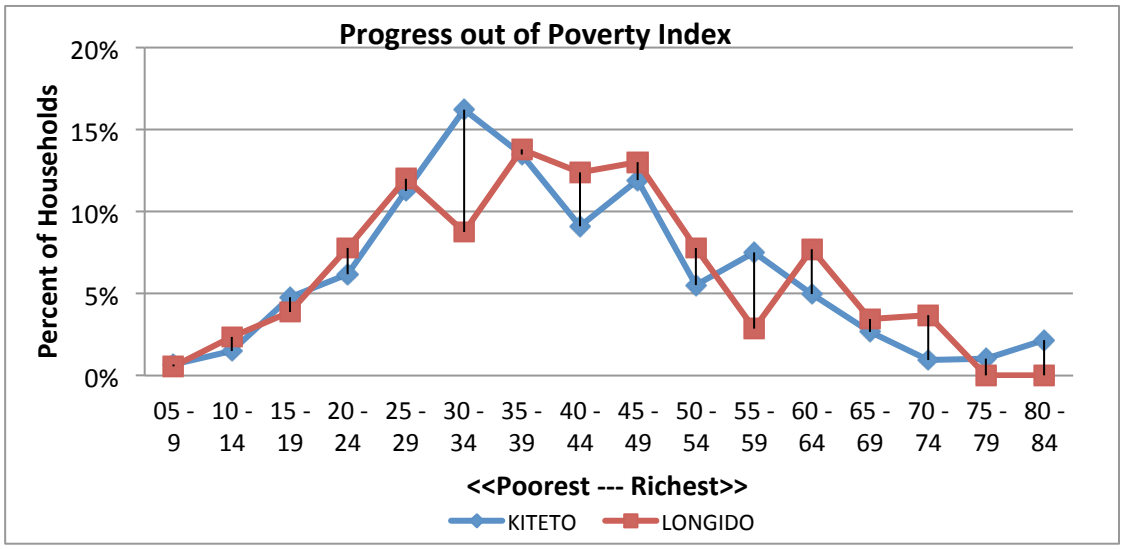


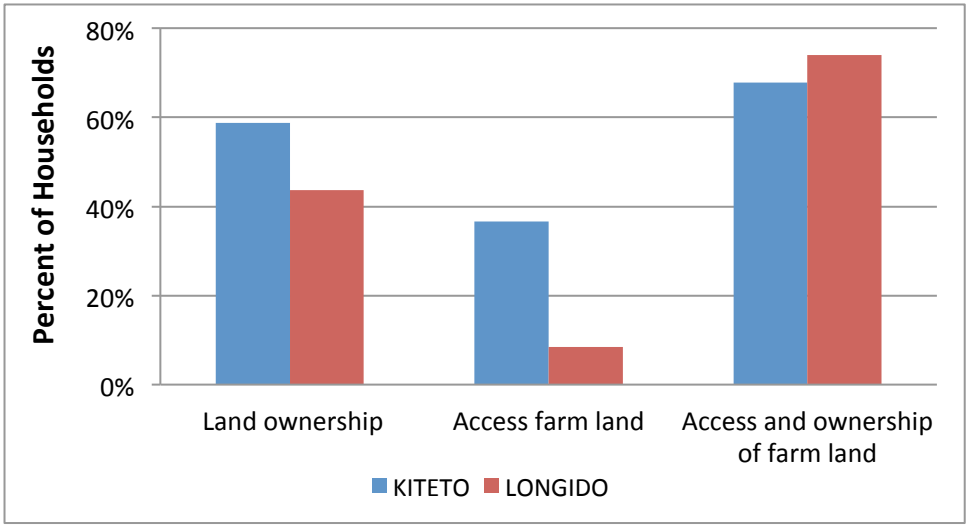
Figure 2. Distributions of households by the progress out of poverty index scorecard and district, CCAFS baseline survey.



Land ownership

The majority of the respondents, almost 70% in the two districts, have access to land through renting and own their land through customary rights (Fig. 3). Also, households interviewed reported to get permission from the Local Government Authority in order to have access to land.

Figure 3. Ownership and access to land in the districts surveyed, CCAFS baseline survey.



Market access

Results in Table 5 show that markets for the agricultural commodities (crop and livestock) and farm inputs (seeds and fertilizer) are located relatively far from the households interviewed. The average distance travelled is 4 km by foot. This may constrain households' ability to have access to the farm inputs and influence the adoption of agricultural innovations.

Table 5. Average distance in kilometers to nearest market, CCAFS baseline survey.

	Kiteto	Longido	Total
Market for Crop Outputs	4.3	1.1	3.1
Livestock Market	4.6	3.5	4.2
Nearest market for farm inputs (seeds, fertilizer)	5.4	3.0	4.6
Nearest Agricultural Officer (for Farm advice)	3.6	4.2	3.8

Key Risks to Agricultural Productivity

In Kiteto and Longido, climate variability and extreme climate events were identified as the key challenges to agricultural productivity by individual households and key informants (Fig. 4). Specifically, drought and pest and diseases were listed as the biggest threats to farmers' livelihood. Almost 40% of the respondents in Longido and 26% of the interviewees in Kiteto have identified drought as their biggest threat. These are also the climate shocks that have affected households over the past 5 years. As a result of drought, many households have lost their cattle because of water and pasture scarcity. Further, depletion and increased pressure over these natural resources have led to some conflicts between pastoralists and peasant farmers as most pastoralists invade crops farms to graze on crops planted mainly pigeon peas. Pest and diseases are largely prevalent in Kiteto as claimed by 38% of respondents compared to Longido where it was reported by 26% of households interviewed. Key informants have also corroborated drought and pest and diseases as major constraints to Agricultural production in Kiteto (Fig. 5). But in Longido, key informants have identified drought as the first major threat to agricultural production and lack of inputs as the second one.

Figure 4. Top five risks that jeopardize livelihood activity according to households, CCAFS baseline survey.

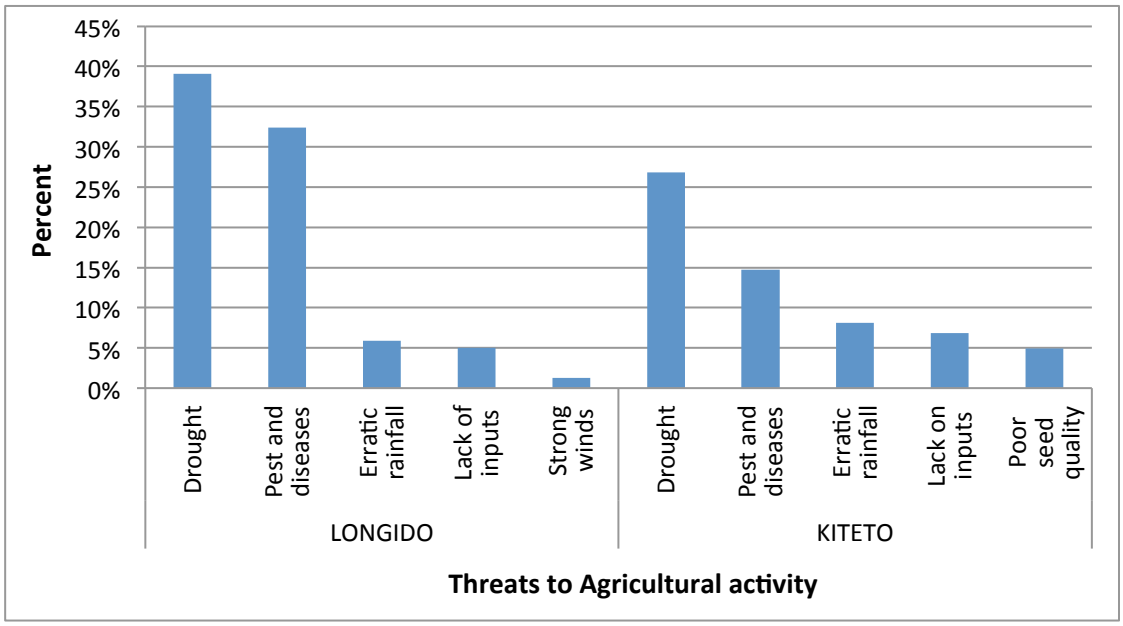
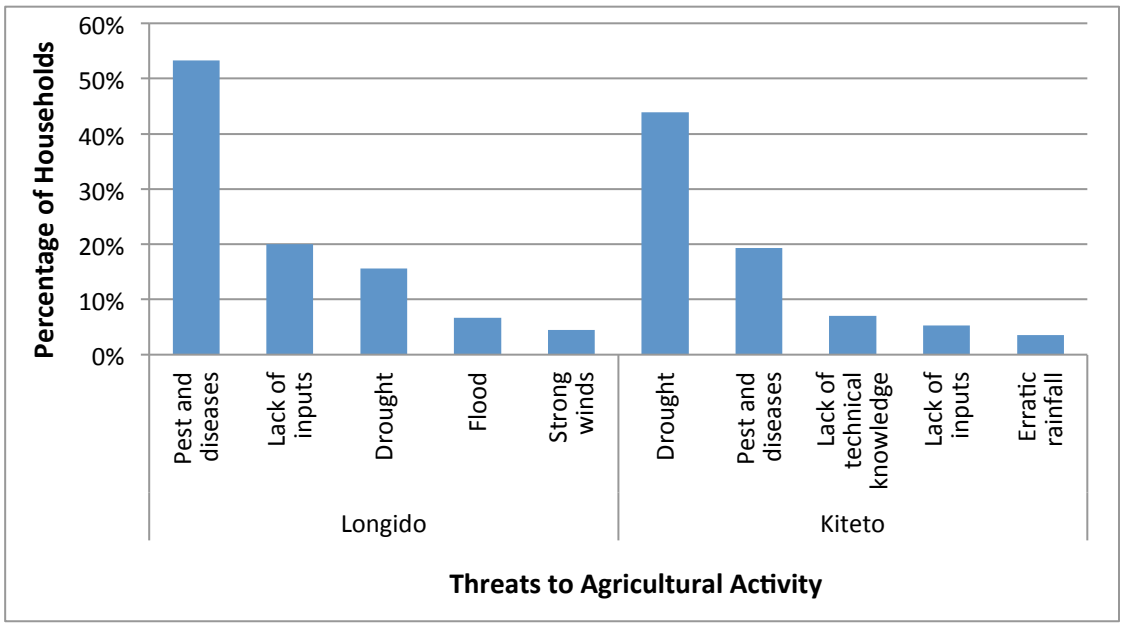


Figure 5. Top five risks that jeopardize livelihood activity according to Key Informant Survey, CCAFS baseline survey.



Climate shocks during the last 5 years

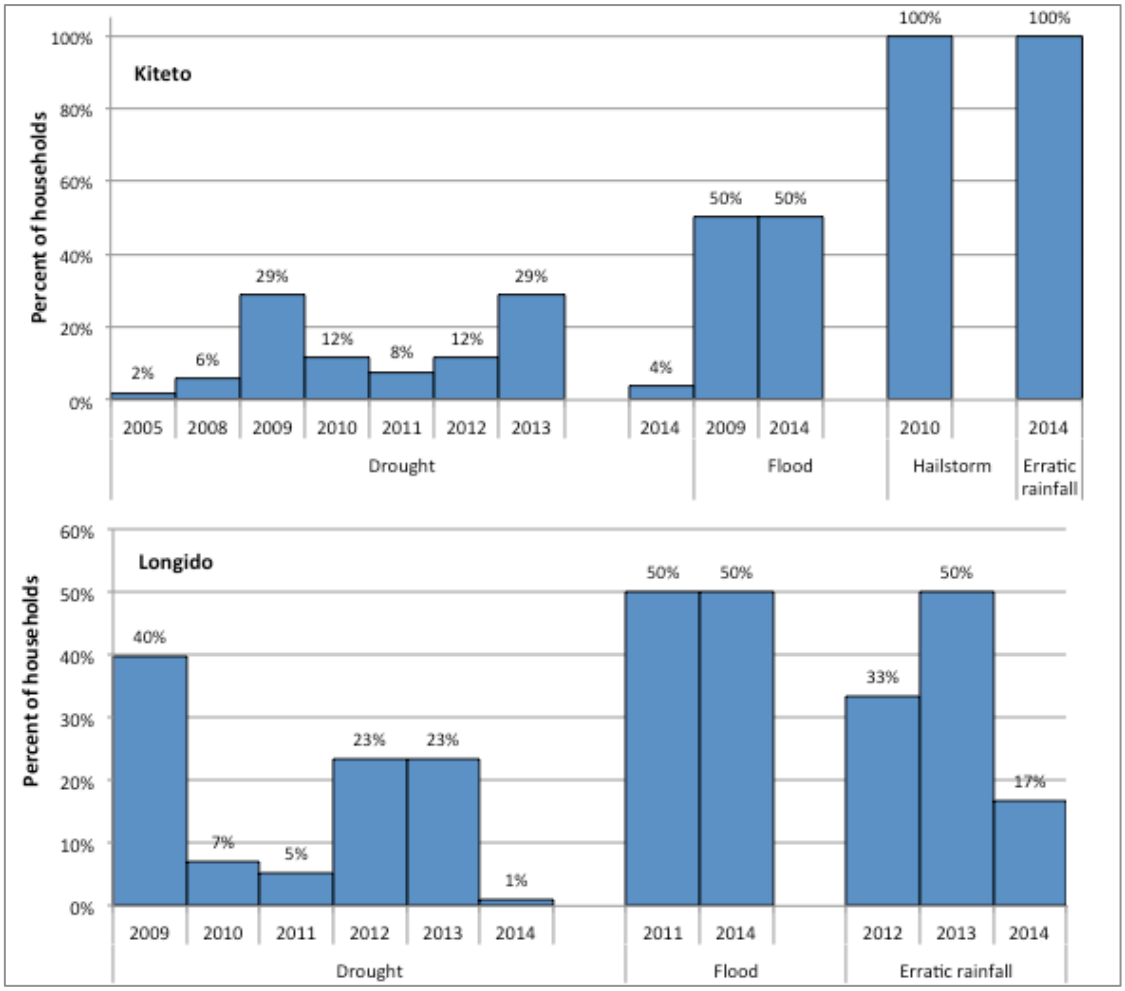
The climate shocks that have affected the households surveyed are drought, erratic rainfall, flood and hailstorms in Kiteto and Longido (Fig. 6). According to the respondents, drought

has been experienced yearly over the last 5 years. A proportion of 29% of the respondents reported drought in 2009 and 2013 in Kiteto. In Longido, 40% of the households interviewed reported drought in 2009 while 23% of the respondents reported this threat in 2013 and 2012.

Impact of the shock

The primary impact of the shocks in Kiteto was a decline in crop yield which often led to a situation of food insecuirty in the household (Fig. 7). In Longido, drought and flood resulted often in the death of animals as reported by 55% to 100% of the respondents. Erratic rainfall led to several impacts including decline in crop yield, crop yield, food insecurity and loss on assets equally reported by 25% of respondents.

Figure 6. Climate shocks that have affected households during the last 5 years, CCAFS baseline survey.



Strategies adopted by households

When the climate shocks struck a given village, 35% to 100% of the households interviewed did not adopt any coping strategy (Fig. 8). This was the case for flood in Longido for which none of the households interviewed were able to cope with it. Those who adopted some coping mechanisms often sold their livestock, borrowed from relatives, were involved in food for work, or migraged to other non-affected areas.

Figure 7. Impact of climate shocks experienced in the last 5 years, CCAFS baseline survey.

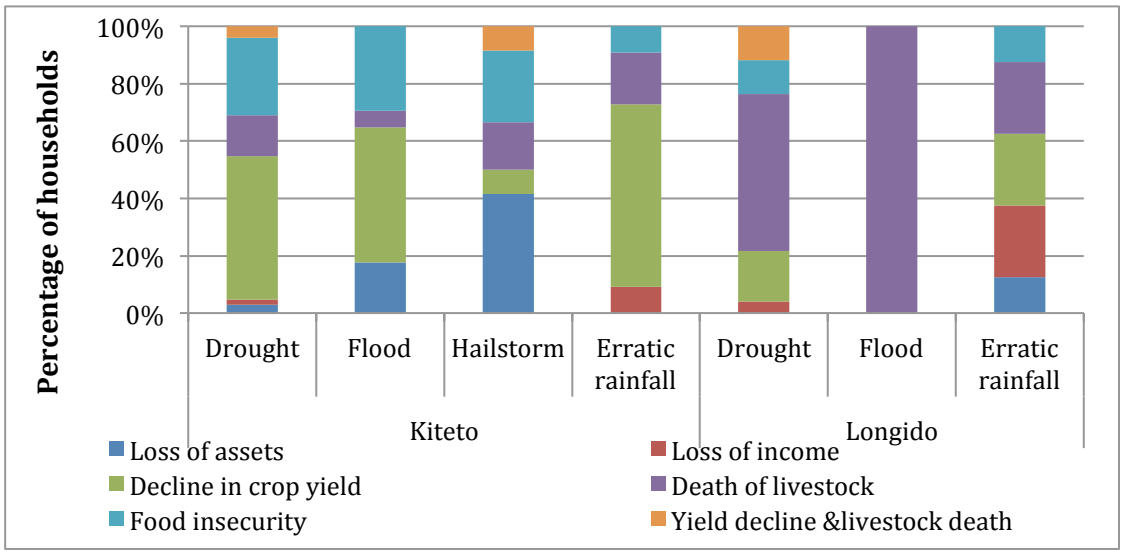
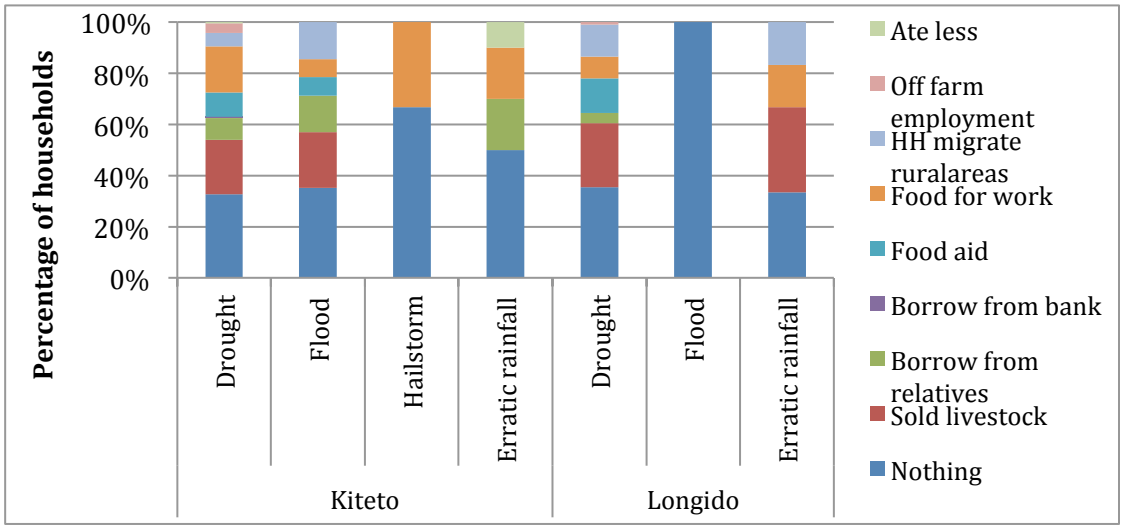


Figure 8. Strategies adopted to cope with the climate shocks, CCAFS baseline survey.



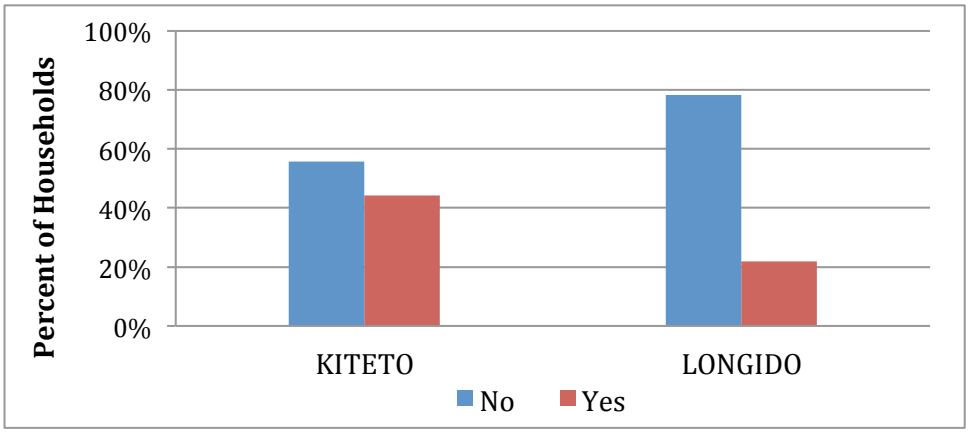
Food Security Status in Surveyed Districts

The most common definition used for food security, "secure access to sufficient food for a healthy life" (Maxwell & Frankenberger 1992), captures the notions of food supply, access, vulnerability and sustainability. It can also be applied at a global, regional, national and local, household level. At the local level, household food insecurity occurs when there is some uncertainty about food availability and access, insufficiency in the amount and kind of food necessary for meeting dietary requirements, or the need to use socially unacceptable ways to acquire food. So, the analysis of households' food security will require understanding the household supply, consumption and ability to cope with insufficient level of food.

Household food supply and consumption

The analysis of the food supply component of food security shows that majority of households interviewed did not produce enough food to meet their food requirement. This was revealed by 56% of the respondents in Kiteto and 78% in Longido (Fig. 9). The same proportions of the interviewees added that food supply has been on a decreasing trend over the years in the two districts (Fig. 10).

Figure 9. Household food supply in Kiteto and Longido in 2013 crop season.



When faced with food shortage, most households interviewed in Kiteto (39%) failed to cope (Fig. 11). Those who adopted some coping strategies preferred to sell their assets particularly livestock as declared by 26% of the respondents in Kiteto and 63% in Longido. Livestock is indeed a major household asset that they use to cope with food insecurity. The other most popular coping mechanism was the purchase of food reported by 23% to 27% of the respondents in the districts. The staple foods consumed in Kiteto and Longido were sorghum

and maize. These foods were consumed almost every day in Kiteto and at least 4 times a week in Longido.

Table 6. Household food consumption pattern in Kiteto and Longido.

Food consumption	Kiteto	Longido
	Average number of days	
Sorghum	5.9	4.8
Maize	6.6	3.8
Cassava	0.7	0.7
Pulses	2.9	2.4
Vegetables	2.9	1.3
Fruits	1.4	1.1
Meat	2.5	1.2
Eggs	0.6	0.1
Fish	0.4	0.6
Milk	3.3	3.2
Sugar	5.0	4.3
Oils	5.5	3.4

Figure 10. Change in food supply over the last year, CCAFS Household Survey 2014.

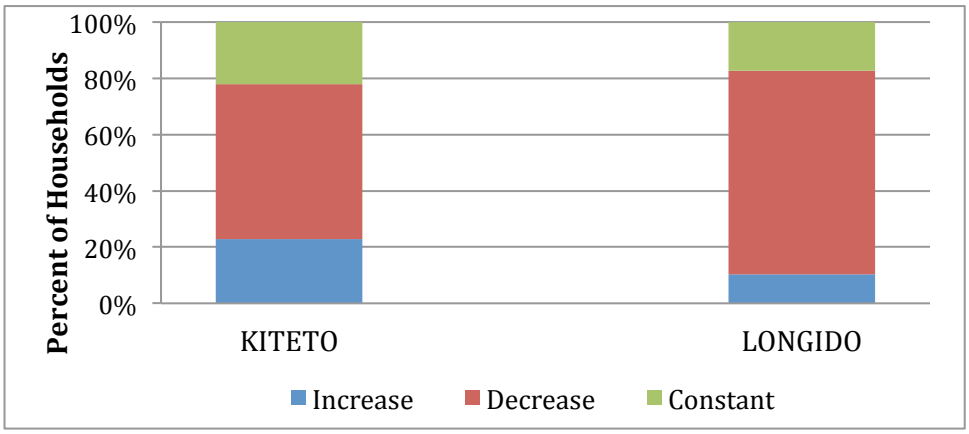
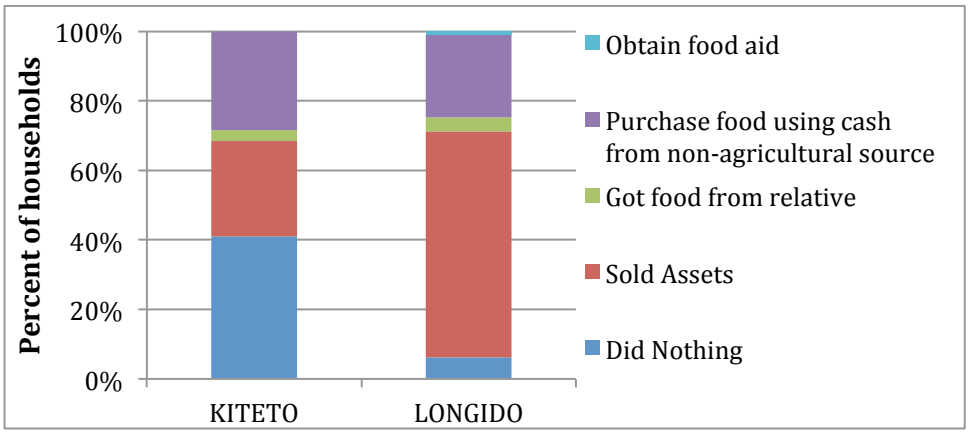


Figure 11. Strategies households adopted to cover the gap in food supply, CCAFS baseline survey.



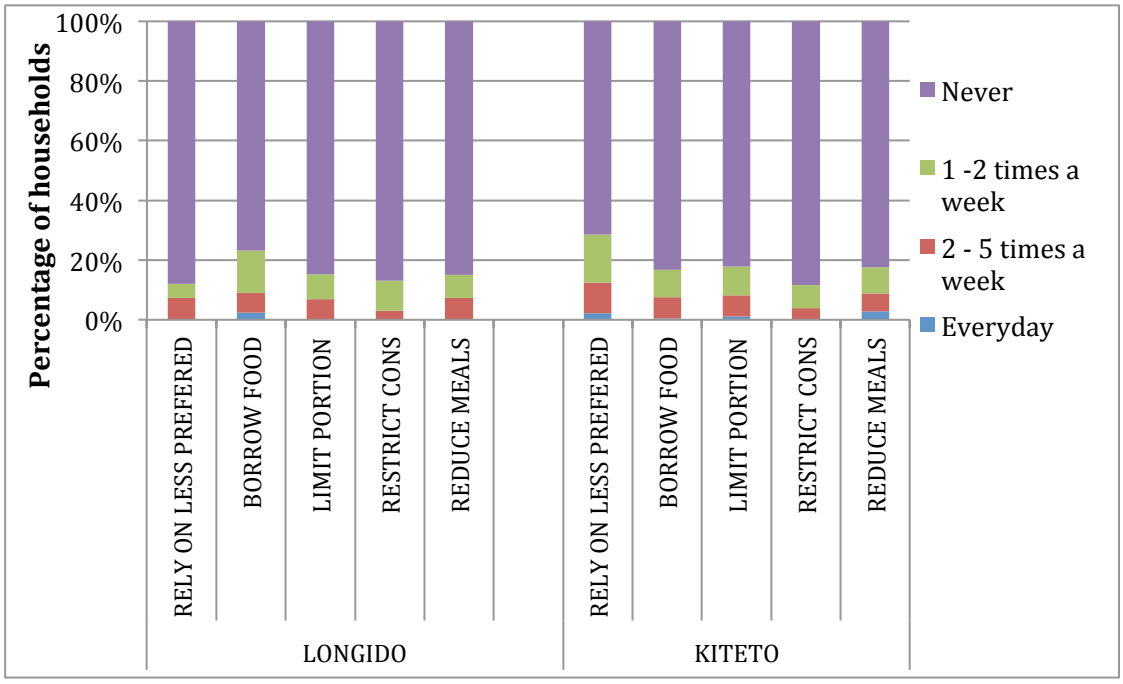
Food security index

Food security is estimated in this study using a set of questions to capture the short-term food sufficiency at the household level following the approach developed in Maxwell (1995). Reliance on a range of short term coping mechanisms to deal with food insufficiency and the frequency ("every day," "never," "one to two times a week," or "3 to 5 times a week") of using a given coping strategy in the past 7 days is measured as indicator of food security at the household level. A scale of 1 to 4 was developed for the frequency of each individual coping strategies with the number 1 assigned to the highest number of times a strategy is used by the household and the 4 to the lowest frequency as follows: 4="never" 3="one or fewer times a week" 2="3 to 5 times a week", 1="every day." So, the higher the number on the scale and the less often a strategy has to be used, indicating higher level of food security. Focusing on short-term food security strategies, Table 7 shows comparable food security index across districts. But reliance on less preferred and reduction of number of meals per day were the most common strategies adopted in Kiteto. In Longido, households rather borrowed food or rely on help from relatives. The frequencies of the short-term food measures are reported in Figure 12.

Table 7. Food Security index of households interviewed in the surveyed districts.

Short-term coping strategies	Kiteto	Longido
1. Rely on less preferred food	3.3	3.7
2. Borrow food or rely on help from relatives	3.6	3.4
3. Limit portion size at meals	3.5	3.6
4. Restrict consumption	3.7	3.8
5. Reduce number of meals	3.4	3.6

Figure 12. Frequency of food shortage coping Strategies undertaken by households, CCAFS baseline survey.



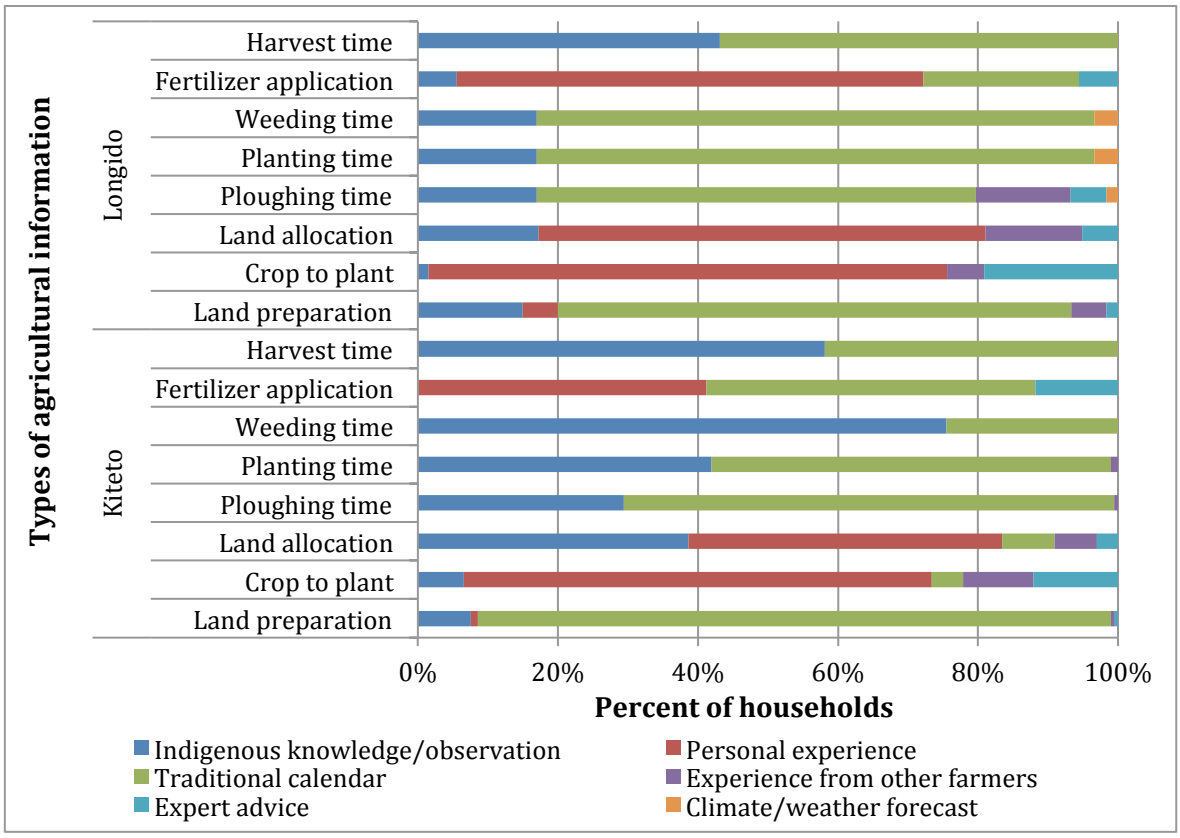
Climate Information Households Currently Receive

Sources of information

In both districts, farm households relied on the same types of information to inform their agricultural decisions (Fig. 13). Land preparation was informed, in more than 70% of the cases, by the traditional calendar. Generally, the months of September to December are used for land preparation. Decisions on the types of crop to plant were primarily based on personal experience. On average 75% of households interviewed used the seeds from the previous season since improved seeds are not always available or plant the crop varieties that are adapted to their climatic conditions. At least 80% of the respondents relied on indigenous

knowledge and personal experience to guide their land allocation decisions. They based their decisions on priority crops i.e. important crops such as maize, and sunflower. Two third of the respondents relied on their traditional calendar (October to December) to know the right time to plough the land. Planting time was informed by traditional cropping calendar (on average 60%) and indigenous knowledge (on average 30%). When guided by their traditional calendar, farmers usually plant in December/January.

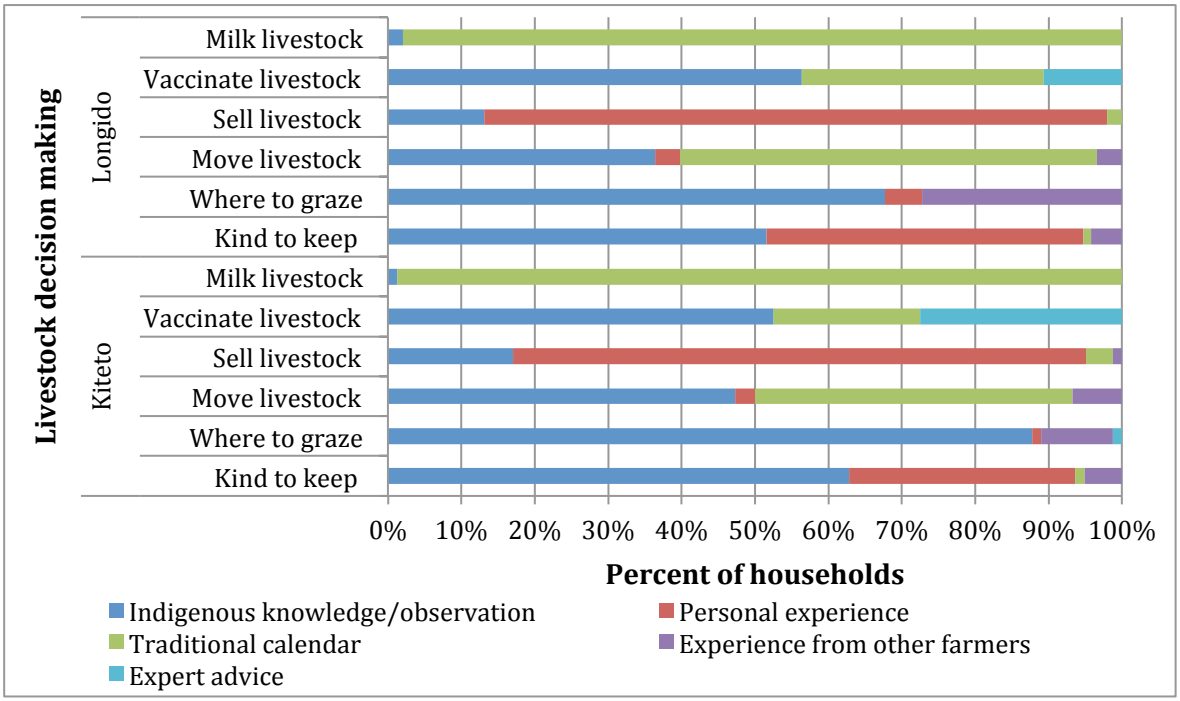
Figure 13. Source of information to inform crop decision making, CCAFS baseline survey.



For the indigenous knowledge, traditional forecasters make use of natural indicators to forecast the climate/weather. These include observation of the colour of clouds (the dark cloud foretells the occurrence of the rain) and the colour of the intestine after slaughtering the animals (the red colour is a sign of upcoming rain). Weeding time and harvest time were also mainly informed by traditional calendar and indigenous knowledge as reported by almost all households interviewed. Farmers observe the emergence and height of weeds and decide when to do weeding to respond to the information generated through observation. Farmers observe the dryness of crops to make the right decision on when to harvest crops. Those who relied on traditional calendar do weeding in February/march and harvest in July and August.

Very few farmers declared applying chemical fertilizer on their fields because of high fertilizer price or farmers' perception that the original soil fertility is sufficient for crop growth. But those who applied fertilizer based their decision equally on personal experience and traditional calendar. From the results presented above, it can be noticed that external meteorology-based climate/weather forecast is not among the common sources of information for the respondents' agricultural decision making.

Figure 14. Source of information to inform livestock decision making, CCAFS baseline survey.



Information received by households

Figure 15 reports households' access to climate information. Respondents have limited access to climate information as less than half of them acknowledged receiving climate information. Moreover, across districts, Longido reported a significantly lower percentage of households who claimed to receive climate forecasts compared to Kiteto. The most common climate information received by farmers and pastoralists in Kiteto and Longido regardless of the gender are forecast of an extreme event and forecast of the onset of the rainfall. Households recollected receiving these types of information certainly because these are information of greatest interest for them. In Kiteto a larger percentage of male household heads (42%) acknowledged receiving these forecasts compared to female household heads (38%). This is

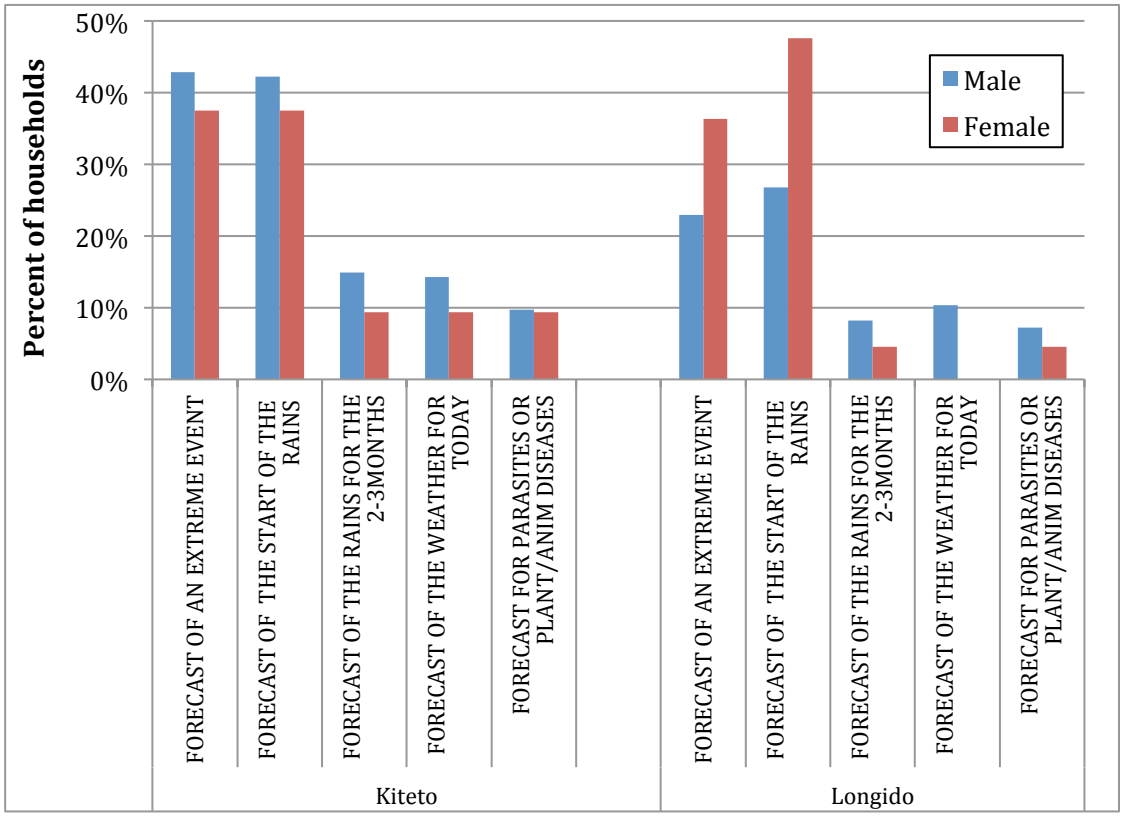
in contrast to Longido where a significantly higher proportion of women, 42% on average relatively to men (on average 25%) reported receiving the information. One possible explanation is that in the pastoralist communities, women often stayed at home and are in charge of the household chores while men lead their cattle to graze in the pastures. Women are therefore more likely to receive the climate information delivered through radio. Forecast of monthly rainfall, daily weather and probability of pest and animal diseases are received by less than 15% of the respondents. Daily weather forecast contrary to expectation has not been frequently reported probably because farmers and herders missed to listen to this information since they have to leave their home early every day for their farming and pastoralism activities.

Current Sources of Information

Figure 16 shows the current sources of climate information identified above and received by the respondents. Radio is the most common source of external climate information in Kiteto and Longido. On average, 65% of the respondents in Kiteto and 45% in Longido declared receiving seasonal forecast for the next 2-3 months, forecast of the start of the rains and forecast of an extreme event on radio. Most respondents (70%) obtained daily weather through radio. Forecast of parasites and animal diseases is the type of climate information least frequently received on radio. Only 10% of the respondents in Longido and 43% in Kiteto declared receiving this information on radio.

Following radio, the second source of climate information varies according to the type of information received. Indigenous knowledge has been reported as the second most important source of climate information on onset of rainfall, forecast of extreme event and probability of pest and diseases. In Kiteto, 15% of the interviewees reported relying on traditional forecast to predict onset of the rains while in Longido 20% and 15% relied on this source to get information on pest and diseases and probability of extreme events, respectively. Television is the second most frequently cited source of information on pest and diseases. A proportion of 13% of the respondents reported to get information on pest and diseases forecasts from this source. Other non-negligible sources of climate information include government extension workers, NGOs, friends and neighbours.

Figure 15. Current climate information received by households, CCAFS baseline survey.



Frequencies

At least half of the households and key informants interviewed agreed that extreme events, onset of the rain were often received seasonally (Fig. 17). Pest and diseases and seasonal rainfall forecast were either received seasonally or monthly. On average 85% of respondents who acknowledged to receive weather forecast for the next 2-3 days got it on a daily basis since this information is serviced every day.

Lead times

The most cited lead-time households and key informants reported receiving climate information was months ahead of the forecasting event; except for daily weather forecasts, which are received days to hours before the event (Fig. 18).

Figure 16. Current sources of climate information received by respondents, CCAFS baseline survey.

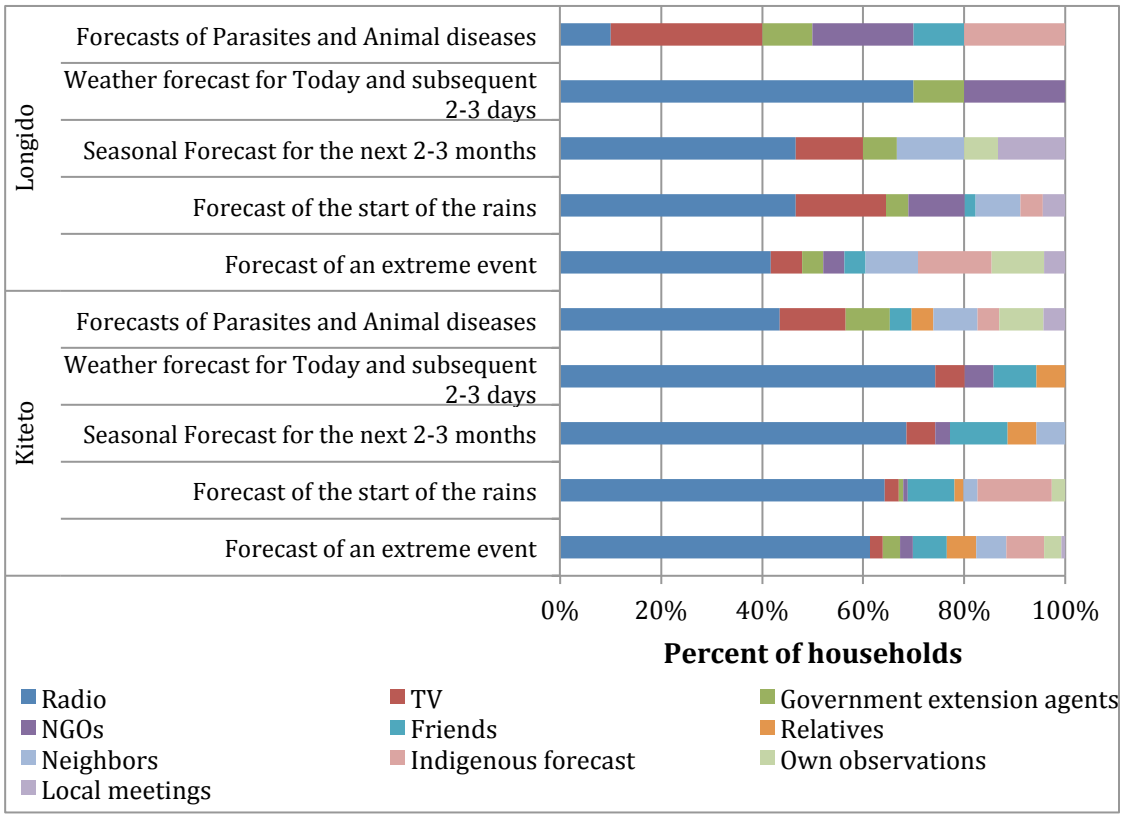


Figure 17. Frequencies of climate information currently received by respondents, CCAFS baseline survey.

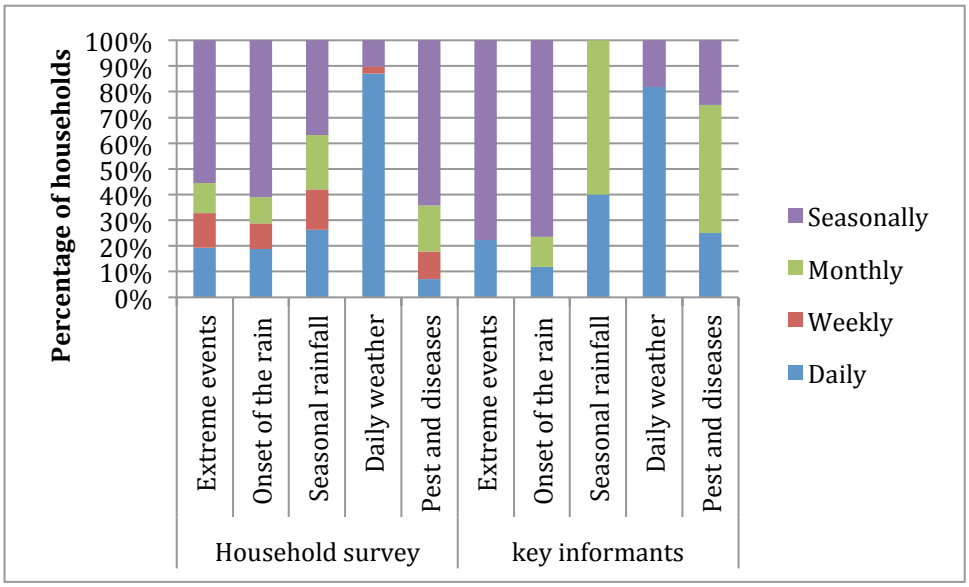
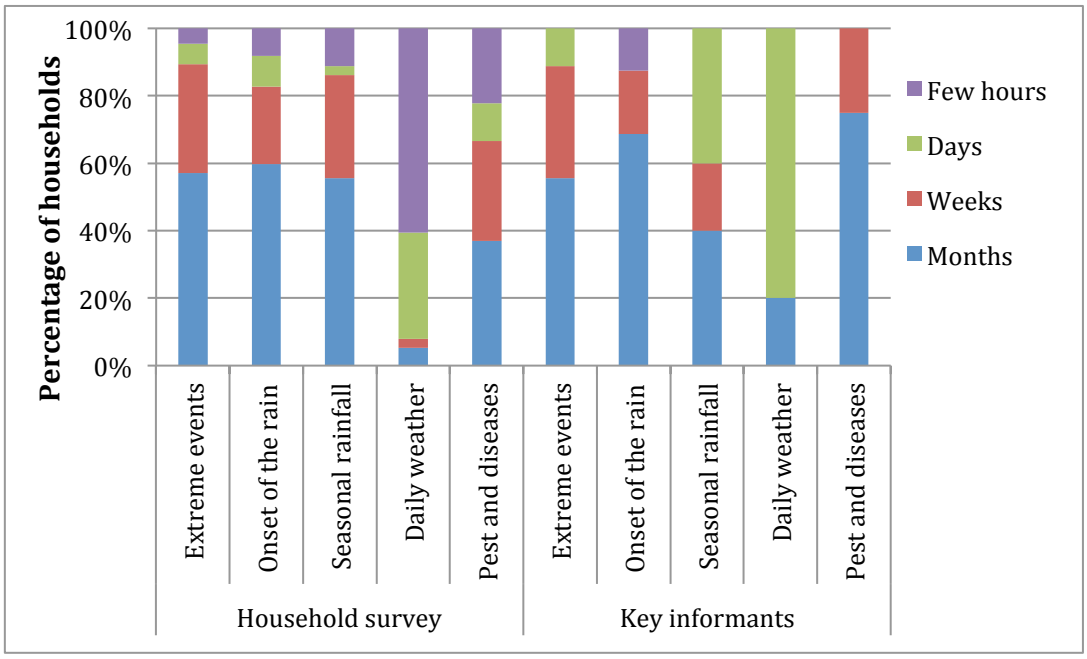


Figure 18. Lead times of climate information currently received by the respondents, CCAFS baseline survey.



Climate information received with advice

Overall, less than half of the households interviewed in Kiteto and Longido who had access to climate information reported that climate information was received with advice (Table 8). Farmers and pastoralists are not generally advised on how to cope with the forecasted climatic condition. The percentage of women claiming this fact is more than that of men except for the forecast on extreme events and onset of rainfall. When climate information is delivered with advice, majority of the respondents (more than 60%) reported to not be able to use the advice with the exception of forecast on onset of rainfall. On average, women are less able to use the advice associated with climate information since they have poor control of agricultural resources (Fig. 19).

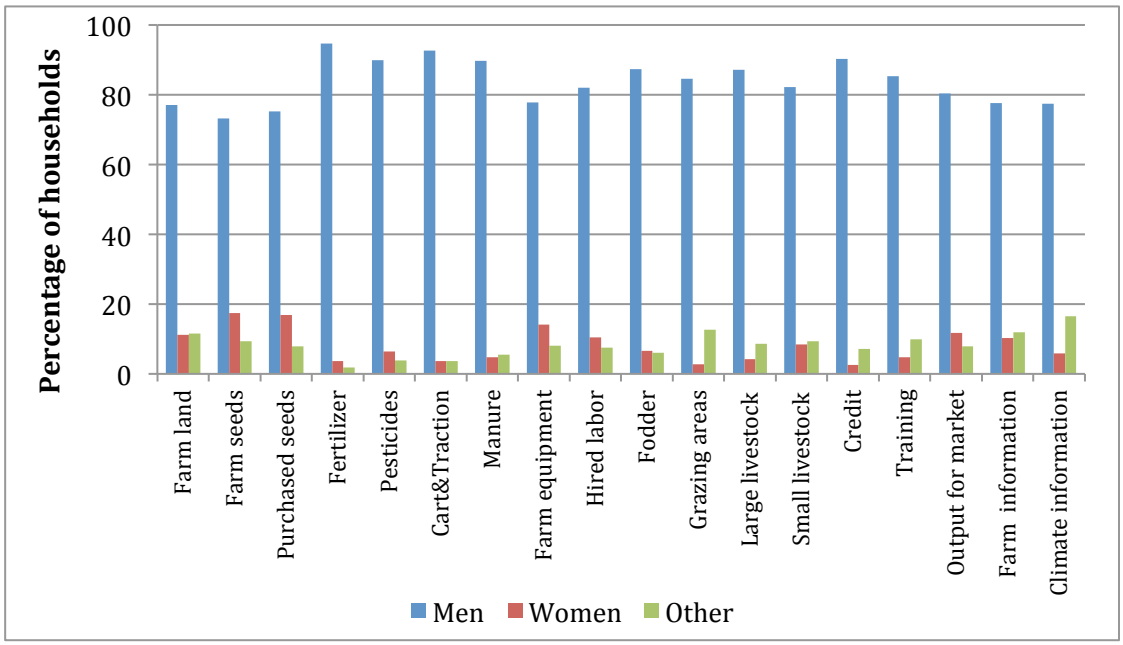
Impact

Over the households who declared receiving scientific climate information, the overwhelming majority attested that the main impact was an improvement in crop yield (see Fig. 20).

Table 8. Information received with advice and ability to use the advice.

		Information received with advice		Ability to use the advice	
		Kiteto	Longido	Kiteto	Longido
Forecast of extreme events	Male	31.00	6.00	33.00	40.00
	Female	*43.00*	*43.00*	*40.00*	*40.00*
Forecast of onset of rainfall	Male	28.00	38.00	58.00	58.00
	Female	*50.00*	*60.00*	*57.00*	*75.00*
Seasonal forecast	Male	25.00	25.00	36.00	20.00
	Female	*20.00*	*0.00*	*33.00*	*0.00*
Daily weather forecast	Male	6.00	0.00	0.00	0.00
	Female	*0.00*	*0.00*	*0.00*	*0.00*
Forecast on pest and diseases	Male	43.00	71.00	63.00	57.00
	Female	*17.00*	*0.00*	*33.00*	*0.00*

Figure 19. Control of agricultural resources within the household, CCAFS baseline survey.



Trend

The trend in scientific climate information has stayed mainly constant in Kiteto and Longido, as declared by respectively 58% and 20% of farmers (Fig. 21). When asked about their attendance of training on climate information, almost all households in the two districts revealed that they did not participate in any training over the past year.

Figure 20. Impact of climate information received, CCAFS baseline survey.

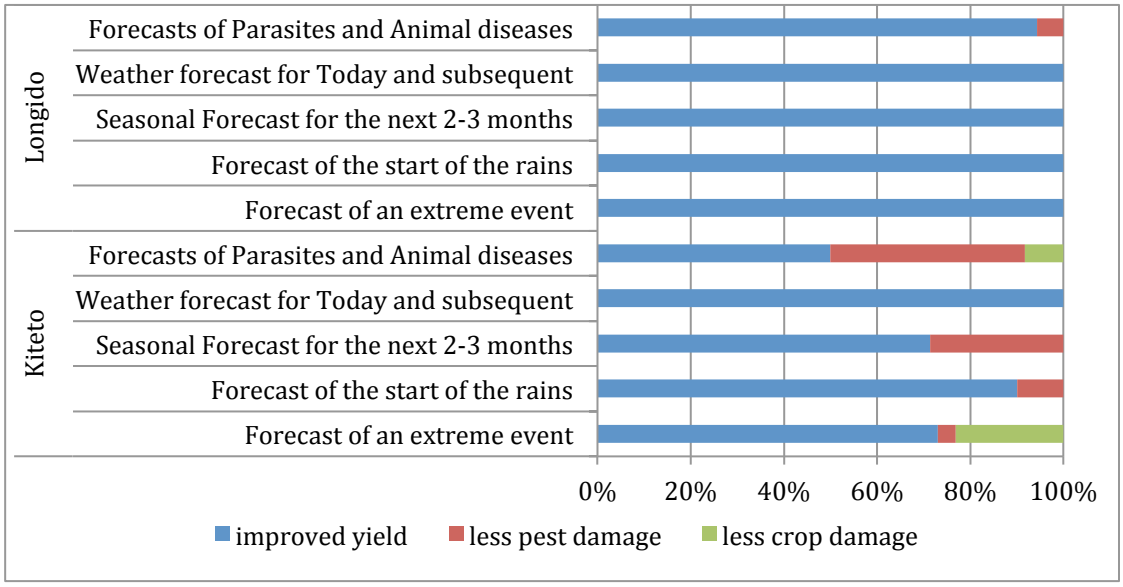
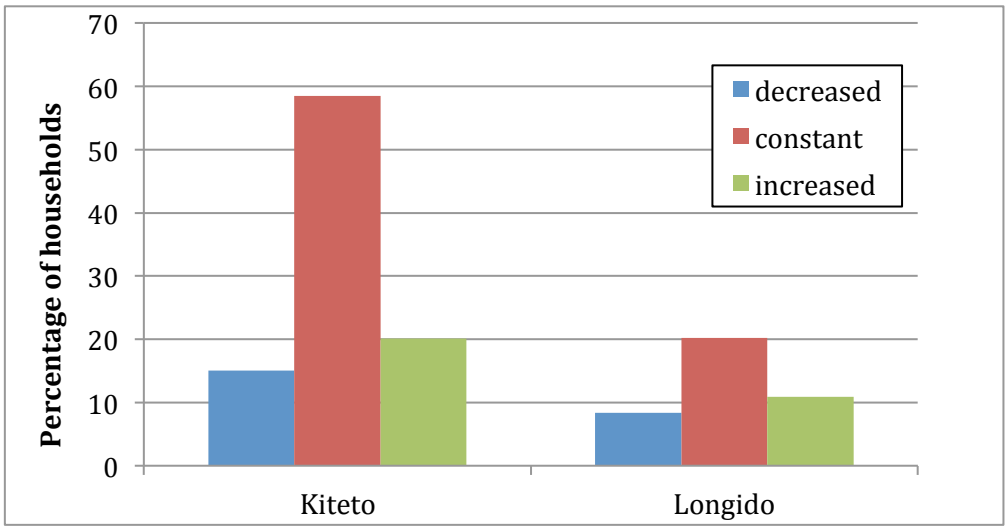


Figure 21. Trend in climate information received over the past year, CCAFS baseline survey.



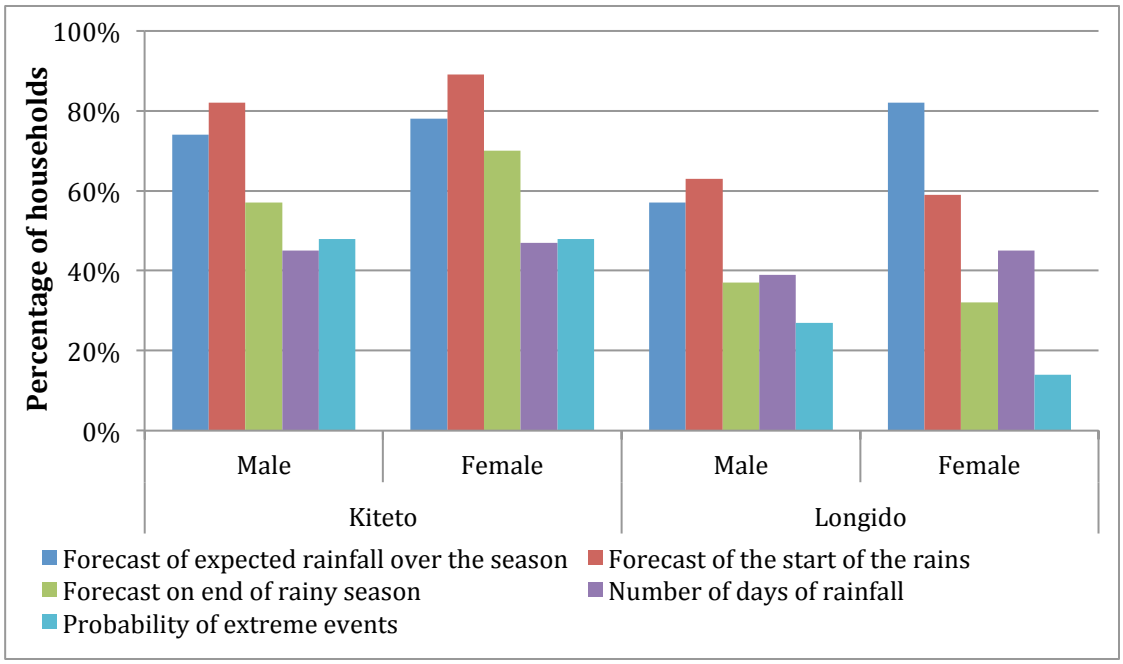
Types of Climate Information that Farmers Want

Types of climate information

The five most important types of climate information desired by farmers interviewed are forecasts of the start of the rains, expected rainfall over the season, end of the rainy season, number of days of rainfall and probability of extreme events (Fig. 22). In Kiteto, men and women have the same ranking of these information. Forecast of the start of the rains and

forecast of expected rainfall over the season are their first and second choices as reported by on average 86% and 76% of the respondents respectively regardless of the gender. In Longido, men and women have different priorities. For women, forecast of expected rainfall over the season is their first priority (82%) followed by forecast of the start of the rains (59%). However the reverse is noticed with men. They ranked forecast of the start of the rains first (63%) and forecast of expected rainfall over the season second (57%).

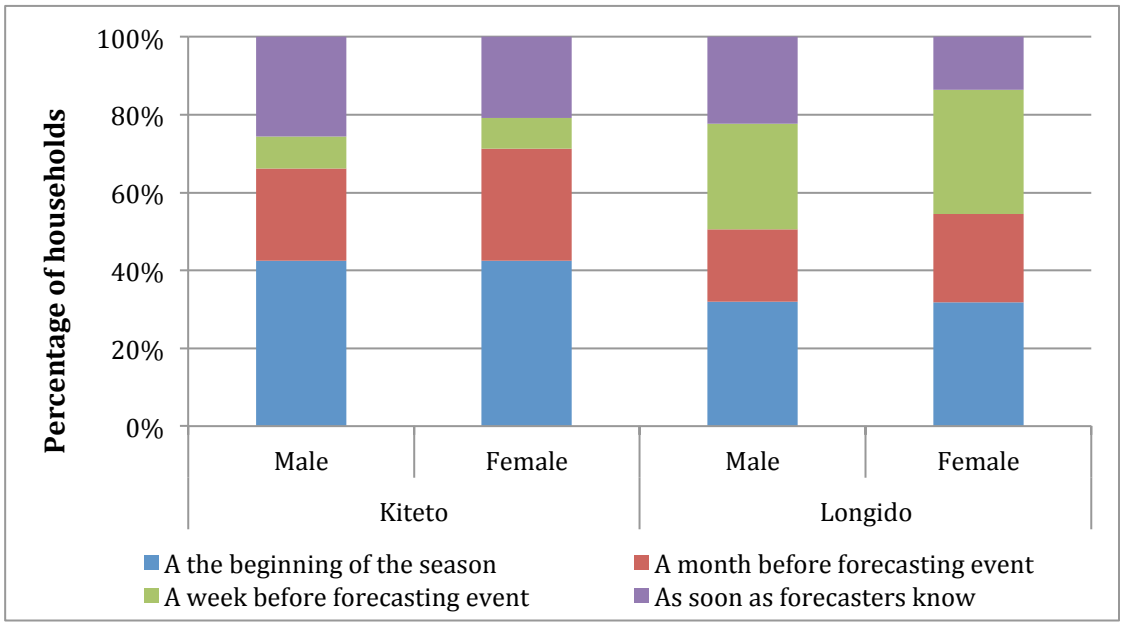
Figure 22. Types of climate information that farmers and pastoralists wish to receive, CCAFS baseline survey.



Lead-time

With regard to the lead-time, "at the beginning of the season" is the most frequently cited time by the same proportion of men and women (32%) in Kiteto (Fig. 23). Then, a "month before forecast events" and "as soon as forecasters know" about the event are the next most cited lead-time by about 20% of the respondents. In Longido, at "the beginning of the season" is the most preferred lead-time by 32% of men and women. Next, "a week before the forecasting event" is their second best as declared by approximately 30% of the households interviewed. "A month before forecasting event" and "as soon as forecasters know" about the event are their last choices.

Figure 23. Lead times farmers and pastoralists wish to receive climate information, CCAFS baseline survey.

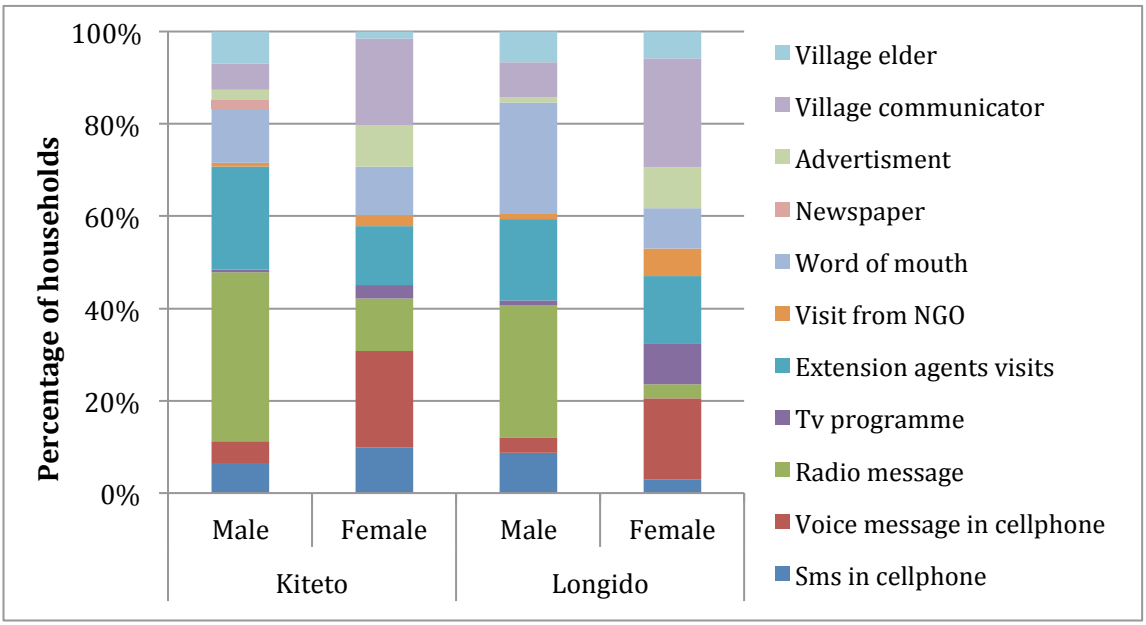


Format

The format under which farmers and pastoralists would like to receive climate information varies significantly across gender surveyed in the same district (Fig. 24). In Kiteto, radio message is the most preferred format selected by 37% of male household heads. Visits from government extension agents (22%) are their next choices. Word of mouth (12%) is the third most preferred format for men. Female household heads on the other hand selected voice message in cell phones (21%) as their first choice. Then follow closely village communicators (19%). Government extension agents' visits ranked third (13%). Other relatively important formats preferred by about 11% of females include radio message, SMS and word of mouth.

Radio message (28%) is also the most preferred format for men interviewed in Longido. Word of mouth (24%) and extension agents' visits (17%) are their second and third preferences. The most preferred formats for female household heads interviewed in Longido are by order of importance village communicator (24%), radio message (18%), and extension agents visits (15%). As it can be noticed in the results above, although the formats preferred varied substantially across gender in a same district, gender preferences are almost identical across districts.

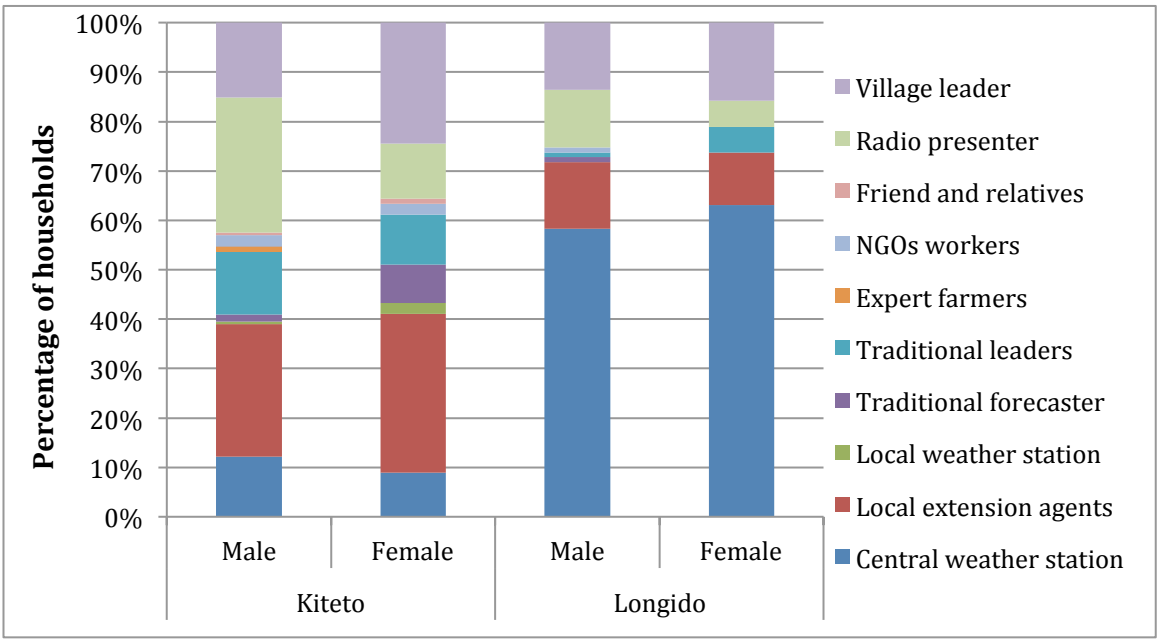
Figure 24. Format preferred to communicate climate information, CCAFS baseline survey.



Messengers

Respondents' preferences for the messengers of climate information are presented in Figure 25. In Kiteto, local extension agents and radio presenters have been equally cited by about 26% of men as their first most preferred messengers. Other cited messengers are village leaders, traditional leaders and central weather station. Female household heads would like to receive climate information first from local extension agents (32%) and second from village leaders (24%). Other messengers cited are radio presenters, traditional leaders and central weather station. In Longido, more than half of men and women (on average 60%) have reported central weather station as their first messengers. Village leaders are their second choice (14% on average) followed by local extension agents (12% on average).

Figure 25. Messengers desired to communicate climate information, CCAFS baseline survey.



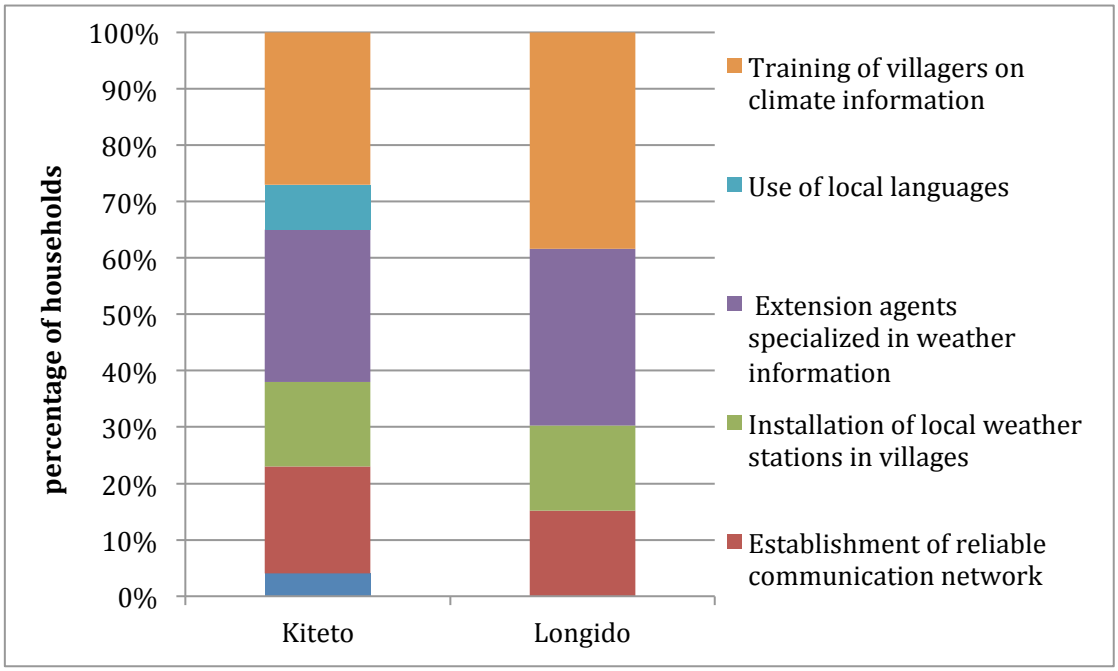
Ways Key Informants Want Climate Communication Improved

In Kiteto and Longido key informants have suggested various ways to improve climate information communication in their communities (Fig. 26). The most common suggestions were training of extension agents as acknowledged by about 30% of respondents in both districts and capacity building of farmers on climate information as reported by 27% of respondents in Kiteto and 38% in Longido. Respondents believe that local extension workers expert in climate information will understand their context of decision making and thereby will be able to communicate climate information with agricultural advice relevant for their farming activities. Building capacity of farmers on climate information will enhance their understanding of the probabilistic nature of climate information and enable them to rely on this information in their decision-making.

Further, establishment of reliable communication network and downscaling climate information through the installation of local weather stations have been suggested by almost 20% of the respondents in each district. Farmers acknowledged that downscaling climate information will ensure the delivery of information useful for their local agricultural activities.

Uses of local languages, brochures and posters have been additionally recommended in Kiteto to improve climate information communication by less than 10% of the respondents.

Figure 26. Ways key informants suggested communicating climate information, CCAFS baseline survey.



Discussion and Conclusion

Households interviewed in Tanzania were a mix of agro-pastoralists and pastoralists. In the districts surveyed, few households acknowledged receiving climate information despite that most of the respondents own the communication assets radio and cell phones. In fact, in some villages surveyed, there is unstable and poor network coverage for radio and cell phones. Farmers and pastoralists rely mostly on their indigenous knowledge and personal experience to inform their crop and livestock decision-making. Scientific climate information mostly received, rainfall onset and forecast on extreme events, are often perceived as unreliable because the experts' forecasts do not unfold as predicted. As a result, they hardly trust these forecasts. Another likely reason is that as the demographic results have stressed out most of the respondents in Kiteto and Longido have no or only primary school education. Hence, scientific probabilistic forecast and the uncertainty concept may not be comprehended very clearly for them to rely on this information in their decision-making. Furthermore, climate

information disseminated is barely associated with advice, which constrains the usefulness of the information. In general, women are less able to act on the advice provided because of their lower ability to control production resources.

Farmers and pastoralists' needs of climate information are the same across gender but ranked differently for men and women. Forecast of the start of the rains and forecast of expected rainfall over the season are the greatest interests of the respondents with the former being preferred by men and the latter by women. Forecast on the onset of rain, information most desired by respondents, is sourced both from external source radio and from indigenous forecasters. Indigenous providers are very familiar to the respondents and deliver information specific to their communities. Therefore, farmers and pastoralists will integrate the scientific climate information delivered from radio in their decision making if this information is complementary to the indigenous forecast or add more value to this latter information.

Format desired to communicate climate information varies across gender as well. Men generally preferred radio while women desire voice message in cell phones and village communicators. Women ownership of cell phone is higher than radio. Also, village authorities generally receive information from extension agents and communicate the information to farmers through village assembly. This format has advantage over other formats as it facilitates the delivery of information to a large proportion of farmers and livestock keepers in rural communities and do not require ownership or access to communication assets (radio, cell phone, TV). Respondents regardless of the gender want the information to be timely in order to incorporate it in their crop and herd management. They want to receive the information at the beginning of the season or several weeks before the event.

Men and women have also slightly different preferred messengers. Men preferred messengers are radio presenters and local extension agents. Women preferred to receive the information through local extension agents and village leaders. Receiving information from these messengers is not constrained by ownership of communication assets and will therefore be of advantage for women.

Here are some of the key insights and recommendations that can be derived from this analysis to inform the design of partners' interventions: First, it is essential to integrate indigenous

knowledge to scientific climate forecast to enhance relevance of climate information for local communities. Second, good radio channel coverage is critical for the delivery of climate information as most households have access to climate information through radio. Third, using cell phones messages and relying on village leaders are important means to reach women with climate information. Fourth, good training of government extension agents in understanding climate forecast and relying on these agents to deliver the information will be critical to communicate climate information to farmers, especially for women. Fifth, getting timely and accurate climate services is essential for these services to be useful to farmers and pastoralists agricultural decision-making. Finally, downscaling climate information to be location specific will make the service more relevant and credible for farmers.

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