User Needs Assessment for Climate Services in Zambia

Working Paper No. 399

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

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Abstract

Between February and April 2021 research was conducted to assess the user needs of selected farmer groups in Zambia for farmer centric agrometeorological information services. Specifically, it aimed to:

- Identify the types of weather information and agronomic advice that farmers currently receive, the sources that they use and how satisfied they are with the information they receive;
- Better understand the effects of climate variability and change on different agricultural activities and the decisions farmers are able to make; and
- Enable farmers to identify what weather and climate information, services and agronomic advice they need and how they would like to access it.

The results were then presented to key stakeholders and used in an ideation process to help design potential climate services for implementation at scale.
Key findings from the user research are that:

- Respondents articulated a demand for information and advice on a range of different weather variables at a range of different timescales to aid both their long-term planning and more immediate decisions.
- There is a gap between the climate and weather information and services that are produced (by Zambia Meteorological Department) and those that farmers are accessing.
- The complexities of challenges facing respondents, and the variety of different decisions affected, means that addressing these challenges is not simply about the provision of climate information but supporting farmers to contextualise and use this information. Farmers outlined a range of existing practices that they use to address challenges that are related to weather and climate. Many of these practices address multiple challenges and are often proactive rather than reactive options for farmers.
- Engaging farmers with climate services requires a range of different and complimentary approaches. Radio is the most commonly used and requested going forward. Extension staff, lead farmers and farmer groups are important sources of information and support in farmer decision making.

Climate services products should be designed with the aim to address multiple farmer 'problems'. For example, information on the amount of rainfall to expect in a season can aid decision making on choice of land preparation and cultivation methods, choice of crop variety, weeding, as well requirements for pest and disease management in cattle.

Keywords

Climate services; user needs; contextualisation; radio; Zambia

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Till Below is an advisor at Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ).

Acknowledgements

This report summarizes the findings from a User Needs Research implemented by Bongo Hive and University of Reading for GIZ. The evaluation was carried out under the auspices and with financial support of the Climate Risk Insurance and Information in Zambia (CRIIZ) project implemented by GIZ on behalf of the German Federal Ministry for Economic Cooperation and Development (BMZ).

Our thanks go to the organisations that made up the steering committee for this User Needs Research which included Ministry of Agriculture, Ministry of Fisheries and Livestock, Zambia Meteorological Department of the Ministry of Green Economy and Environment, Community Markets for Conservation (COMACO), Dairy Association Zambia (DAZ), Lima Links. The Ministries and organisations provided vital support during the fieldwork and provided feedback on initial findings presented during stakeholder meetings. Thanks also to the survey and focus group respondents for sharing their time. Any errors are those of the authors.

Contents

Acronyms

BMZ	Bundesministerium für Wirtschaftliche Zusammenarbeit und Entwicklung
COMACO	Community Markets for Conservation
CRIIZ	Climate Risk Insurance and Information in Zambia Project
DAZ	Dairy Association of Zambia
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
PICSA	Participatory Integrated Climate Services for Agriculture
USSD	Unstructured Supplementary Service Data
ZMD	Zambia Meteorological Department

1. Introduction

Background and context of work

The Climate Risk Insurance and Information in Zambia (CRIIZ) project implemented by Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) seeks to support the access of agricultural actors to private-sector climate risk insurance and information on climate risk. The project targets four key stakeholders: farmers, insurance companies, government actors and climate service providers (including the private sector). This task required a team to assess the user needs of selected farmer groups in Zambia for agrometeorological information services to support the conceptualisation, preparation, and facilitation of a Product Innovation Lab to inform the development of future innovative agrometeorological products.

The consortium used a farmer-focused approach to best understand and contextualise the needs of farmers. This built on previous experience of developing and analysing participatory climate services in several countries in sub-Saharan Africa, the Caribbean, Latin America, and Asia.

Aims and objectives of user needs research

The user needs research aimed to assess the user needs of selected farmer groups in two provinces of Zambia for agrometeorological information services. This process aimed to:

- Identify the types of weather information and agronomic advice that farmers currently receive, the sources that they use and how satisfied they are with the information they receive;
- Better understand the effects of climate variability and change on different agricultural activities and the decisions farmers are able to make; and
- Enable farmers to identify what weather and climate information, services and agronomic advice they need and how they would like to access it.

2. Methodology

The user needs research utilised a combination of qualitative and quantitative methods in order to provide both depth of understanding and representativeness of results. Each of the different elements were developed in an iterative process of discussion between the research team and all were piloted with respondents before finally being used for the data collection process. The different methods used are outlined in this section and the protocols used for the qualitative research are included in appendices 1, 2 and 3.

Qualitative

The research team undertook a range of qualitative methods in each province. These included **Resource Allocation Maps** which provide in-depth information about the mixture of livelihoods a household undertakes, the different resource flows that are available to a household and the way that they flow between different enterprises and activities. As part of this exercise the maps were used as a focus for a discussion around how different activities are affected by weather and climate. **Decision Calendars** provided enterprise-by-enterprise information about the key activities that farmers undertake, the decisions that they make and how those decisions link to weather and climate conditions. Understanding these different decisions and how they are influenced by weather and climate can help to explore what information is useful to support farmer decision making as part of a climate service. The **Options Identification Exercise** is a participatory tool that enables farmers to identify and explore options (alternative ways of doing things) which can help them respond to challenges and opportunities they face. Individual attitudes to risk and resources available to a household are likely to influence farmers' choices and so this tool aims to explore a broad range of options to ensure that all farmers are able to identify and explore options that may be suitable for their circumstances. Table 1 details the number of each of the activities undertaken in each of the two provinces where the research was conducted.

Table 1: Number of qualitative activities undertaken in each province

	Eastern Province	Southern Province
Resource Allocation Maps	14	12
Decision Calendars	13	11
Options Identification Exercises	5	5

Quantitative

Following the completion of the qualitative activities, quantitative surveys were undertaken in each province. The surveys were undertaken by two teams of three enumerators (one team in each Province), under the supervision of two research team members, using tablets and used open data kit software. The enumerators were trained in the survey methods and in the ethical considerations of data collection in rural communities before they pilot tested the survey. The first survey was undertaken in Eastern Province (n = 173) and then Southern Province (n = 164).

The quantitative surveys aimed to identify the types of weather information and agronomic advice that farmers currently access, the sources that they use and how satisfied they are with the information that they receive. Alongside information access and use, data were collected on the decisions that farmers make that are influenced by weather and climate variables and how they are influenced. In the context of these decisions, respondents were asked what types of weather and climate information they would like to receive in the future and which sources they would like to interact with to access and use the information. The survey also collected information on basic demographic, social and economic characteristics as well as access and use of different communication sources.

Sampling and analysis approach

Provinces were selected based on ongoing project activities related to agriculture by GIZ as well as representation of two different agro-ecological zones with associated differences in farming systems (Zones 1 and 2 in Southern Province and Zone 2 in Eastern Province). Within each Province, three districts were chosen based on two criteria: 1) availability of 30 years plus of observed meteorological data (rainfall and temperature) and 2) complementarity with other ongoing projects in the area of agrometeorology. The selected districts were Chipata, Lundazi and Petauke in Eastern Province and Choma, Magoye and Monze in Southern Province. Key stakeholder partners were asked to provide lists of farmers split by gender, wealth and, importantly, targeting the specific value chains (dairy in Southern Province and soya beans and groundnuts in Eastern Province). The research team randomly selected respondents for both qualitative and quantitative aspects.

The qualitative data were analysed using a thematic analysis. This involved reviewing the transcripts and participatory tools from each of the interviews and focus groups in detail and identifying themes in the responses that farmers gave. We then used these themes to

develop summary farmer profiles, activity calendars, and response options matrices for the two provinces. We also explored differences between men and women, and between the districts within each province. The quantitative analyses were undertaken using Microsoft Excel and SPSS. The analysis consisted of basic descriptive statistics and were disaggregated by gender and wealth.

3. Results

Demographics, social and economic information

In Eastern Province the sample was evenly split between men (49%) and women (51%) and there was a wide range of ages between 18 and 83 years old. In Southern Province, due to the nature of the sampling undertaken and the dairy value chain being dominated by men, the survey sample was skewed heavily (86% men) though there was a similarly wide range of ages (17 to 90 years old). As part of the survey a set of questions were asked to establish relative wealth of survey respondents.

In Eastern Province the majority of respondents were associated[1] with Community Markets for Conservation (COMACO) (79%) whilst a small proportion (5%) were associated with Lima Links and 17% had no association to either organisation. In Southern province, all respondents were associated with Dairy Association Zambia (DAZ).

Farm profiles and livelihoods

The Resource Allocation Map activities enabled the research process to develop different farm profiles and the results of this process are summarised here for each of the Provinces:

Eastern Province

The farmers who were interviewed in Eastern Province typically cultivated a small area of land, made up of 3-4 fields. The interviewed farmers were mainly engaged in groundnuts and soya beans value chains, but also grew other crops including maize, beans, and sunflower. Some farmers also had small vegetable gardens in areas of wetland, where available. One farmer in Petauke also grew cashew nuts and cotton as part of a specific project. A few farmers kept a small number of cattle, as well as some goats and chickens. The interviewed farmers used a mixture of family and hired labour. In most households, all family members were involved in decision-making and doing farming activities, and there were more women-headed households than in Southern Province. Women tended to be more involved in day-to-day activities such as weeding, whilst men were responsible for tasks such as ploughing, and children were responsible for caring for chickens. The main inputs they used were manure and compost, though some farmers in Chipata also said they used inorganic fertiliser on crops that they did not sell to COMACO. The farmers in Eastern

[1] In this context, 'associated' means that the respondent receives services or information from the organisation

province perceived that they had few options available to respond to inclement weather.

Southern Province

The farmers who were interviewed in Southern Province were generally wealthier than their Eastern counterparts and were engaged in the dairy value chain. The number of cattle varied from farmer to farmer, and some farmers were reluctant to disclose their precise numbers. The farmers typically kept a mixture of local, improved, and cross-bred cattle. Some cattle were used for dairy, others for beef and bulls were kept as oxen. The amount of milk produced for dairy ranged from 6-60 litres per day and appeared to be lower among farmers in Monze district. These farmers also typically kept other livestock such as goats and chickens. More men than women were involved in caring for the cattle, as well as milking and marketing, although there were some exceptions in which women were more involved, or even in charge of, handling the cattle. The main inputs involved in dairy enterprises were medical treatments for the cattle and supplementary fodder.

These dairy farmers were also engaged in cultivation of crops, including maize, sunflower, sorghum, sweet potato, beans, and groundnuts, as well as some vegetable gardens. The farmers grew these crops for a mixture of fodder-production (maize stalks, sunflower heads, sorghum, sweet potato, and velvet beans), commerce (sunflower oil, groundnuts) and consumption (maize grain). These farmers typically had larger fields for crop growth than their counterparts in Eastern province, and their crop-related inputs included inorganic fertiliser, hired labour, pesticides, and herbicides.

Though the project was focused on the key value chains of soya beans and groundnuts in Eastern Province and dairy in Southern Province the quantitative survey aimed to provide an overview of the crops grown and livestock kept. The reason for this is that impacts of weather and climate challenges are of course broader than those value chains and farms are integrated systems that need to be considered as a whole. Figures 1 and 2 outline the different crops grown and livestock reared in the two provinces.

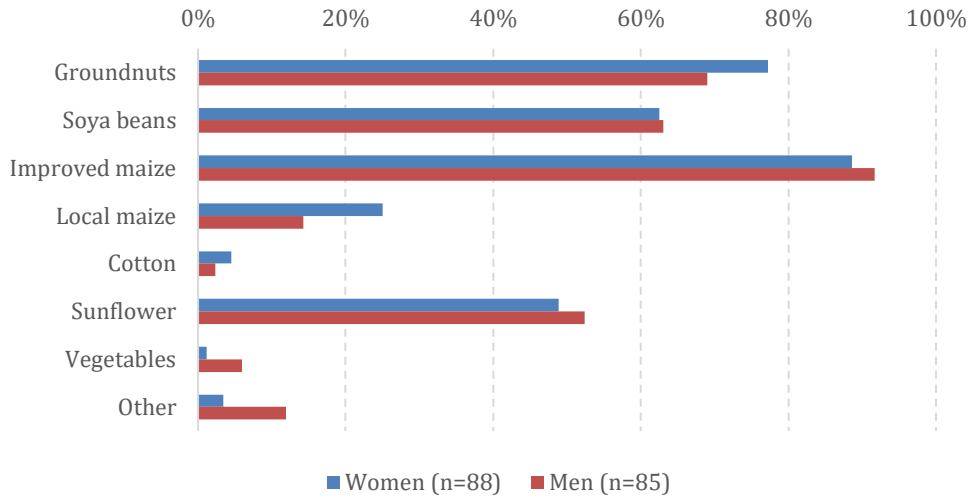

Figure 1: Proportion of respondents growing different crops in Eastern Province

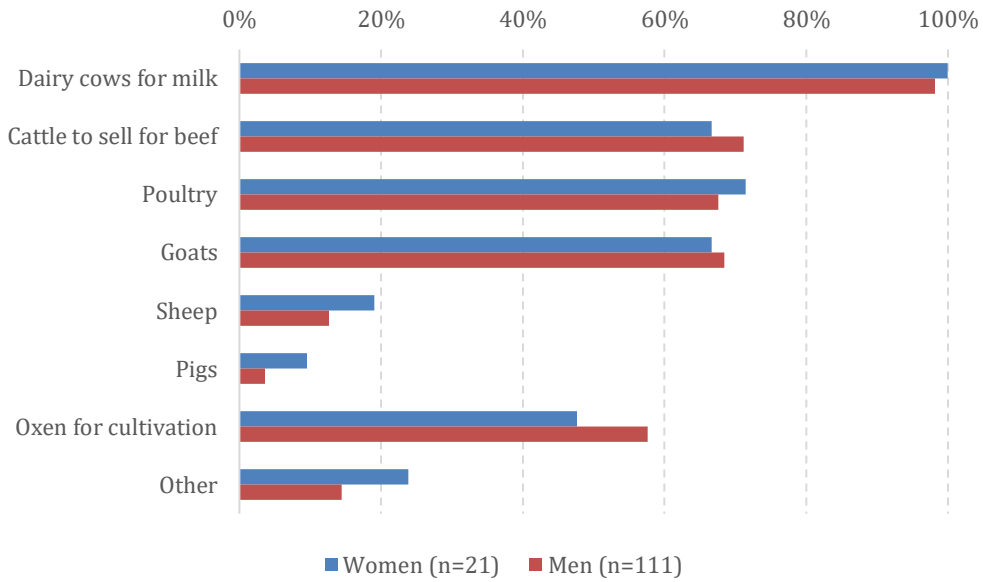

Figure 2: Proportion of respondents rearing different livestock in Southern Province

With regards to the scale of different enterprises: groundnuts respondents grew between one and six acres with a median of one acre and for soya beans respondents grew between one and eleven acres with a median of 1.5 acres for women and 2 acres for men. In Southern province respondents kept between 1 and 32 dairy cows with a median of four for women and six for men.

Current sources of agricultural advice, agro-met information and use of weather and climate information

Respondents were asked to outline the sources of agricultural advice that they currently access. Most (88%) of respondents in Eastern province had received agricultural advice and highlighted a range of different sources (see figure 3). The most popular sources were radio programmes, lead farmers and government extension services.

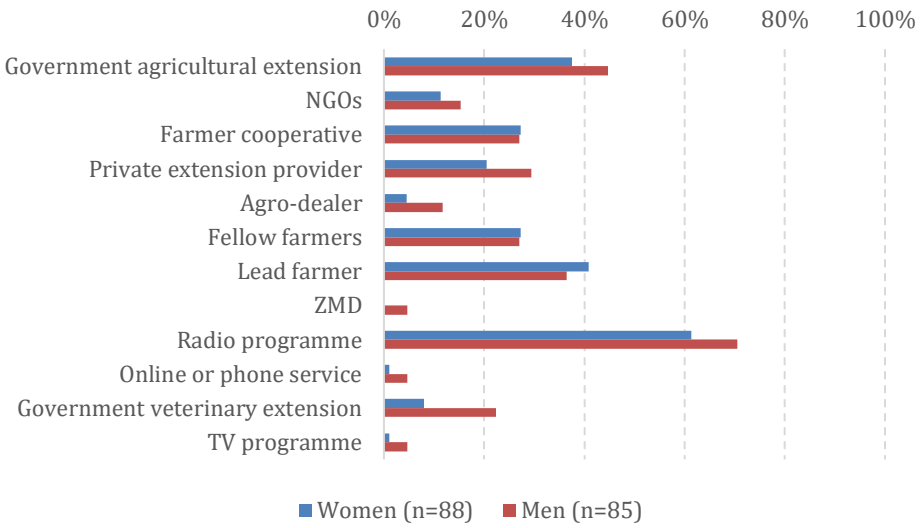

Figure 3: Sources of agricultural information in Eastern province

As well as being the most frequently cited source of advice, radio was also the most frequently accessed with more than half of respondents in Eastern province reporting that they access agricultural advice from the radio on a weekly basis. Advice from lead farmers came on a weekly to monthly frequencies whilst a larger proportion of those accessing advice from government agricultural extension did so less frequently than monthly.

Almost all (93%) of respondents in Southern province had received agricultural or livestock advice and again, this had come from a range of sources (figure 4). The most popular sources of advice were farmer cooperatives, government agricultural and / or veterinary extension and radio programmes.

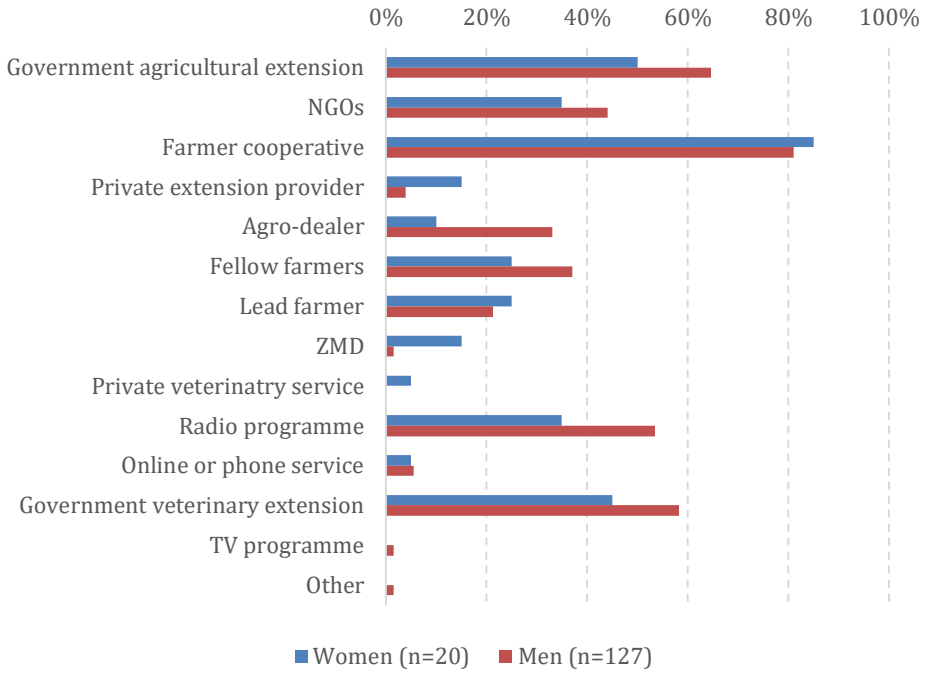

Figure 4: Sources of agricultural and livestock advice in Southern Province

Similarly to Eastern province, radio was accessed most frequently (often on a weekly basis). This was followed by farmer cooperatives which were most frequently accessed on a monthly basis and then government agricultural and veterinary extension which were accessed by most every two to three months.

With regards to weather and climate information, the research team undertook key informant interviews and desk research to explore sources of weather and climate information and available products at national, provincial and district level. It should be noted that this information is what is produced or made available but may not necessarily reach the farmers. Furthermore, though reliable, the sources of this information may be limited to only the stakeholders that the key informants work with. At national level, Zambia Meteorological Department (ZMD) is the primary producer and provider of weather and climate information and services. They have a network of stations around the country which provide data on a range of weather and climate variables. ZMD have several platforms via which they communicate information and partner with a range of stakeholders who also provide weather and climate information to users (see table 2).

Table 2: Table of existing climate service products

Existing Climate Service Solution	Implemented By	Geographical Area (Country / Province)	Access by rural farmers
1. 7-day weather forecast 2. 10-day agro met bulletin 3. Lunchtime and evening weather report (facebook) 4. Weather warnings (facebook) Seasonal rain forecast	ZMD	National	1. Television 2. Radio 3. Facebook 4. Twitter 5. WhatsApp 6. Email currently not working 7. SMS subscription (not working currently)
Warning of extreme weather events	Department of Agriculture	Chipata	Extension system (farmer groups or radio)
Irregular weather forecasts	1. Department of Agriculture 2. Zambia Meteorological Department	Lundazi	1. Extension (farmer groups) 2. Radio or physical visits
1. Weather updates in the event of catastrophes that affect the crop (post) 2. Periodic weather updates provided by camp officers when they meet farmers	1. Farmer Input Support Programme in cooperation with insurance companies 2. Department of Agriculture	Reported in Petauke but considered to be a national programme	1. Farmers are contacted either directly (through meetings and field visits) or via radio 2. Through camp officers (who themselves receive through a WhatsApp group)
Seasonal weather forecasts and short-term weather warnings	Department of Agriculture	Monze	Farmer meetings through camp officers
1. Seasonal weather forecasts 2. Daily weather forecast 3. Weather forecasts on demand	1. Conservation Farming Unit 2. Zambia Meteorological Department 3. Zambia National Farmers Union 4. Department of Agriculture	Choma	1. Phone calls, SMSs, field days and special trainings 2. Radio programs (for warnings) 3. Farmers request for information 4. Print outs (meetings and councillors), radio programs, and farmer to farmer word of mouth
1. Seasonal weather forecasts (daily) 2. Seasonal weather forecast 3. Daily weather forecast 4. Irregular weather forecasts	1. Heifer International 2. Zambia Meteorological Department 3. Zambia sugar 4. Dept. of Agric.	Mazabuka	1. Farmer-to-farmer meetings 2. Through dept. of Agriculture 3. For use on their plantations Meetings, personal requests

The survey explored whether respondents currently access and use weather and climate information in their planning and decision making. In Eastern province most respondents accessed and used weather and climate information (90%). When asked how regularly they sought to access information on weather and climate farmers highlighted how their information seeking differs before and during the rainfall season with increased regularity during the season (see figures 5 and 6).

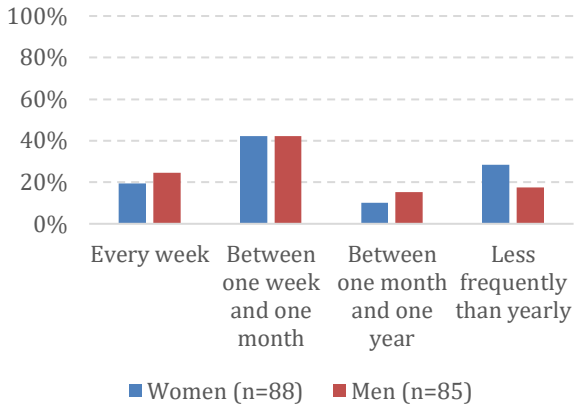

Figure 5: How often do you access weather and climate information in the lead up to the season? (Eastern Province)

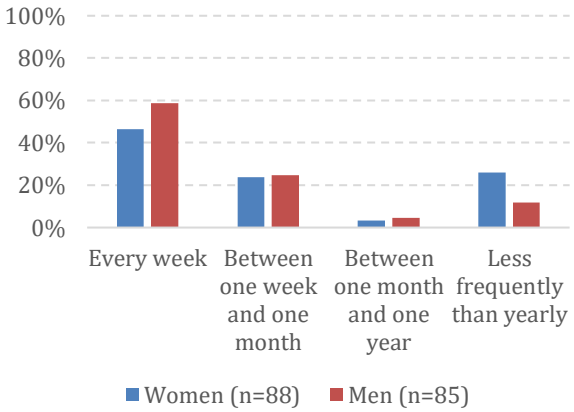

Figure 6: How often do you access weather and climate information during the season? (Eastern Province)

There was a similar situation reported in Southern province though the difference before and during the season was perhaps more pronounced (see figures 7 and 8).

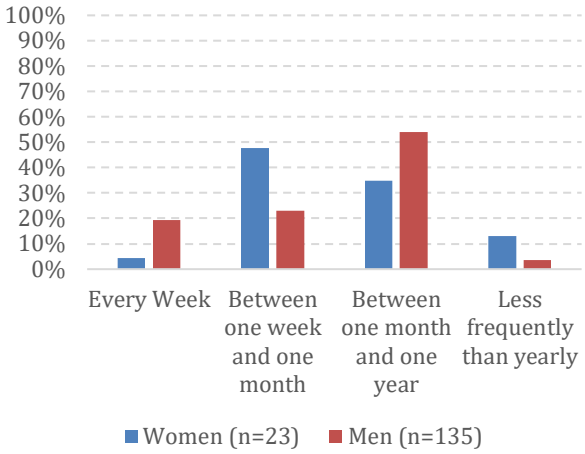

Figure 7: How often do you access weather and climate information in the lead up to the season? (Southern Province)

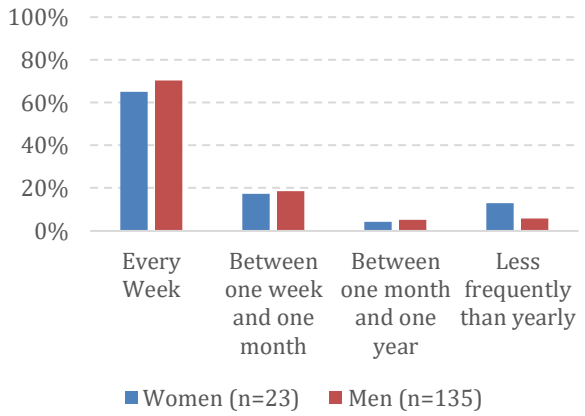

Figure 8: How often do you access weather and climate information during the season? (Southern Province)

When considering the type of weather and climate information used there was a difference between respondents in Eastern and Southern provinces (figures 9 and 10). While seasonal forecasts were used by a similar proportion of farmers in each Province larger proportions of farmers in Southern province were using forecasts on a daily, weekly, or monthly basis.

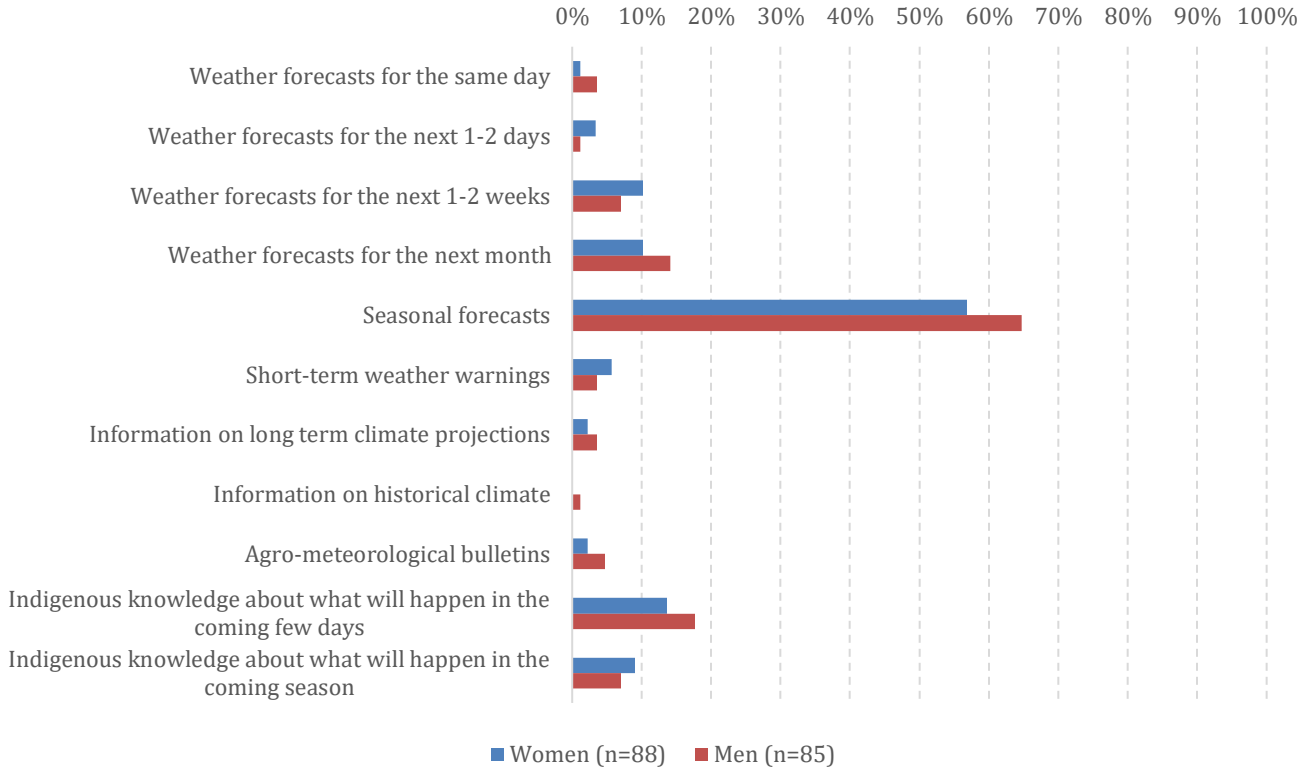

Figure 9: Weather and climate information used by respondents in Eastern Province

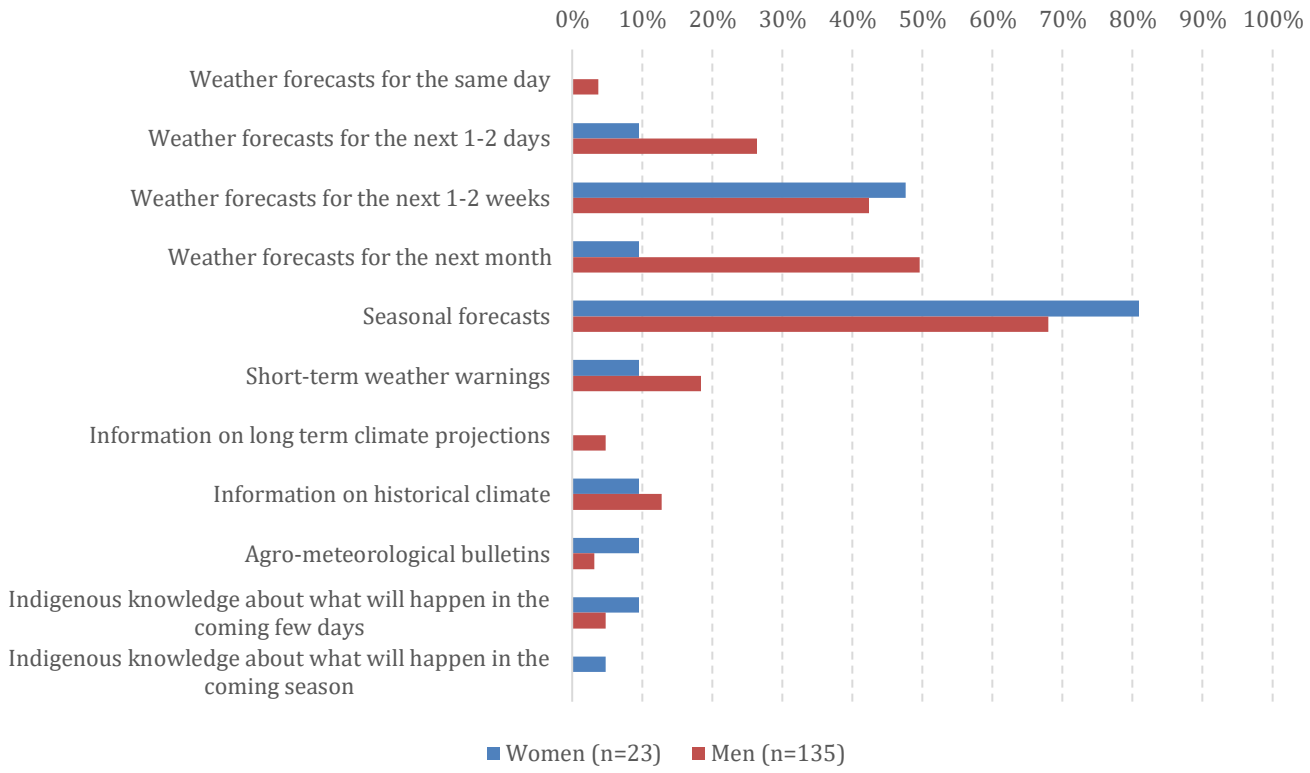

Figure 10: Weather and climate information used by respondents in Southern Province

Timing of agricultural activities / decisions and how they are influenced by weather and climate - seasonal calendar activities

This section will first present the results of the decision Calendar activities which were used to identify the timing of key activities and decisions in the key value chains and how they are influenced by weather and climate (figures 11 and 12). We then outline the results from the quantitative survey which provided further evidence r.e. which decisions were most frequently influenced by weather and climate factors and which factors are most likely to influence them.

Eastern Province

	Heavy rainfall		Moderate rainfall		Dry, sunny, cold			Dry, hot, windy			Increasing chance of rainfall	Heavy rainfall
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Soybean	Growth period - weeding			Harvesting, shelling		Marketing	Manure making and application		Land preparation			Planting, weeding
Ground-nuts	Growth period - weeding					Harvesting, shelling, drying			Marketing		Planting	
Maize	Planting, weeding		Growth period - weeding, fertiliser			Harvesting, shelling, drying		Marketing		Land preparation		Planting, weeding

Figure 11: Composite crop decision calendar for Eastern Province

The above activity calendar shows the expected seasonal climate conditions for Eastern province, as well as the timing of activities for the key crops cultivated. The calendar shows increasing likelihood of rainfall through November, and then heavy rainfall between December and February, reducing in March and April. There is then a dry period from May to October, with increasing temperatures from August. The growing season is from December to March for soybean and November to May for groundnuts. In relation to the calendars, we asked farmers how different cropping activities were influenced by the weather at different times.

<u>Soya Beans</u>

- Timing of planting was influenced by variability in the onset of seasonal rainfall because it is required for germination.
- Decisions around the variety of crops were influenced by seasonal amounts of rainfall and variability in the onset and length of the season.
- Land preparation and compost application was influenced by the timing of sustained rainfall, as the soil needs to be moist but not too wet for successfully creating rip lines and applying compost.

- Weeding was influenced by the timing of sustained rainfall (this was particularly raised by women), as it is best done when the soil is moist, but not too wet.
- Harvesting and shelling were influenced by the timing of sustained rainfall, the end of the season, and high temperatures, because they require dry and warm conditions.

<u>Groundnuts</u>

- Timing of planting was influenced by variability in the onset of seasonal rainfall because it is required for germination.
- Decisions around the variety of crops were influenced by seasonal amounts of rainfall and variability in the onset and length of the season.
- Weeding was influenced by the timing of sustained rainfall (this was particularly raised by women), as it is best done when the soil is moist, but not too wet.
- Harvesting and shelling were influenced by the timing of sustained rainfall, the end of the season, and high temperatures, because they require dry and warm conditions.
- Marketing was influenced by the timing of the season end date.

Southern Province

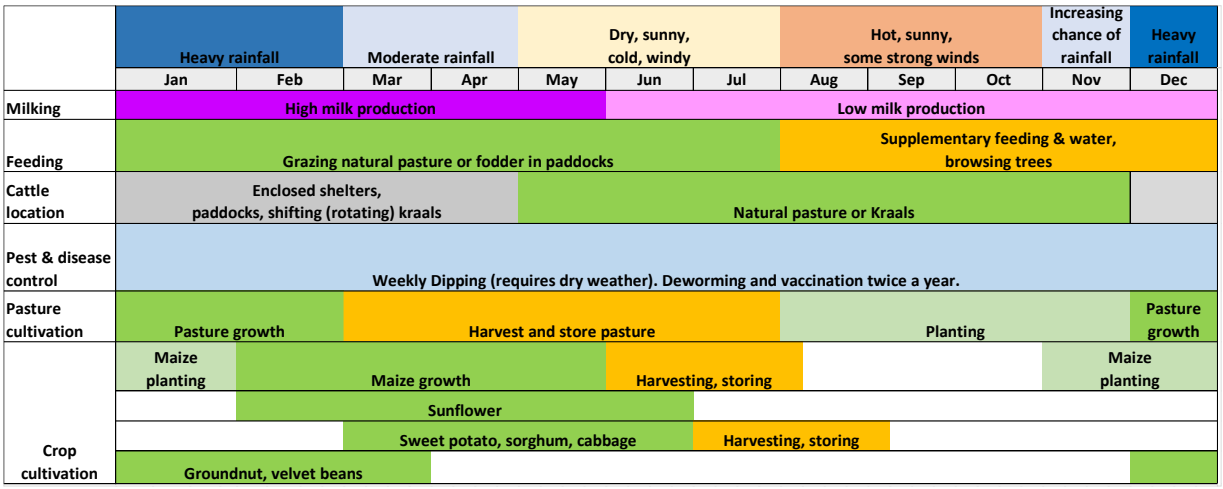

Figure 12: Composite crop and dairy production decision calendar for Southern Province

The above activity calendar shows the expected seasonal climate conditions for Southern province, as well as the timing of activities for dairy farmers. The calendar shows increasing likelihood of rainfall through November, and then heavy rainfall between December and February, reducing in March and April. There is then a dry period from May to October, with increasing temperatures from August. For dairy farmers, this means milk production is highest during the months of January through to May, because of increased availability of pasture and fodder. However, health risks associated with high rainfall mean cattle are kept

in shelters or shifting kraals during this time. During the dry season, cattle can be released to browse freely, but require supplementary feeding from August to December. The timing of crop cultivation is typically associated with the rains. Crops for fodder are then harvested and stored for use in the dry season. The farmers in Southern province indicated the following effects of weather on their activities.

- Milk production reduces during periods of high temperatures, dry spells, and drought.
- Kraal rotation is influenced by sustained rainfall, excess rainfall in shorter periods, the timing of the season end date, because it is predominantly used in the rainy season, as well as weather-related pests and diseases.
- Supplementary feeding and watering are required during dry spells, drought, late onset of rains and also early ending of the season, as well as during sustained periods of high temperature.
- Dipping is affected by sustained rainfall and extreme rainfall events, as well as by early onset and late end of the season, as it needs to be done during dry conditions.
- Providing shelter for animals is required during sustained periods of rainfall, as well as extreme rainfall events. It is also needed during periods of sustained high temperatures and to avoid over-exposure to sunshine.
- Movement of cattle for grazing is influenced by the timing and amount of rainfall, both in the short term and over the course of a season. It can be influenced by both low and high rainfall, as the cattle may be moved to find fresh pasture, or to avoid waterlogged conditions.
- In the rainy season, milk prices drop due to increased production, whilst medicine prices increase due to increased demand.

Timing of agricultural activities / decisions and how they are influenced by weather and climate – quantitative survey results

The quantitative survey enabled a broader sample of farmers in both provinces to report how decisions at different stages were influenced by weather and climate and broadly agreed with the results of the qualitative work. For groundnuts and soya beans in Eastern Province (figures 13 and 14) the main decisions influenced included planting time which is influenced by both early and late onsets of the season; decisions around choice of crop variety which were influenced by variability in both the amount of rainfall that falls over the course of the season and the length of the season; weeding which was influenced by long periods of increased rainfall; harvesting which was influenced by late end of seasonal rainfall

as well as the variability in the amount of rainfall in the season; also decisions around marketing were influenced by late end of the seasonal rains.

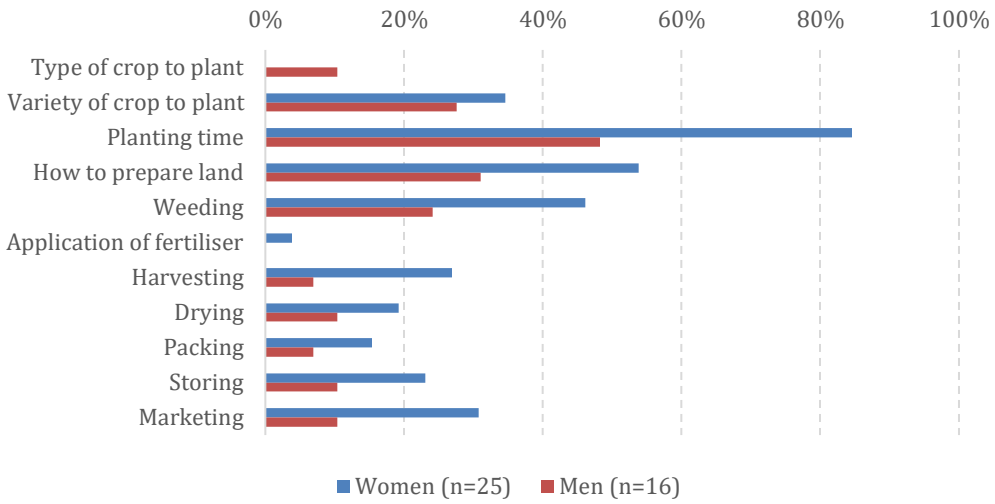

Figure 13: Groundnut production decisions influenced by weather and climate in Eastern Province

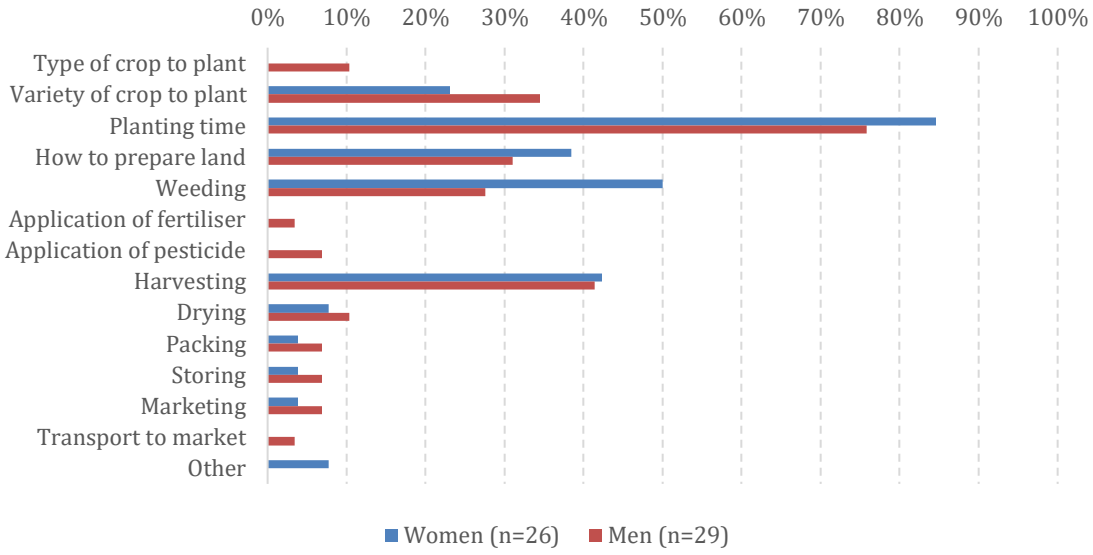

Figure 14: Soya bean production decisions influenced by weather and climate in Eastern Province

For dairy farmers in Southern Province the respondents outlined how their decisions were influenced by weather and climate (figure 15). For dairy, kraal rotation and movement of animals for grazing are influenced by increased rainfall over both long and short time periods as well as a delayed end of the season and by pests and diseases that are linked to weather conditions. Providing supplementary feeding and water to animals is influenced by dry spells or drought, high temperatures over long and short time periods and (for feed) an early end to the season. Dipping and disease management are influenced by increased rainfall

amounts over a longer period as well as early onset and delayed ending of the season. Farmers highlighted that milk production is influenced by high temperatures, dry spells, and drought.

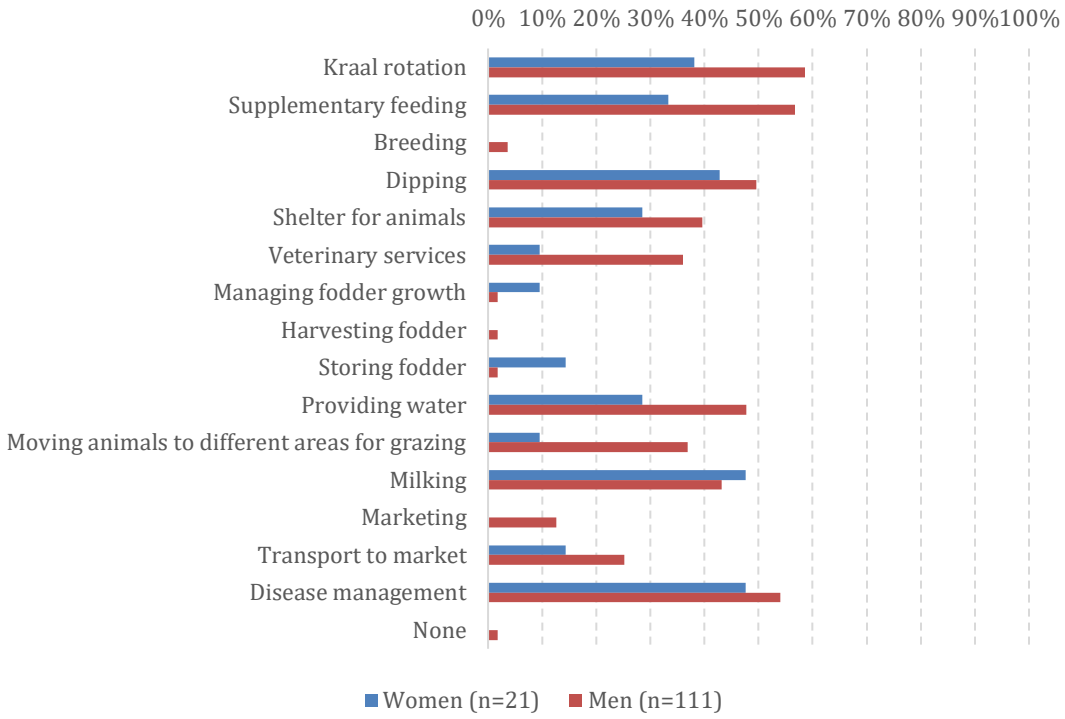

Figure 15: Dairy production decisions influenced by weather and climate in Southern Province

Identifying existing options and strategies with farmers

The Options Identification activities were used to enable farmers to highlight the key challenges that they face with regards to weather and climate and then consider the options and strategies that they are aware of and use to combat them.

Eastern Province

We asked the interviewed farmers about the challenges they face associated with the weather and climate. As shown in table 3, the main challenges for crop farmers were associated with the timing and amount of seasonal rainfall. Challenges caused by drought, such as low yields and pests were of greatest concern, though challenges associated with excess rainfall were also considered important.

Table 3 Challenges associated with the weather and climate for crop farmers in Eastern province

Weather and climate conditions	Challenges caused
Excess rainfall during rainy season	Weeds outcompete crops and the rainfall hinders weeding.
	Causes crop rot in maize, soybean, and groundnuts.
	Washes away fertiliser, which reduces yields.
Heavy rainfall	Damages and leads to waterlogging in rip lines.
Late season end	Post-harvest rot in maize and beans can be caused by wet conditions.
Drought and intermittent/low rainfall	Reduces crop yields, encourages certain pests and diseases (e.g. termites, rosette).
	'Pegging' of groundnuts fails due to hard ground, which reduces yields.
High temperatures	Hinders germination, cause soybeans and groundnuts to mature with unfilled pods and increases risk of pests and diseases.

We then asked farmers to complete 'Response Option Matrices,' in groups, in which they listed possible responses they could take to mitigate or manage challenges, or take advantage of opportunities, associated with weather and climate (see image below for example). The interviewed farmers described a range of different responses, as follows:

- Conservation Agriculture methods, including rip lines, basins, compost, and manure application to conserve water.
- Planting *gliricidia sepium* trees to reduce the impacts of wind and to make herbicide from the leaves to control weeds.
- Diversifying their livelihoods to spread risk and increase income and food – e.g. using vegetable gardens, goats, chickens, honey, and small businesses (making fritters, selling sunflower oil etc).
- Growing early maturing varieties that can tolerate drought.
- If conditions are favourable, plant both early and late maturing varieties to ensure food before the end of the season.
- If season starts late then plant late, although this shortens the growing season.

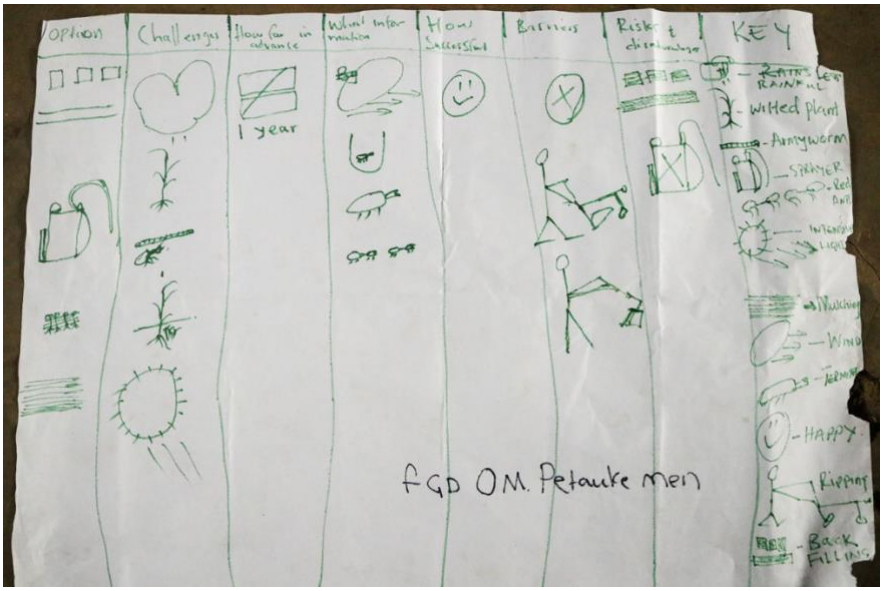

Image 1: Example Response Options Matrix from Eastern Province

Southern Province

In Southern province, there were more challenges associated with excess rainfall, compared with Eastern (see table 4). Dairy farmers were particularly concerned with increased risk of animal diseases during very wet conditions, as well as damage to stored fodder and fodder crops. Drought and extreme heat were also considered problematic, as they reduced availability of food and water, and thus reduced milk production.

Table 4 Challenges associated with the weather and climate for dairy farmers in Southern province

Weather and climate conditions	Challenges caused
Excess rainfall	Increases animal disease incidence, which reduces milk production.
	Makes grazing difficult in lowland areas.
	Contaminated water, due to flooding, increases the likelihood of worms.
	Roads become muddy and impassable, which hinders access for delivery of milk to the market.
	Heavy rain after dipping washes off the dipping chemical.
	Encourages weeds to outcompete fodder crops.
	Stored fodder goes rotten if it gets too wet.
	Damages velvet beans (fodder crop).
	Encourages crop diseases.

Drought	Reduces crop yields, water availability and thus milk production if the animals are undernourished.
	Price of animal feed increases.
	Increases spread of disease through increased use of communal water sources.
High temperatures	Causes heat stress and reduces milk production.
	Can cause fodder crops to dry out, which results in them losing nutrients.
Normal rainy season	Milk prices drop due to increased production, whilst medicine prices increase due to increased demand.

The interviewed dairy farmers in Southern province also completed Response Options Matrices, in which they identified the following options for responding to climate and weather-related challenges:

- Growing and conserving crops specifically for fodder (e.g. sorghum, grass, sunflower, sweet potatoes and bi-products) for use in dry season and dry years.
- Planting crops early and then storing maize stalks for silage to use during dry conditions.
- Plant trees to provide shade in high temperatures.
- Diversifying to alternative incomes to spread risk e.g. garden crops and small businesses (selling scones and tailoring) during bad years.
- Using dams or sink bore holes to access supplementary water during drought.
- Improving animal shelters to protect them from heavy rainfall.
- Buying fodder from outside the farm during droughts.
- Moving cattle to alternative sources of food and water (when food is low due to high rainfall or drought).
- Building fences around water sources to avoid contamination during dry periods (when water sources are scarce and are shared by others).
- Increase dipping and buy medicines to reduce pests and diseases when rainfall is high, or use traditional remedies.

Image 2: Example Response Options Matrix from Southern province

Future weather and climate information demand for crops and livestock and their source

Reflecting on the weather and climate information they already receive and the different decisions that they make that are influenced by weather and climate, respondents were asked what different types of information they would like to receive in the future and the sources that they would most like to receive it from / interact with. In Eastern Province, considering crops (figure 16), the largest proportion of respondents wanted information about the start of the season (both with and without consideration of dry spells). As well as the start of the season, respondents highlighted the importance of information about the end and the length of the season. Amounts and distribution of rainfall over the course of the season as well as extreme events were also regularly highlighted.

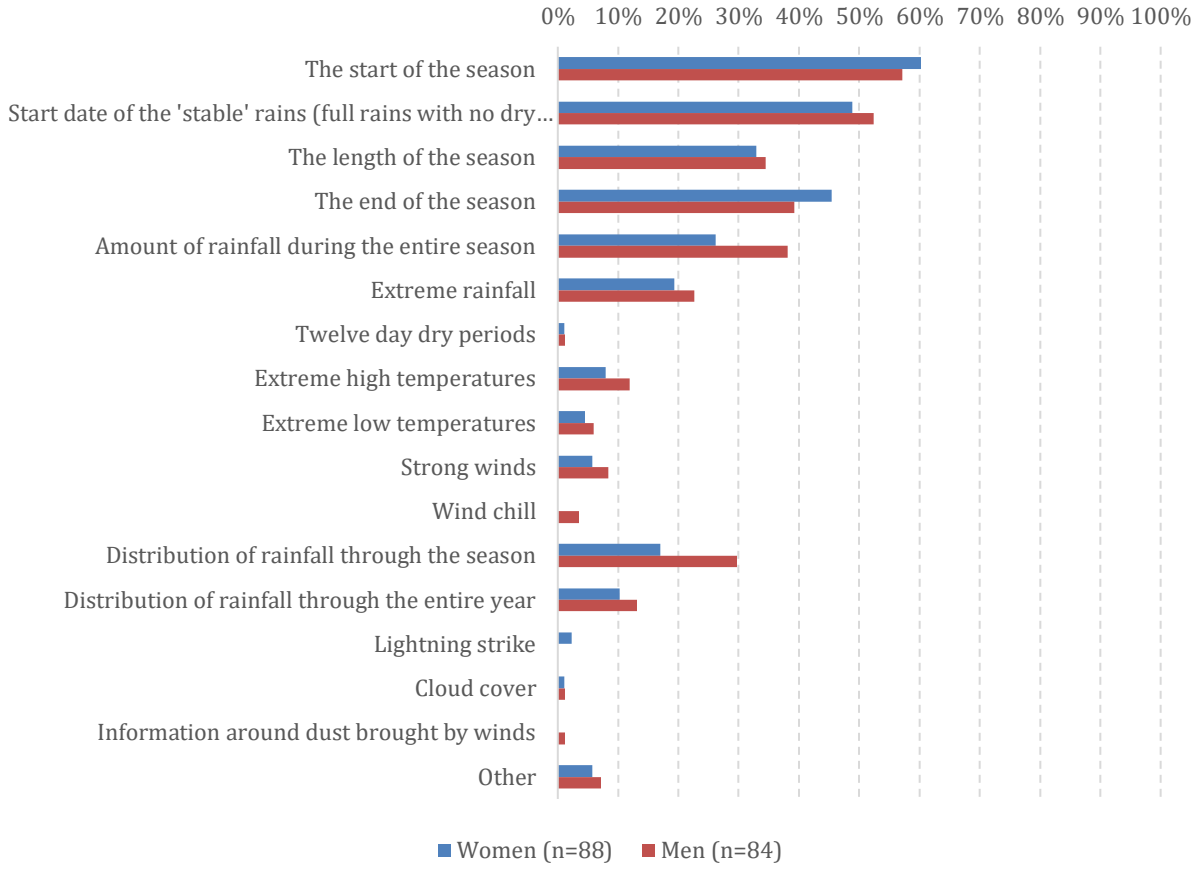

Figure 16: Weather and climate information demanded by respondents in Eastern Province

Respondents in Southern Province referred to the same elements of information when considering both crops (figure 17) and livestock (figure 18). There were differences which included less emphasis on the end and length of the season in Southern Province as well as more emphasis on extreme high and low temperatures (especially for livestock – see figure 18).

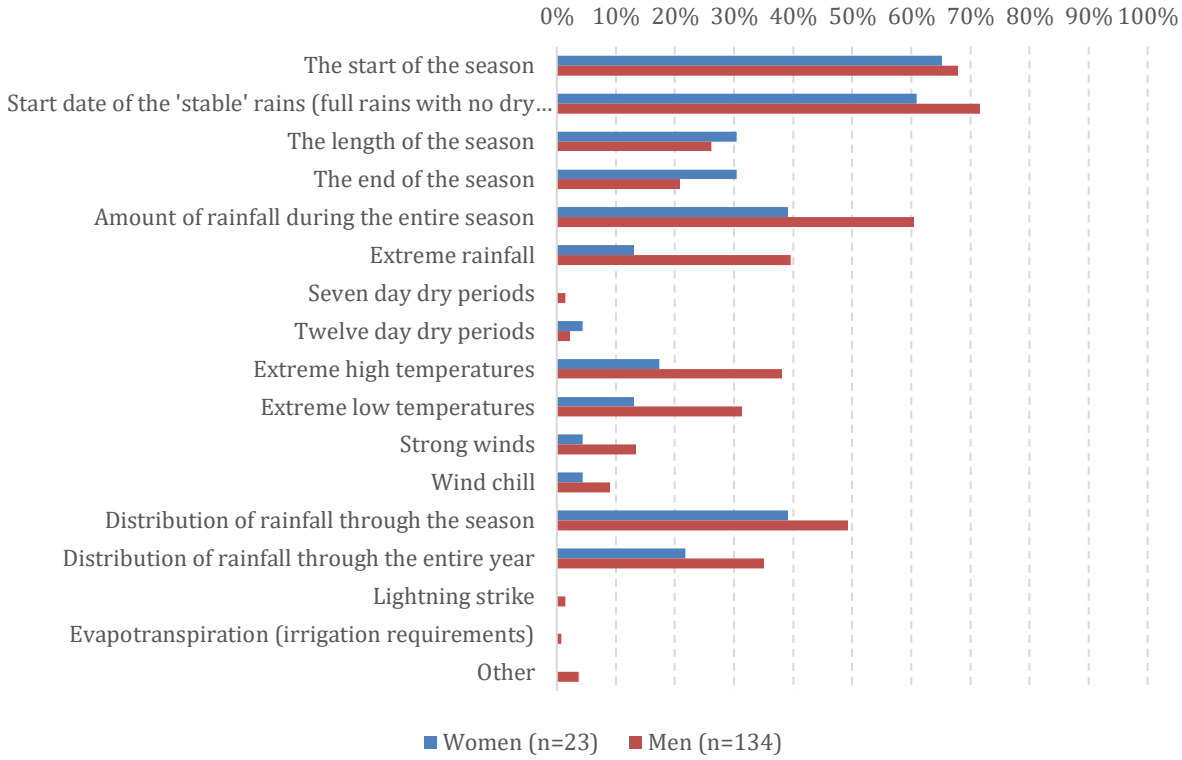

Figure 17: Weather and climate information related to crops demanded by respondents in Southern Province

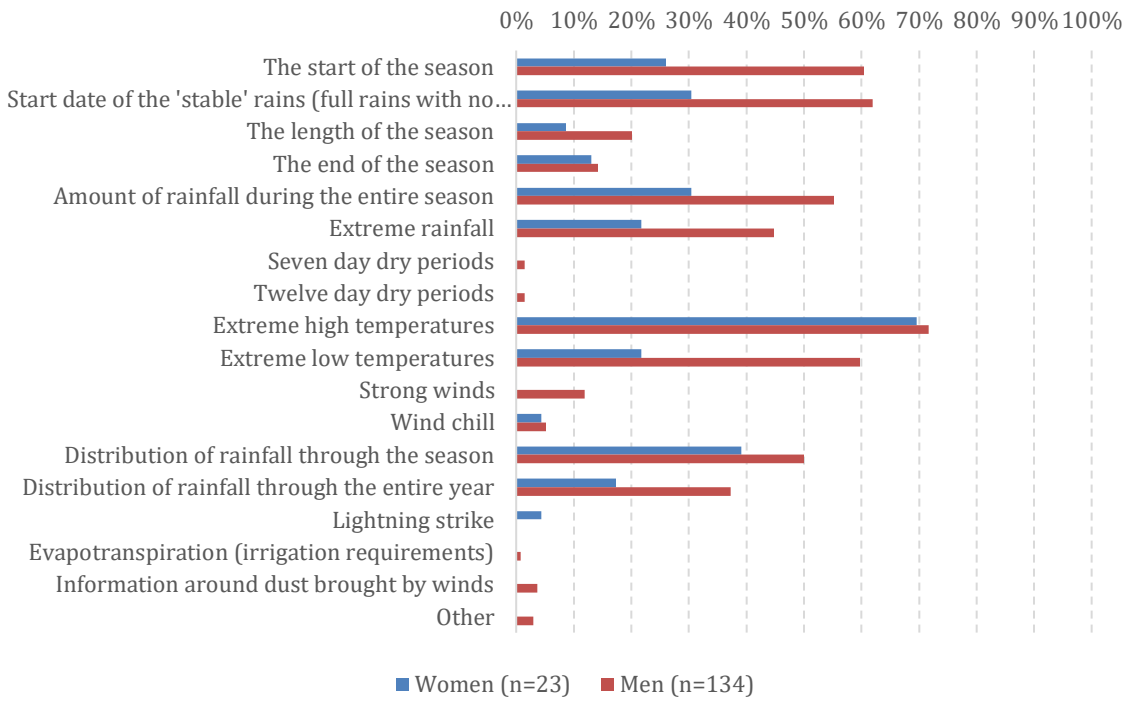

Figure 18: Weather and climate information related to livestock demanded by respondents in Southern Province

With regards to sources from which respondents would like to receive the information, the most popular in Eastern Province (Figure 19) were the radio, government or private extension provider, lead farmers or via mobile phone (respondents mainly referred to SMS as the source via phone).

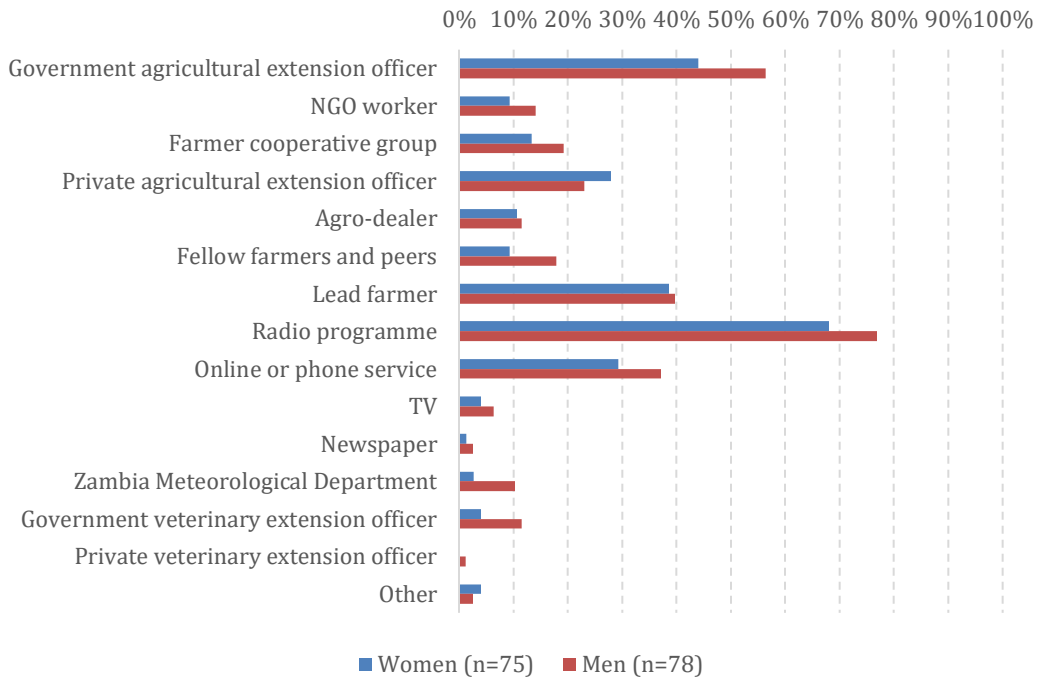

Figure 19: Preferred source of weather and climate information (Eastern Province)

In Southern Province respondents reported a wider range of possible sources (Figure 20) and, whilst radio was as popular a source as in Eastern province, mobile phones and farmer cooperatives were referred to by similar proportions. Government extension officers (both agricultural and veterinary), NGO workers and Zambia Meteorological Department were also referenced by a relatively large number of farmers.

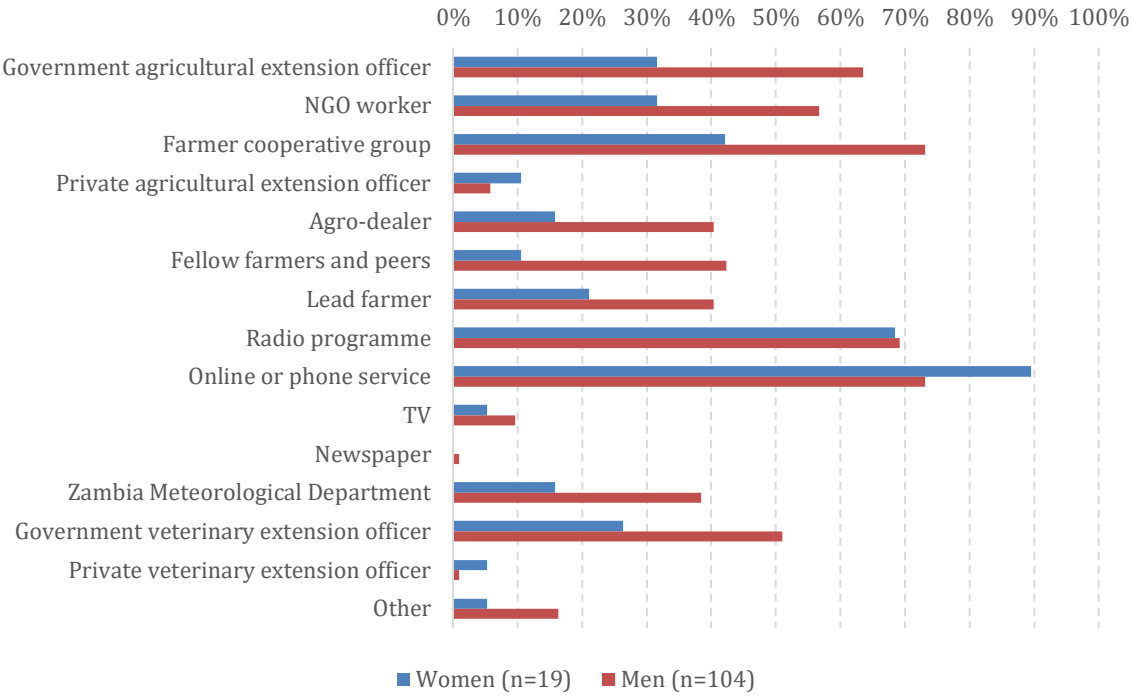

Figure 20: Preferred source of weather and climate information (Southern Province)

Access to mobile phones, television, and radio

As the development of future climate services may consider focusing on digital delivery mechanisms, it is important to understand farmers' access and use of mobile phones. There was a difference between the two provinces with a higher proportion of respondents in Southern province reporting being able to access and use at least a basic mobile phone (Figures 21 and 22). Fewer than 70% of women respondents in Eastern province have access to and use basic mobile phones.

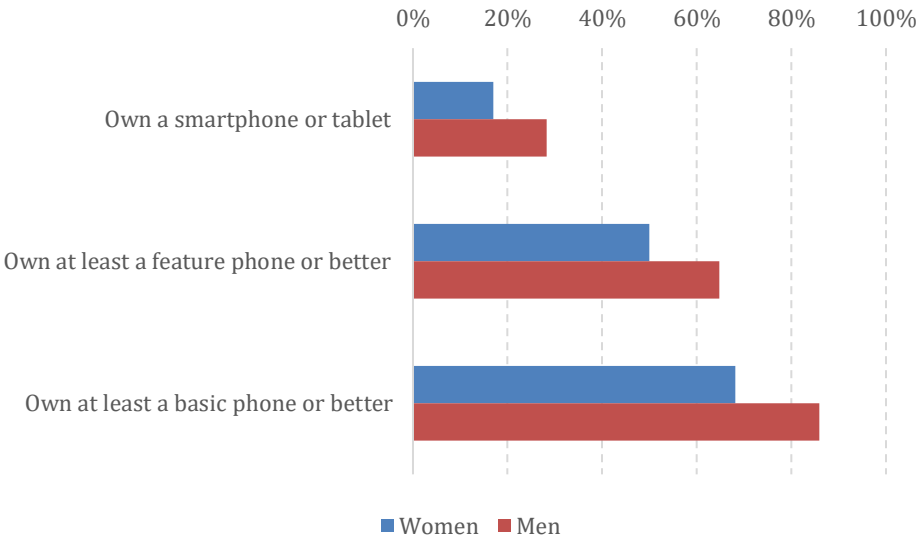

Figure 21: Access and use of mobile phones (Eastern Province)

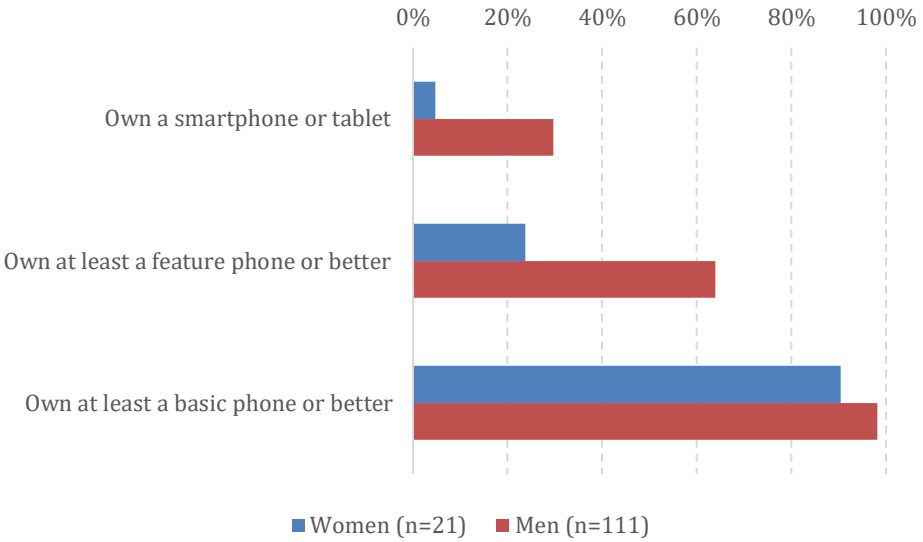

Figure 22: Access and use of mobile phones (Southern Province)

The proportion of respondents who can access and use a smartphone is much lower in both provinces and again there is a clear difference when gender is considered with fewer women being able to access and use smartphones.

4. Key issues and conclusions

It is clear from the results presented in this research that the respondents have articulated a demand for information and advice on a range of different weather variables at a range of different timescales to aid both their long-term planning and more immediate decisions. Farmers highlighted multiple effects of climate and weather information on the decisions that they take when planning and implementing their farming and livestock enterprises.

It is also clear from this research that there is a gap between the climate and weather information and services that are produced and those that farmers are accessing. Zambia Meteorological Department are providing forecast products on a short and medium range that are not accessed by large numbers of farmers (though they are used and appreciated by those farmers who do access them).

The complexities of challenges facing respondents and the variety of different decisions affected means that addressing these challenges is not simply about the provision of climate information but supporting farmers to contextualise and use this information. It is also important to provide feedback mechanisms regarding reliability, understanding and specific demands for further and different information and decision support. Through the qualitative element of this research farmers outlined a range of existing practices that they use to address challenges that are related to weather and climate. Many of these practices address multiple challenges and are often proactive rather than reactive options for farmers.

Engaging farmers with climate services requires a range of different approaches. Respondents access information in different ways and from different sources. Radio is the most commonly used and the most commonly requested going forward, including call-in shows with options for interaction and exchange between farmers. It is also clear that extension staff, lead farmers and farmer groups are important sources of information and support in farmer decision making. Respondents expressed a demand for services via mobile phones / SMS and further consideration should be given as to the appropriate types of information that can be shared and the aim of sharing information via these methods. Mobile phones / SMS also offer opportunities to coordinate simple feedback and monitoring of services through simple messages and / or USSD.

Few, if any, of the respondents are accessing or using historical climate information. The fact that a key problem identified by farmers was variability in the start, end, and length of the

season and in the amount of rain that falls over the course of a season means there is a clear opportunity for information on the climatology of local areas to assist in farmers understanding of the variability and the risks of different weather and climate variables. The climatology is also key to understanding how the climate is changing.

Climate services products should be designed with the aim to address multiple farmer 'problems'. For example, information on the amount of rainfall to expect in a season can aid decision making on choice of land preparation and cultivation methods, choice of crop variety, weeding, as well as requirements for pest and disease management in cattle.

This report has outlined the results of the user needs research and the findings will be used to develop climate services for the selected value chains in the Two Provinces and will potentially scale more widely in Zambia.

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