



The Impacts of Climate Change on Food Security and Livelihoods in Karamoja



RESEARCH PROGRAM ON
Climate Change,
agriculture and
Food Security



The Impacts of Climate Change

on Food Security and Livelihoods in Karamoja



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Acronyms

CARE	Cooperative for Assistance & Relief Everywhere
CCA	Climate Change Adaptation
CDKN	Climate & Development Knowledge Network
CISs	Climate Information Services
DRR	Disaster Risk Reduction
FEWS NET	Famine & Early Warning Systems Network
FGDs	Focus Group Discussions
IPCC	Intergovernmental Panel on Climate Change
JJA	June, July, August
MAM	March, April, May
NOAA	National Oceanic & Atmospheric Administration
OPM	Office of the Prime Minister
SACCO	Savings & Credit Cooperative Organizations
SON	September, October, November
UNFCC	United Nations Framework Convention on Climate Change
WFP	World Food Programme

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Executive Summary

Karamoja's population is highly dependent on subsistence agriculture, which is sensitive to climate conditions, making agriculture one of the most vulnerable sectors to the impacts of climate change. As a result, the region suffers chronic food insecurity due to the combined impacts of high levels of poverty, low human development and unfavourable climatic and weather conditions.

However, little is known about the impacts of climate change on household food security, and in particular, the ability of households to adapt to

climate change over time. This has resulted in gaps in food security and resilience programming.

The objective of this study is therefore to contribute to, and facilitate, efforts in mainstreaming climate change adaptation into broader resilience programming initiatives and to identify appropriate adaptation policies and programmes that support the most vulnerable and food insecure communities in the Karamoja region.



Key Findings

Climate Analysis

Increasing Rainfall and Variability

Average monthly rainfall in Karamoja has increased over the last 35 years. However, the variability of monthly rainfall over the same period has also increased. This increase in variability will likely perpetuate the historic trend of unpredictable and unreliable rain, leading to an increase in the frequency of periods of low/no rainfall and heavy rainfall events. With low efforts in climate change adaptation (CCA) in the region, increased rainfall variability will have a detrimental impact upon agricultural production, exacerbating the already elevated levels of food insecurity in the region.

Changing Seasonality

There is evidence of an emerging late rainfall phase in Karamoja as a result of increased rainfall during September, October and November. This extension of rainfall into the latter part of the year has the potential to lengthen the growing season in Karamoja, which could be beneficial for agricultural production in the region, if capitalized upon.

Increasing Temperatures

Average monthly temperatures in Karamoja have increased over the last 35 years. Rising temperatures will impact households directly through the increased frequency, intensity and duration of heat waves and reduced water availability. Rising temperatures will also detrimentally impact agricultural and livestock production in the region, exacerbating food insecurity.

Average monthly rainfall and temperature in Karamoja has increased over the last 35 years.

There is however a corresponding increase in rainfall variability over the same period.

Increasing rainfall during the September, October, November period could potentially extend the growing season in Karamoja.

Household Level Analysis

Climate Shocks and Coping

Nearly three-quarters of respondents cited droughts/prolonged dry spells as a climate shock that had significantly affected their households in the last five years. Begging/borrowing and income generating activities such as the sale of local brew and charcoal/firewood production were common coping strategies undertaken by households. The sale of assets, particularly livestock, was most frequently employed in order to cope with droughts/prolonged dry spells.

These findings fit the climate analysis findings of a more erratic rainfall system and increasing temperatures, demonstrating the impact that climate shocks have upon agricultural production, incomes and livelihoods in Karamoja.

Perceptions of Climate Change

Nearly two-thirds of respondents in Karamoja have not perceived any changes in climate or were unsure if climate change had occurred over their lifetime. Of the respondents who reported observing changes in climate patterns, the most frequently noticed change was the increase in the number of hot days. This finding fits the climate analysis findings of increasing temperatures in the region.

Half of respondents do not think that the climate will continue to change over their lifetime. Given that climate change is impacting households in Karamoja, this suggests low levels of preparedness among households for future climate related shocks. Of the respondents who think that the climate will continue to change, reduced agricultural productivity is the most anticipated future impact of climate change.

Access to and Utilization of Climate Information Services

Access to climate information services (CISs) is low across Karamoja. However, when received, utilisation of such information is high. Access to and utilisation of seasonal climate forecasts is higher for the March, April, May period compared to the September, October, November period, suggesting there are no systematic efforts to promote agriculture in the emerging late rainfall phase.

Own knowledge and indigenous information systems (elders/traditional forecasters and community meetings) were regarded as important sources of CISs. Community meetings were also regarded as important sources of information and were suggested in the focus group discussions as an entry point for the dissemination of CISs, which would provide an excellent form of participatory information dissemination.

Respondents who received CISs, particularly related to production and management, were more likely to make adaptation changes.

Droughts/prolonged dry spells were the most common climatic shock in the last five years.

Nearly two-thirds of respondents have not perceived any changes in climate, and half of respondents do not think the climate will continue to change over their lifetime.

Own knowledge and indigenous information systems are the most common sources of climate information services.

Charcoal/firewood production is recognised by communities to degrade the environment however they have no alternatives.

Receiving climate information services and being a member of a formal/informal group were positively associated with households' ability to adapt to climate change.

Executive Summary

Adaptation to Climate Change

Three-quarters of respondents have not made efforts to adapt to the impacts of climate change. The main reason for not taking adaptation measures was not knowing how to. Respondents who do not make changes place themselves and their households at an increased risk to the impacts of climate change and food insecurity.

Tree planting is the most popular adaptation measure made. However, the sale of charcoal/firewood is a frequently employed strategy to cope with climate shocks and is recognised by communities to degrade the environment - however they have no alternatives.

Deforestation results in environmental degradation which worsens the impacts of future climate shocks, thereby increasing the likelihood of households having to practice charcoal/firewood production.

Over two-thirds of respondents do not belong to a formal/informal group in their village. This widespread low level of membership has a detrimental impact upon CCA at the local level in Karamoja, as respondents who were members of a formal/informal group in their village were more likely to make adaptation changes, improving their coping capacity.

Gender Analysis

Climate Shocks and Coping

- There was no significant difference in the percentage of female compared to male headed households that reported being impacted by the enumerated climate shocks in the last five years;
- There was no significant difference in the percentage of female compared to male headed households that sold assets in order to cope with climate shocks. However, it was noted that female headed households generally owned fewer assets, particularly livestock (the most frequently sold asset).

Perceptions of Climate Change

- Female household heads were less likely to have noticed changes in climate/weather patterns over their lifetimes and were more likely to not know/be unsure if they had noticed changes;
- There was no significant difference in the percentage of female compared to male headed households and their perception of the likelihood of future climate change.

Access to and Utilization of Climate Information Services

- There was no significant difference in the percentage of female compared to male headed households that had access to CISs. However it was noted that female headed households were considerably less likely to own radios, which were one of the most popular sources of information;
- Female headed households were less likely to have sourced CISs from indigenous information systems and NGOs. However they were more likely to have sourced CISs from government extension workers.
- Female headed households were less likely to have utilized seasonal climate forecasts and post harvest management information.

Adaptation to Climate Change

- There was no significant difference in the percentage of female compared to male headed households that have made CCA measures;
- Female heads of households were however less likely to be members of formal/informal groups in their village.

Recommendations

Encourage Water Harvesting and Conservation Schemes

Erratic rainfall has historically been a major factor inhibiting agricultural production in Karamoja and the trend of increasing rainfall variance and temperatures further threatens water security in the region. Therefore, there is a need for multi-stakeholder investment in water harvesting and conservation solutions if food availability is to be stabilised in the region in the medium to long-term.

Sensitize Households to the Threat Posed by Climate Change

Across Karamoja there is a lack of awareness and knowledge about climate change and its impacts. The inability to recognise climate change will reduce the likelihood of adaptive measures being made. Efforts are therefore required to sensitize households in order to strengthen awareness and spur adaptation. Furthermore, it is necessary to educate households on the most appropriate changes they can make to adapt to the impacts of climate change to increase their resilience.

Improve Access to Climate Information Services

Low access to CISs detrimentally affects the ability of households to make informed decisions on how to capitalise upon or prepare for future conditions, increasing their vulnerability to climate shocks and food insecurity. Should access to CISs be improved, findings suggest great potential given the high rates of information utilisation and sharing.

Synergise Dissemination of Climate Information Services with Existing Information Systems

The heavy reliance upon own knowledge and indigenous information systems (elders/traditional forecasters and community meetings) for climate and agriculture related information represents an opportunity to integrate information dissemination efforts with these existing local sources, e.g. encouraging the use of the emerging late rainfall phase for crop production. Additionally, any incorrect or inaccurate information being perpetuated through these sources can be dispelled.

Mainstream Gender in Climate Change Related Interventions

There is a need to focus climate change sensitisation efforts on female headed households as they were less likely to have noticed changes in climate/weather patterns. Additionally, female household access to CISs through indigenous information systems and NGOs must be improved as they were considerably less likely to receive information from these popular information sources. Finally, there must be a focus upon improving membership of women in formal/informal groups in their villages.

Executive Summary

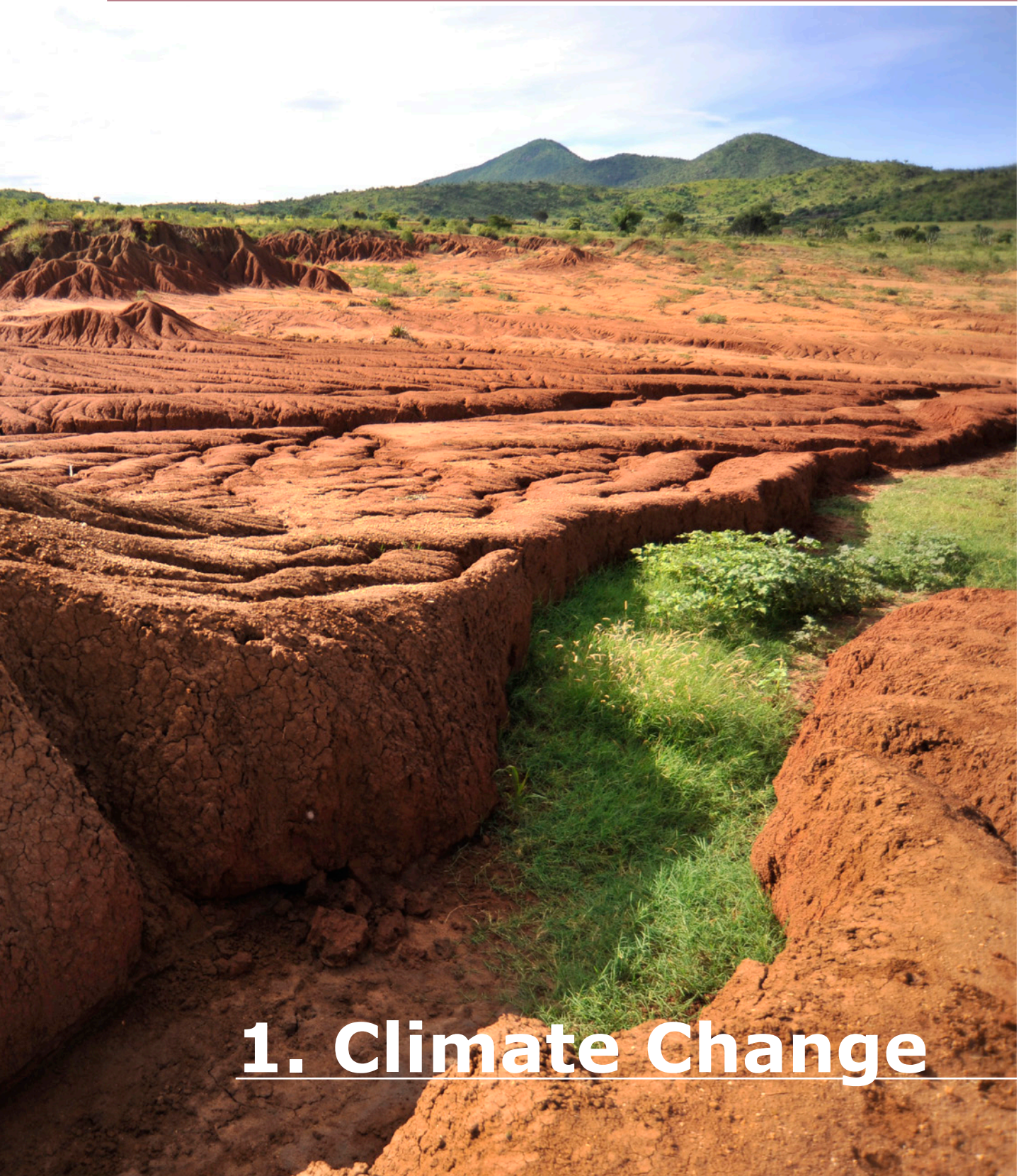
Encourage Agro-forestry Schemes

Appropriate agro-forestry schemes have the potential to reduce food insecurity in the region. Such schemes will diversify livelihoods, providing an alternative source of income and reducing the pressure on natural stands for charcoal/firewood. Additionally, this will reduce environmental degradation in the region, thereby buffering the impact of climate shocks and strengthening food insecurity.

Increase Membership to Formal and Informal Village Groups

Over half of respondents are not members of a group. The main reasons for non-membership are the inability to meet requirements and the lack of available groups. Therefore, efforts to increase membership should focus upon knowledge and skills capacity building and/or technical assistance and group creation.





1. Climate Change

1. Climate Change

1.1. Impacts of Climate Change on Food Security

The United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as:

"A change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods"¹.

The main cause of recent climate change is the release of greenhouse gases, particularly carbon dioxide, into the atmosphere as a result of human activities such as fossil fuel combustion and land use change. Pre-industrial (circa. 1750) atmospheric carbon dioxide concentrations measured 277 parts per million and have risen significantly since, exceeding 400 parts per million in 2015² – unprecedented since records began.

Greenhouse gases released by human activities trap outgoing infrared radiation within the Earth's atmosphere, enhancing the natural greenhouse effect and resulting in anthropogenically induced global warming. This increase in temperature leads to other observable effects on the climate system, such as more frequent, intense and protracted extreme weather events, with increasingly detrimental impacts upon societies³.

Climate change has the potential to increase food insecurity. Existing threats to food security and livelihoods will be exacerbated by climate change due to a combination of factors that include; the increasing frequency and intensity of climate hazards, diminishing agricultural yields and reduced production, rising sanitation and health risks, increasing water scarcity, and intensifying conflicts over scarce resources. These impacts of climate change on food insecurity will lead to new humanitarian crises as well as increasing displacement⁴.

Regions already vulnerable to food insecurity and societies that depend on natural resources or practice climate sensitive activities – such as rain fed agriculture – will be particularly vulnerable to the impacts of climate change and at an increased risk of food insecurity as a result.

Owing to an increase in extreme weather events and variability of weather patterns, climate change is expected to negatively affect food security outcomes, potentially affecting all four dimensions of food security as shown in **Figure 1**:

1 UNFCCC, 1992
2 NOAA, 2015
3 IPCC, 2013

4 IPCC, 2007

1. Climate Change

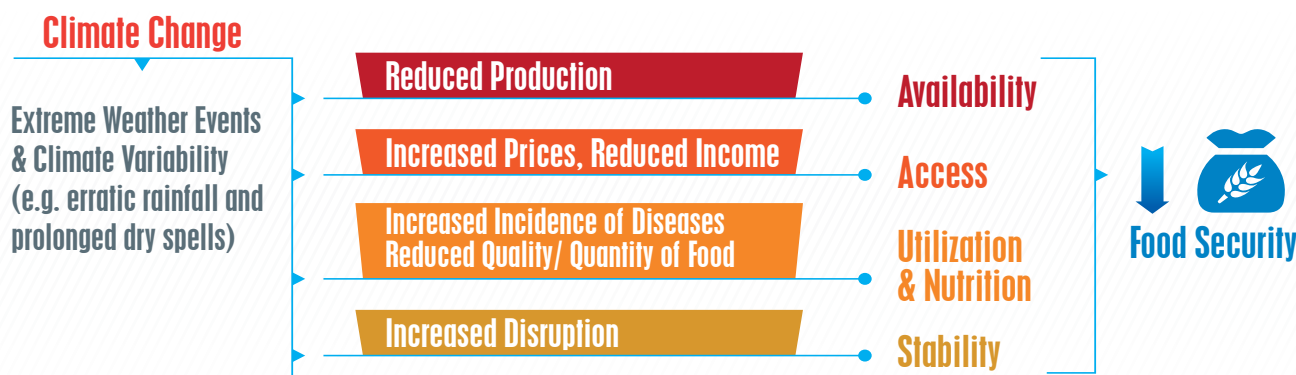


Figure 1: Impact of climate change on the four dimensions of food security.

Availability:

Climate change will reduce agricultural production, through environmental degradation, changing agro-ecological conditions and shifting growing seasons. Changes in rainfall and higher temperatures will also affect crop productivity, reducing food availability.

Access:

Food prices will increase as a result of reduced production, reducing access to food.

For the most vulnerable, reduced agricultural production will also mean lower income. Under these conditions, the poorest – who already use most of their incomes on food – will have to sacrifice additional income to meet their nutritional requirements.

Utilisation:

Climate change is expected to increase the incidence of diseases, therefore affecting utilisation of food, particularly among children. Moreover, reducing agricultural production means that the most vulnerable households will have less food available, increasing the risk of malnutrition.

Stability:

Extreme weather events disrupt the stability of food production and access as well as people's livelihoods.

1. Climate Change

1.2. Gender and Climate Change

The impacts of climate change will be distributed differently among different regions, generations, age classes, occupations, income groups and genders⁵. Women represent 70% of the poor throughout the world and the effects of climate change will fall disproportionately upon this social category. Most of the key areas of the negative consequences of climate change are therefore strongly connected to gender equality issues⁶.

The vulnerability of men and women to climate change and food insecurity is not the same. Men and women play different roles in household livelihoods; therefore they experience the impacts of climate change differently. Furthermore, men and women have differing abilities to respond to the threat that climate change poses to their lives and livelihoods. As a result it is often women who are at a disadvantage when it comes to CCA, increasing their vulnerability to food insecurity⁷.

For instance, in Karamoja, women are often acknowledged as owners of crops, but not land. The role of women in ensuring household food security and their dependence upon climate sensitive activities and natural resources to do this reinforces their vulnerability to climate related disasters⁸.

Additionally, the uncertainty of the tenure of land by women results in lower investment and environmental degradation, compromising future production potential and increasing food insecurity. Women also often lack access to adequate and timely climate information and other inputs, which has implications for agricultural productivity⁹. A reduction in agricultural production reduces women's potential income, and the availability of food for household consumption, resulting in undernutrition.

Effective, equitable adaptation therefore requires an understanding of the dynamics of vulnerability and the influence of gender upon these dynamics.

5 IPCC, 2001

6 Röhr

7 Dazé, 2011

8 Neumayer and Pluemper, 2007

9 Antwi, 2013

1.3. Climate Change in Uganda

Since 1980 temperatures have increased by up to 1.5°C across much of Uganda and over the next 50 years average temperatures are expected to rise by a further 2°C¹⁰. Changes in rainfall patterns and amounts are also expected but these are less certain than changes in temperature. Generally, rainfall is expected to become more unpredictable, unreliable and intense. Climate change will also cause an increase in the frequency and intensity of extreme weather events in Uganda, such as droughts and floods.

Indeed, Uganda is already experiencing the impacts of climate change and associated economic losses. For instance, drought conditions in 2010/11 caused economic losses of US\$470m in food crops, cash crops and livestock. This equated to about 16% of the total annual value of these crops in 2011¹¹.

Although the cost of adaptation is high, estimated at around US\$406m over the next five years (2015 – 2020), the cost of inaction is 20 times greater, estimated at between US\$3.1bn and 5.9bn per year by 2025¹². Climate change is a long-term and probably irreversible problem. Therefore, the earlier adaptation measures are made the more resilient individuals, communities, organizations and countries will be to the increasingly detrimental impacts of climate change.

As such, Uganda's Second National Development Plan (2015 – 2020) recognizes that climate change will affect most of its key economic sectors and that action on climate change is crucial if the country is to meet its goal to become a competitive, upper middle-income country by 2040 (Vision 2040). The Plan recognizes that, for development to be economically and socially sustainable, climate resilience must be at the heart of policies for growth and development, energy access and security, education and health, and agricultural production.

10 Funk et al, 2012a
11 OPM, 2012
12 CDKN, 2015



A herd of cattle, including several large brown and white cows and a smaller calf, stands in a field. The sky is filled with large, dark clouds, with a bright sun low on the horizon, creating a dramatic sunset or sunrise scene. The ground is dry and dusty.

2. Climate Change and Food Security in Karamoja; 1981 - 2015

2. Climate Change and Food Security in Karamoja; 1981 - 2015

2.1. Karamoja Overview

Positioned in the northeast of Uganda, the semi-arid region of Karamoja borders South Sudan to the north and Kenya to the east and forms part of a broader cluster of neighbouring pastoral and agro-pastoral areas (**Figure 2**).

Karamoja is the most impoverished region of Uganda, with the poorest development indicators. It's population is highly dependent on subsistence agriculture, which depends upon rainfall during the critical March to October period and is therefore inherently sensitive to climate conditions, making agriculture one of the most vulnerable sectors to the impacts of climate change. Indeed, the region suffers chronic food insecurity (half of the population is food insecure, of which 12% are severely food insecure¹³) due to high levels of poverty, low human development and unfavourable climatic/weather conditions.

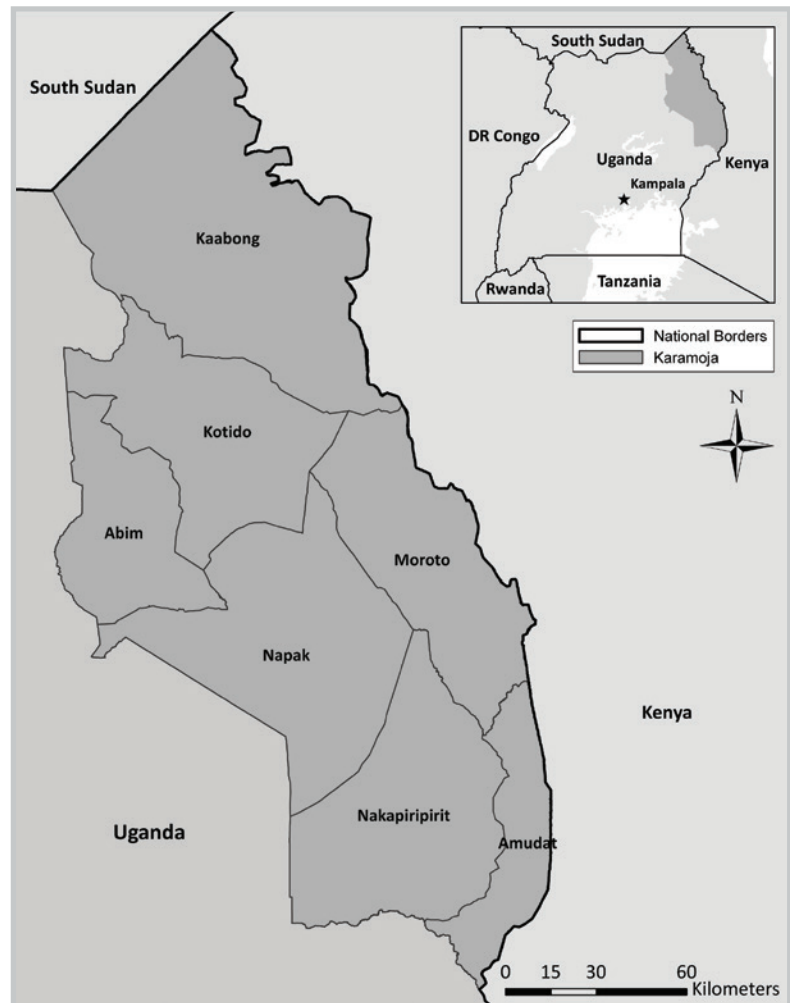


Figure 2: Overview map of Karamoja and its seven districts.

2. Climate Change and Food Security in Karamoja; 1981 - 2015

Unlike most regions of Uganda that have a bi-modal rainfall pattern, Karamoja has a uni-modal rainfall pattern. The rainfall season typically commences in March and ends in October and is followed by a prolonged, often severe dry season. As a result, one growing season exists, with land preparation, planting and weeding taking place from March until October. The lean season then lasts from March until July and harvesting takes place between August and December (**Figure 3**).

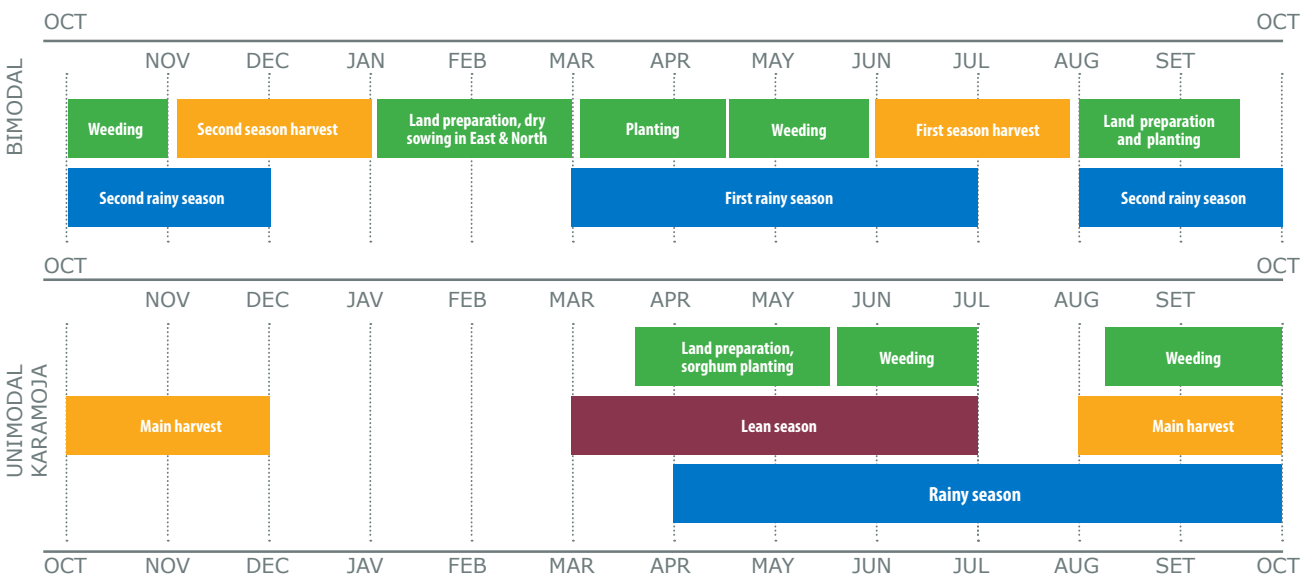


Figure 3: Karamoja’s seasonal calendar¹⁴, a typical year.

Whilst the impact of climate change upon food crops and livestock is projected to be relatively small for most regions of Uganda, the already chronically food insecure region of Karamoja is particularly vulnerable to the impacts of climate change. Recent droughts in the region have wiped out 50 – 100% of crop yields for affected households¹⁵.

Climate-related shocks, often as a result of unpredictable and uneven rainfall, increase the vulnerability of households and leave them less able to cope or adapt.

Households that have lost their productive assets and are relatively new to cultivation, or those with little access to services, support and information, face particular difficulty withstanding climate-related shocks in Karamoja. However, little is known on the impact of climate change on household food security, and more so, on the ability of households to adapt to climate change over time. This has resulted into gaps in food security and resilience programming.

14 FEWS NET, 2013

15 CDKN, 2015

2. Climate Change and Food Security in Karamoja; 1981 - 2015

2.2. Climate Analysis of Karamoja

Results and analysis of monthly rainfall estimates, normalised vegetation indices¹⁶ and temperatures¹⁷ for Karamoja.

Key Messages

- Temporal distribution of rainfall during the rainfall season is poor and vegetation growth is reliant upon rainfall (**Figure 4**), making agricultural based livelihoods vulnerable to variations in rainfall;
- Total rainfall per year is increasing. However this has been accompanied by the increase in variability of total rainfall per year (**Figure 7**), making the timing of planting increasingly difficult for agriculturalists;
- There is considerable variation in average monthly rainfall (**Figure 5**), demonstrating the erratic behaviour of rainfall and the susceptibility of agricultural production to poor/failed harvests;
- Total rainfall per year can vary considerably from year-to-year (**Figure 8**), demonstrating that in addition to intra-monthly and yearly variations in rainfall, Karamoja also experiences year-to-year variations;
- Average monthly rainfall during the rainfall season has increased, particularly during September, October and November. However this has been accompanied by the increase in variability of average monthly rainfall (**Figure 6**). This increase in rainfall during the latter part of the year has extended the rainfall season, therefore potentially extending the growing period in Karamoja
- Average monthly temperatures have increased (**Figure 9**) which will have a detrimental impact upon agriculture and livestock, exacerbating food insecurity.

¹⁶ Rainfall and vegetation data was obtained from the WFP Data Visualization Platform (WFP, 2016b)

¹⁷ Temperature data was obtained from the Royal Netherlands Meteorological Institute (KNMI, 2016)

2. Climate Change and Food Security in Karamoja; 1981 - 2015

Rainfall and Vegetation Period¹⁸

Analysis of Karamoja’s uni-modal rainfall pattern reveals two distinct rainfall phases within the rainfall season (**Figure 4**):

1. First phase starts in late March, with rainfall peaking in early May and then declining to a relative low in late June;
2. Second phase starts in early July, with rainfall peaking later in the month and then declining (with noticeable fluctuations) to early November.

This finding demonstrates the poor temporal distribution of rainfall within the rainfall season in Karamoja.

The growth and decline of vegetation in Karamoja reflects that of rainfall (**Figure 4**). Vegetation begins to develop in early March then displays a flat maximum from May to August, after which vegetation declines as the rainfall season comes to an end.

There is no month in Karamoja when rainfall exceeds potential evaporation and permanent water features are scarce. As a result, agricultural production in the region is reliant upon and sensitive to rainfall, making agricultural based livelihoods vulnerable to variations in rainfall.

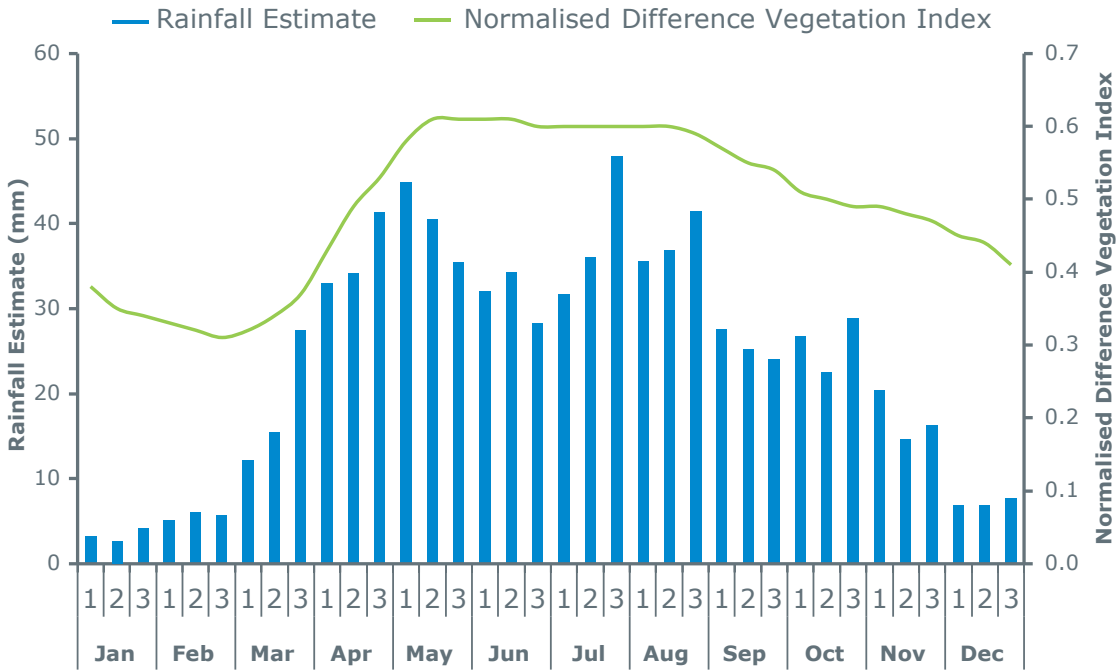


Figure 4: Average period rainfall estimates and normalised difference vegetation index for Karamoja.

18 A period refers to 10 days. A month consists of three periods.

2. Climate Change and Food Security in Karamoja; 1981 - 2015

Monthly Rainfall and Temperature

There is considerable variation in Karamoja's rainfall pattern, particularly during the months with high rainfall (**Figure 5**). This erratic behaviour of rainfall during the growing season indicates the susceptibility of agricultural production to poor/failed harvests.

Karamoja's climate is predominantly semi-arid. Average monthly temperatures peak during February and March and then decline to a low in July.

This combination of a uni-modal rainfall pattern with poor temporal distribution, high variability and a growing season that is reliant upon rainfall makes the inhabitants of Karamoja vulnerable to food insecurity as they only have one unpredictable and unreliable chance in a year for food production.

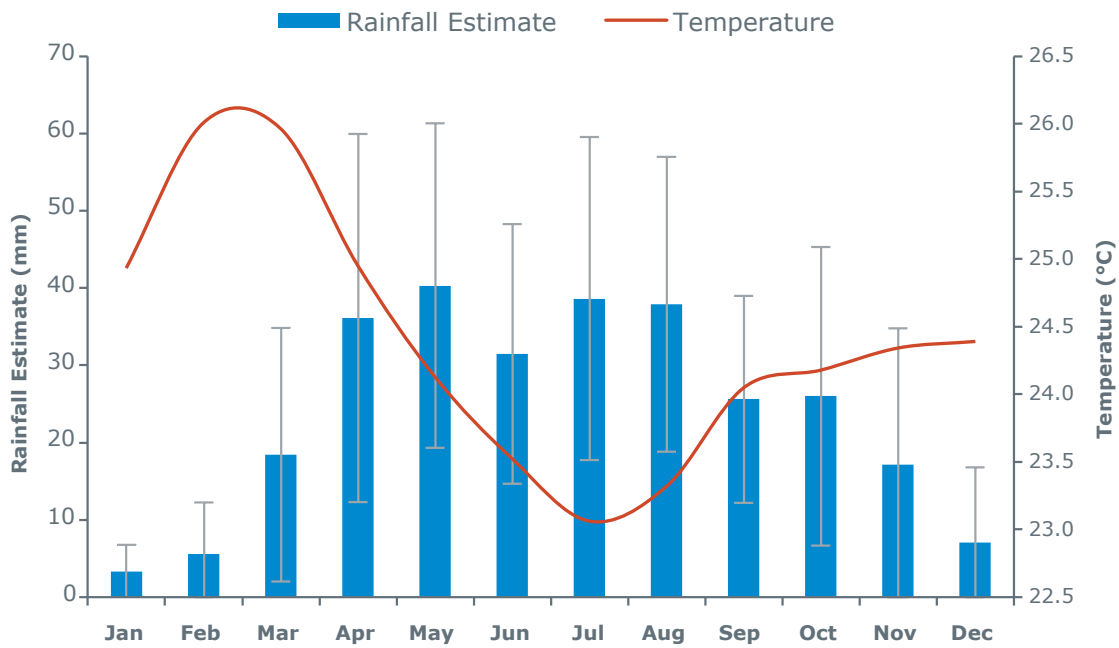


Figure 5: Average monthly rainfall estimates and temperature for Karamoja from 1981 to 2015. Error bars represent standard deviation in average monthly rainfall estimates.

2. Climate Change and Food Security in Karamoja; 1981 - 2015

Decadal Changes in Monthly Rainfall

Analysis of monthly rainfall over the 3 decades between 1981 and 2015 shows that average monthly rainfall has generally increased for Karamoja over the 35-year period – particularly during September, October and November (SON) (**Figure 6**).

The increase in rainfall during the SON period has extended the rainfall season to November, therefore potentially extending the growing period in Karamoja.

Indeed, anecdotal evidence suggests that the SON period is increasingly being regarded as more reliable than the early March, April, May (MAM) period. However the SON period is not utilised to its full potential as households are reluctant to change their traditional times of planting.

The variability of rainfall within the month has also increased; leading to more frequent extended periods of low/no rainfall (resulting in droughts); and more frequent heavy rainfall events, (resulting in floods).

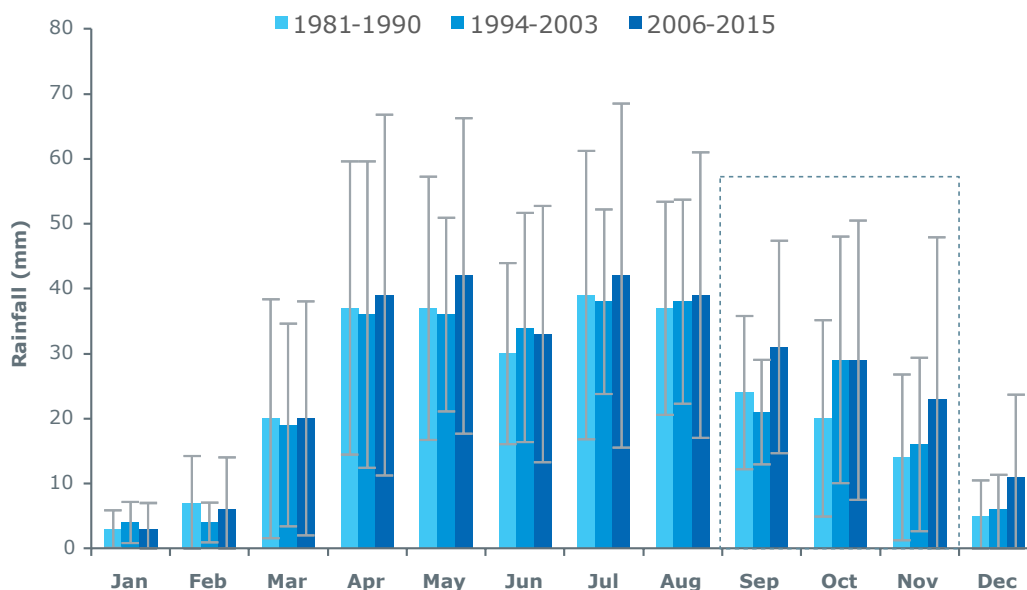


Figure 6: Decadal change in average monthly rainfall estimates for Karamoja. Error bars represent standard deviation in monthly rainfall estimates.

2. Climate Change and Food Security in Karamoja; 1981 - 2015

Decadal Changes in Yearly Rainfall

Analysis of average rainfall received per decade shows that yearly rainfall has increased significantly since 1981 for Karamoja (**Figure 7**). Average yearly rainfall received during the most recent decade was on average 137mm more than during the years of the earliest decade.

However, variance in yearly rainfall has also increased.

These findings suggest that average yearly rainfall is increasing for Karamoja. However, yearly rainfall is becoming more variable. This will make the timing of planting increasingly difficult for agriculturalists in the region.

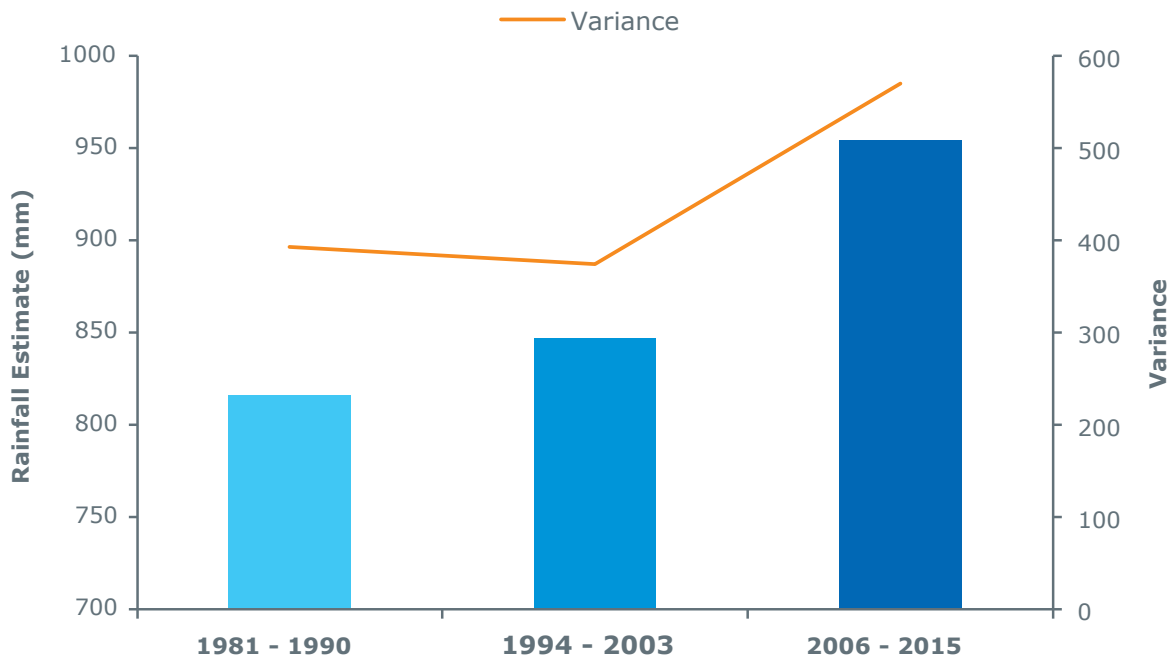


Figure 7: Decadal change in average yearly rainfall estimates and variance for Karamoja.

2. Climate Change and Food Security in Karamoja; 1981 - 2015

Yearly Rainfall Anomalies and Variance

Trends in total rainfall per year and variance in yearly rainfall both indicate a general increase over the 35-year period for Karamoja (**Figure 8**).

Total rainfall per year can vary considerably on a year-to-year basis. For instance from 284mm above the average in 2007 to 110mm below the following year.

This finding demonstrates that in addition to significant and increasing intra-monthly and yearly variations in rainfall, Karamoja also experiences year-to-year variations in rainfall.

There is a cyclical pattern of years of above average rainfall followed by periods of below average rainfall. This cyclical pattern is recognised by the Karamojong.

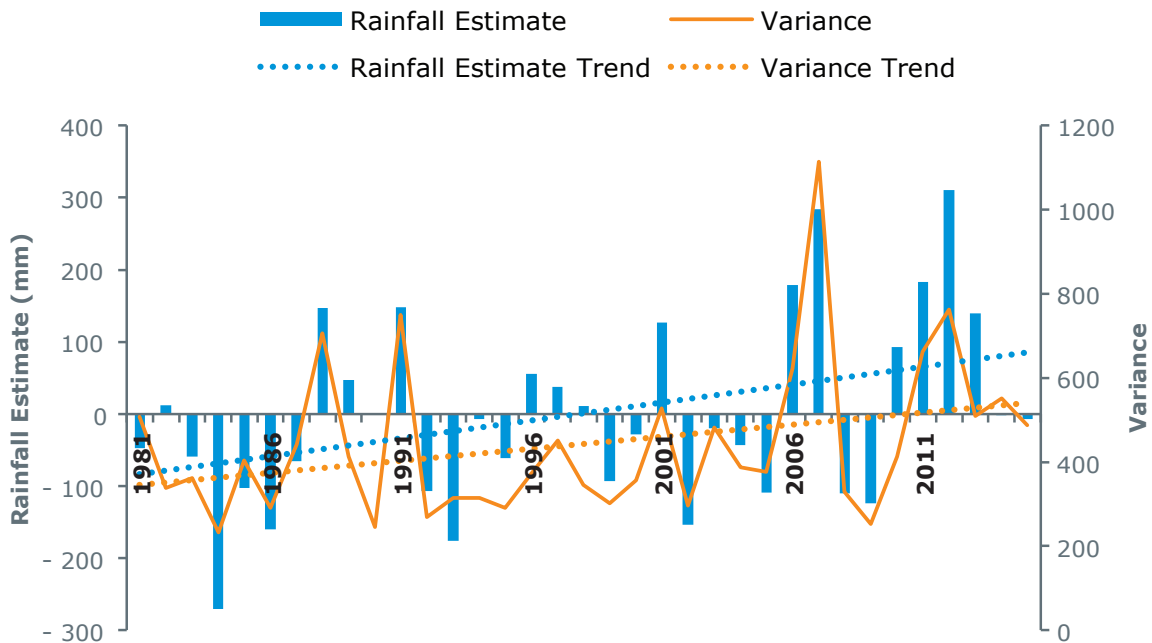


Figure 8: Total rainfall estimate per year anomalies (difference from the average of 860mm) and variance in yearly rainfall estimates for Karamoja from 1981 to 2015.

2. Climate Change and Food Security in Karamoja; 1981 - 2015

Monthly Temperature Anomalies

Average monthly temperatures for Karamoja have on average increased over the 35-year period (**Figure 9**).

From 1980 to 2000 average monthly temperatures were generally cooler than the average for the period. However from 2001 to 2015 temperatures were generally warmer than the average.

Increasing temperatures will have a detrimental effect upon agriculture and livestock in Karamoja, with negative consequences for food security.

Analysis of maximum and minimum monthly temperatures for Karamoja also reveals an increase over the 35-year period (see **Annex 1** and **2**). It is the extremes of weather variability that will have the most detrimental impacts upon lives and livelihoods in the region.

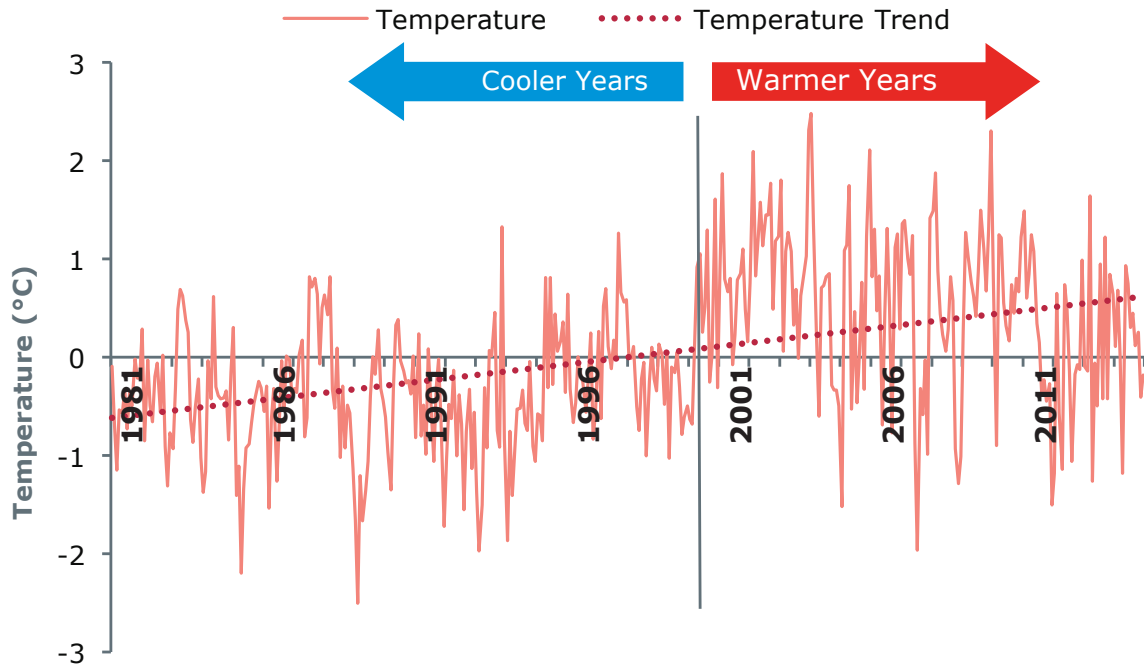
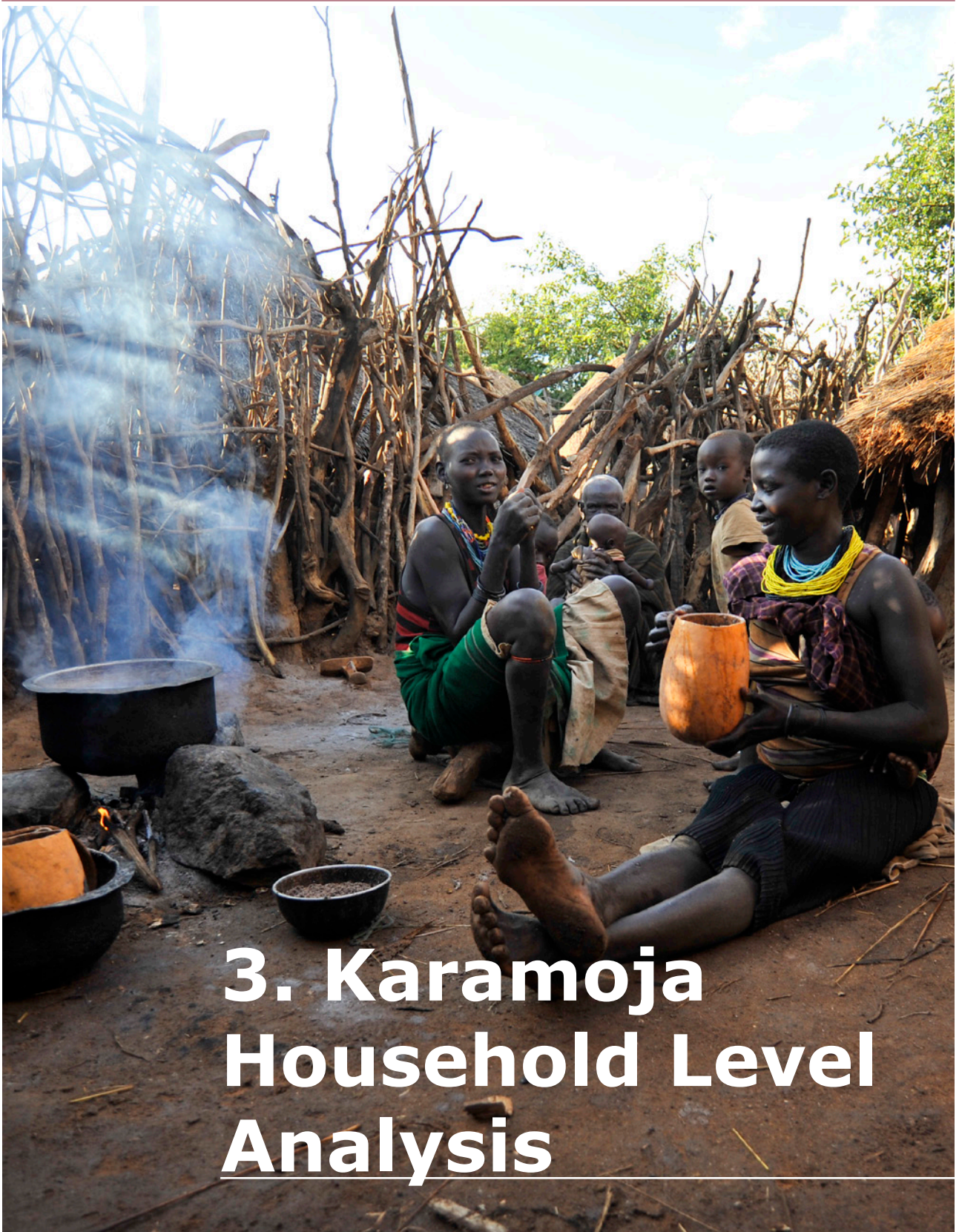


Figure 9: Average monthly temperature anomalies for Karamoja from 1981 to 2015.



3. Karamoja Household Level Analysis

3. Karamoja Household Level Analysis

3.1 Objectives and Methodology

The overall objective of this study is to contribute to, and facilitate, overall efforts in mainstreaming CCA into the broader resilience programming initiatives, and to identify appropriate adaptation programmes that support the most vulnerable and food insecure communities in the Karamoja region. Specific, objectives were to:

1. Develop a standard climate change questionnaire module to be incorporated into regular food security assessments;
2. Assess climate change risks and adaptation approaches among households in Karamoja;
3. Identify and disseminate key programme innovations to address risks associated with climate change.

The assessment covered all 7 districts of Karamoja viz. Abim, Amudat, Kaabong, Kotido, Moroto, Nakapiripirit and Napak.

Questionnaire

Sampling:

A two stage cross-sectional cluster sampling methodology was used, with the village as the geographical unit. At the first stage a probability sample of clusters was selected using an updated list of parishes that constitute a district (probability proportional to population size approach); at the second stage, households were selected using systematic random sampling methodology. Representative samples of households were therefore selected at district level.

Data collection:

Quantitative data was collected using a standardized questionnaire uploaded on mobile tablets (ODK). The questionnaire was administered to all household heads through face-to-face interviews.

Data analysis:

Data was exported from ODK to excel and SPSS for analysis.

Focus Group Discussions

Objectives of the FGDs were to:

- I. Assess local/community perceptions, understanding and indicators of climate variability and change;
- II. Assess the most vulnerable livelihoods based on community's perception;
- III. Identify current and potential adaptation options for local communities with investment projections.

Constitution of the focus groups

Four focus groups were conducted in each zone; male, female, youth and forecasters. Youth and forecaster FGDs were mixed (male and female);

Each FGD comprised of a minimum of 15 people and a maximum of 20 people to ensure rich discussion and participation of all.



3. Karamoja Household Level Analysis

3.2. Climate Shocks¹⁹ and Coping

Climate and weather shocks deteriorate livelihoods and undermine the capacity of households to adapt to moderate shocks as well as their ability to produce and purchase food, increasing their vulnerability to food insecurity and placing them at need for assistance.

Key Messages

- Nearly three-quarters of respondents cited droughts/prolonged dry spells as a climate shock to have impacted their households in the last five years, making this the most frequently cited climate shock;
- Begging/borrowing and the sale of local brew and charcoal/firewood were the most frequently cited coping strategies practised in order to deal with the impacts of climate shocks;
- There are considerable district level differences in the occurrence of climate shocks;
- Assets, particularly livestock, are most frequently sold in order to cope with droughts/prolonged dry spells.

Climate Shocks:

72% of respondents stated that droughts/prolonged dry spells have impacted their households in the last five years, whilst 15% of respondents stated floods as a shock during the same period (**Figure 10**).

These results fit the climate analysis findings of more erratic rainfall and increasing average monthly temperatures; leading to extended periods of low/no rainfall (resulting in droughts/prolonged dry spells) and heavy rainfall events (resulting in flooding).

The occurrence of specific climate shocks differs between districts, for instance:

- Kotido suffers considerably more from droughts/prolonged dry spells (87%) and Nakapiripirit less so (50%);

- Nakapiripirit and Amudat suffer disproportionately more from floods, 30% and 28% respectively.

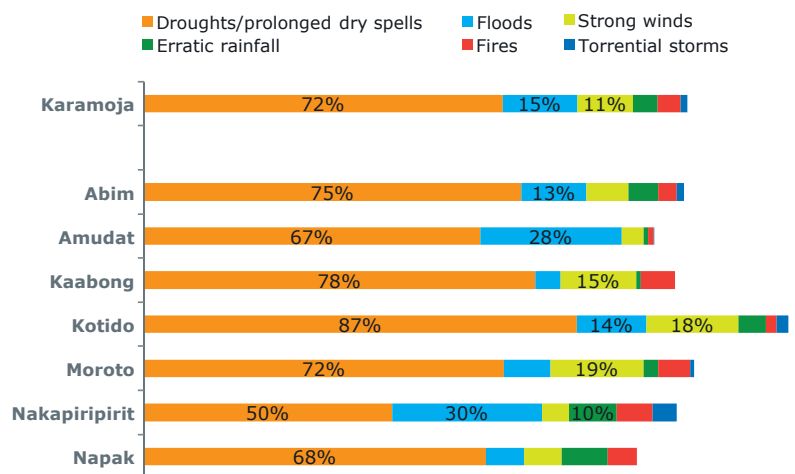


Figure 10: Which climate or weather shocks have significantly affected your household during the last five years? Values under 10% not labeled.

19 'Climate shocks' refers to: droughts/prolonged dry spells, floods, strong winds, erratic rainfall, fires and torrential storms.

3. Karamoja Household Level Analysis

Coping Strategies:

During times of difficulty households are forced to practise coping strategies in order to deal with the impacts of climate shocks. These measures are typically not sustainable solutions and may be detrimental in the long-term.

Begging/borrowing were frequently cited as actions taken by respondents to cope with the impacts of climate shocks (**Table 1**). This is supported by findings from the FGDs of well established and functioning social support networks at the local level, indicating a conducive environment for begging/borrowing as a coping strategy.

Income generating activities such as the sale of local brew and charcoal/firewood production were also frequently employed as a coping strategy; however charcoal/firewood production is recognised by communities to degrade the environment and exacerbate the impacts of climate shocks. Finally, migration was often undertaken during times of difficulty in order to find fresh pastures and water for livestock and employment through casual labour.

Table 1: What immediate actions did you and members of your household take? Results shown at regional level.

Climate Shock	Most Common Actions Taken by Respondents
Droughts/ prolonged dry spells:	Begging/borrowing, brewing, charcoal/firewood production, casual labour, early planting, planting fast growing/drought resistant crops, migration, reducing meals, petty trade
Floods:	Begging/borrowing, building defences, early harvesting, migration, replanting
Strong winds:	Planting trees, reconstruction
Erratic rainfall:	Charcoal/firewood production, early planting
Torrential storms:	Reconstruction

Assets Sold:

The selling of assets is a commonly employed coping strategy among households in Karamoja. Assets, particularly livestock, are most frequently sold in order to cope with droughts/prolonged dry spells, particularly in Amudat (11%), Kaabong (13%) and Kotido (15%) (**Figure 11**).

Given that female headed households in Karamoja are generally less likely to own assets (especially livestock); findings suggest limited coping capacity among female headed households.

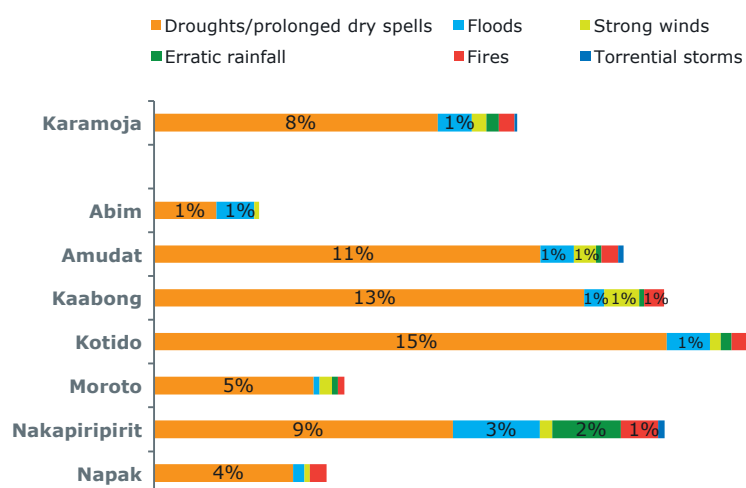


Figure 11: Did you sell any assets to cope with the climate shock? Values under 1% not labeled.

3. Karamoja Household Level Analysis

3.3. Perceptions of Climate Change and Shocks

Identifying perceptions of current and future climate change amongst respondents in Karamoja is critical as perceptions heavily influence the willingness of households to adapt. At risk communities must recognise current climate change and acknowledge future changes in climate and the impacts upon their lives and livelihoods. Perceptions at the local level also significantly influence the process of change in development projects.

Key Messages

- Nearly two-thirds of respondents in Karamoja had not perceived any changes in climate or were unsure if climate change had occurred over their lifetime;
- Half of respondents do not think that the climate will continue to change over their lifetime;
- Of the respondents who reported observing changes in climate, the most frequently noticed change was the increase in the number of hot days;
- Of the respondents who do think the climate will continue to change, reduced agricultural productivity is the most anticipated future impact of climate change.

Changes in Climate:

At the regional level nearly two thirds (62%) of respondents reported not having noticed, or not being sure of climate change, this was particularly the case in Kaabong (73%) and Nakapiripirit (70%) (**Figure 12**). Given that climate analysis for Karamoja shows increasing rainfall variability, increasing temperatures and changing seasonality, findings suggest that these households have not adapted their agricultural practices to prevailing conditions and are thus exposed to risk now and in the future. There is a need to sensitize communities on climate change and its impacts upon agriculture and livelihoods.

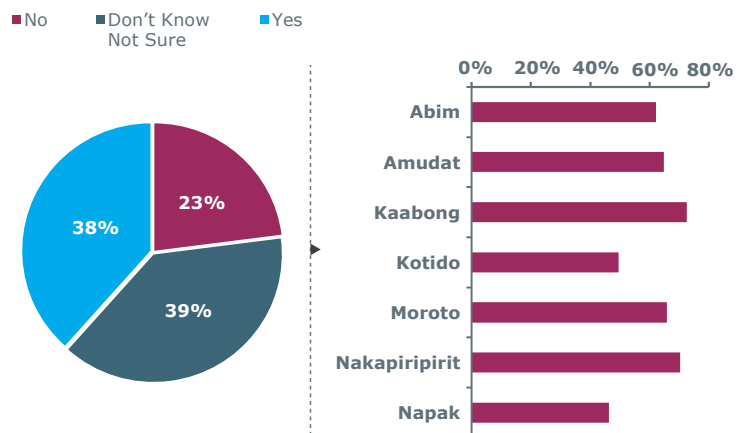


Figure 12: Have you noticed any changes in weather patterns or climate over your lifetime? Respondents who answered 'no' and 'not sure' or 'don't know' expanded to district level.

3. Karamoja Household Level Analysis

Changes Noticed:

Among respondents that had noticed changes, the most frequently observed change was the increase in the number of hot days (59%) (**Figure 13**). This fits with climate analysis findings of increasing average monthly temperatures over the 35-year period examined.

Around 10% of households report both increasing and decreasing rainfall, which is inferred as more erratic rainfall.

The duration of droughts is reportedly becoming longer. As such, their impact upon households will become more severe.

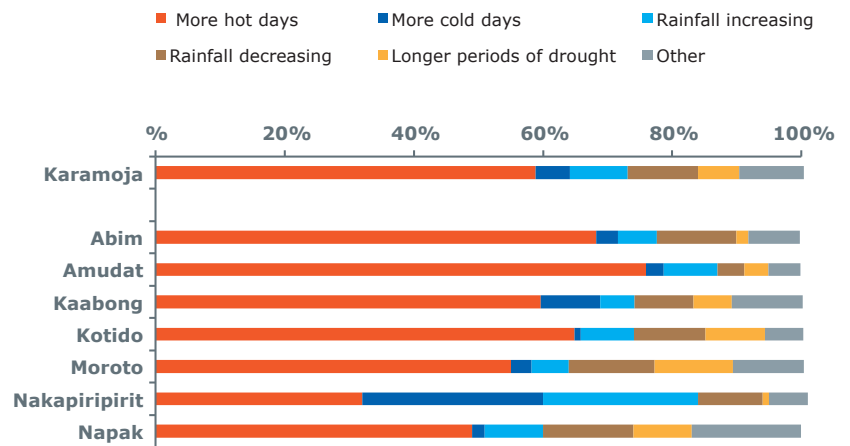


Figure 13: If yes, what changes have you noticed over your lifetime?

Likelihood of Future Change:

51% of respondents across Karamoja do not think that the climate will continue to change, especially in Abim (69%) and Nakapiripirit (57%) (**Figure 14**). Given that climate change is happening now and its effects are growing, findings suggest high levels of unpreparedness among households for future climate related shocks, and a predisposition to business as usual e.g. with regard to agricultural practices. Efforts to promote CCA must therefore tackle, as a pre-requisite, the recognition by households of climate change and its possible impacts upon agriculture and livelihoods.

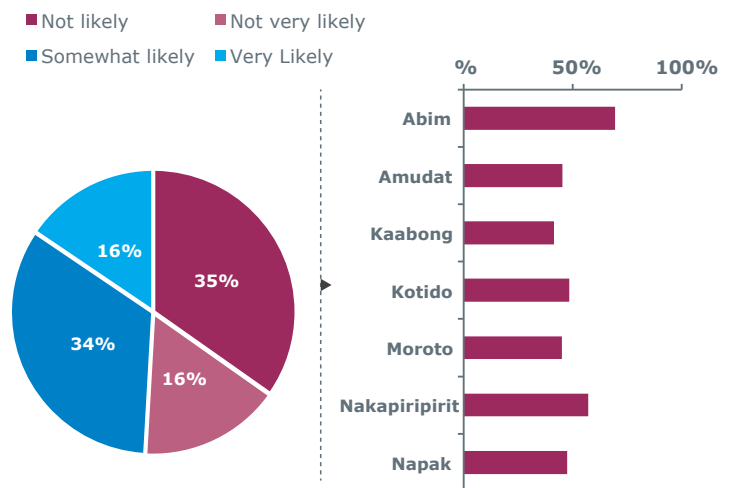


Figure 14: How likely do you think it is that the weather or climate will continue to change over your lifetime? Respondents who answered 'not very likely' and 'not likely' expanded to district level.

3. Karamoja Household Level Analysis

Expected Impacts of Future Change:

Among respondents that expected climate change to continue, reduced agricultural productivity is the most anticipated impact across Karamoja, with nearly half (48%) reporting so (**Figure 15**).

A significant proportion (18%) do not know what impacts to expect from future changes. This finding highlights the need to sensitise households on climate change and its impacts relevant to their livelihood activities.

An additional impact frequently mentioned during the FGDs was environmental degradation and its impact upon the status of natural resources. Environmental degradation increases soil erosion and reduces soil fertility – increasing the

vulnerability of agricultural production to climate variability and extreme weather events.

Other impacts of climate shocks cited in the FGDs included:

- Increasing insecurity as a result of conflict over resources;
- Migration of pastoralists from impacted areas (due to reduced pasture) and those seeking labour;
- Increasing prevalence of pests and diseases, affecting both people and livestock.

[See **Annex 3, 4 and 5** for perceptions related to the likelihood, severity and anticipated impacts of climate shocks]

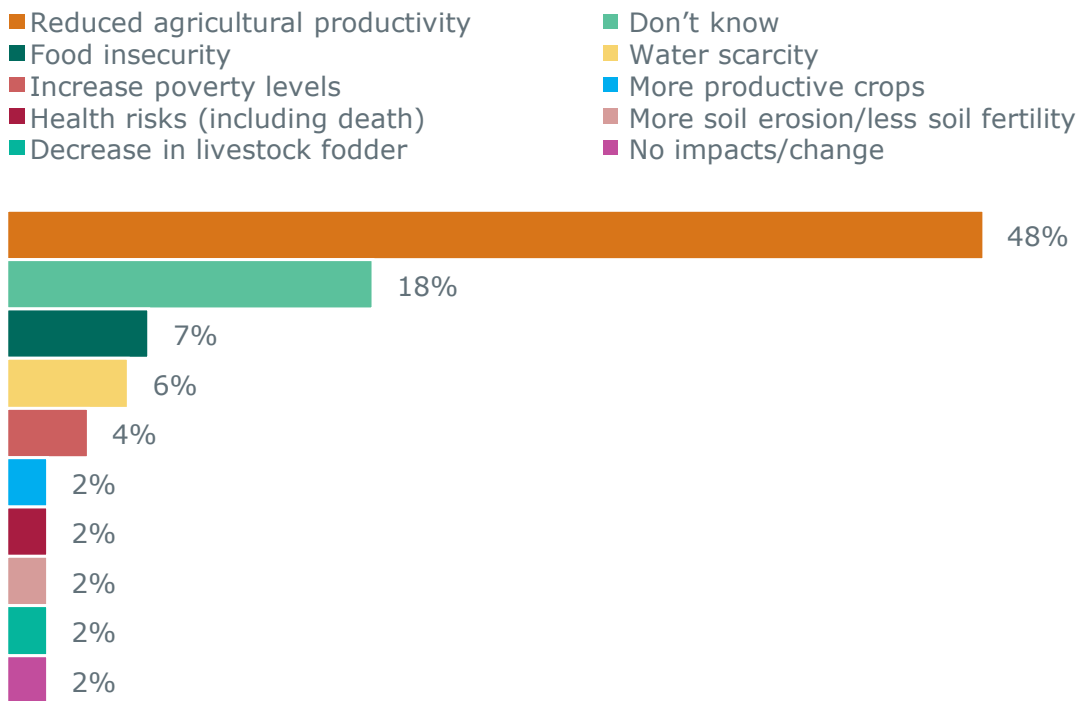


Figure 15: What do you expect the impacts of such future changes to be? Results shown at regional level.

3.4. Access to and Utilisation of Climate Information Services

In order to adapt to the impacts of climate change, individuals and communities at risk must have access to timely and meaningful information (hereby referred to as 'climate information services' - CISs). Access to CISs enables households to prepare for and to act appropriately and in sufficient time to reduce the possibility of harm or loss or take advantage of opportunities that may arise.

Smallholder farmers in the developing world are especially vulnerable to climate shocks, and are expected to suffer disproportionately from climate change. CISs, including forecast, production and management information offer a powerful tool to help farmers adapt to the impacts of climate change. Access to information empowers individuals and communities, developing capacities from the bottom up.

Key Messages

- Access to CISs is low across Karamoja; however utilisation of such information is high;
- Respondents who received climate service information were more likely to make adaptation changes;
- Community meetings were also regarded as important sources of information and were suggested in the FGDs as an entry point for the dissemination of CISs.
- There is a decline in access to and utilisation of seasonal climate forecasts from the March, April, May period to the September, October, November period;
- Own knowledge and indigenous information systems (elders/traditional forecasters and community meetings) were regarded as important sources of CISs;

Access to Climate Information Services

Access to CISs is low across Karamoja (Figure 16). At the district level, access to CISs is lowest in Abim and Amudat and relatively high in Kotido.

The most accessed information type was extreme weather forecasts, with just under a third (32%) reporting access. The least accessed was post-harvest management, with only 7% reporting access.

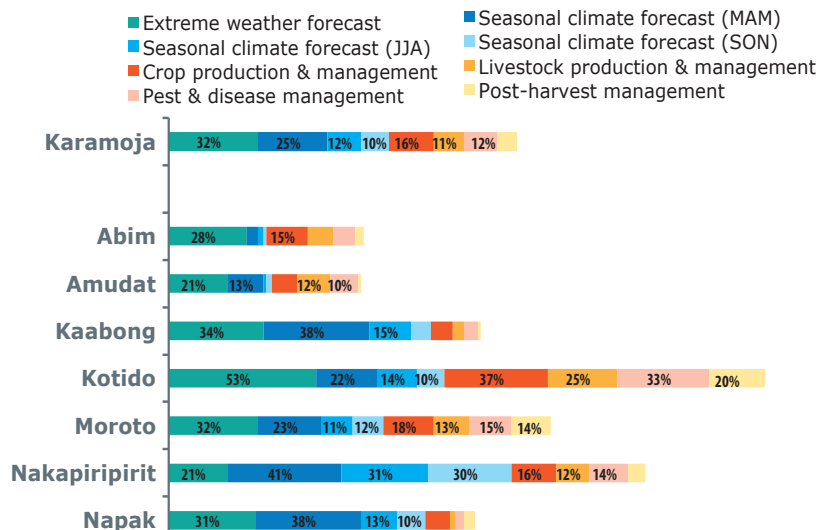


Figure 16: Did you have access to [information type] information in the last 12 months? Percentage of respondents who answered 'yes' according to the information types provided. Values under 10% not labeled.

3. Karamoja Household Level Analysis

There is a noticeable decline in access to seasonal climate forecasts from the MAM period to the SON period. This finding resonates with cropping patterns in Karamoja as most households traditionally engage in agricultural activities during the MAM period. However, it also suggests there is no systematic effort to promote agriculture through seasonal forecasts in the emerging late rainfall phase. Deliberate efforts are therefore required to increase access to forecast information given the changing seasonality of rains in the region.

Not shown is access to insurance information for crops and livestock. Access to this type of CIS was negligible, highlighting the critical need to improve dissemination of this information type in Karamoja.

In general, access to forecast information is higher than that of production and management information, suggesting that households that do receive forecast information may be lacking follow up production and management information, detrimentally affecting their ability to prepare for or capitalize upon forecast information.

Role of Access to Climate Information Services in Adaptation:

Respondents who received CISs, particularly related to production and management, were more likely to make changes to protect themselves, family and community against climate change (**Figure 17**). This link between access to information and its utilisation to adapt to climate change demonstrates its importance in allowing households to anticipate the adverse effects of climate change and take appropriate action to prevent or minimise potential damage.

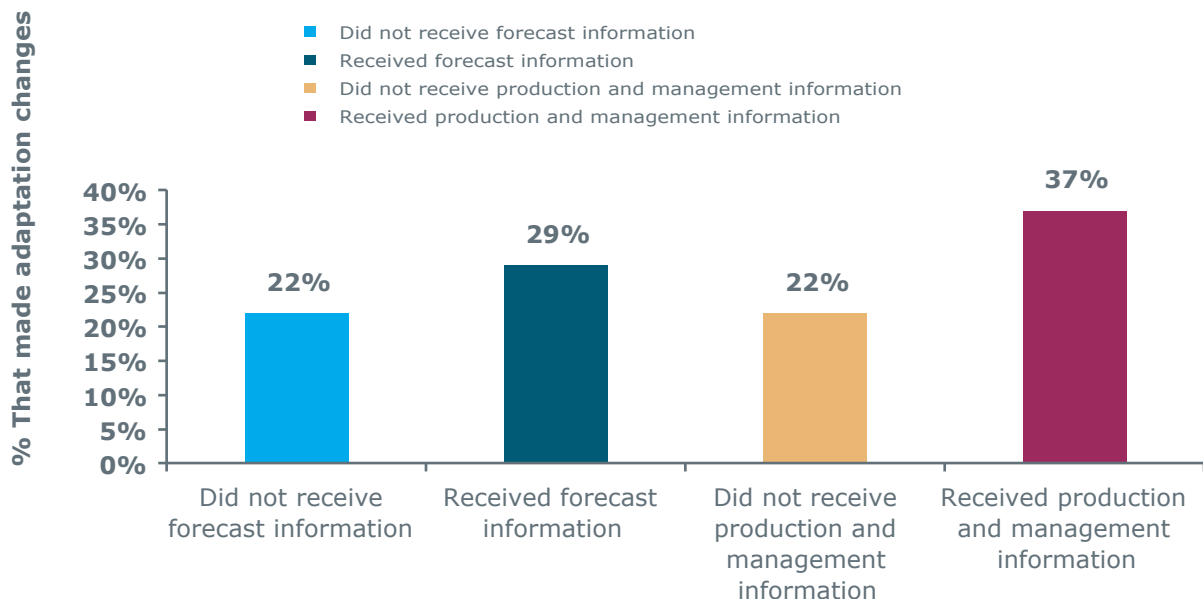


Figure 17: Adaptation rates amongst respondents who did not vs. did have access to climate information services related to forecasts and production and management. Results shown at regional level.

3. Karamoja Household Level Analysis

Main Sources of Climate Information Services:

Around one in every five respondents relies upon own knowledge for seasonal climate forecasts (**Table 2**). This suggests a gap in information dissemination that prompts reliance on own knowledge. Furthermore, elders/traditional forecasters were regarded as important information sources for forecast information, demonstrating the importance of involving this category of stakeholders in the dissemination of CISs so as to increase the acceptability of messages to households.

Community meetings were identified as important sources of information for respondents, thus representing a potential dissemination forum for forecast and related production and management information. Community meetings were also frequently suggested by the participants of the FGDs as a possible entry point for the dissemination of CISs which would provide an excellent form of participatory information dissemination.

These findings of high reliance on own knowledge and indigenous information systems (elders/traditional forecasters and community meetings) have double faceted implications. On the one hand it suggests that households rely on their own knowledge and beliefs (also perpetuated through elders/traditional forecasters and community meetings) that may be misleading and counterproductive. On the other hand, it presents an opportunity to integrate scientific information with highly localised indigenous information systems, enhancing the acceptability and utilization of this information.

Table 2: Please list the main sources you received this type of information from in the last 12 months. Three most frequently cited sources shown for each information type. Results shown at regional level.

Type of Information	Information Sources		
	1 st Source	2 nd Source	3 rd Source
Extreme weather forecast:	Radio (27%)	Community meetings (18%)	NGO's (14%)
MAM seasonal climate forecast	Radio (20%)	Own Knowledge (20%)	NGO's (14%)
JJA seasonal climate forecast:	Own knowledge (23%)	Elders/traditional forecasters (19%)	Community meetings (14%)
SON seasonal climate forecast:	Own knowledge (23%)	Elders/traditional forecasters (20%)	Community meetings (14%)
Crop production & management:	NGOs (23%)	Radio (16%)	Community meetings (15%)
Livestock production & management:	Gov't extension workers (20%)	Radio (17%)	NGOs (16%)
Pest & disease management:	NGOs (16%)	Community meetings (16%)	Radio (15%)
Post-harvest management:	Community meetings (24%)	NGOs (18%)	Own knowledge (17%)

3. Karamoja Household Level Analysis

Gender and Access to Information:

Radio is a common source of CISs for households. However, the July 2016 Food Security and Nutrition Assessment report indicated that only 9% of female headed households owned a radio, compared to 14% among male headed households ²⁰. This suggests that female headed households are at a considerable disadvantage and are less likely to receive CISs, inhibiting their ability to adapt to climate change.

Utilization of Climate Information Services:

Despite the fact that access to CISs is low across Karamoja, analysis showed that the rate of information utilisation among respondents that receive CISs is high, particularly in Kotido, Nakapiripirit and Napak (**Figure 18**).

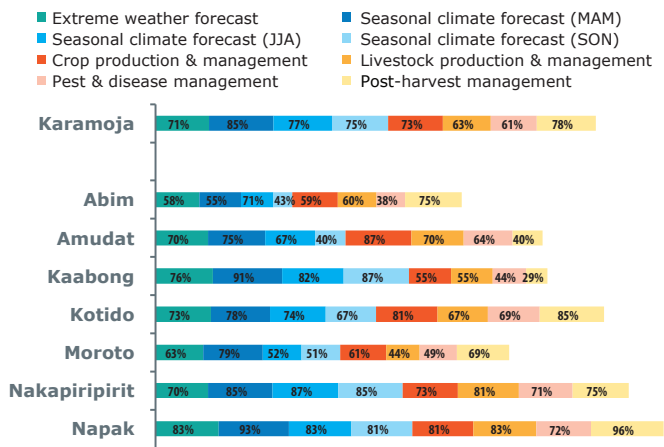


Figure 18: *Were you able to use this information?* Percentage of respondents who answered 'yes' according to the information types provided

This contrast between the low accessibility of CISs but its high utilization is positive and highlights the need for increased information dissemination to households. It also suggests households are open to integrating indigenous and scientific information systems.

Information Use:

The most frequently cited uses of CISs are outlined in **Table 3** below. Across information types, reasons respondents were unable to utilise available CISs included: 1) the lack of capacity to implement actions (due to knowledge deficits and financial restrictions); 2) they did not deem it necessary and 3) sickness.

Table 3: *How were you able to use this information?* Frequently cited uses listed for climate information services. Results shown at regional level.

Type of Information	Information Uses
Extreme weather forecast:	Land (bush/garden) clearance, cultivation, crop production (early planting and fast growing/resistant crops), migration
MAM seasonal climate forecast:	Land (bush/garden) clearance, cultivation, early planting, weeding, purchasing seeds/tools
JJA seasonal climate forecast:	Early harvesting, weeding, scaring birds
SON seasonal climate forecast:	Harvesting, drying, storing
Crop production & management:	Crop production (early and fast growing crops), harvesting, weeding, storing, mixed farming
Livestock production & management:	Migration, treating livestock (spraying and vaccinations)
Pest & disease management:	Purchasing vaccines, medicine and pesticides, spraying against parasites, early treatment
Post-harvest management:	Purchasing storage equipment, building granaries, proper handling techniques, transporting

Information Sharing:

At the regional level three-quarters (75%) of respondents stated that they shared CISs within their household and 60% outside of their household. These findings demonstrate great potential for the diffusion of information at the local level in Karamoja. However it also calls for clarity in messaging to reduce potential information distortion.

3.5. Adaptation to Climate Change

Adaptation involves anticipating the adverse effects of climate change and taking appropriate action to prevent or minimise the damage they can cause (or taking advantage of opportunities that may arise). In the context of Karamoja especially, goals related to poverty reduction, education, health and water and food security are critically influenced by climate change. As a result CCA measures are necessary for safe and sustainable development.

Key Messages

- Over three-quarters of respondents have not made changes to adapt to the impacts of climate change. The main reason for not making adaptation measures was not knowing how to;
- Tree planting was the most popular adaptation measure made. However, the sale of charcoal/firewood is a frequently employed coping strategy during times of difficulty;
- Over two-thirds of respondents do not belong to a formal/informal group in their village. The main reason for non-membership being the inability to meet the requirements join available groups;
- Credit, microfinance, SACCO or gift circle was the most popular group.

Household Adaptation to Climate Change:

Over three quarters (76%) of respondents across Karamoja stated that they have not made changes to protect themselves, their family or their community from the impacts of climate change, especially in Kaabong (86%), Moroto (85%) and Nakapiripirit (82%) (**Figure 19**). Respondents that do not adapt to climate change place themselves and their households at an increased risk to the impacts of climate change and food insecurity.

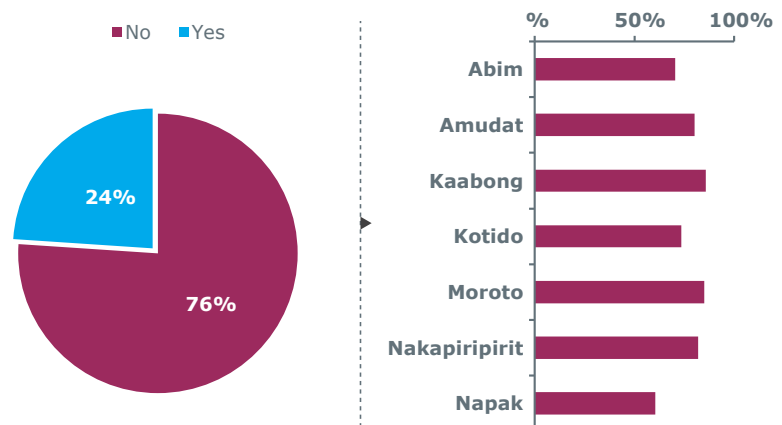


Figure 19: Respondents who have made changes to protect themselves, their family or community against climate change. Respondents who answered 'no' expanded to district level.

3. Karamoja Household Level Analysis

Awareness and Future Adaptation:

Respondents who have noticed changes in climate were 19% more likely to take adaptation measures. This finding demonstrates the relationship between awareness and preparedness, stressing the importance of sensitizing communities on the real threat of climate change and its impacts and the need to adapt.

Looking ahead, just 12% of respondents plan to make additional changes to protect against climate change over the next five years, a concerning percentage given climate trends in Karamoja. A significant proportion (41%) of respondents do not know if they will make changes, these respondents may acknowledge the threat presented by climate change but lack the capacity or resources to implement changes.

Reasons for Not Making Changes:

At the regional level over half (52%) of respondents have not made any changes as they don't know how to, particularly in Napak (75%). This finding indicates the need to strengthen knowledge and skill capacities in order to allow households to make informed and appropriate adaptation choices. A third (33%) of respondents cited restricted resources as their reason for non-adaptation.

Adaptation Measures Made:

Tree planting is the most popular adaptive measure made (44%) (**Figure 21**). According to the FGDs, trees are planted in order to:

- Reduce soil erosion;
- Shield from wind and sun;
- Provide food and materials.

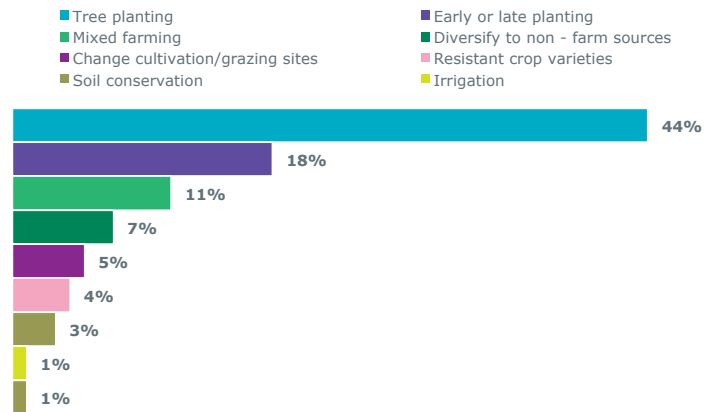


Figure 21: If 'yes' what changes have you made? Results shown at regional level.

However, trees are also regarded as a source of income as they provide charcoal/firewood during times of difficulty (often as a result of failed/poor harvests due to climate shocks).

As such, deforestation and related environmental degradation is a problem in Karamoja. This has created a positive feedback mechanism as environmental degradation exacerbates the impact of climate shocks upon agricultural production, increasing the likelihood of households having to practise coping strategies, such as charcoal/firewood production. Livelihood diversification may help to reduce deforestation.

Early or late planting was cited by 18% of respondents as an adaptive measure. This is encouraging given the changing seasonality of the rains in Karamoja and the need for farmers to alter their traditional periods of planting. This finding emphasises the need for seasonal climate forecasts and their effective dissemination in order to allow farmers to better time their planting, particularly during the SON period.

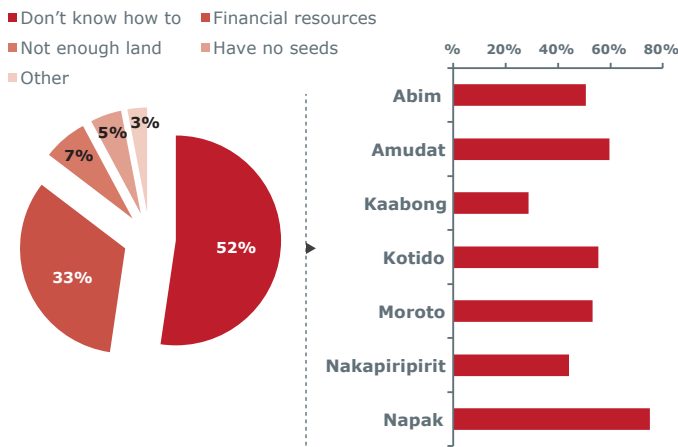


Figure 20: If no, why have you not made any changes? Respondents who answered 'don't know how to' expanded to district level.

3. Karamoja Household Level Analysis

3.5.1. Role of Local Institutions in Adaptation

Local institutions (both formal and informal) play a pivotal role in facilitating adaptation and reducing vulnerability to the impacts of climate change. Local institutions are also a potential vehicle through which capacity development for CCA could be delivered.

Local Institution Membership:

Membership is low in Karamoja, with over two-thirds (67%) of respondents not belonging to a formal/informal group in their village, especially in Amudat, Kaabong and Moroto where up to 81% of respondents do not belong to a group (Figure 23).²¹ Low membership of formal/informal groups will have a detrimental impact upon adaptation to climate change at the local level in Karamoja.

Membership and Adaptation:

Analysis showed that respondents that were members of a formal/informal group were 15% more likely to make changes to protect themselves, livelihoods and households against climate change compared to non-members (Figure 23). This finding demonstrates the benefits of formal/informal memberships and the role local institutions can play in fostering resilience and reducing vulnerability to climate change.

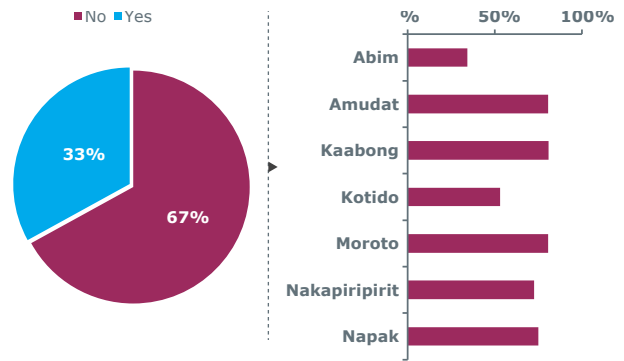


Figure 22: Do you or your household belong to any formal or informal group in your village? Respondents who answered 'no' expanded to district level.

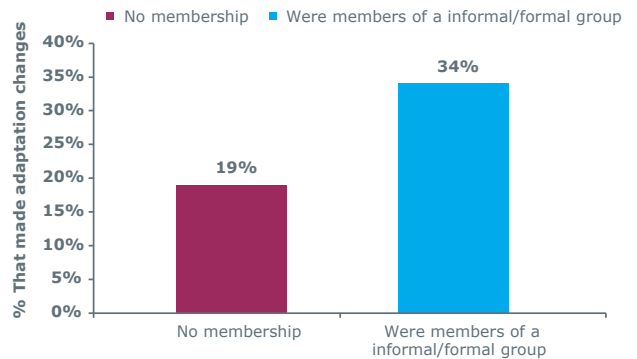


Figure 23: Adaptation rates amongst respondents who were not vs. were members of an informal or formal group in their village. Results shown at regional level.

²¹ Low levels of membership are not indicative of weak social cohesion. Coping strategies practised during periods of difficulty (evident from the FGDs) such as the sharing of information and resources and borrowing, as well as evidence from previous findings, such as the popularity of indigenous knowledge systems as sources of information, suggests well established and functioning social networks.

3. Karamoja Household Level Analysis

Furthermore, there was a notable link between membership and debt. Members of a formal/informal group were 18% more likely to have debt compared to non-members. This is inferred as members having more access to credit through credit, microfinance, savings and credit cooperative organizations (SACCO), or gift circle groups. Indeed, this type of membership was the most popular in the region (**Figure 25**) and frequently mentioned in the FGDs as being beneficial in allowing communities to better cope with and adapt to climate change.

Reasons for Non-membership:

Of the respondents who are not members of any formal/informal group in their village, main reasons cited include:

- Unable to meet the requirements to join groups available to them (42%);
- No available groups in the community (34%);
- Not interested in joining available groups (12%) (**Figure 24**).

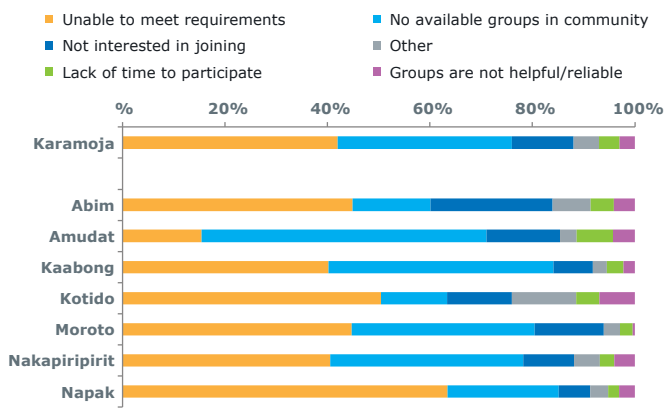


Figure 24: If no, why are you not a member of any social or formal group?

Further analysis showed that:

- Household heads with no formal education were 27% more likely than those with some type of formal education not to be a member of a group;
- Both female headed households and disabled or chronically ill headed households were 13% more likely than male headed households and able bodied household heads not to be a member of a group;
- Households with no income earner were 11% more likely than households with at least one income earner not to be a member of a group.

Types of Membership:

Of the respondents who are members of a formal/informal group in their village, main groups cited include:

- Credit, microfinance, SACCO or gift circle (54%);
- Agricultural groups (16%);
- Other women’s groups (12%) (**Figure 25**).

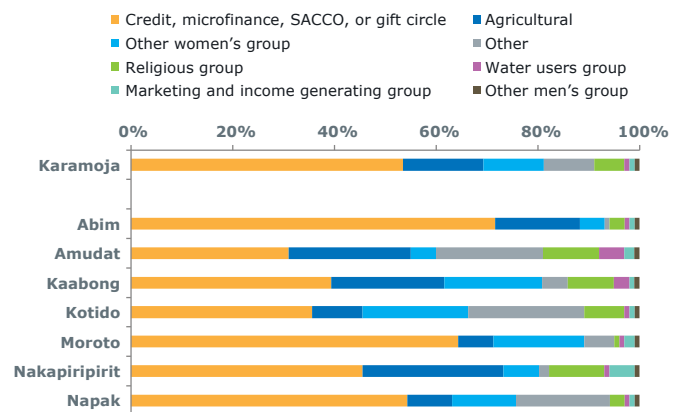


Figure 25: If yes, indicate the type of group.



4. Recommendations



Encourage Water Harvesting and Conservation Schemes

Erratic rainfall has historically been a major factor inhibiting agricultural production in Karamoja and the trend of increasing rainfall variance and temperatures further threatens water security in the region. Therefore, there is a need for multi-stakeholder investment in water harvesting and conservation solutions if food availability is to be stabilised in the region in the medium to long-term.

Sensitize Households to the Threat Posed by Climate Change

Across Karamoja there is a lack of awareness and knowledge about climate change and its impacts. The inability to recognise climate change will reduce the likelihood of adaptive measures being made. Efforts are therefore required to sensitize households in order to strengthen awareness and spur adaptation. Furthermore, it is necessary to educate households on the most appropriate changes they can make to adapt to the impacts of climate change to increase their resilience.

Recommendations

Improve Access to Climate Information Services

Low access to CISs detrimentally affects the ability of households to make informed decisions on how to capitalise upon or prepare for future conditions, increasing their vulnerability to climate shocks and food insecurity. Should access to CISs be improved, findings suggest great potential given the high rates of information utilisation and sharing.

Synergise Dissemination of Climate Information Services with Existing Information Systems

The heavy reliance upon own knowledge and indigenous information systems (elders/traditional forecasters and community meetings) for climate and agriculture related information represents an opportunity to integrate information dissemination efforts with these existing local sources, e.g. encouraging the use of the emerging late rainfall phase for crop production. Additionally, any incorrect or inaccurate information being perpetuated through these sources can be dispelled.

Mainstream Gender in Climate Change Related Interventions

There is a need to focus climate change sensitisation efforts on female headed households as they were less likely to have noticed changes in climate/weather patterns. Additionally, female household access to CISs through indigenous information systems and NGOs must be improved as they were considerably less likely to receive information from these popular information sources. Finally, there must be a focus upon improving membership of women in formal/informal groups in their villages.

Encourage Agro-forestry Schemes

Appropriate agro-forestry schemes have the potential to reduce food insecurity in the region. Such schemes will diversify livelihoods, providing an alternative source of income and reducing the pressure on natural stands for charcoal/firewood. Additionally, this will reduce environmental degradation in the region, thereby buffering the impact of climate shocks and strengthening food insecurity.

Increase Membership to Formal and Informal Village Groups

Over half of respondents are not members of a group. The main reasons for non-membership are the inability to meet requirements and the lack of available groups. Therefore, efforts to increase membership should focus upon knowledge and skills capacity building and/or technical assistance and group creation.

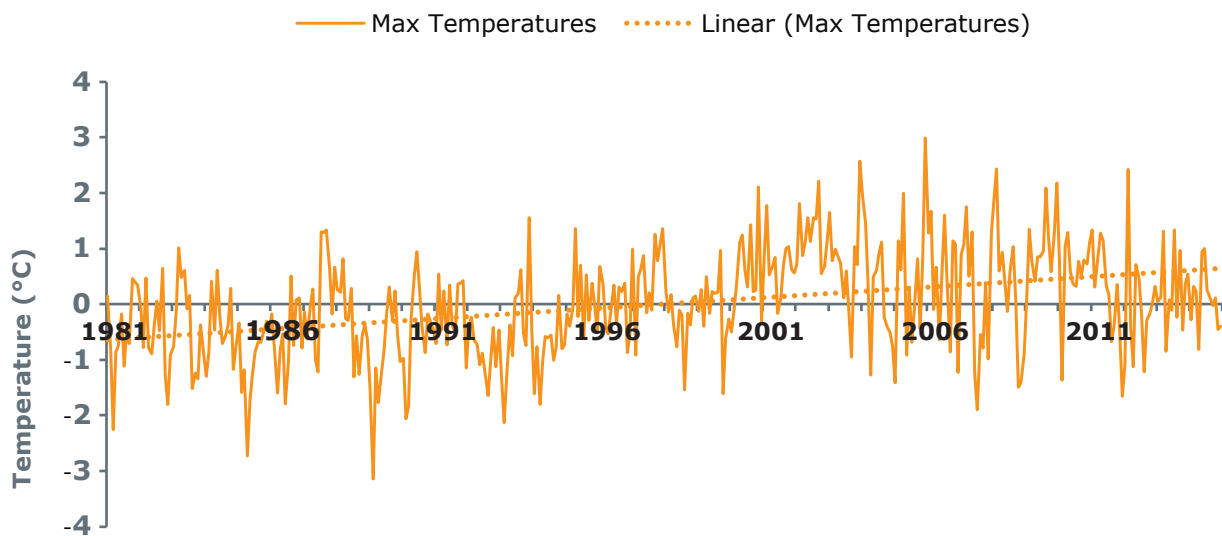
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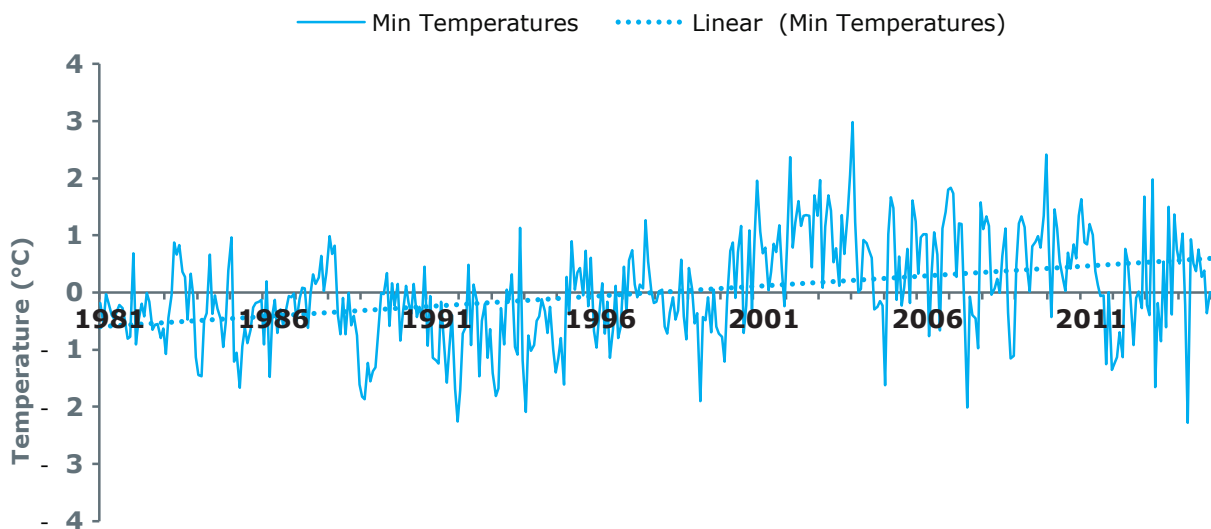
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Annex



Annex 1: Max monthly temperature anomalies for Karamoja from 1981 to 2015.



Annex 2: Minimum monthly temperature anomalies for Karamoja from 1981 to 2015.

Annex

Annex 3: What is the likelihood that [this climate change] will occur in your area in the future. Results shown at regional level.

Climate Change	Likelihood			
	Not likely	Somewhat likely	Likely	Very likely
More frequent/severe droughts	55%	22%	17%	5%
More frequent/severe floods	84%	10%	5%	1%
Hotter dry season temperatures	60%	20%	16%	4%
Rainfall pattern shifts	69%	19%	11%	2%
Less water availability	59%	20%	16%	5%
More frequent storms	85%	9%	5%	1%

Annex 4: How much of an impact do you think [this climate change] will have on your livelihood? Results shown at regional level.

Climate Change	Severity of Impact				
	None	Minimal	Moderate	High	Severe
More frequent/severe droughts	2%	15%	24%	45%	13%
More frequent/severe floods	7%	27%	37%	23%	5%
Hotter dry season temperatures	3%	17%	31%	40%	10%
Rainfall pattern shifts	4%	21%	45%	27%	3%
Less water availability	2%	17%	30%	40%	11%
More frequent storms	9%	25%	32%	27%	6%

Annex 5: What possible impacts do you anticipate from these changes? Results shown at regional level.

Climate Change	Impact		
	1 st Impact	2 nd Impact	3 rd Impact
More frequent/severe droughts	Reduced agricultural productivity (46%)	Water scarcity (13%)	Food insecurity (11%)
More frequent/severe floods	Reduced agricultural productivity (30%)	More soil erosion/less soil fertility (18%)	Don't know (11%)
Hotter dry season temperatures	Reduced agricultural productivity (34%)	Water scarcity (19%)	Decrease in livestock fodder (7%)
Rainfall pattern shifts	Reduced agricultural productivity (37%)	Water scarcity (9%)	Don't know (9%)
Less water availability	Reduced agricultural productivity (44%)	Water scarcity (20%)	Food insecurity (7%)
More frequent storms	Reduced agricultural productivity (19%)	Don't know (14%)	More soil erosion/less soil fertility (13%)

