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# CRAVE

CLIMATE RESILIENT AGRICULTURE  
IN THREE VULNERABLE EXTREME  
NORTHERN CROP GROWING REGIONS

## INTERNAL REPORT: JUNE 2019

### KNOWLEDGE, ATTITUDE, BEHAVIOUR AND PRACTICES (KABPs), BASELINE AND ENHANCED LIVELIHOOD SURVEY

THROUGH SUSTAINABLE AGRICULTURE IN THE CROP GROWING REGIONS OF  
KAVANGO WEST, KAVANGO EAST AND ZAMBEZI



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## EXECUTIVE SUMMARY

This study serves as baseline and explores the Knowledge, Attitude, Behaviour and Practices (KAPBs) on climate change and livelihood diversification of small-scale crop farmers in the three north eastern regions of Namibia, namely Kavango West, Kavango East and Zambezi (CRAVE Project target areas). The main objective of the study was to understand the level of knowledge, attitude, behaviour and practices of small-scale crop farmers, and their response to determine knowledge gaps and behaviours toward climate change.

The study employed a mix of quantitative and qualitative methodologies using both primary and secondary data collection methods. In engaging with small scale crop farmers, a range of methods was used, including Household Questionnaire Survey, Focus Group Discussions (FGDs) Key Informants Interviews (KI) and field observations.

Results on current agricultural practices indicate that a significant number of farmers were still using the conventional farming methods. Of the total respondents, 83% reported that they were still using unsustainable farming practices such slash and burn as part of land preparation method.

The study results indicated that the most commonly grown crops by dryland farmers were Pearl millet (*Pennisetum glaucum*), maize, sorghum, bambara nuts, groundnuts and beans. While small scale horticulture farmers mostly grow vegetables such as tomatoes, cabbage, mutata and rape e

Generally dry land farmers planted own/recycle seeds from the previous harvest for most crops, while most horticulture farmers used improved seeds and mainly use bucket irrigation method which is too labour intensive.



The results indicate that some horticulture farmers use indigenous methods to control pests and diseases in their gardens. Of the total horticultural farmer, 25.3% indicated that they make use wood ash to control crop pests and diseases. Other indigenous methods reported by some farmers to control pest include crushed leaves of chilli, neem and tobacco leaves, onions as well as use of washing powder and sunlight bar. This suggests the need for CRAVE PMU and MAWF to understand indigenous knowledge system in a bid to adapt their local farmers situation and enhance the acceptance and adoption of the improved technologies. An integration of local knowledge into the scientific knowledge of crop pests and diseases will promote integrated pest and disease management

Dryland farmers mainly produce for home consumption while horticulture farmers produce for both home consumption and the market. Informal markets such as open market, road side, local cuca shops, farm gate, street market and schools were the most popular marketing channel reportedly used by small scale farmers.

Pests and diseases, access to farm inputs and lack of processing or preservation technologies top the list of key farming challenges experienced by horticulture farmers across the target regions. While dry land farmers revealed limited availability of labour, costly hired labour, drought, delayed rains, soil degradation, disturbance by birds, pests, lack of equipment for ploughing services, limited availability of inputs of production, delayed ploughing services from ADCs, and lack animal for drought power as the major challenges to crop production.

The study further assessed small -scale crop farmers' knowledge on climate change, their awareness, and attitudes as well as how climate change and variability is impacting their crop production and livelihoods. It further assessed farmers' awareness and understanding of Climate Smart Agriculture (CSA) practices; the coping strategies adopted by farmers as well as the constraints faced by farmers in responding to climate change and variability impacts.



Finally, the study assessed livelihood and household food security of the small scale crop farmers in the target regions.

The respondents were asked to indicate whether they were aware that climate change exists. A total of 93.5% of the respondents indicated that they were aware of climate change, whilst 6.5% were not aware. Of the respondents who indicated that they were aware of climate change, 58% were female, and the remaining 42% were male. A cross tabulation between gender and awareness of climate change revealed that there was no significant difference between gender and awareness of climate change.

Nevertheless, being aware of climate change does not necessarily guarantee farmers' knowledge of climate change. It was thus important to establish farmers' knowledge and understanding of climate change in detail. Hence, further investigation was done to assess farmers' perception on the causes of climate change and its effects on crop production and livelihoods.

The findings have shown that the majority of the respondents (81.7%) perceived that there has been a decrease in rainfall over the past 10 years. A cross tabulation between regions and rainfall revealed that perceived change in rainfall patterns did not differ significantly among the regions. However, majority of the respondents (86%) felt that rainfall duration has been decreasing over the past 10 years with high variability. This denotes that cultivation season has been shortened. Of the total sample size, 84% of the respondents reported that they have experienced an uneven rainfall distribution over the past 10 years. The remaining 16% of the respondents reported that rainfall has been evenly distributed over the past 10 years.





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In terms of experienced changes in temperature, more than half of the respondents (86%) have indicated that temperature has been increasing over the past 10 years. Only 8% of respondents reported to have not felt any change in temperature trends, while 6% reported that temperature has been decreasing over time. From the FGDs, majority of the respondents felt summer days or months were getting hotter and hotter.

With regards to farmers' perceptions on the causes of climate change, 61.3% of the respondents indicated deforestation as a major cause of climate change. Other causes reported were poor agricultural practices, transportation emissions, wild fires and work of God. About one third of the respondents (25.2%) did not know about the causes of climate change. These findings indicated a knowledge gap on climate change among small scale crop farmers in the study area.

The study findings indicate that climate change has a negative effect on livelihoods, food security and income at household level resulting from recurrent floods and severe floods. The study established that the impact of flood on crop production is more experienced in Zambezi and Kavango East regions. Flood is perceived to have less impact on crop production in Kavango West.

Majority (49%) of the respondents perceived crop production to have declined by 50% as a result of persistent drought. Drought is perceived to be more devastating across the target regions. However, flood had varied effects across the target regions with Zambezi region being perceived to have more adverse flood effect than in other two target regions.

Small scale farmers perceived to have been impacted by prolonged droughts, recurrent floods and strong winds which resulted in poor yields, increased pests/diseases, loss of livestock, reduced income and poor soil fertility.



## KNOWLEDGE, ATTITUDE, BEHAVIOUR AND PRACTICES (KABPs), BASELINE AND ENHANCED LIVELIHOOD SURVEY

Respondents were asked to state their level of awareness on CSA practices. The results indicate that 74.5% of the respondents were aware of CSA practices, while the remaining 25.5% were not aware.

Of those farmers who were aware, cited that they were aware of CSA practices through different ways such as the media (specifically radio 44.2%), training by MAWF/DAPEES Extension Officers, NGOs and donor funded projects such as SCORE and GIZ, (27.8%) community meetings (27.1%), home visits (14.3%) and leaflets (14.2%).

The study revealed that small scale farmers have adopted various CSA practices to overcome the negative effects of climate change and variability. The study found that intercropping, row planting, use of manure and improved seeds were the most commonly used CSA practices by both horticulture and dry land farmers, except for the use of manure which was found to be less popular among the dry land farmers. However, the use of CSA technologies and practices is still at lower level.

Farmers' understanding on the concept of conservation agriculture (CA) is also found to be limited to ripping (soil minimal disturbance) as a complete package of CA practice leaving out the other two principles of CA (crop rotation and soil cover).

Despite the high level of CSA awareness among smallholder farmers, there is still a low adoption of some of the climate smart agriculture among the smallholder farmers. The major barriers faced by small scale horticulture farmers to climate change adaptation across all target regions are as follows:

- Cost of production inputs such as pesticides, seed etc.
- Inadequate and cost of farm implements as well as
- Limited extension services

While the most significant barriers cited by dry land farmers in the three target regions are:

- Inadequate technical knowhow on CSA,
- Delayed/limited extension services such as ripping services,
- Inadequate and cost of farm implements mainly rippers and planters,
- Cost of inputs such as seeds and ripping service,
- Access to climate information and
- Opportunity cost: Animal feed vis crop residue incorporation.

It was also found that small scale farmers derive their livelihood from various sources. The most significant identified livelihood activities in Kavango regions were dry land crop production, small business/petty trading, gardening, pension grants, livestock farming, fishing and casual employment. While dry land crop production, gardening, harvesting of grass and poles, fishing and livestock farming were significant in Kavango region. Similarly, crop production, gardening, old age pension and grants and small business were more commonly livelihood strategies employed by small scale farmers in Zambezi region.

Overall, most household in the target regions were food insecure. Specifically, most households in Kavango East (79.7%) and Zambezi region (55.2%) were food insecure. Surprisingly, majority of the respondents (53.3%) in Kavango West perceived to be food secure. The most common strategy to ensure household food security mentioned by majority of survey respondents (31.4%) in Kavango West was small business/petty. Other coping strategies reported were casual work (25%), gardening (20%). In Kavango East. Other livelihood options employed by farmers were fishing (32%), casual work 918), small businesses/petty trading (16%) and social grants (12%). In Zambezi, gardening (30%), small business (17%) and piece work (13%) were the most common livelihood options employed by farmers.



Overall, this study concludes that an increased farmer education and awareness on climate change is necessary to fill the existing knowledge gap on climate change. This study revealed that small scale crop farmers in the study area are keen to adopt new technologies and interventions that would transform agriculture into a more relatively productive, higher-income and low carbon activity.

Based on the study findings, the following recommendations are being suggested:

- Timely communication of climate information is highly encouraged to help farmers in planning of their agricultural activities more effectively.
- Timely provision and accessibility of agricultural machinery/equipment and inputs is necessary to reduce
- (e.g. machinery for ploughing, ripping planting, improved seeds, organic fertilizers etc.) Farmers also expressed concern about delayed agricultural services such as ploughing services, or ripping services therefore acquisition of more tractors and/ rippers is recommended to ensure timely provision of agricultural services.
- Overall, there is need to improve the input supply system so that farmers receive the right type of production inputs such as seed and fertilizers in sufficient quantity and on time. This will obviously protect small scale farmers from buying uncertified seed that poses unknown level of risk to production.
- Investment in efficient water infrastructures and technologies that increase productivity such as drip irrigation is needed to allow horticultural farmers to intensify and diversify crop production and thus increase crop production and household incomes and hence household food security. For example, the project beneficiaries/farmers residing along the river should be provided with solar water pumps, 5000L water tanks and drip irrigation systems.



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- Farmers expressed concern about insect infestation on their crops in some parts of the surveyed areas, therefore there is need to conduct research in pest control to investigate those insects and educate farmers on how to control them.
- Overall, CRAVE should encourage farmers to diversify their crop production and move into horticulture production and also expand their gardens given the available opportunity reduce vulnerability to climate risks and ensure food security at the household level.
- Continued capacity building and awareness for both Extension/Technical staff and farmers on climate change adaptation and Good agricultural practice should be a high priority for enabling the implementation of CSA in the study area. This is particularly critical in the areas of :
  - Climate Smart Agriculture practices and technologies such as micro drip irrigation systems and CA practices
  - Integrated Pest and Disease Management, taking into account the Indigenous Knowledge
  - Crop production chain from land preparation through to post-harvest technologies
- Awareness and training should include mechanisms of information sharing through farmer to farmer extension approach, farmer exchange visits, on-farm demonstrations, on-farm trials, video documentaries on project success stories and field days to showcase the best agricultural practices and/ CSA.
- Overall, effective communication approach should be developed along with a variety of educational support materials which should include the use of various communication means (e.g. media, public meetings )to promote good agricultural practices



- Radio is still the most popular source of information for most people in the rural areas. Hence must be utilised in order to reach the majority of small scale farmers.
- Stakeholder engagement throughout the project implementation is commended to ensure its success and sustainability of its interventions after the project had faced out
- Farmers need to be supported (financially and technically through ongoing extension services) to implement CSA practices, but just be mindful of creating a dependency syndrome among farmers.
- Extension services should consider mainstreaming farmer's indigenous knowledge into scientific knowledge to encourage farmers to make use of the local knowledge and essential experiences for improving crop production, land productivity and improve income. In other words, local and traditional knowledge should be embedded into the modern technology.



## **ACCRONYMS / ABBREVIATIONS**

<b>ADCs</b>	Agricultural Development Centres
<b>AGRIBUSDEV</b>	Agricultural Business Development Agency
<b>AMTA</b>	Agro Marketing and Trade Agency
<b>CA</b>	Conservation Agriculture
<b>CBNRM</b>	Community Based Natural Resources Management
<b>CC</b>	Climate Change
<b>CCA</b>	Comprehensive Conservation Agriculture
<b>CPP</b>	Country Pilot Program
<b>CRA</b>	Climate Resilient Agriculture
<b>CRAVE</b>	Climate Resilient Agriculture in three of the Vulnerable Extreme northern crop growing regions of Namibia
<b>CSA</b>	Climate Smart Agriculture
<b>DAPEES</b>	Directorate of Agriculture, Extension and Engineering Services
<b>EBA</b>	Ecosystem Based Adaptation
<b>EIF</b>	Environmental Investment Fund
<b>FGDs</b>	Focus Group Discussions
<b>GAP</b>	Good Agricultural Practices
<b>GCF</b>	Green Climate Fund
<b>GIZ</b>	Deutsche Gesellschaft für Internationale Zusammenarbeit
<b>HDI</b>	Human Development Index
<b>IPCC</b>	Inter-governmental Panel on Climate Change
<b>KABPs</b>	Knowledge, Attitudes, Behaviors and Practices
<b>KAP</b>	Knowledge, Attitudes and Practices
<b>MAWF</b>	Ministry of Agriculture and Forestry
<b>MET</b>	Ministry of Environment and Tourism
<b>MLR</b>	Ministry of Lands and Resettlement
<b>MLR</b>	Ministry of Lands Reform
<b>NAB</b>	Namibia Agronomic Board
<b>NAP</b>	National Agricultural Policy
<b>NCCA</b>	Namibia Comprehensive Conservation Agriculture
<b>NCCAP</b>	Namibia Comprehensive Conservation Agriculture Programme
<b>NDPs</b>	National Development Plans

<b>NGOs</b>	Non-Governmental Organisations
<b>NNF</b>	Namibia Nature Foundation
<b>NPC</b>	National Planning Commission
<b>PMU</b>	Project Management Unit
<b>PWC</b>	Price Water Coopers
<b>SCORE</b>	Scaling up Community Resilience to Climate Variability and Climate Change
<b>SPSS</b>	Statistical Package for Social Science
<b>TEC</b>	Tortoise Environmental Consultants
<b>TOR</b>	Terms of Reference



## 1. SECTION 1

### 1.1. Background

Namibia's agricultural industry is considered to be extremely vulnerable to climate change. As a semi-arid country, livelihoods and agricultural production systems are tightly linked to the availability of rain. Therefore, the impacts of climate variability and climate change are already felt severely. This is critical to vulnerable people living in the rural areas who are particularly dependent on subsistence agriculture.

Green Climate Fund, through the accredited Environmental Investment Fund (EIF) of Namibia has provided financial resources for the implementation of the CRAVE Project. The project is being implemented by the Ministry of Agriculture, Water and Forestry in partnership with stakeholders e.g. AMTA, AgriBusDev, Regional Cooperatives, Regional Councils, Traditional Authorities etc. This project will be implemented over a period of five (5) years (2017 – 2022).

The aim of the project is to increase resilience and enhanced livelihoods of the most vulnerable rural communities in the three (3) northern regions of Kavango West, Kavango East and Zambezi. The project will thus increase resilience of health and well-being, food and water security while strengthening adaptive capacity and reduce exposure to climate risks.

The CRAVE project seeks to reduce vulnerability and food insecurity of rural populations caused by climate risks and threats while increasing the adaptive capacity, well-being and resilience of the vulnerable small-scale farming communities.



The scope of work of this study was to conduct a Knowledge, Attitude, Behaviour and Practices (KABP), baseline and enhanced livelihood survey on small-scale farmers' perception and knowledge on climate change. Through this, the project will identify potential gaps in knowledge, attitude and behavioural practices in crop production. Knowledge on sustainable agricultural practices including the existing traditional knowledge, attitudes, practices and their impacts on how these influence the livelihoods, food, water and health security is critical.

This study report will therefore aid in developing a communication and awareness creation strategy and implementation plan for the uptake of climate change information and agricultural practices messages.

## 1.2 Problem Statement

About 70% of Namibians are directly dependent on subsistence agriculture for survival (NPC, 2012). However, Namibia is a very dry country and suffers significant agricultural production losses due to climate change. Water is scarce, rainfall is variable and droughts are frequent. As a result, agricultural activities are subjected to the scarcity and unpredictability of rainfall, and further aggravated by climate variations (mainly in the form of droughts and to a lesser degree floods), combinations of which impacts on agricultural productivity, food security, nutritional health and the livelihoods of rural communities.

According to MAWF (2015), Namibia needs more than 4% agricultural growth per year to meet the food requirements for the growing population. However, the expansion of cultivated areas to compensate for low yields, exploitation of low nutrients status soils without restoration of soil fertility, changing climatic patterns including low erratic rainfall & lack of well adapted technologies are major challenges of soil nutrient management (ibid).



As a result, the MAWF through the CRAVE Project, intends to increase resilience for most vulnerable people and communities within the target regions by enhancing, diversifying and upscale crop production in order to improve farmers' livelihoods and their well-being.

### 1.3 Study objectives

- Conduct a Knowledge, Attitude, Behaviour and Practices (KABP) baseline and livelihood survey on small-scale farmers' perception and knowledge on climate change.
- Understand the level of knowledge, attitude, behaviour and practices measures of small-scale farmers with regard to climate change and Climate Smart Agriculture (CSA) and livelihood diversification.
- Identify potential gaps in knowledge, attitude and behavioural practices in crop production, as well as knowledge on sustainable agricultural practices

### 1.4 Specific Tasks

As indicated in the ToR, the specific tasks are:

- a) Measure the level of knowledge of small-scale crop farmers on Climate Smart and livelihood diversification
- b) Identify to what extent do small-scale crop farmers understand climate change and its impacts on their livelihoods;
- c) Explore knowledge and perception on climate change and climate smart agriculture practices;
- d) Determine constraints' response of crop farmers to climate change effects;



- e) Determine conservation agriculture practices currently used by the small-scale farmers;
- f) Determine the food security of small-scale farmers at household level;
- g) Identify the cultural beliefs, knowledge gaps, behavioral patterns and practices that create barriers to practice sustainable agriculture.

### 1.5 Deliverables

The following are the key deliverables for the Knowledge, Attitude, Behaviour and Practices (KABP), baseline and enhanced livelihood survey:

1. Design and present the Knowledge, Attitude, Behavior and Practices (KABP), baseline and enhanced livelihood survey methodology and develop comprehensive tools for data collection according to the national survey guidelines.
2. Train data Collectors and meet with various stakeholders at field level. Be able to transfer skills in undertaking Knowledge, Attitude, Behaviour and Practices (KABP), baseline and enhanced livelihood survey.
3. Detailed framework/design and implementation plan agreed with the project team, MAWF and EIF.
4. Draft Knowledge, Attitude, Behavior and Practices (KABP) baseline and enhanced livelihood survey inception report. Whereby, the inception report is expected to detail the study design, methodology, tools, work plan schedule and budget for the assignment.
5. Data entry, data analysis and compilation of a comprehensive Knowledge, Attitude, Behavior and Practices (KABP), baseline and enhanced livelihood survey report.
6. PowerPoint presentation with preliminary findings to be validated by key stakeholders before the final Knowledge, Attitude, Behavior and Practices (KABP), baseline and enhanced livelihood survey report is completed.
7. Final Knowledge, Attitude, Behavior and Practices (KABP), baseline and enhanced livelihood survey report that includes aspects of gender.



## 1.6 Rationale

Climate change awareness and innovation in the agricultural sector is of significant importance. It facilitates effective climate change adaptation through innovative adaptation measures to ensure food and nutritional security in a sustainable manner. The knowledge, attitude and behavioural practice survey will play a pivotal role in identifying knowledge gaps and cultural practices that create barriers for smallholder farmers to practice sustainable agriculture and adapt to the new challenges of climate change.



## SECTION 2

### 2.1 OVERVIEW OF CLIMATE CHANGE

#### 2.1.1. Global perspective

Climate change is recognized as one of the world's development challenges in the 21st century (Boko et al, 2007). Across the globe, climate change continues to pose serious challenges to the environment and to human life. Experts have pointed out that human activity is increasing the level of greenhouse gases (GHGs) in the atmosphere, causing global warming, which is leading to changes in the climate (IPCC, 2007). Many indicators of climate extremes and variability, including the annual numbers of frost days, warm and cold days, and warm and cold nights, show changes that are consistent with warming (IPCC, 2001).

Climate change is undermining efforts to achieve key development goals including poverty reduction. It is one of the severe impediments to the attainment of the Millennium Development Goals (MDGs) and sustainable development aspirations globally, regionally and nationally. There is now sufficient scientific evidence and consensus that climate change is caused and particularly exacerbated by human activities. This is mainly through the burning of fossil fuels and changes in land use patterns due to rapid economic growth, related changes in lifestyles, rapid increases in human population, and the growing fuel and resource needs to meet these development imperatives. In addition, these may also be compounded by natural climate variability.



## **2.1.2. African context**

In all climate change discussions, Africa with other developing countries such as South and West Asia are expected to have worst impacts; suggesting that developing countries are more vulnerable to climate change than developed countries (Boko et al., 2007). In Africa for instance, observed warming trends, droughts and dry spells in the last few decades have posed serious challenges on the inhabitants and economies. For instance, Lesotho, Malawi, Mozambique, Swaziland, Zambia and Zimbabwe faced food deficits in 2001/2002 resulting from drought and dry spells with consequential food losses estimated at 1.2 million tonnes (SADC, 2002). Further food deficits of 3.3 million tonnes were experienced in the 2002/2003 drought, with an estimated 14.4 million people in need of assistance (SADC, 2002).

## **2.1.3. Namibian Context**

Like other African Countries, Namibia's vulnerability to climate change is evidenced by continued exposure to extreme flooding and droughts, erratic rainfall patterns as well as gradual temperature increases observed over time.

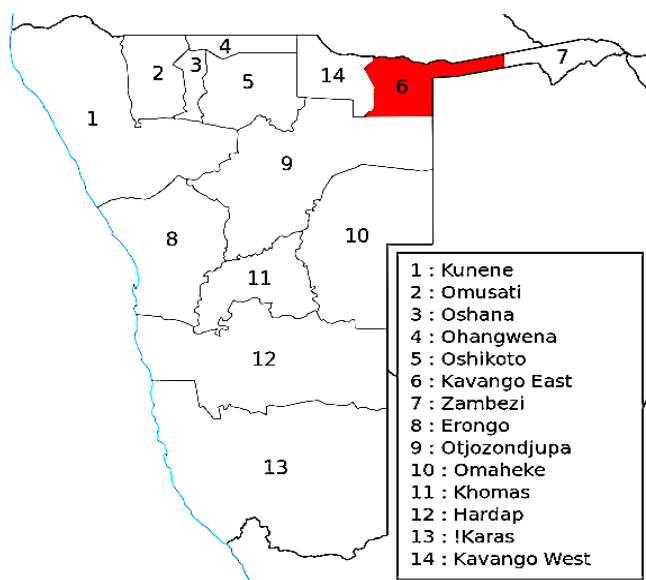
Namibia was classified as the 7<sup>th</sup> most at risk country in terms of agricultural losses caused by climate change globally (Wheeler 2011). Climate change is expected to impact agricultural yields through variations in temperature and rainfall. Increased rainfall variability due to climate change impacts directly on the livelihoods food security of smallholder farmers in the north-central-and north eastern regions of Namibia. Crops and livestock production food and water security as well as other related aspects such as nutrition, health and wellbeing are threatened. Angula (2010) indicated that subsistence farmers have noted impacts of observed climate change on the quality of soil and productivity of agricultural lands in Northern central Namibia, and thus led to a decline in crop yields and eventually decreased household food security.

CSA has the potential to increase resilience of farming communities because it integrates environmental management and climate change adaptation with social and economic sustainability (Chioreso and Munyani, 2015). As a result the Namibian government has endeavored to enhance productivity by addressing the effects of climate change. The government adopted a number of policy interventions and CSA is one of the adopted programme. These include initiative such as drip irrigation, planting early maturity varieties, use of draught animal power and farm tools for ripping and engaging in rice farming. Although some farmers have adopted CSA practices, others have been slower to adopt such methods/practices. It was found that cultural factors such as religious belief, reliance on traditional knowledge and the symbolic significance of certain agricultural practice led to low uptake of CSA (Davies *et al*, 2018). Previous studies have also shown that the major barriers include inadequate policy and insufficient access to finance, technology, land and human resources (Sibandana *et al*, 2017)

## 2.2. STUDY AREA OVERVIEW

### 2.2.1. KAVANGO EAST REGION

Covering an area of 23,988.59 km<sup>2</sup>, Kavango East is located in the far north eastern part of Namibia, bordering with the Kavango River and Angola in the north and the Zambezi Region and Botswana to the east and the Otjozondjupa Region to the south.



**Figure 1:** Location of Kavango East region (highlighted) within the Namibian map (source: Ministry of Urban & Rural Development, n.d.)

The region has a population of approximately 136,823 (NSA, 2014) and has six (6) constituencies namely: Mashare, Mukwe, Ndiyona, Ndonga Linena, Rundu Rural and Rundu Urban. Its regional capital is Rundu is situated on the Trans-Capriivi Corridor and has important trade links with Angola. The literacy rate of the Kavango East Region is 74.40%, well below the national average of 89%, with an unemployment rate of 53.7% (NSA, 2014).

Approximately 70% of the Kavango population lives within a “ribbon 10km wide along the river” (Namibia Nature Foundation, 2010) placing immense pressure on natural resources on this stretch of land.

The Kavango East Region is located within the heart of the conservation, tourism and trade potential. Not only is the region strategically located within one of the largest conservation areas (KAZA TFCA), and have two of the most important national parks (Bwabwata and Khaudum National Park). Abundant wildlife in the most eastern part of the region makes this area extremely attractive and valuable for tourism activities.

In terms of agriculture in the Kavango East region, majority of the rural population still relies on subsistence livestock (26.1%) and crop farming (60.2%), with very limited formal employment. 35.6% of the region's households derive income from subsistence farming seconded by wages and salaries (26.31%). Furthermore, the small-scale commercial farm units (SSCF) within the Kavango East Region are the largest land user covering 38.3% of the region and national parks covering 29.7% of the region.

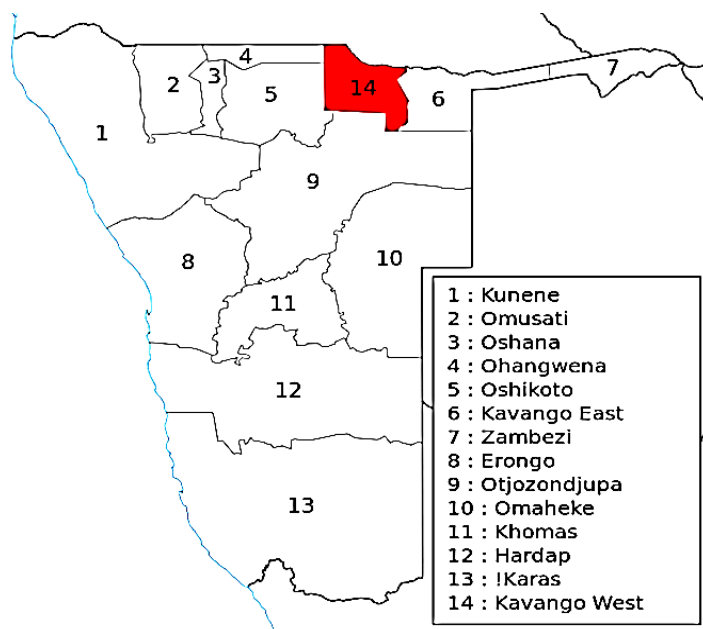


The biggest potential for the region is the accessibility to a viable water resource, the Kavango River. Kavango River can provide water for a number of various livelihood activities including horticulture (irrigation); livestock; lodging and tourism activities. In addition, the Kavango River valley is an important wetland system with some near-endemic plant species and riverine forests. The extensive floodplains as well as the rocky stretch of the river in some areas and remaining riverine forest are sensitive areas that need to be conserved. Only a few patches of riverine forest are remaining in the eastern part of the region. The main threat to the riverine forest is the slash and burn cultivation systems implemented by communities



## 2.2.2. KAVANGO WEST REGION

The Kavango West region covers an area of 24,591.27 km<sup>2</sup> and lies directly south of Angola and the Kavango River and east of Ohangwena and Oshikoto Regions, north of Otjozondjupa Region and west of the Kavango East Region. The region has eight constituencies, namely: Kapako; Mankumpi; Mpungu; Musese; Ncamangoro; Ncuncuni; Nkurenkuru and Tondoro.



**Figure 2:** Location of Kavango West region (highlighted) within the Namibian map (source: Ministry of Urban & Rural Development, n.d.)

In terms of tourism, the region is behind its counterpart on the eastern side, this is mainly due to the far less wildlife found within the Kavango West Region compared to the Kavango East and Zambezi region, respectively. Business tourism around Katwitwi and Nkurenkuru is expected to grow in the future.

In terms of agriculture, the region's larger rural population relies on subsistence livestock and crop farming. With 76.86% of the region's population living in the rural area and with very limited formal employment, the majority of the household income in the regions is reliant on subsistence farming. The main employment

industry within the Kavango West Region is the Agriculture, Forestry and Fishing Industries with the majority of income for households being from farming activities (61%).

The main type of agriculture activity practiced by households in the Kavango West Region is crop farming (63%). Worth noting is the fact that region is in the fortunate position of having approx. 45% of land still available for communal purposes. Further, the region has a number of opportunities and challenges that will have an impact on development and land use within the region. One major opportunity is the access to water resources, the Kavango River. The majority of the population live in a 10km stretch along the Kavango River, putting pressure on the available land and water resources along this stretch of land and leading to land use conflicts between various land uses.

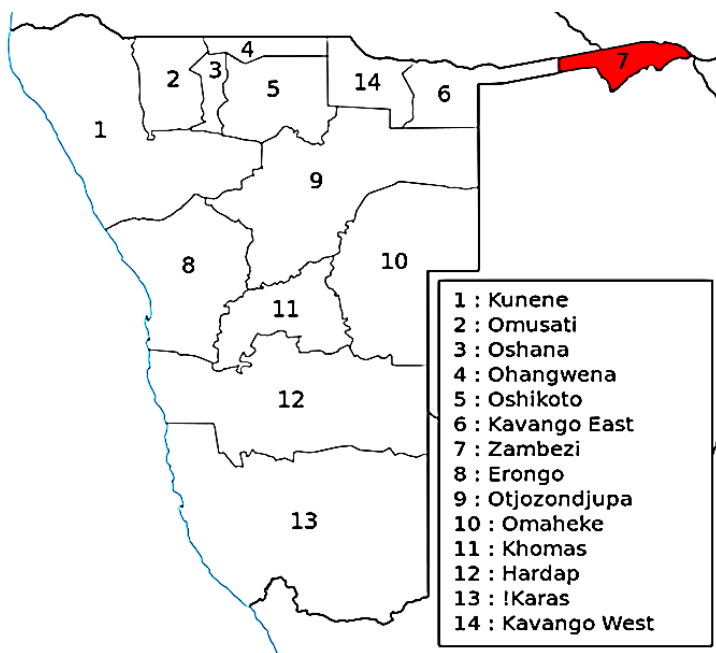
In terms of climate change, it is predicted with a high degree of certainty that Namibia can expect an increase in temperature and evapotranspiration at all localities, with the maximum increase of temperature (2 - 6°C) in the interior by 2050 (Turpie *et al*, 2010). Climate change can lower the carrying capacity of the region and make crop and livestock farming increasingly difficult in the future. Climate change on water availability can lead to a reduction in runoff of the Kavango and other rivers by approximately 25%, which will have an impact on irrigation schemes and the availability of water from the Kavango River for horticulture production.

The Kavango River valley is an important wetland system with some near-endemic plant species and riverine forests. The extensive floodplains as well as the rocky stretch of the river and remaining riverine forest are sensitive areas that need to be conserved.



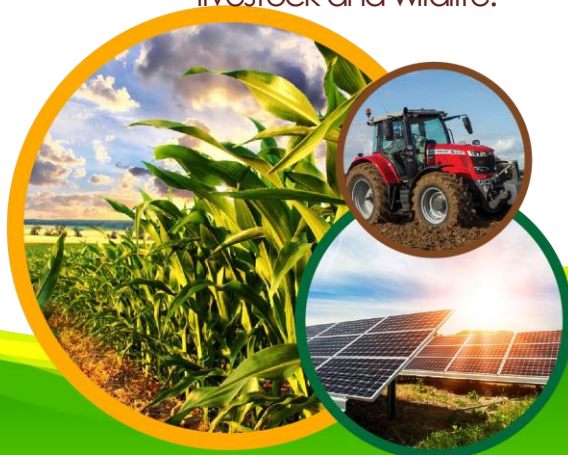
### 2.2.3. ZAMBEZI REGION

The Zambezi Region covers an area of 14,785 km<sup>2</sup> and is located in the most eastern part of Namibia, bordered by Botswana, Angola, Zambia and Zimbabwe. It has eight constituencies: Kongola, Judea Lyaboloma, Linyanti, Sibbinda, Kabbe North, Kabbe South, Katima Urban and Katima Rural. A large part of the region is floodplains while other areas of the western parts are covered by national parks



**Figure 3:** Location of Zambezi region (highlighted) within the Namibian map (source: Ministry of Urban & Rural Development, n.d.)

Perhaps one of the biggest advantages the Zambezi Region has is the network of rivers on the southern (Linyanti River), eastern (Zambezi River) and western (Kwando River) parts. These rivers have potential for food security for communities, and also provide water and other life sustaining functions for communal communities, livestock and wildlife.



The Zambezi Region's economy is mainly subsistence from nature with an income diversification into tourism and conservation. The Zambezi Region is not only in terms of economics strategically located, but also in terms of conservation. It is in the centre of one of SADC's largest conservation initiatives – KAZA. Supported by its geographical locality, the region is also well advanced in conservation efforts with an ever-increasing number of communal conservancies developing.

The Zambezi Region has 'a higher rainfall, less evaporation and a warmer winter than the rest of Namibia, providing a home to many tropical plants that are unable to survive elsewhere in Namibia' (Mendelsohn & Roberts, 1997). Rainfall averages about 700 mm per year in the wetter north-east, and about 500 mm in the southern Zambezi Region. Rainfall, as in the rest of Namibia, is highly variable, with standard deviation values from 30–40% (Mendelsohn & Roberts, 1997). This variability directly affects the livelihoods of farmers, exposing them to the risk of crop failure and poor grazing in some years, and floods in others.

In terms of agriculture, the subsistence livestock farming, cropping, and fishing remains the most important contributors to the subsistence livelihood income for residents of the region. A second important and growing economy is from conservancy benefits, devil's claw harvesting, fishing, collection and sale of grass and reeds and income from tourism enterprises and spinoff industries from these tourism activities. Combined with the growth potential in the tourism industry, the region also has economic potential in the trade sector, due to its excellent location with Southern African Development Community (SADC) neighbours. The importance of infrastructure corridors such as the Trans-Caprivi Highway will continue to grow, giving the region an ideal advantage.



The region has three potential focal target areas linked with the fourth National Development Plan (NDP 4).

- Logistics: especially in the border towns of Katima Mulilo and Ngoma;
- Tourism: with the increased conservation status and protection of resources, the tourism industry will grow;
- Agriculture: subsistence farming is still the main source of livelihoods.

The role of subsistence communal livelihood in the communities is an important aspect to consider within the development for the region. Around 69% live in the rural area and practice subsistence cattle and crop farming. Other livelihood activities supplement income, such as gathering reeds, fruits, grass, Devil's Claw and fishing.

However, the region is faced with a challenge of annual flooding within the eastern part of the region and along main rivers. These floods annually displace thousands of households that then rely on flood relief. These flood-inundated areas have weak infrastructure and development, and as yet, no proper flood analysis has been carried out by the government to investigate the various possibilities of alleviating this situation. Illegal fishing and overfishing within the Zambezi and Chobe Rivers are a threat to subsistence livelihoods of the communities. Such illegal fishing and overfishing can be controlled by proper implementation of the legislations, in addition to the creation of fish protection areas.

The region has potential to generate additional income for communities from conservancy enterprises (e.g tourism), harvesting of Devil's Claw, recreational fishing and wildlife viewing. With the creation of KAZA, the Zambezi Region is in an ideal position to reap benefits from the accompanying synergies and marketing that will flow from the full implementation of such an initiative. With the increase opening of trade opportunities within Africa and SADC neighbours, the role of the region, as a gateway, stopover and logistical hub should not be underestimated.

## **2.3. An overview of crop production industry**

### **2.3.1 Rain-fed Crop Production**

Rain-fed crop production takes place in areas with relatively high annual rainfall (400 mm and above), mainly in northern Namibia. Field areas are limited by soil fertility and by the availability of labour since most work are done manually through limited family labour. About 1% of the total surface area of Namibia is suitable for seasonal and permanent crop production (Christelis and Struckmeier, 2001). Low and sometimes poorly distributed rainfall have limited rain fed crop production to only those areas receiving 400 mm and above annually or about 34% of the country. Such production is associated with a high risk of crop failure due to the erratic nature of the rainfall. Of the cereals, a large amount of the rain-fed maize is produced in the commercial sector while pearl millet or Mahangu and to a small extent sorghum is almost exclusively grown by an estimated 150 000 subsistence communal farmers mainly for own consumption.

Mahangu, maize and sorghum are the dominant rain fed cereals while small quantities of vegetables or field crops such as beans, cowpeas, bambara nuts, groundnuts, pumpkins, melons, tomatoes and spinaches and cabbages grown within the cereal crop fields.

### **2.2.2 Irrigated Crop Production**

Agricultural crop production in Namibia primarily consist of arable production of a variety of crops both under irrigation and rain-fed. Government green scheme projects form a major part of irrigated crop production. MAWF have instituted deliberate efforts to expand irrigated agricultural production along perennial water sources in Namibia. These projects by design consist of large commercial operators and medium to small-scale farmers operating smaller plots. The green scheme projects consists of, in the northeast; Kalimbeza rice project, Shatikongoro, Shitemo, Ndongalinenena, Mashare, Uvungu-vungu, Sikondo and Musheshe. Apart from

Kalimbeza which focus primarily on rice production the other projects in the northeast produces maize, wheat and horticultural products. These crops are cultivated under irrigation with the Kavango, Kwando and Zambezi Rivers as the source of water.

### **2.3.3 Trends/Developments**

Government through MAWF is geared to increase production of the green scheme projects. These efforts are aimed at enhancing the potential of the green scheme projects towards meeting government objectives of increasing food security and job creation through the sustainable optimum utilization of the country's natural resources. To date the total agricultural area under irrigation consists of about 8,600 hectares. Considering existing national water and land resources, the arable development potential through irrigation in Namibia is estimated at 43,500ha (PWC, 2005). This area leaves sufficient development potential not only to cover the subsidization of existing food imports, which in terms of cereals, crops and horticulture products amounted to an amount of N\$450 million in 2004, but also to enhance the exports of high value horticulture products such as grapes, dates, mangoes and some vegetable produce (ibid).

Horticultural production systems have greater potential for expansion in Namibia. Currently the system supports more than 100 crop types, categorized into 21 commodity groups. Based on similarity in natural resource management approach, these commodity groups broadly fall into two categories: annual horticulture (mostly vegetables) and perennial horticulture (mostly fruit) crops.

In addition, horticultural production registered positive growth, 20.87% in 2009, and this trend is set to continue due to existing Market Share Promotion Scheme and also due to NAB's lobbying efforts for pre-planting arrangements between producers and traders.

There is also a current drive to promote rain fed crop production, notably for mahangu. Mahangu was recently declared a controlled crop with the aim of commercializing its production among subsistence farmers. Government has built several silos to capture excess supply associated with this move.

#### **2.4. National Policy and Programme Framework related to climate change, agriculture and livelihood diversification.**

The Government of Namibia is promoting sustainable livelihoods by engaging in various agricultural and natural resources and related activities such as policies, action plans, strategies and legislation – impacting upon food security and environmental sustainability. All policies in Namibia should facilitate the Vision 2030 of the Government of the Republic of Namibia, which is to inspire and direct long-term socio-economic development and to provide a guide for the formulation of the five-year National Development Plans (NDPs), namely NDP 1 - 5 of which the NDP 5 covers the period of 2017/2018 - 2021/2022. Some of the main agricultural and environmental existing national policies and related activities are reviewed in this section of the study.



**Table 2.1. Relevant legal frameworks relevant to the study**

INTERNATIONAL LAW
<p><b>United Nations Framework Convention on Climate Change, 1992 (UNFCCC):</b></p> <p>In consideration of the implications of global climate change, the Namibian government ratified the UNFCCC in May 1995. As a developing country Namibia is mandated to provide prescribed data in the form of emission inventories and submit periodic national communications to the UNFCCC secretariat. It also makes several other contributions, which are essentially of a voluntary nature. According to the UNFCCC, there are general commitments applicable to all parties; however, developed countries, designated as annex-1 countries, have specific extra commitments applicable only to them.</p> <p><b>Objective:</b> To stabilize concentrations of GHG emissions in the atmosphere at a level that would prevent anthropogenic interference with the climate system.</p>
NATIONAL POLICIES AND PROGRAMMES ON CLIMATE CHANGE AND ENVIRONMENT (NPCC)
<p><b>National Policy on Climate Change (NPCC) for Namibia (2011):</b></p> <p>NPCC is the national vision on addressing climate change. It seeks to outline a coherent, transparent, and inclusive framework on climate risk management in accordance with Namibia's national development agenda, legal framework, and in recognition of environmental constraints and vulnerability. The policy further takes cognizance of Namibia's comparative advantages with regard to the abundant potential for renewable energy exploration. NPCC will be implemented through the NCCSAP in order to deal with the threats associated with climate change.</p> <p><b>Objectives :</b> To develop and implement appropriate adaptation strategies and actions that will lower the vulnerability of Namibians and various sectors to the impacts of climate change; To develop action and strategies for climate change mitigation; To integrate climate change effectively into policies, institutional and development frameworks in recognition of the cross-cutting nature of climate change; To enhance capacities and synergies at local, regional and national levels and at individual, institutional and systemic levels to ensure successful implementation of climate change response activities; To provide secure and adequate funding resources for effective adaptation and mitigation investments on climate change and associated activities (e.g. capacity building, awareness and dissemination of information)</p>
<p><b>A multi-sectoral National Climate Change Committee (NCCC):</b></p> <p>Was formed in 2001 to provide overall oversight and to advise government on CC issues</p>
<p><b>National Climate Change Strategy and Action Plan (2013-2020) approved by Cabinet in 2014:</b></p> <p>The NCCSAP aims to build Namibia's adaptive and mitigate capacities by identifying potential adaptation options and, where development actions also have mitigation benefits, committing to pursue these opportunities to bring the country on to a low-carbon development pathway. The NCCSAP will help to clarify national goals and objectives regarding climate change, and lay out a plan for implementing, reporting and monitoring a series of priority activities in pursuit of this aim. Furthermore, it will enable Namibia to be a more active participant in the global effort to combat climate change.</p> <p><b>Objectives:</b> To reduce climate change impacts on Namibia's key sectors and vulnerable communities; To integrate climate change issues (adaptation and mitigation) into sectoral policies, and national development planning at all levels; To develop and enhance capacities at all levels and strengthen institutions to ensure successful implementation of climate change response activities; To facilitate funding resources for effective mitigation and adaptation investments necessary for the effective implementation of the NCCSAP; To provide an institutional framework to guide international and national climate financing modalities and support climate readiness (linking to Namibia's Climate Finance Readiness Strategy).</p>
<p><b>The Environmental Management Act 7 of 2007:</b></p> <p>This Act serves as an overall governing instrument to promote co-ordinated and integrated management of the environment, to give statutory effect to the compilation of environmental assessments and to enable obligations under international environmental conventions. This Act establishes a Sustainable Development Commission and Environmental Commissioner to implement the provisions of this legislation. In addition to everybody else, the state, including all government institutions, will be subject to the provisions of this Act</p>

## AGRICULTURAL POLICIES, ACTS AND INITIATIVES

### ***The Agricultural (Commercial) Land Reform Act No.6 of 1995***

It provides the legislative basis for the acquisition and distribution of land. The Act emphasizes the need to ensure that all land, private and or commercial is efficiently utilised and developed. The Act is an important prerequisite for land and nutrition security for many rural families To ensure food security and improve nutritional status; To create and sustain viable livelihood and employment opportunities in rural areas ; To improve the living standard of farmers and their families as well as their families as well farm workers The agricultural sector should contribute to economic growth, poverty alleviation and sustainable natural resources management

### ***The Cooperative Act of 1996***

Has provided a mandate to the MAWF to promote development of the cooperative movement. The Multipurpose Cooperatives are relevant to the farming community because they provide for the following components: savings and credits, agricultural inputs supply and farm produce marketing, and consumer goods supply.

### ***The National Horticulture Development Initiative 2002).***

To promote increased local production and marketing of fruit and vegetables and other horticultural products

### ***Green Scheme Policy (2008)***

This policy is primarily aimed at expanding horticultural production through appropriate irrigation practices

### ***Namibia: Draft Seed Policy, June 2005***

This policy addresses the challenges in the seed sector with respect to research and extension, seed imports, seed production, processing and quality control, marketing, distribution and strategic seed reserves, as well as the institutional and legal framework

### ***Dryland crop production programme 2010-2013***

To support the majority of households who depends on rain fed crop farming and commercialisation of surplus production

### ***The National Small Stock Development Plan (2004)***

Is a coordinated approach to the development of the small stock sector to increase its contribution to the national agricultural output, agricultural value-adding and improved balance of trade

## NATURAL RESOURCES AND ENVIRONMENT POLICIES AND ACTS

### ***The Communal Land Reform Act of 2003 authorities***

Provides guidelines and regulations for acquiring and distributing of land in communal areas through land boards and recognized traditional

### ***The National Resettlement Policy (2001)***

Aims to redress the past unequal land distribution, to alleviate poverty and to improve the living standard of former disadvantaged Namibians. The policy provides a strategic framework for land reform and resettlement in Namibia

### ***The Forest Development Policy (2001) and the supporting Forest Act of 2001 (as amended by the Forest Amendment Act No. 13 of 2005).***

Provides general direction for the management of Namibia's forest resources. The policy states that forestry should play a key role in the contribution to sustained food production and must therefore be closely integrated with other rural sources of livelihood such as animal husbandry and farming in order to improve nutrition in the country

### ***The Water Supply and Sanitation Policy (2008)***

Replaces the *Water and Sanitation Sector Policy (1993)*.

It pledges to ensure environmentally sustainable development and availability of essential water supply and sanitation service to all Namibians at affordable costs.

### ***The Water Resources Management Act (2004)***

Aims to harmonise the management of water resources in the country and has distinguished four important subsectors: irrigation, rural water, urban and industrial, mining

<p><b>The Marine Resources Policy (2004)</b></p> <p>Describes the state of Namibia's marine resources and fishing industry and states the principles governing Namibia's marine resources policy. The aim of the <i>Responsible Management of the Inland Fisheries of Namibia</i> (1995) and the <i>Inland Fisheries Resources Act</i> (2003) is to allow the exploitation of the inland fish resources on a sustainable basis and at optimum levels.</p>
<p><b>Aquaculture Policy (2001)</b></p> <p>Makes provision for responsible sustainable development of aquaculture to achieve socio-economic benefits for all Namibians and to secure environmental sustainability. The policy is supported by the <i>Aquaculture Act</i> (2002) and the <i>Aquaculture Development Strategy</i>.</p>
<p><b>The Environmental Policy</b></p> <p>Seeks to achieve food security and good nutritional status through environmental protection and appropriate management of water resources, wetland conservation, the use of wildlife and the exploitation of indigenous plant life which endeavours to establish sustainable systems for the benefit of both local communities and the country as a whole.</p>
<p><b>The National Drought Policy and Strategy (1997)</b></p> <p>This policy was developed to reduce excessive government expenditure on relief programmes during periods of drought. A Drought Fund established as a result of the policy has shifted the responsibilities for tackling drought away from government to farmers through adoption of survival strategies.</p>
<p><b>Namibia's Environmental Assessment Policy (1995)</b></p> <p>The principle of achieving and maintaining sustainable development must underpin all policies, programmes and projects undertaken within Namibia for the benefit of both present and future generations. Seek to ensure that the environmental consequences of development projects and policies are considered, understood and incorporated into the planning process, and that the term "environment" is broadly interpreted to include biophysical, social, economic, cultural, historical and political components.</p>
<p><b>National policy on Human and wildlife conflict management (2009)</b></p> <p>Provides a framework for addressing human and wildlife conflict efficiently and effectively and promote both biodiversity conservation and human development.</p>
<p><b>Community Based Tourism Policy (1995)</b></p> <p>Provides a framework for ensuring that local communities in communal land have access to opportunities in tourism development and are able to share in the benefits of tourism activities that take place on their land.</p>
<p><b>Draft Tourism Policy 2001 – 2010</b></p> <p>Aims to provide the framework for collaboration within strategies and programs among government, private sector and NGOs.</p>
<p><b>Desertification and biodiversity Policy: A Policy Review March 2005 Extended Summary</b></p> <p>Based on issues pertinent to the improvement of land management and biodiversity conservation in Namibia. There is a need for all government sectors to acknowledge that coherency between well-formulated multi-sectoral policies plays a vital role in laying a foundation for combating desertification and biodiversity loss. An important review of national policies and legislation pertinent to combating desertification in Namibia was undertaken in 1996.</p>
<p style="text-align: center;"><b>NATIONAL FOOD AND NUTRITION POLICY AND STRATEGIES</b></p>
<p><b>National Food and Nutrition -Policy 1995</b></p> <p>The overall objective is to improve the nutritional status of the population, taking into account the policy initiatives in other sectors, particularly in health and agriculture.</p> <p><b>Objectives</b> are (1) to improve the quantity and quality of food consumed by the population with the aim of ensuring an adequate diet for all, (2) to empower households to use the resources available to them to improve childcare, feeding practices and their environmental sanitation, and (3) to provide an adequate level of social and supporting services.</p>
<p><b>The Food Security and Nutrition Action Plan 1995</b></p> <p>Was prepared in response to deteriorating conditions of food security and nutrition in many urban and rural parts of Namibia. The Food Security and Nutrition Action Plan is major tool for the implementation of the National Food and Nutrition Policy.</p>

### **National Poverty Reduction Action Programme 2002-2006**

Presented a poverty reduction framework addressing *inter alia* economic growth, empowerment of the poor, and food security.

**Objectives** include: (1) intensification of agricultural production (crop and livestock) through innovative land-use strategies that hold the possibilities of increasing farm productivity and incomes, (2) development of small and medium manufacturing enterprises based on wood and non-wood forest raw materials, (3) conservation of the wildlife habitat as the base service for development of Tourism industry, and (4) development of a sustainable rural economy that the country is capable of supporting indefinitely.



## SECTION 3

### METHODOLOGY

#### 3.1 Study Approach

The study approach was designed to meet the study objective which is to understand the level of knowledge, attitude, behaviour and practices of small scale farmers on climate change and climate smart agriculture. To guide the process of data collection as well as the type of data to be collected, a methodology was devised to satisfy the data needs of the research outputs a multi-disciplinary methodological approach was adopted. Both qualitative and quantitative approaches were used for cross-fertilization in-order to gain an in-depth understanding of the study elements.

The study used both primary and secondary data collection methods and employed broad categories of research tools as follows: (1) Survey structured questionnaires, (2) semi-structured interviews, (3) Focus Group Discussions, (4) Field Observations and Desk Research. These research methods and tools are discussed below. The methodology used was devised to gather information in order to satisfy the data needs of the research outputs as outlined in the terms of references. This section of the report unpacks the methodology in greater detail based on the terms of references.



## 3.2 Data Collection

### 3.2.1 Secondary data

This report is preceded by a presentation of the overview of the Climate change and livelihood profile of rural livelihoods in Namibia, specifically the three target regions, namely Kavango West, Kavango East and Zambezi region. This information was sourced through secondary information by conducting desk research review of relevant documents, policies, regulations, reports and journal articles. Desk research review was an ongoing activity throughout the study and the information was used to augment and contextualize research findings obtained through primary data.

### 3.2.2 Primary data

The study adopted both a participatory and structured survey design for collecting primary data using both semi-structured questionnaire and structured questionnaires. The secondary method involved the design of four different types of questionnaires for data collection, namely dryland farmers, horticulture farmers and key informants questionnaires as well as focused group discussion guideline. Two different survey structured questionnaires (for dryland and horticulture) were designed to capture information from dry land and horticultural farmers. These were administered through face to face interviews.





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### ***Structured Questionnaire***

A structured questionnaire was designed to collect data on small-scale farmers' socioeconomic characteristics, knowledge, behaviour, attributes, attitude towards the climate change, CSA and livelihood diversification as well as household livelihoods. Data was collected on various socioeconomic variables (eg gender, age, location, education, marital status, family size, income etc), climatic variables (eg rainfall, temperature, drought, floods). It is important to ensure the purpose of the survey is clear and questions were presented in a way that entices the respondent to respond positively. Combination of questions were employed, i.e Open-ended questions where respondents are asked to answer the question in their own words, close-ended questions with defined response categories. The questionnaires avoided vague terms or response categories. The study also adopted a Likert Scale<sup>1</sup> to record the responses to evaluate knowledge, behaviour and attitude.

### ***Semi Structured Interviews and Focus Group Discussions***

Additionally, key informants were interviewed and focus group discussions were also held by using semi structured questionnaires in order to get detailed information on the subject. The interviews and group discussions were adopted to solicit information from key informants on issues pertaining to KABPs of small scale farmers. The interviews were conducted through a guideline that maintained the direction of the interview. That means that a checklist of questions to guide the interviews with various key informants in the crop industry supply chain was developed.

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<sup>1</sup> A scale used to represent people's attitudes to a topic

The interviewee puts forward his/her views on a particular issue, while the consultant maintained focus and direction to prevent the conversation diverting from the topic. The most crucial part of the interview was to develop a rapport with the informants, and this was established by listening to the people rather than suggesting solutions. The semi-structured interviews were mostly face-to-face, but where there was no chance of meeting, telephonic interviews were accepted. . The interviewees were identified and selected through a snow bowling research mechanism.

### **3.2.3 Sampling Procedure**

To ensure that the sample size is are a representative of the small-scale farmers in the three regions, Zambezi, Kavango East and Kavango West regions, a multi-stage sampling method was employed to select constituencies, villages and households that were interviewed. Constituencies were selected purposefully based on their agro-ecological characteristics, while villages and the respondents (farmers) were selected using simple random sampling. Interviews were mostly conducted with individual households. The target was to interview the head of the household, but if absent any other eligible person (>18 years) available was interviewed instead. Regardless of the number of people from the same household partaking in the interview, only one questionnaire was completed per household. In other words, one household equals to one sample. Focus group interviews were also adopted per region.

The KABs survey targeted both dry-land crop and horticulture farmers. A total sample size for each categories are then presented below:

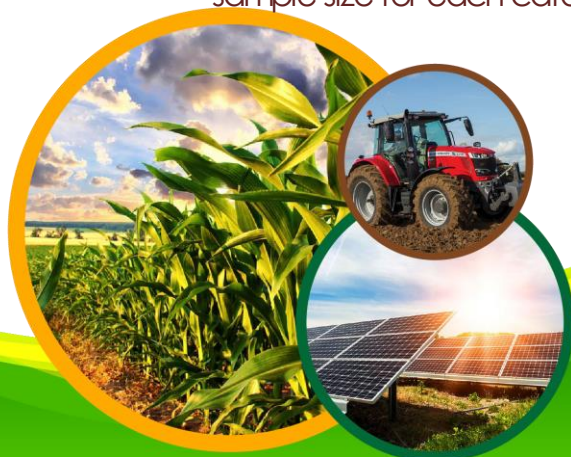


Table 3.1 Number of Samples per Region

Region	Sample	
	Dry-land crops	Horticulture
Kavango West	90	25 individuals
Kavango East	64	28 individuals
Zambezi	96	46 individuals s
<b>Total</b>	<b>250</b>	<b>99</b>

### 3.2.4 Training of Enumerators

The administration of the questionnaires to respondents was superseded by the selection of enumerators who were trained in the administration of the questionnaires. The enumerators were selected from local residents of the 3 targeted regions. A training session was held for each regional team to ensure common understanding of the exercise and most importantly to ensure that the survey objectives, research questions, data capture are clear and easy to apply.

#### **Enumerator Requirements**

The requirements that were used for the appointment of enumerators are as follows:

- Graduate in agriculture or closely related field
- Originally from the region to which she / he is assigned
- Good understand traditional customs (how to talk to elders)
- Speak the local language

Enumerators were required to be fluent in English and local languages. They were then trained on how to administer the questionnaire. Questions were asked in local languages but responses were recorded in English.



### **3.2.5 Validation / Pre-testing of Questionnaires**

The validation or pre-testing of the questionnaires is important to ensure that the questions are clear and easy to understand for both the observer (interviewer) and the respondents (interviewee). The pre-testing of questionnaire entails interviewing a small number of respondents to test the appropriateness of the questions and comprehension thereof. The purpose of pre-testing is to enable the researchers to identify shortcomings with the questionnaire and necessary adjustments were made before the actual survey commenced. Hence pre-testing was conducted.

The training of enumerators culminated into a pre-testing exercise of the questionnaire with 10 dummy respondents before actual fieldwork commenced. The pre-test intended to capture any problems or gaps in the questionnaire in order to eliminate them and to ensure adequate record of the required data.

### **3.3 Data Analysis**

Prior to data entry, responses were coded for easy entry, reference and analysis. The coded data has been entered into excel spreadsheet and was analysed with SPSS statistical software. The data was then interpreted to generate descriptors in accordance with the KABPS objectives. Results have been presented as descriptive statistics. Descriptive statistics includes frequencies, percentages, mean values, frequencies. Cross tabulations analysis was also employed to look at relationships. The Qualitative data was synthesized in order to make logical explanations of the situations on the ground and key relationship of factors.



KNOWLEDGE, ATTITUDE, BEHAVIOUR AND PRACTICES (KABPs), BASELINE AND ENHANCED LIVELIHOOD SURVEY

### **3.4 Gender Mainstreaming**

As a result, gender mainstreaming was further applied to ensure that the study group is representative of the demographic reality on the ground. The gender mainstreaming included sex (women representation) and age (youth representation).

### **3.5 Survey Limitations**

Some of the difficulties experienced during the research process were the availability of farmers for interviews, some of the farmers were not willing to be interviewed and some had difficult in answering to some of the questions.





KNOWLEDGE, ATTITUDE, BEHAVIOUR AND PRACTICES (KABPs), BASELINE AND ENHANCED LIVELIHOOD SURVEY

## SECTION 4

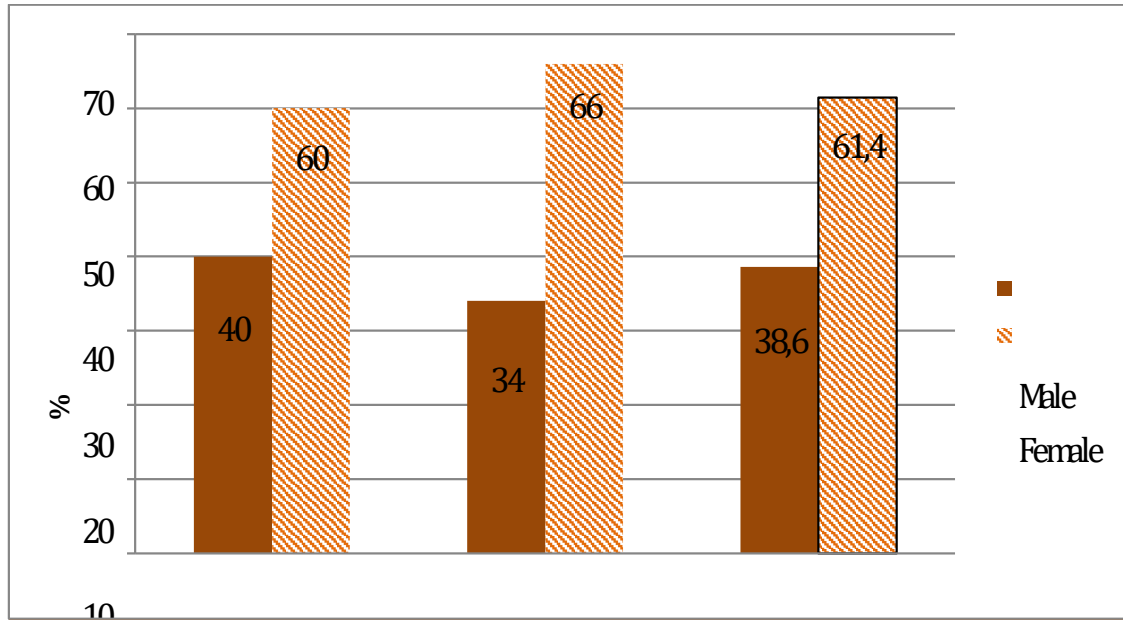
### 4. FINDINGS AND DISCUSSIONS

This section presents the findings of the study. The total sample size for the study was 349 of which 250 were dryland farmers and 99 were horticulture farmers. All households were randomly selected.

#### 4.1. Profile of the respondents

##### a) Gender

Of the total dryland farmers interviewed, 61.4% were female, while 38.6% were male. For horticultural farmers, 65.7% were female and the remaining 34.3% were male. These statistics imply that there was an adequate gender representation in the study sample. The findings confirms the stereotype signifying agriculture as an activity for women due to their perceived roles as guardians of families, while men are usually involved in other cash based activities to secure their families livelihood. (See figure 4.1)

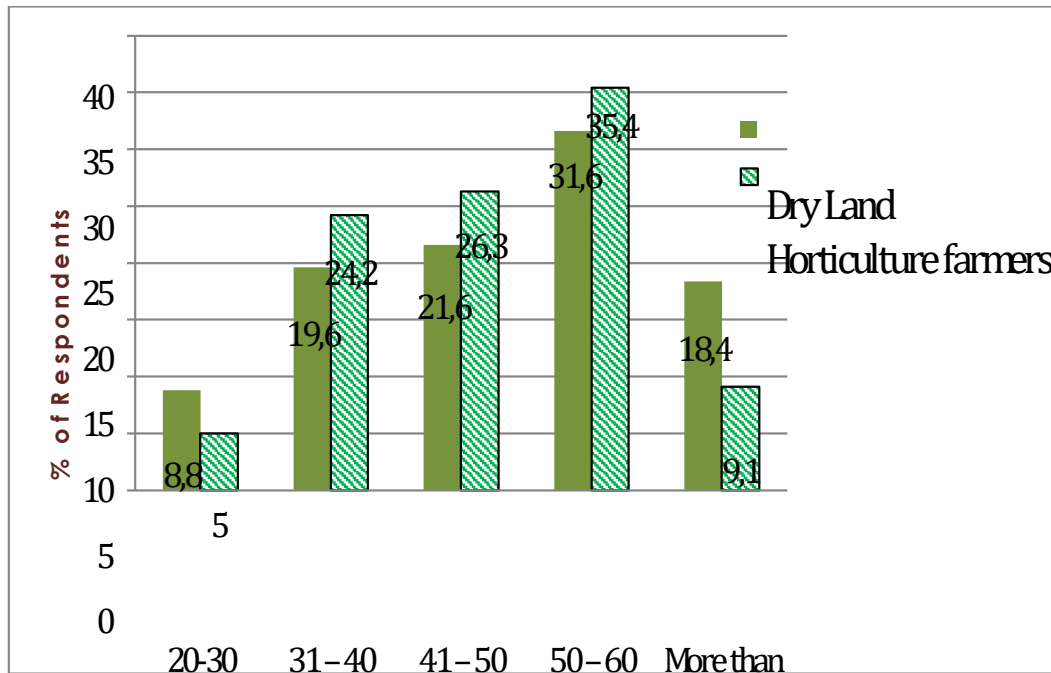


**Figure 4.1:** Gender distribution of respondents

### b) Age

Another trend verified in this study was that the most active age group in farming were elderly respondents whereby majority of both dryland farmers (31.6%) and (35%) of horticultural farmers fell under the age category of 50 to 60 years old. This showed that older people were more involved in farming than youth leading to two concerns : first, this is exacerbating the youth employment crisis; second, that agricultural knowledge could disappear as the older generations are the custodians of information; and third, an aging agricultural labour force which could have a negative impact on agricultural output.

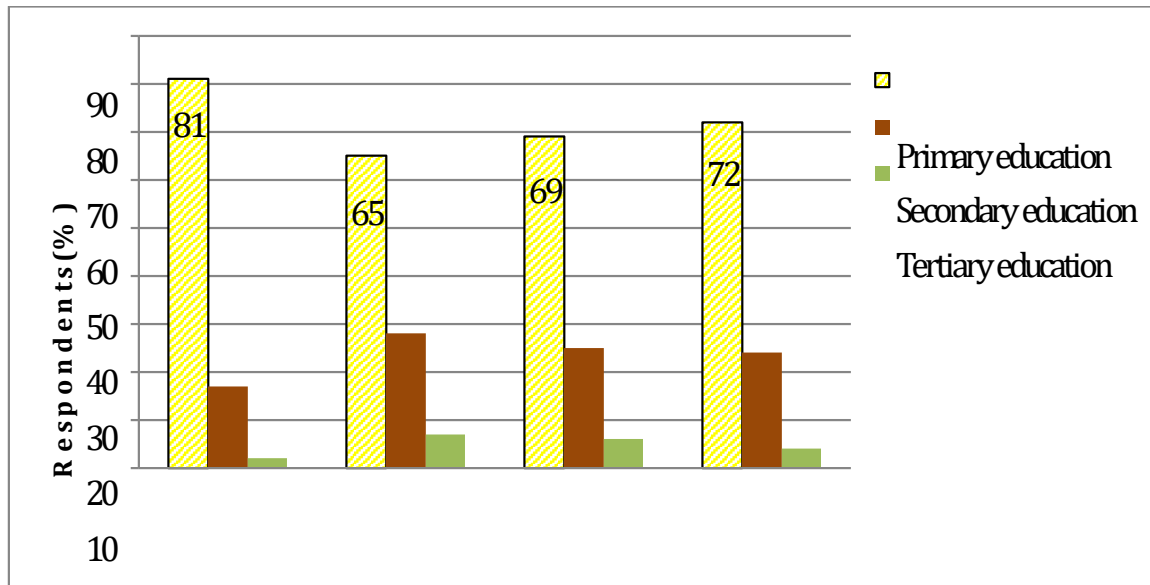




**Figure 4.2:** Age distribution of respondents

### c) Level of Education

Generally, education level of the respondents was low across the regions indicating that farming was one of the coping strategies for most of the rural people with low education. The study findings indicated that primary education level was the highest with 81%, 69% and 65% in Kavango West, Zambezi and Kavango East regions respectively. The study further revealed that few respondents have attained tertiary education across the regions with only 7.3%, 3.1% and 1.1% in Zambezi, Kavango East and Kavango West respectively. The data also showed that a greater proportion of the farmers in the Zambezi region have been to formal schools than farmers in the two Kavango regions. Overall, these results indicated a high proportion of illiteracy among small scale farmers. These findings are consistent with the Namibia Census of Agriculture Report of 2013/2014, indicating that the majority of agricultural household population had primary education as their highest level of education. The education level per region is outlined in figure 4.3 below.



**Figure 4.3** Education level of respondents per region

#### **d) Farming experience and farming unit size**

Results on farmers' farming experience, size of farming unit and household size are presented below. Based on the study results, the average farming unit size was 6.4 ha across all the regions. On average, Zambezi was found to have the largest farming unit size of 11.4ha followed by Kavango West and Kavango East with 3.8ha and 2.5ha respectively. The results indicated a mean cultivated land area of 4.1 hectares and 1.5 ha per household for dry land farmers and horticulture farmers respectively. The results revealed that not all the land that is available to small scale farmers is being used for cultivation. This suggests that there exists potential to increase production across the target regions.



**Table 4.1:** Mean Comparison of Dry land and Horticultural farmers on farming experience and household size

Demographic variables	Kavango West Region (N= 115)		Kavango East Region (N = 92)		Zambezi Region (N = 142)	
	Dry land (N=90)	Horticulture (N=25)	Dry land (N=64)	Horticulture (N=28)	Dry land (N96)	Horticulture (N=46)
Years of farming in the area (Years)	14.1	13.9	13.1	17.7	19.7	14.9
Household size (persons)	10.9	6.8	10.8	6.9	12.3	4.2

The study results show that majority of the respondents have been farming in the area for about 13.7 year. The average household size was 8.7 and 5.6 people for dry land and horticulture respectively. This represents a high dependency ratio and could have negative implication on household food security.

## 4.2 Current Agricultural Practices

This section summarizes the findings on current agricultural practices being undertaken by small scale farmers in the study area

### 4.2.1. Land clearing and preparation

The results have shown that majority of the farmers (83%) relied on slash and burn for clearing lands. Panga, axes, rakes, spades and fire were the common identified tools used for land clearing. Only 14% of respondents indicated that they incorporate crop residues into their crop fields to improve soil fertility Cost of hiring labour, cost and availability of tools, human-wildlife conflict during land clearing were identified as the most pressing problems facing small-scale farmers.



With regard to land preparation, mould ploughing was more common among the small scale farmers (70%) and few farmers used disc ploughs (14%), hand hoes (11%) and minimum tillage (5%). Although regarded as one of the CSA practice, ripping and minimum tillage (basin) was only used by 0.5% and 5% of the respondents in the study area, respectively. Among the most common problems associated with land preparation were: Stumps and big tree residues, lack of oxen for animal draught power, expensive hiring and availability of oxen and tractors, delayed rain, delayed ploughing services by ADCs, and germination failure due to insufficient soil moisture and pests (birds and rodents).

#### **4.2.2. Planting methods**

Manual row planting was most preferred by farmers (66%), while broadcasting methods (30%) was minimal. None of the farmers made use of the planter for planting or seeding. Lack of modern planting equipment was highlighted by respondents as one of the major challenge. Horticultural farmers, most preferred indirect planting by first planting in nursery seedbeds and transplant seedlings in their gardens. The process of transplanting is regarded by respondents as labour intensive. Farmers are also faced with replanting and re-transplanting due to pests.

In terms of cropping patterns, respondents revealed that farmers use a combination of various cropping patterns. Multiple cropping is more common among dryland farmers (31.7%), while crop rotation is practiced by horticultural farmers (29%). Other cropping patterns employed by small scale farmers in the study area are: Intercropping (21.3%) and monoculture (11.7%). Farmers have pointed out that constraints to cropping pattern are among others: lack of knowledge on crop rotation and other cropping patterns, lack of other seeds for crop diversification, germination failure for other crops, flood tolerant crops, and implementation of crop rotation and other cropping patterns is assumed to be time consuming to farmers.



### **4.2.3. Fertilizer application**

Majority (75%) of dry land farmers did not use any fertilizer, although organic fertilizer (manure) was the most preferred fertility management option for dryland farmers, only 14% of the respondents applied manure. Respondents pointed out that it was mainly as a result of manure not readily available and too costly to transport between farms. Only 3% of dryland farmers reported that they were using chemical fertilizer such as NPK and Urea. The remaining 8% did not respond either way. None of the respondents used compost. This indicates knowledge gap on compost usage, hence necessitates the need to promote compost preparation and usage amongst farmers.

### **4.2.4. Weed and pest control**

The study results shown that 95% of the respondents control weed manually by use of hand hoe weeding. None of the interviewed farmers reported to have used herbicides. Very few farmers (4% of the dry land farmers) used insecticides to control pest and diseases in their farms. However, some of the respondents practiced various indigenous pest and disease control methods such as wood ash (14%) and burning of pests after hand picking (3%).

Other protection measures used are bird scaring (75%) and fencing of crop fields and gardens (33%). Bird scaring in a challenge as farmers pointed out that they have no effective practice to control birds. As for livestock and wild animal, majority of crop fields are not fenced (54%). Furthermore, those that are fenced are not livestock proof (see figure 4,4). Other constraints experienced by small-scale farmers were high cost of fencing material, cost of hiring labour, limited monitoring as some crop fields are located far from the houses.



**Figure 4.4:** A): Many of the gardens have poor fences that are not livestock proof. B): Nursery for seedlings are made using available materials such as old mosquito nets

#### 4.2.5 Farmers' Indigenous Knowledge on Pest and Diseases Management and Control

The evaluation of farmers' knowledge and perceptions is essential for the development of management strategies that match farmers' aspirations and are thus likely to be adopted. In addition, the evaluation of farmer's knowledge, perception and practices regarding new technologies is essential for the development of strategies to sustain the new technologies and techniques. Hence when providing new technologies to farmers, it is important to understand their perceptions, attitudes as well as their indigenous knowledge systems. This is particularly important for DARD /CRAVE in a bid to adapt their technologies to local farmers' situations in order to enhance the acceptance and adoption of these technologies.

A key area that has to be adequately addressed in the area of crop pests and diseases management and control is indigenous knowledge accumulated by local communities. Indigenous knowledge/information is essential for priority setting as well as for development of integrated pest Management strategies that meet local aspirations and are thus likely to be adopted by local communities.

This section examines farmers' knowledge of crop pests and diseases with the aim of developing and promoting integrated pest and diseases management in the study area. Insects, pests and diseases are some of the threats to small scale crop farmers. To protect crops from insects and pests infestation, some farmers made use of innovative indigenous technical knowledge/practices which is evolved by farmers on their own experience and are passed from generation to generation. Figure 4.2 below, indicates a number of indigenous technical practices and their application method.

**Table 4.2:** Indigenous knowledge to control pests and diseases in horticulture gardens

Indigenous knowledge Aspect	Frequency N= 99	Application methods
Ash	25 (25.3%)	Mix with water and applied directly to plants
Chilli	3 (3%)	Mix with water and applied directly to crops
Neem and tobacco leaves	5 (5.1%)	Crushed leaves mixed with water and applied directly to crops
Rows of onions	1 (1%)	Plant onions in between crops to prevent pests
Washing powder	1 (1%)	Mix with water and applied directly to crops
Sunlight bar	2 (2%)	Mix with water and applied directly to crops

The above practices are more common for horticultural farmers. Of the total horticultural farmers, 25.3% indicated that they make use of wood ash to control crop pests and diseases. Other indigenous methods reported by some few farmers were the use of chilli, neem and tobacco leaves which are crushed and then mixed with water before the solution is applied directly on the crops.



Planting of onions between other vegetables, use of washing powder and sunlight bar were also used by a small percentage of respondents. This represent a great opportunity for further research needed to standardize the indigenous knowledge and practices.

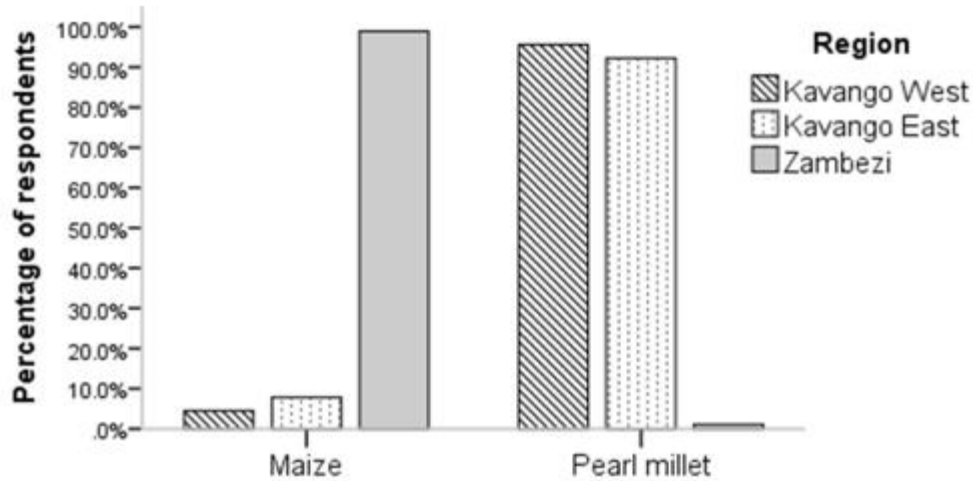
#### **4.2.6. Harvesting and storage**

All the dryland respondents indicated that harvesting was done manually using knives. They further narrated that harvesting is followed by threshing and winnowing which are also done manually. Threshing is normally done by beating with sticks. With regard to storage of pearl millet or maize grains, farmers use bags or sacks (50%), drums (5%) and traditional granaries (29%). Most farmers pointed out the lack of proper storage facilities which resulted to post harvest losses due to insects such as termites, rodents and other pests. Furthermore, harvesting and storage is impacted by wildlife in most case elephants damaging their crops and storage facilities.

#### **4.2.7 Types of Crops**

##### **Dryland**

Farmers grow a wide range of crops with Pearl millet (*Pennisetum glaucum*) being the dominant crop cited by 90% of the dryland farmers in both Kavango West and Kavango East regions (see figure 4.5 below). While for Zambezi region, the dominant crop was maize accounting for 99% of the respondents. This is not surprising because these crops are the main staple food in the respective study regions. Other crops intercropped with maize and Pearl millet included sorghum, ground nuts, bambara nuts, melons and cowpeas. See figure 4.5 below. These results revealed that both dryland and horticulture farmers have adopted a mixed cropping system as their most common cropping system.

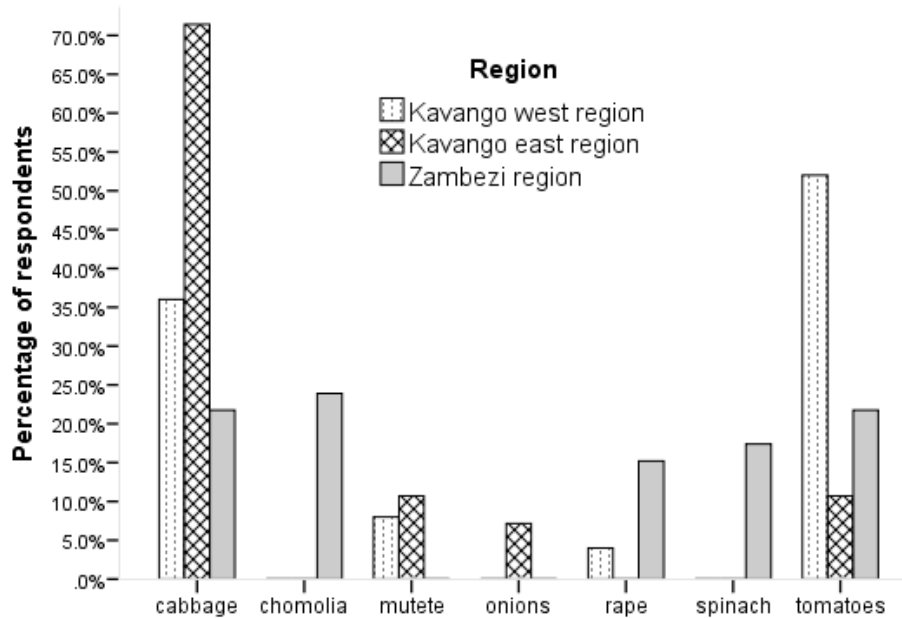


**Figure 4.5:** Major crops grown in the study area disaggregated by regions

### Horticulture

In Kavango West, the most grown vegetables were tomatoes, cabbage, mutete and rape. While cabbage, mutete, tomatoes and onion were the most preferred vegetables in Kavango East region. The most preferred vegetable in Zambezi were chomolia/rape, tomatoes, cabbage and spinach among others. See figure 4.6 below.





**Figure 4.6:** Types of vegetables most grown/preferred in the study area.

The interesting finding is that although mutete is known to be one of the most preferred traditional vegetable in the both Kavango regions, majority (70%) of the respondents reported cabbage to be the most preferred vegetable grown in Kavango East instead. The most preferred vegetables in Kavango West reported to be tomatoes and cabbage, accounting for about 50% and 35% of responses respectively. These results are consistent with the focus group discussion where the respondents indicated that cabbage and tomatoes adapt very well and their market is good. Chomolia, tomatoes and cabbage were most preferred by horticultural farmers in Zambezi region (See Figure 4.6).



#### 4.2.8. Seed types and sources

In Kavango west and Kavango East regions, majority of the farmers used grains from the previous harvest as seeds. While in Zambezi region, most of the farmers used a combination of grains (own seeds) and certified seeds. Most farmers indicated that they mainly source certified seeds from MAWF Agricultural Development Centers (ADCs) where they buy them through the government subsidy DCPD program. A few farmers have indicated that they borrow from others.

**Table 4.3.** Sources of seeds by regions (figure represent % of respondents)

Sources of seeds	Kavango West		Kavango East		Zambezi	
	Dryland	Horticulture	Dryland	Horticulture	Dryland	Horticulture
Own harvest	48	40	45	29	19	2
Certified seeds	31	52	36	68	27	96
Combination	21	8	9	4	53	2
Borrow	0	0	6	0	1	0

Majority (52%, 68% and 96% in Kavango West, Kavango East and Zambezi regions respectively) of the horticultural farmers, reported that they mostly use certified seeds acquired from the local supermarkets eg Shoprite, Spar, and Pharmacies etc. These statistics clearly indicate a gap in the practice of GAPs such as the use of hybrid seeds to ensure increased productivity and food security at the household level.



## 4.2.9 Water sources for irrigation

In terms of water sources, respondents indicated their main water sources in Kavango East (85.7% of the respondents) and Zambezi (50% of the respondents) to be the river. While the main water source in Kavango West was reported to be wells (48% of respondents) and boreholes (44% of respondents). (See table 4.4).

**Table 4.4:** Source of water for irrigation

Types of water supply	Kavango West N= 25	Kavango East N =28	Zambezi N = 46
River	7 (28%)	24 (85.7%)	23 (50%)
Piped water	0	0	9 (19.6%)
Boreholes	11 (44%)	1 (3.6%)	2 (4.3%)
Wells	12 (48%)	2 (7.1%)	10 (21.7%)
Earth dams	1 (4%)	1 (3.6%)	2 (4.3%)
Rooftop-Rain water harvesting	0%	0%	2 (4.3%)

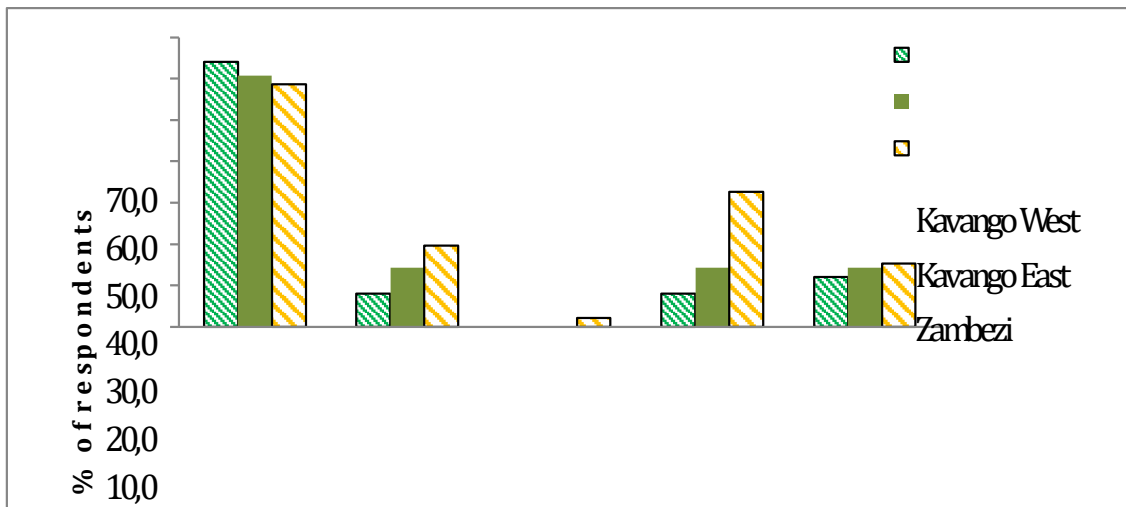
Some useful observations made from the survey were that that most farmers draw water directly from the river to their gardens where they practice furrow irrigation. While this practice saves farmers on irrigation related costs, it is mal-adaptation and ill-suited to climate change adaptation and can result in environmental problems such as salinity, nitrate leaching and water wastage. Farmers should be advised to use drip irrigation systems using solar powered water pumps to draw the water from the river. It is further advised that they must use elevated water tanks as water reservoirs.



From the survey data above, It can be seen that rain water harvesting is only practiced by 4.3% of respondents in the Zambezi regions. There is thus an opportunity to promote rain water harvesting technologies to small scale farmers in the study area to increase available water for agriculture, particularly horticulture production.

#### 4.2.10. Irrigation methods

Farmers used various irrigation methods. Most of the horticulture respondents indicated that they were using bucket irrigation method. However, different methods were more popular in the different target regions. For instance, in Zambezi, bucket irrigation (58.7%) and hose pipe (32%) were most used.



**Figure 4.7.** Proportion of farmers using different irrigation methods

In Kavango West and Kavango East bucket irrigation (64% and 60% respectively) was the most popular method. Bucket irrigation was more popular across all target regions because is reported to be affordable and readily available to farmers. Respondents cited lack of financial resource as the major barrier limiting them to use more efficient irrigation methods such as drip irrigation which they regard to have higher initial investment cost.

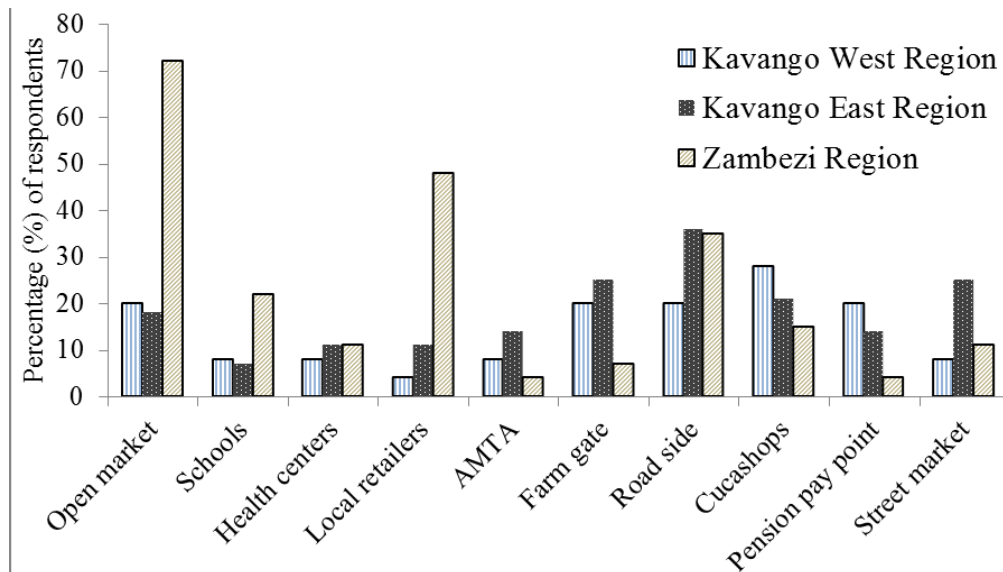


**Figure 1.8:** Irrigation methods used by local horticultural farmers: (A) Hose pipe; (B) Micro-drip irrigation supported by SCORE project; (C) Sprinkler irrigation method and (D) Bucket irrigation on basin planting

### 4.3. Consumption and marketing of garden produce

Overall, majority of the small-scale horticultural farmers (72%) in the study area produce for both own consumption and market. Zambezi region had the highest small-scale farmers (91%) producing for both own consumption and market, Of those producing mainly for marketing, Zambezi region is the highest (92%) followed by Kavango East (64%) then Kavango West (44%). Farmers harvest and sort their produce destined mainly for informal market in their communities such as open market, road side, local cuca shops, farm gate, street market and schools

(Figure 2). Only few farmers sell their produce to formal market like AMTA (8%, 14% and 4%) as well as local retailers (4%, 11% and 48%) in Kavango West, Kavango East and Zambezi regions, respectively.



**Figure 4.9:** Marketing channels used by small-scale horticultural farmers

With exception of Zambezi region, this study revealed that small-scale horticultural farmers are not selling their garden produce to the established formal markets such as AMTA and local retail shops. This could be due to the fact that local garden produce are not able to meet the standards in term of quality, uniformity, as well as handling and transport hygiene (See figure 1 below). However, Zambezi region has the highest number of farmers (44%) selling their produce to local retailer shops.

Farmers were asked about the hygiene and safety measures they have put in place in handling their fresh produce. Farmers have indicated that there is no specific standard measures used, but each individual farmers rather use own common sense. Based on field observation, sorting of produce was based only on ripeness. Garden produce such as tomatoes and anions are normally washed and packed in plastic buckets (figure 4.10), crates, bags, and boxes and then covered with nets or plastics when transported to the market.



**Figure 4.10:** Small-scale horticultural farmer near Sauyemwa in Rundu Rural Constituency of Kavango East region being interviewed by field enumerators while harvesting and sorting out tomatoes destined for street market in Rundu Town (photo by: Isak Kaholongo, 2018)

Table below indicates that farmers use multiple means of transporting fresh produce to the market. In Kavango West region, public transport is the most transport method used (52%) and only 8% local horticultural farmers are using own transport. However, in Zambezi region, 41% of local farmers hire transport to take their produce to the market. Footing is also fairly used in Kavango East (32%) and Kavango West (28%), respectively (Table 4.5). Hygiene and safety measures used by local farmers during transportation of vegetables to the market involve carrying their produce in plastic buckets, crates or bags and boxes covered with nets or plastics.

**Table 4.5:** Transport methods used by local small-scale horticultural farmers

How do you transport fresh produce to the market?	Kavango West region	Kavango East region	Zambezi region
Own transport	2 (8%)	6 (21%)	7 (15%)
Hire transport	3 (12%)	7 (25%)	19 (41%)
Public transport	13 (52%)	5 (18%)	11 (24%)
Walk on foot	7 (28%)	9 (32%)	4 (9%)

## 4.4 Challenges/Major constrains to crop production

### 4.4.1 Major constrains to Horticulture production

The table below summarizes the main constraints experienced by horticultural farmers among the three regions. The results indicated that the most prevailing constraints affecting horticultural farmers are pests and diseases (76%, 93% and 87%) in Kavango West, Kavango East and Zambezi region, respectively (Table 4.6). Only farmers from Zambezi region lacked market access (52%), but this was not the case in Kavango East and Kavango West regions.

This could be a clear indication that the existing horticultural farmers and probably Green schemes irrigation are currently not able to meet the demand for horticultural produce. Therefore, there is great opportunity for more horticultural gardens both in Kavango East and Kavango West region. Access to farm inputs was also among the most cited constrain in the study area. Other cited constrains were lack of transport, livestock and birds damage, water pump, fencing materials and storage facilities.



**Table 4.6** Main constraints experienced by horticultural farmers in each region

Types of Constraint	Kavango West Region (N = 25)	Kavango East Region (N = 28)	Zambezi Region (N = 46)
Access to farm inputs (seed, fertilizers, pesticides, manure)	19 (76%)	25 (89%)	28 (61%)
Pests and diseases	19 (76%)	26 (93%)	40 (87%)
Lack of preservation and processing technologies	18 (72%)	19 (68%)	16 (35%)
Lack of market access	0 (0%)	0 (0%)	24 (52%)
Heat stress/High temperature	16 (64%)	23 (82%)	22 (48%)
Flood	15 (60%)	17 (61%)	16 (35%)
Labour	17 (68%)	23 (82%)	19 (41%)
Access to implements and machineries eg, rippers,	13 (52%)	12 (48%)	21 (46%)
Access to Extension services	14 (56%)	14 (50%)	13 (28%)
Access to markets	10 (40%)	18 (64%)	29 (63%)
Competing land uses (crop residues for soil cover versus fodder)	10 (40%)	12 (43%)	5 (11%)

#### 4.4.2 Major constrains for dry land crop production

Information collected from dry land farmers revealed that major challenges to crop production were limited availability of labour, costly hired labour, drought, delayed rains, soil depletion, disturbance by birds, pests, lack of equipment for ploughing services, limited availability of inputs of production, delayed ploughing services from ADC, with reference to governments which do not come on time and lack animal for drought power. Some farmers also indicated poor fencing materials and also some had to walk long distance to their crop fields which is reported to be at the risk of being destroyed by livestock.

Feeding of livestock with crop residue is a cultural thing that cannot be easily changed, but rather can be promoted through crop livestock integrated farming.

#### 4.5. Farmers' perception on agricultural practices

Dryland farmers were asked if there was any difference between the timing of current agricultural activities and ten/twenty years ago. This question forms the basis to find out whether the cultivation season has shifted over the past ten years. It was therefore found that 74.7% of the respondents felt that there has been a change in terms of land preparation, planting, weeding and harvesting to follow the rainfall patterns. (See table 4.2).

**Table 4.7:** Difference between the timing current agricultural activities and 10 years ago

Is there any difference between the timing of your agricultural activities 10 years ago and now	Kavango West N= 92	Kavango East N=61	Zambezi N = 88
Yes	64 (69.6)	52 (85.3%)	64 (62.7%)
No	28 (30.4)	9 (14.7%)	24 (27.3%)

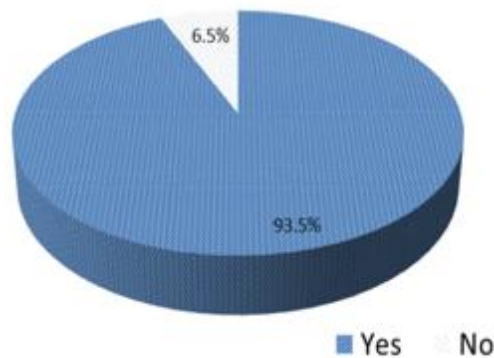
#### 4.6. Farmers' knowledge of climate change

One of the specific objectives of the study was to explore the knowledge and perception of small-scale crop farmers on climate change and CSA practices. Therefore, this section provides findings on farmers' awareness and understanding of climate change.

##### 4.6.1 Awareness of climate change

When respondents were asked to indicate whether they were aware that climate change exists. A total of 93.5% of the respondents indicated that they were aware that climate change exists, whilst 6.5% were not aware.

Of those who indicated that they were aware, 58% were female, while 42% were male. A cross tabulation between gender and awareness of climate change revealed that there was no significant difference ( $X^2 = 2.324$ ,  $DF = 2$ ,  $p = 0.313$ ).



**Figure 4.11:** Respondents awareness of climate change per region

Furthermore, FGDs revealed that most farmers were able to explain the concept of climate change and only few participants had limited understanding on concept. Most of the respondents referred climate change to increased temperatures and reduced rainfall and/ rainfall variability.

One farmer explained climate change as *“unpredictable pattern of rainfall as one cannot predict whether it will rain or not”*.

Another farmer explained climate change *“as the shift in rain season from the normal pattern such as summer season shifting to winter and vice versa”*.



Key informants understood well what climate change is all about as described by one key respondent in the quote below (see figure 4.4 below).

1. What does climate change mean to you?  
 Climate change is a phenomena taking place around the world where the average temperature of the earth's climate has been increasing due to CO<sub>2</sub> emission that is trapped in the ozone layer, causing erratic weather patterns. The implication of climate change is most felt in agriculture.

**Figure 4.8:** Definition of climate change as provided by key informant (source: Survey data)

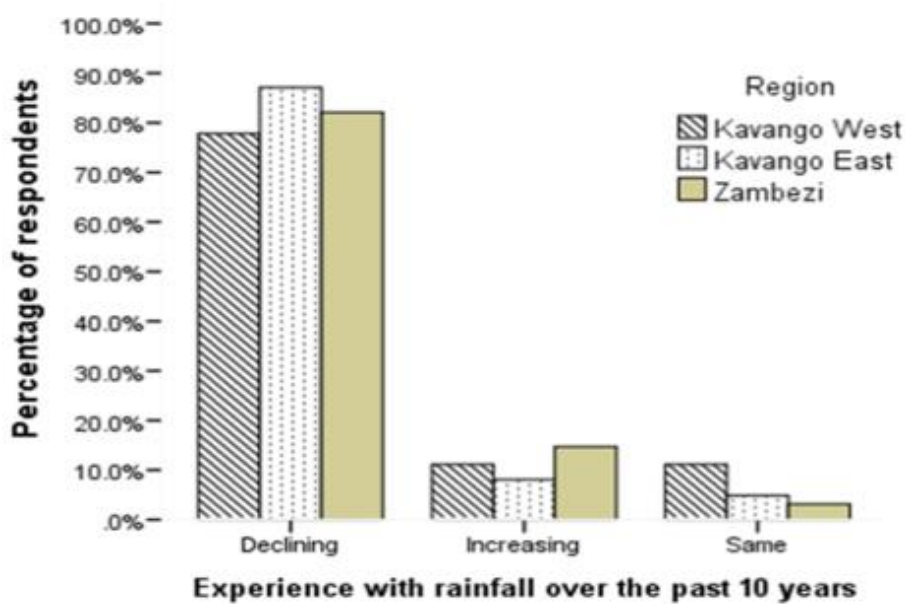
#### 4.6.2 Farmers' perceptions on indicators of climate change

##### Rainfall patterns

Respondents were asked to indicate whether rainfall has been declining, increasing or the same for the past 10 years. Overall, respondents observed changes in rainfall patterns over the past 20 years. The findings have shown that the majority of the respondents (81.7%) observed that there has been a decrease in rainfall over the past 20 years (Figure 4.8). The same pattern is observed across the three target regions with slight differences. (See figure 4.8 below). These findings are consistent with the report by Lu et al, 2016 that there has been a moderate reduction in rainfall for the same period in Namibia.



A cross-tabulation of the respondents among the target regions and experience on weather patterns revealed that there is statistically significant difference in terms of temperature ( $X^2 (6) = 17.075$ ;  $p = 0.009$ ); flood ( $X^2 (8) = 62.194$ ;  $p = 0.001$ ); and Wind ( $X^2 (12) = 29.749$ ;  $p = 0.003$ ). However, perceived change in rainfall patterns did not differ significantly among the regions.



**Figure 4.12:** Respondents' experience with rainfall patterns among the three different regions of north eastern Namibia (Kavango West, Kavango East and Zambezi region).

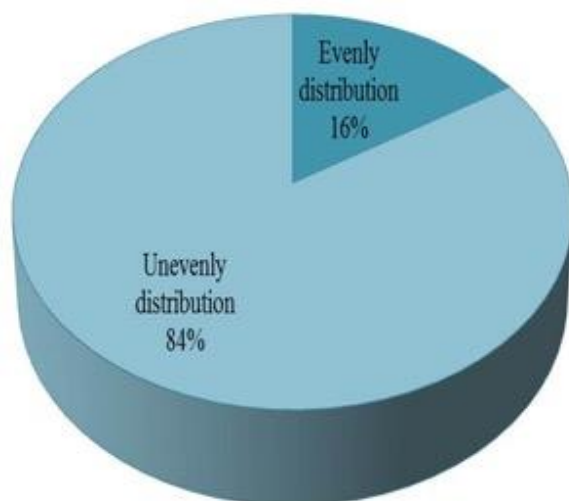
A change in the timing of rainfall was also mentioned by majority of farmers. Farmers observed that the main rainfall season is shorter and delayed. .



**Table 4.8:** Farmers' perception on rainfall duration by regions

Is rainfall season becoming shorter, longer or same?		Kavango West N = 90	Kavango East N= 64	Zambezi N= 96	Total N = 250
Rainfall	Shorter	80 (89%)	53 (83%)	81 (84%)	214 (86%)
	Longer	7 (8%)	4 (6%)	12 (13%)	23 (9%)
	Same	3 (3%)	6 (9%)	3 (3%)	12 (5%)

Of the total sample size, 84% of the respondents reported that they have experienced an unevenly rainfall distribution over the past 10 years. (Only 16% of the respondents reported that rainfall has been evenly distributed over the past 10 years. (See figure 4.13)



**Figure 4.13:** Farmers' experience on rainfall distribution over the past 10 years



## Temperature

Respondents were asked to indicate whether the temperature has been getting hotter, cooler or same over the past 10 years. Across the three target region, about 81% of the respondents perceived long term changes in temperature. Most of the farmers (86%) perceived the temperature in the three target regions to be increasing. Only 6% noticed the contrary, a decrease in temperature, whereas, 8% of respondents have not noticed any changes in the temperature. (See table 4.9 below).

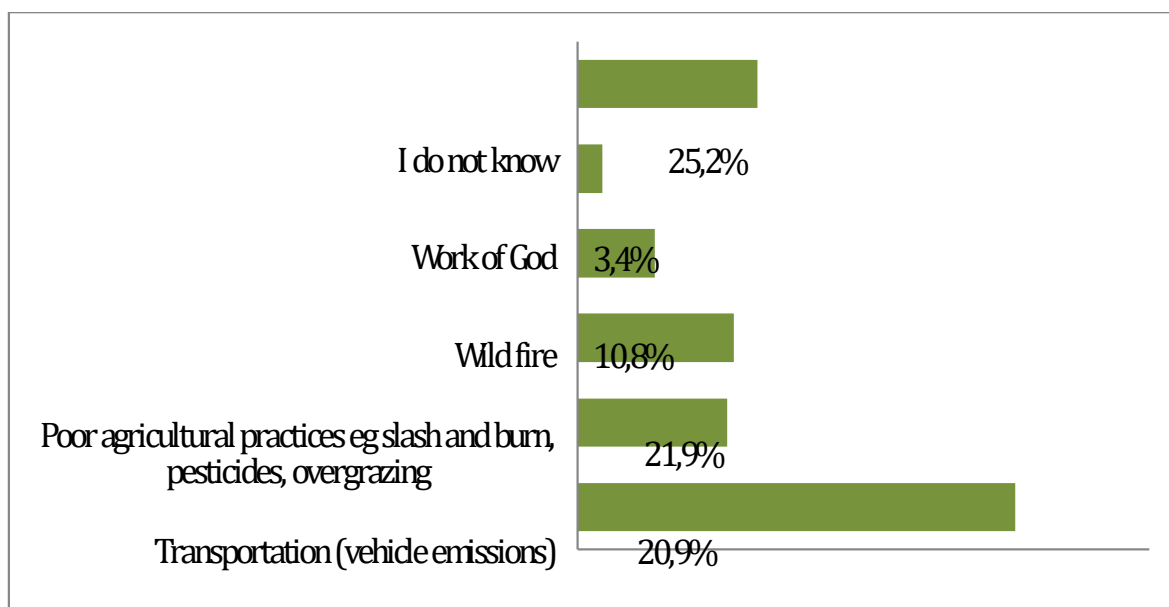
From the FG discussions, majority of the respondents felt summer days or months were getting hotter and hotter.

**Table 4.9:** Farmers perception on temperature patterns

Is the temperature increasing, decreasing or constant?	Kavango West N= 88	Kavango East N = 63	Zambezi N=96	Total N= 247
Increasing	69 (76.7%)	56 (87.5%)	88 (91.7%)	213 (86%)
Decreasing	4 (4.4%)	5 (7.8%)	5 (5.2%)	14 (6%)
Constant	15 (16.6%)	2 (3.1%)	3 (3.1%)	20 (8%)

### 4.7 Farmers' perception on the causes of climate change

Understanding farmers' perceptions on the causes of climate change is very crucial for developing climate change mitigation measures. Given the high level of farmers' awareness on climate change, only a few of them were able to identify its causes. Majority of the respondents (61.3%) indicated deforestation as a major cause of climate change. Other causes reported were poor agricultural practices, transportation emissions, wild fires and work of God. About one third of the respondents (25.2%) did not know about the causes of climate change. (Figure 4.14) These findings indicated a knowledge gap on the causes of climate among small scale crop farmers in the study area.



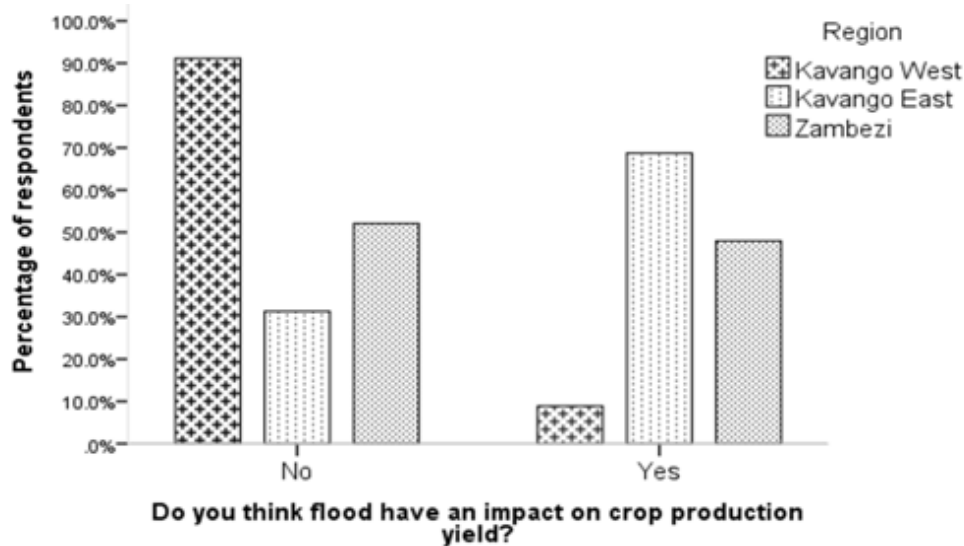
**Figure 4.14:** Perceived causes of climate change

#### 4.8. Impact of climate change on household livelihoods

This section presents the results of the study on the perceived effects of climate change on both crop production and household livelihoods in the study area. The study findings indicated that climate change had a negative effect on household livelihoods and food security and income at household level resulting from recurrent floods and severe floods.

The study established that the impact of flood on crop production is more experienced and in Zambezi and Kavango East regions. The results have indicated that flood has less impact on crop production in Kavango West. See figure 4.8 below.





**Figure 4.15.** The impact of flood on crop production

The analysis in table 4.6 summarizes the perceived extent of impact of drought and flood on crop production in the target regions. Respondents were asked to rate the perceived extent of impact of climate change on crop production on a basis of 10% less, 25% less and 50% less. Majority (49%) of the respondents perceived crop production to have declined by 50% as a result of persistent drought. These results indicated that drought is perceived to be more devastating across the target regions.

However, flood was reported to have varied effects across the target regions with



**Table 4.10:** Extent of drought and flood effect on crop production

Climate variables	Kavango West (N=85)	Kavango East (N=62)	Zambezi (N=92)	Total (N=239)
<b>Extent of drought impact</b>				
10% less	14.1%	9.7%	22.8%	16.3%
25% less	38.8%	25.8%	37%	34.7%
50% less	47.1%	64.5%	40.2%	49%
<b>Extent of flood impact</b>				
10% less	53.3%	28.3%	14.6%	26.6%
25% less	20%	45.3%	26.8%	34.9%
50% less	26.7%	26.4%	58.5%	38.5%

Small scale farmers in the study areas are exposed to a number of climatic shock that affect their livelihoods. Farmers highlighted that they have been experiencing prolonged droughts, recurrent floods and strong winds which resulted in poor yields, increased pests/diseases, loss of livestock, reduced income and poor soil fertility. Farmers perceived prolonged droughts/increased temperatures (95.6%), recurrent floods (24%) and wind (48%) as the main climatic risks leading to poor crop yields.

From the FGDs, some farmers revealed that most of the wild fruit trees that farmer used to survive on have disappeared, which has led to food and nutrition insecurity. Farmers have also reported a decline in livestock production and this has led to reduced milk production, hence food security is affected. One farmer at Shinguru village in Ndonga Linena also stated that:

*“Life has become so terrible since field crop production is no longer helpful and the only way is that the government must intervene”.*

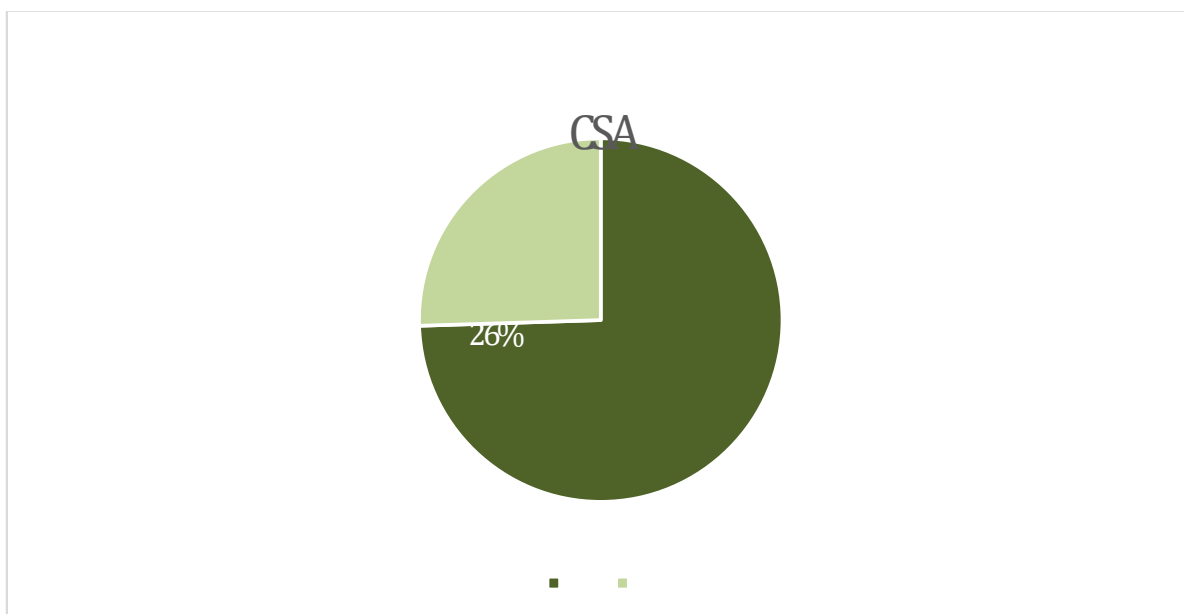
## 4.9 Knowledge on Climate-Smart Agriculture

This section discusses the study results on the level of knowledge of farmers on CSA. The aim was to assess whether small scale crop farmers are aware and practicing CSA practices to enhance crop production, increase resilience while conserving the environment. CSA is used as a mitigation and adaptation option to reduce the impact of climate change and improve agricultural productivity. To achieve the desired outcome, CSA requires a complete package of practices that increase productivity and income, build resilience and reduce greenhouse gas emissions

### 4.9.1 Awareness and understanding of CSA practices

Respondents were asked to state their level of awareness on CSA practices. The results (Figure 4.16) indicate that 74.5% of the respondents were aware of CSA practices, while the remaining 25.5% were not aware. However, it is worth noting that awareness about CSA does not necessarily guarantee good understanding and knowledge of CSA practices. It was thus important to establish farmers' understanding and perceptions of CSA practices as discussed below.





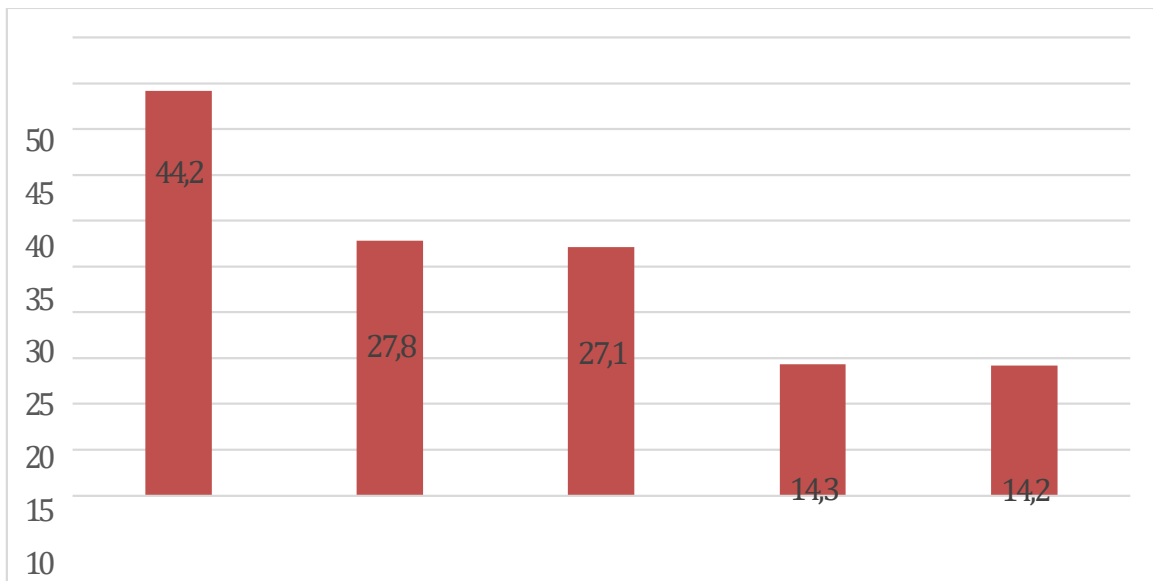
**Figure 4.16:** Proportion of farmer's awareness of CSA

Almost three quarter of farmers (74%) were aware of CSA, but they had limited knowledge of various CSA practices. Farmers' knowledge of CSA/ CA was found to be limited to ripping services and hybrid seeds. Female respondents were more aware and practiced CSA practices compared to their male counterparts. Again, education level and access to extension training services was found to have a positive effect on CSA awareness.

Through FGDs, respondents indicated that they were aware of CSA practices through different ways. The main sources of information mentioned by many respondents were media (specifically radio (44.2%), training by MAWF/DAPEES Extension Officers, NGOs and donor funded projects such as SCORE and GIZ, (27.8%) community meetings (27.1%), home visits (14.3%) and leaflets (14.2%).



The source of information is important information dissemination. The commonest method can help to send messages to the masses in a shortest possible time. It is also easier to send the messages using the commonly used method.



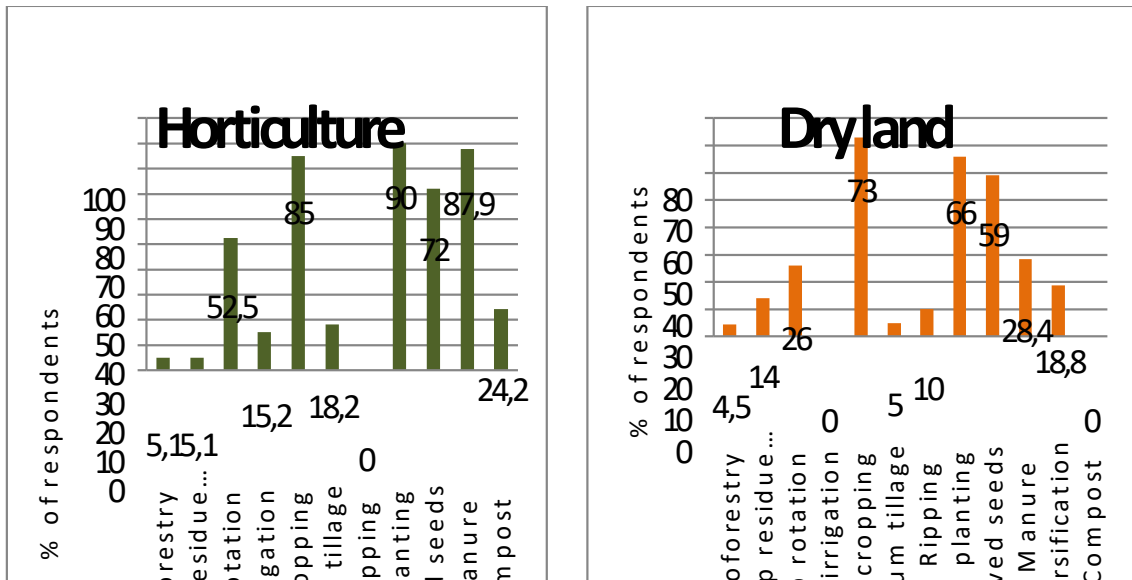
**Figure. 4.17.** The information sources on CSA

The study revealed that small scale farmers have adopted various CSA practices to overcome the negative effects of climate change and variability discussed above. The main objective is to increase crop productivity and household income. Many of the adapted measures are not new to farmers. Farmers in southern Africa have been coping with climate variability by implementing measures based on traditional knowledge accumulated through previous experience (O'Farrel et al, 2009). However, climate change continue to pose new risks and uncertainties for communities and past experience alone can no longer provide a reliable guide to dealing with future conditions (Armitage and Plummer 2010). This has led to the need to implement adaptation measures that are suited to present conditions and will be beneficial in future.

The adaptation methods employed by farmers in the study area are indicated in Figure 4.18 below. Even though a large number of farmers interviewed noticed changes in climate, most of them did not undertake any remedial actions. Indeed, seven adaptation measures could be identified in the study area.

The study found that intercropping, row planting, use of manure and improved seeds were the most common CSA practices reported by majority of the interviewed horticulture farmers (Figure. 4.8). Similar results were also observed for dry land farmers, except for the use of manure which is found to be less popular among the dry land farmers. Greater use of intercropping method could be associated with the traditional practices. The least adopted CSA practices by horticultural farmers were crop residue incorporation and use of agroforestry practices, while none of the horticulture respondents reported using the ripping service. This could be an indication that small scale horticultural farmers do not have access to ripping services. Therefore, there is a need to extend the ripping service to all small scale farmers in the target regions. This is necessary to break the hard pan to improve crop productivity. For dry land farmers, the least adopted CSA practices were use of compost, minimum tillage as well as agroforestry practices. The above results indicate a low or limited uptake of CSAs among small scale farmer and therefore more support is needed more especially in terms of CSA training.





**Figure 4.18(a).** CSA practices by horticulture farmers **Figure 4.18 (b)** CSA practices by dryland farmers

In addition to CSAs/Good agricultural practices highlighted above by farmers, a significant number of farmers were still using the conventional farming methods. Of the total respondents, 83% reported that they were still using slash and burn as part of land preparation method. Other conventional methods mentioned by farmers were disc harrowing, mold board ploughing, broadcasting planting and monoculture cropping system.

Based on the FGDs, when respondents were asked to state their main purpose to practice CSA majority indicated that the main purpose of practicing CSA was to increase crop productivity and thus enhance household food security. These findings show that there are other important reasons for practicing CSA other than adaptation to climate change. In practice small scale farmers are more concerned with food security and income to meet household basic needs. This implies that the majority of small scale farmers lack an in depth knowledge as to why CSA practices should be employed in their cropping systems.



This study suggests that, for the success and sustainability of the interventions among small scale farmers, there is a need to consider all the three objectives of CSA. Despite that there is high awareness of CSA among small scale farmers, there is still a low adoption of climate smart agriculture among the small scale farmers. However, through the FGDs, farmers were asked to indicate their willingness to adopt CSA practices. All respondents expressed willingness to adopt the practices. Consideration of farmers' knowledge and experience is important for inclusion and sustainability of the interventions. It is therefore important to engage and *plan with people BUT not to plan for people*'

#### 4.9.2 Conservation Agriculture Practices

Interesting finding came out when respondents were asked to explain their understanding on the concept of conservation agriculture (CA). Majority of the respondents understood CA as a *farming practice where ripper was used to break the hard pan in order to improve the soil structure and sowing on the furrows*. Based on these results, the understanding of CA among many farmers is limited to ripping (soil minimal disturbance) leaving out the other two principles of CA (crop rotation and soil cover). In other words, farmers perceived ripping as a complete CA. It can be deduced that most farmers have not really grasped the concept of CA that it is a technology based on three basic principles of permanent soil cover, minimum tillage and crop rotation.

**Table 4.11** Conservation agriculture principles practiced by farmers

CA practices	% frequency (n=99)	% frequency (n=250)	Total sample (n=349)
Minimum tillage	18.2	5	8.6
Crop rotation	52.5	26	33.5
Soil cover	5.1	14	11.5



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From table 4.11 above, it is indicated that overall 33.5% of respondents practiced crop rotation, 11.5% of respondents practiced crop residue retention/incorporation (which is interpreted as soil cover) whilst 8.6% of the respondents did minimum tillage such as basin planting and direct seeding. Of those practicing CA, 62% were female headed households. It was also found that none of the farmers practicing CA principle managed to practice all the three principles of CA.

Among those practicing CA principles, 85% have practiced only one component, 15% have practiced two components and none (0%) practiced all three CA principles. This finding implies that CA is partially practiced in the study area, since most farmers have adopted only one CA principle. As it has been argued that in order to be identified as CA farmers there should be at least two principles practiced and real tangible output of the practice. It is therefore worth noting that most farmers only practice CA at a very small scale with a combination of conventional way of farming as highlighted under section 4.2 (Current agricultural practices) and this may not be significant to qualify as a complete CA practice.

Some of the constrains to adoption of CA as highlighted by farmers during focus group discussions include limited access to information, lack of technical know-how, more weeds, scarcity of materials for mulching for soil cover and trade –off between animal feed and crop residue retention. Retention of crop residues in the field appears to be more of a problem because livestock compete for crop residues as feed. It was also observed during focus group discussion that retention of crop residues could also be hampered by fears of termites and other insects.

Therefore awareness campaign and support system for farmers such as effective training and monitoring are very necessary.



#### 4.10. Farmers' constrains to climate change adaptation

This section identifies the major barriers to climate change adaptation among small scale farmers in the three regions. Study results show that the major barriers for horticultural farmers were found to be the cost of production inputs, inadequate and cost of farm implements as well as limited extension services. While the most significant barriers cited by dryland farmers were inadequate technical knowhow on CSA, delayed/limited extension services such as ripping services, inadequate and cost of farm implements mainly rippers and planters, cost of inputs such as seeds and ripping service, access to climate information and opportunity cost vis crop residue incorporation. The least cited barrier by the horticultural respondents was unavailability of improved seeds while cost of inputs such as seeds and fertilizer was reported by a few dry land farmers as a constraint to climate change adaptation. The above constraints could be addressed by organising advocacy awareness and training farmers on climate smart agricultural practices including regional level planning and implementation.

**Table 4.11:** Constrains to climate change adaptation (Horti = Horticulture)

Barriers to climate change adaptation	Kavango West		Kavango East		Zambezi	
	Horti	Dryland	Horti	Dryland	Horti	Dryland
Inadequate knowledge/technical knowhow on climate smart agriculture	27.2%	60.2%	43.8 %	65.8%	24.8%	55.5%
Access to climate information	30.8%	60.2%	25%	67.4%	30.4%	52%
Unavailability of improved seeds	17.2%	37.2%	11.6 %	45.6%	20.4%	35%
Cost of inputs (affordability) (seed, fertilizer, pesticides)	76%	35%	69%	26%	61.3%	31%

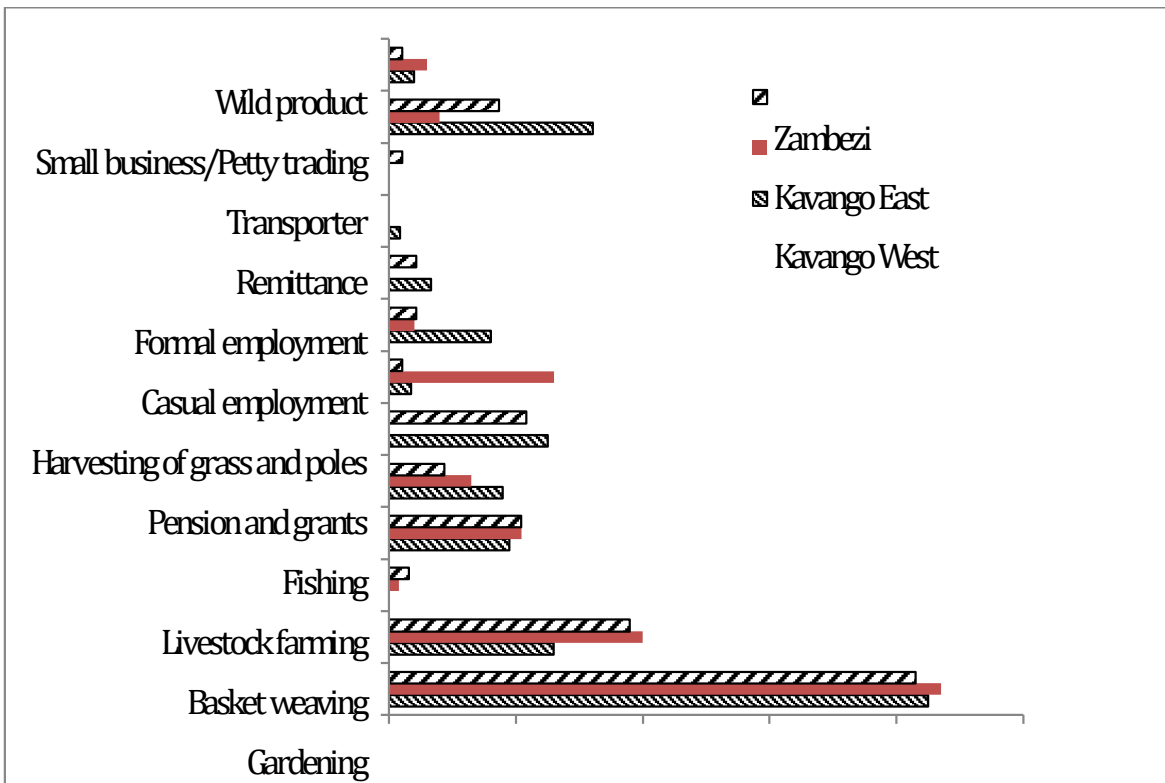
Inadequate and cost of farm implements e.g. rippers or garden tools	52.1%	57.5%	48%	40%	46%	25%
Delayed/limited extension services e.g. ripping service, provision of seed and fertilizers	56%	67%	50%	69%	28%	40.5%
Opportunity cost of land use e.g. livestock feed vs incorporation of crop residue	40%	47%	43.8%	51%	11.2%	25%

Results from the KIs interviews indicate that farmers are unlikely to invest their resources if they are not assured about the outcome of the technology or practice. Therefore access to both extension services as well as credit facilities is crucial. This finding is consistent with (CCFS, 2014) report that farmers preferred the government to invest in insurance and agro advisory services, but expressed a willingness to spend their own money on climatic stress tolerant seeds and on machinery.

#### 4.11. Household livelihood diversification

In the study areas, like other rural areas in Namibia, households derive their livelihood from various activities. The most significant identified livelihood activities in Kavango regions were crop production, small business/petty trading, gardening, pension grants, livestock farming, fishing and casual employment. While crop production, gardening, harvesting of grass and poles, fishing and livestock farming were significant in Kavango region. Similarly, crop production, gardening, old age pension and grants and small business were more commonly livelihood strategies employed by small scale farmers in Zambezi region.





**Figure 4.19.** Livelihood sources

The main reasons of their engagement in various farm and non-farm activities that came out from the focus group discussions were low production and low return from agriculture which is not sufficient to cover all household expenditures.

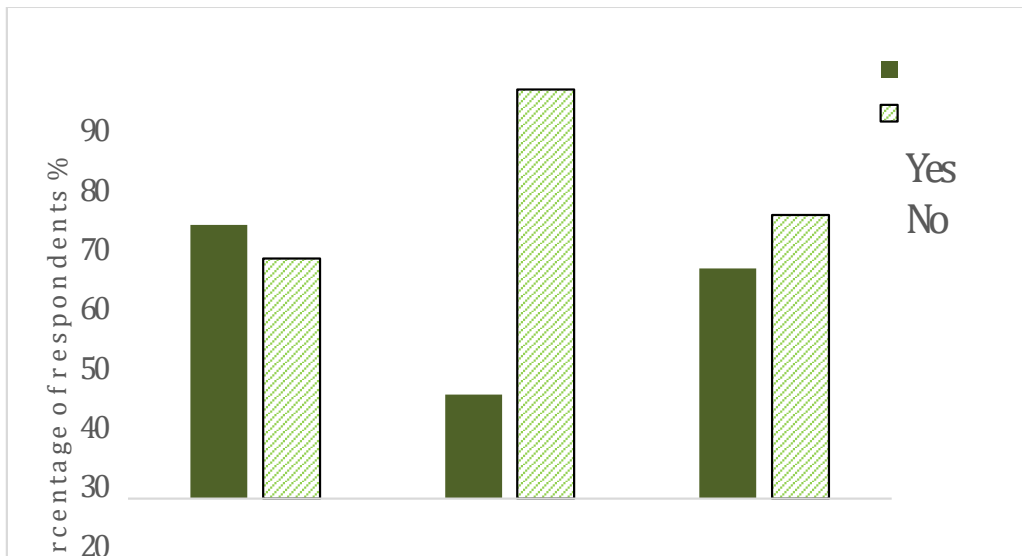
## 4.12. Household Food Security and coping strategies

### 4.12.1 Food security status

Food security remains an overarching government policy. It takes precedence in the Fourth National Development Plan (NDP4), thus enjoying a high priority with the government of Namibia and its attainment is central to the attainment of Vision 2030. “Food security exists when all people, at all times, have physical and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life” (FAO). It refers to continuous food availability, food access, food utilization and nutrition levels.

For this baseline study, indicator such as food availability throughout the year was used to describe the food security status in the study target areas.

Respondents were asked if they produced enough food to feed the whole family all year round until the next harvest (2018/2019 season).



**Figure 4.20:** Household food security status

The findings presented above in Figure 4.20 show that majority of small scale farmers in the study area experienced food shortages. The results above show that very few farmers were food secure in both Kavango East (20.3% of the respondents) and Zambezi regions (44.8% of the respondents ).This obviously implies that the majority of respondents in both Kavango East (79.7% of the respondents) and Zambezi regions (55.2% of the respondents ) were found to be vulnerable to food shortages. Study results revealed that most small scale farmers perceived not to produce enough food to meet their household food demands. Surprisingly, Kavango west region (46.7% of the respondents) was the least perceived vulnerable region in terms of food insecurity. The present baseline results showed that more than half of the interviewed farmers in the Kavango west region had sufficient quantity of food to feed all the members of their households throughout the year.



These results are in consistent with the NEWFIU report (2018) that household food security was reported to be satisfactory in most regions of the country, following a good agricultural production received in the previous season 2016/2017 (NEWFIU, 2018). It was also reported that all major crop producing regions indicated above average production except Zambezi region with a one percent reduction below average production (NEWFIU, 2018).

The above results could also be supported by the NHIES (2016) which indicated that the distribution of severely poor household across the country was found to be highly concentrated in Kunene, Kavango East, Zambezi and Omaheke regions with severely poverty rate above the national average of 10.7% (NHIES, 2016). This could have an indirect effect on household food security.

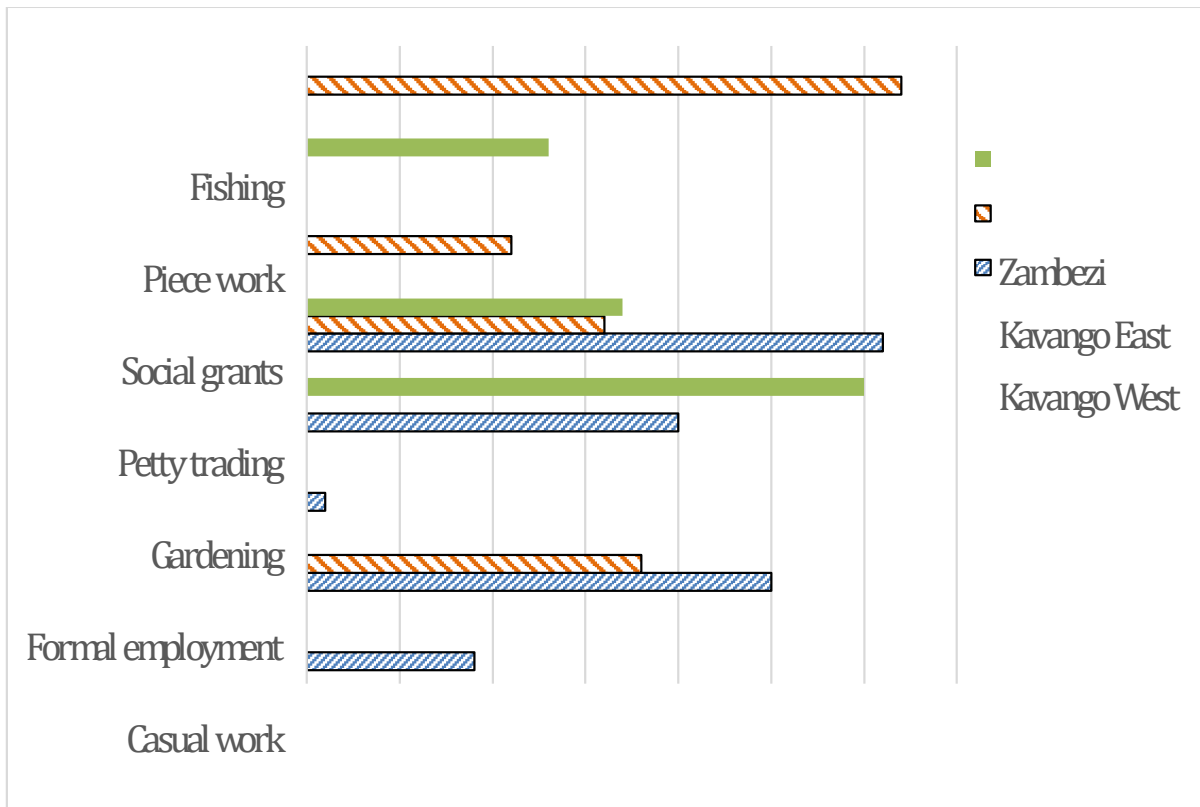
Although, households belonging to male farmers are generally more food secure compared with their female counterparts, a cross-tabulation of gender and household food security revealed that perceived household food security status did not statistically differ in terms of female and male headed households ( $p$ -value = 0.549). Moreover, through a focus group discuss, small scale farmers attributed different factors as the underlining reasons for food shortages among others, poor rainfall, lack of labour, poor soil fertility and sickness were mentioned by some farmers.

#### **4.12.2. Coping strategies to food insecurity**

To cope with food insecurity, small scale farmers have devised several methods to cope with food shortages. (See figure 4.21 below).

Of those who responded, the most important coping mechanism employed by majority of respondents in Kavango West were small business/petty trading and casual work where farmers engage in hiring themselves as manual labourers to other more comfortable farmers.

Other coping strategies reported were piece work, gardening/vegetable production. To a lesser extent, some households resorted to rationing by reducing the amount of food consumed and very few opted to look for formal employment.



**Figure 4.21:** Food insecurity coping strategies

In Kavango East, the most commonly adopted coping strategies to deal with food shortage during lean periods were fishing, casual work, small businesses/petty trading and social grants. In Zambezi, gardening, small business and piece work were the most common cited livelihood options employed by farmers. Other coping strategies employed by the sampled households were borrowing from neighbours and family members and use of government drought relief. Some of the mechanisms tend to encourage poverty for example sale of household labour which may compromise the ability of households to prepare own land early or do weeding timely.



KNOWLEDGE, ATTITUDE, BEHAVIOUR AND PRACTICES (KABPs), BASELINE AND ENHANCED LIVELIHOOD SURVEY

These findings indicate that small scale crop farmers relied on a variety of coping strategies to counter their household food insecurity. This is in agreement that increased reliance on coping strategies is associated with lower food availability (Mjonono, et al., 2009).

## SECTION 5

### 5. CONCLUSION

This study aimed at assessing the KABPs of climate change among small scale farmers in Kavango West, Kavango East and Zambezi region. Overall this study concludes that majority of farmers were aware of climate change and its effects on crop production and livelihood. However, they had minimal knowledge on comprehensive understanding of climate change and how to effectively employ CSA practices. Although majority of farmers were aware of CSA practices, most of them lacked in- depth knowledge of CSAs practices and were still using mal-adaptive farming practices ill-suited to climate change adaptation which results in low yields, poverty and increasing vulnerability to climate change impacts.

In addition, some farmers thought ripping (so referred to as minimum tillage) alone was a complete package of CA practice, although CA is underpinned by the three principles- minimum soil disturbance, crop rotation and crop cover. This is an important knowledge gap to address as farmers may not be motivated to uptake the CSAs practices if they lack the necessary information. This knowledge gap necessitated the need to intensify training paying particular attention to CA principles and integrated pests and diseases management. Furthermore, it is worth noting that farmers are entrepreneurs implying that farmers are likely to adopt innovations and technologies when benefits outweigh the costs. Thus training and on-farm demonstration of benefits of various climate smart agriculture technologies to stimulate their adoption is critical.



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Given the low adoption of CSA technologies, it was found that most farmers had a positive attitude towards climate change adaptation and were even prepared to invest a little more on CSA. Therefore, proper communication strategy must be tailored to influence actions and behaviors of farmers in the target regions.

This study revealed that small scale crop farmers in the study area were keen to adopt new technologies and interventions that would transform their farming practices into a more relatively productive, higher-income and low carbon activity. However, they were found to be constrained by a number of factors such as the limited technical know-how on CSA, cost of input and farm machineries/equipment, delayed/limited extension services and access to climate information among others.

From the study results, it can be concluded that climate change is likely to reduce agricultural productivity and income in some or the other ways. A significant percentage of respondents were aware of some of the impacts associated with climate change and were able to identify some of these impacts on their livelihoods in terms of recurrent floods and prolonged drought resulting in declined crop production, reduced income, loss of livestock and introduction of new pests.

Farmers also experience a number of major constrains to climate change adaptation such as high cost of inputs (affordability), delayed extension services, and inadequate technical knowhow on CSA practices among others.

It was also found that small scale farmers derive their livelihood from various sources such as crop production, gardening, livestock farming as well as grass and timber harvesting. Therefore the entire supply chain of these subsectors need to be developed to ensure sustainable agriculture and livelihood.



KNOWLEDGE, ATTITUDE, BEHAVIOUR AND PRACTICES (KABPs), BASELINE AND ENHANCED LIVELIHOOD SURVEY

With regard to food security at the household level, majority of households were food insecure and employed a variety of coping strategies to deal with food insecurity at the household level.

Overall, this study concludes that an increased farmer education and awareness on climate change and adaptation is necessary to fill the existing knowledge gap and reduce vulnerability and food insecurity of rural populations caused by climate risks and threats while increasing the adaptive capacity.



## SECTION 6

### 6. RECOMMENDATIONS

Based on the study findings, the following recommendations are being suggested:

- Continued capacity building and awareness for both Extension/Technical staff and farmers on climate change adaptation and Good agricultural practice should be a high priority for enabling the implementation of CSA in the study area. This should be a key area for investment to ensure higher level knowledge on climate change and probably contribute to more positive actions. This is particularly critical in the areas of :
  - Climate Smart Agriculture practices and technologies such as micro drip irrigation systems and CA practices
  - Integrated Pest and Disease Management and Control, taking into account the Indigenous knowledge
  - Crop production chain from land preparation through post-harvest technologies
- Awareness and training should include mechanisms of information sharing through farmer exchange visits, on-farm demonstrations, on-farm trials, video documentaries on project success stories and field days to showcase the best agricultural practices and/ CSA. More on farm and off- farm demonstrations should be organised to show case the best agricultural practices, at least two farmers field days be held per year by each ADC
- There is also a need to include project beneficiaries in the farmer-to-farmer extension approach. All these have the potential to motivate and encourage increased actions on climate change adaptation.





#### KNOWLEDGE, ATTITUDE, BEHAVIOUR AND PRACTICES (KABPs), BASELINE AND ENHANCED LIVELIHOOD SURVEY

- Overall, effective communication approach should be developed along with a variety of educational support materials which should include the use of various communication means to promote good agricultural practices
- Radio is still the most popular information source for most people in the rural areas. Hence must be utilised to in order to reach the majority of small scale farmers. In addition, alternative information sources should also be used to ensure all farmers are reached.
- . Stakeholder engagement throughout the project implementation to ensure its success and sustainability of its interventions after the project had faced out
- Farmers need to be supported (financially and technically through ongoing extension services) to implement CSA and CA practices.
- There is a need to closely monitor the impact and success of CRAVE project interventions on CSA to provide an evidence solution and attract further investments for climate change adaptation.
- Extension services should consider local and traditional knowledge to encourage farmers to make use of the local knowledge and essential experiences for improving crop production, land productivity and improve income. In other words, local and traditional knowledge should be embedded into the modern technology.
- Timely communication of climate information is highly encouraged to help farmers in planning of their agricultural activities more effectively.
- Timely provision and accessibility of agricultural machinery/equipment and inputs is necessary to reduce vulnerability and thus improve crop production (e.g machinery for ploughing, ripping planting, improved seeds, organic fertilizers etc.) Farmers also expressed concern about delayed agricultural services such as ploughing services, or ripping services therefore acquisition of more tractors and/ rippers is recommended to ensure timely provision of agricultural services.

- Overall, there is need to improve the input supply system so that farmers receive the right type of production inputs such as seed and fertilizers in sufficient quantity and on time. This will obviously protect small scale farmers from buying uncertified seed that poses unknown level of risk to production.
- Investment in efficient water infrastructures and technologies that increase productivity such as drip irrigation is needed to allow horticultural farmers to intensify and diversify crop production and thus increase crop production and household incomes and hence household food security. For example, the project beneficiaries/farmers residing along the river should be provided with solar water pumps, 5000L water tanks and drip irrigation systems.
- Farmers expressed concern about insect infestation on their crops in some parts of the surveyed areas, therefore there is need to conduct research in pest control to investigate those insects and educate farmers on how to control them. Overall, CRAVE should encourage farmers to diversify their crop production and move into horticulture production and also expand their gardens given the available opportunity reduce vulnerability to climate risks and ensure food security at the household level.





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**SECTION 7**

**2. APPENDICES**

**a. Questionnaire – Dryland Farmer**



**KABPs Survey**

**BASELINE ASSESSMENT ON THE KNOWLEDGE, ATTITUDE, BEHAVIOUR AND PRACTICES (KABPs), AND ENHANCED LIVELIHOOD SURVEY, THROUGH SUSTAINABLE AGRICULTURE IN THE CROP GROWING REGIONS OF KAVANGO WEST, KAVANGO EAST AND ZAMBEZI (Dry Land Farmers)**

Questionnaire number:											
Interview Date											
Enumerator's Name											
GPS Coordinates		S _____ ° _____ ' _____ "									
		E _____ ° _____ ' _____ "									
Region											
Constituency											
Village Name		Distance from the road		Distance of crop field from the house							
Head of Household		Farmer's Name									
		Common Name									
Gender	Male	<input type="checkbox"/>	Female	<input type="checkbox"/>	Disability	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>	Age	<input type="text"/>
Marital Status, Specify:											
If respondent is not the household head		Specify:									
Farming in the area since		Birth				If not since birth, year?					
Interview start – time		.....h.....		Interview end – time				.....h.....			

• Household Information & Gender Mainstreaming

Age / Age group	Household members		Literacy Local language		English		Education (Grade / Tertiary)				Employment + Income			
	Male	Female	Read	Write	Read	Write	<10	G10	G12	Tertiary (Specify)	No	Yes	If yes, Specify	Income e.g < 1,500
0 – 5 years														
5 – 10 years														

## 1. Current Farming Practices (Baseline)

Farming Unit							
Size of Farming Unit (estimate)	Crop Field Size (estimate)	Fenced		Types of Crops / Variety, List from a – d, in-order of magnitude / staple food			
		Yes	No	a.	b.	c.	d.
_____ha	_____ha						
If fenced, is the fence livestock proof (fencing could be wire, branches, etc)							
Source of Seeds (e.g own harvest, DCP certified, etc)							
Activity	Type / Method, Specify:		Equipment Used		Challenges		
Land Clearing (e.g raking and burning of stalk from previous harvest)							
Fertilizers / Manure							
Land Preparation / Cultivation Method/s							
Method of planting							
Cropping pattern, Specify							
Weeding							
Pest Control (e.g army worms)							
Other protection (e.g birds)							
Other protection (e.g livestock)							
Harvesting							
Storage							
Pounding / Milling							

## 2. Knowledge on Climate Change and Climate Change Impacts

Climate Aspect	Guiding Questions	Answers		
Rainfall	What is your experience with rainfall over the past 10 years or more? Is the rainfall declining, increasing or the same (tick)	Declining	Increasing	Same
	Is the rainfall evenly spread over the rainfall season or uneven (fluctuates: high & low)	Evenly spread	Uneven	
	10 years or more, which month did the rainfall start and which month does it stop	Start	End	
	At present, which month does the rainfall start and which month does it stop	Start	End	
	Is the rainfall season becoming shorter, longer or the same	Shorter	Longer	Same
	Do you think (as per the answers above) rainfall affects your crop production?	Yes	No	
	If yes, how? Explain: (e.g poor growth, poor yield, etc)			
	If yes, to what extend / scale of impact on crop production	10 % less	25 % less	50 % less
Temperature	What is your experience with temperature over the past 10 years or more? Is it getting hotter, cooler or the same (tick)	Hotter	Cooler	Same
	Do you think high temperature has or would have an impact on crop productivity?	Yes	NO	

	If yes, it is difficult to quantify separately from rainfall. Therefore, the impact of increased temperature on crop productivity, contributes to wilting (double effect with low rainfall), and can be combined with the estimated crop loss % presented under rainfall impacts				
Flood	What is your experience with floods over the past 10 years or more? Are the floods getting bigger, smaller or the same	Bigger	Smaller	Same	
	Do you think flood have an impact on crop productivity yield?	Yes		No	
	If yes, to what extend / scale of impact on crop production	10 % loss	25 % loss	50 % loss	
Wind	Have you noticed any change with wind patterns over the past 10 years? e.g Is the wind stronger, prevails over longer periods or the same?	Stronger	Prevails longer	Same	
	Do you think it has affected your crops in any way?	Yes		No	
	If yes, how does it affect your crops? e.g crops fall to the ground (rotting and predation)				

### 3. Knowledge on Climate Smart Agriculture

Aspect	Guiding Questions	Answers				
Climate Smart Agriculture	How would you compare your agricultural practices between 10 years ago and now? General					
	What are the most notable differences with your agricultural practices between now and 10 years ago?					
	Is there any difference between your agriculture practices 10 years ago and now?	Yes		No		
	If yes, what are the differences? In other words, what has changed?					
Agricultural techniques	What type of equipment do you have / use to improve crop production?					
	Cultivation					
	Weeding					
Timing of agricultural activities	Is there any difference between the timing of your agricultural activities 10 years ago and now?	Cultivation	Yes		No	
		Seeding	Yes		No	
		Weeding	Yes		No	
		Harvesting	Yes		No	
	If yes, specify					
Soil Fertility	Do you do anything to improve the soil fertility?	Yes		No		
	If yes, please specify					
Capacity Building	Have you attended any training or have you received any information on how to improve your crop production?					
	Training	Yes		No		
	Home visit	Yes		No		
	Community meeting	Yes		No		
	Radio	Yes		No		
	Leaflets	Yes		No		
	If yes, please specify					
Knowledge Gaps	Is there any specific information or training that you are interested in?	Yes		No		
	If yes, please specify					

#### 4. Barriers to Climate Change Adaptation and Livelihood Diversification

Aspect	Guiding Questions	Answers	
		20 years ago	Now
Cultural & Behavioral Practices	How would you compare your agricultural practices between now and 20 years ago?		
Cultural Practices Barriers	Are you happy with the traditional cultivation methods that you learned / inherited?	Yes	No
	If no, please specify		
	Have you introduced new cultivation methods that were not used 20 years ago?	Yes	No
	If yes, please specify		
Crop diversification	Have you introduced new crops that you did not cultivate 20 years ago?	Yes	No
	If yes, please specify		
Livelihood diversification	Apart from crop farming, do you have other sources of food / livelihood?	Yes	No
	If yes, please specify		

#### 5. Food Security

Aspect	Guiding Questions	Answers		
		2018	10 years	20 years
Crop Production and Food Security	How would you compare your crop harvest / yield between now and 10 or 20 years ago?			
	Do you produce enough to feed the family until the next harvest?			
	If the harvest is not enough, how does the family survive?			
	Do you think there is potential to improve your crop production	Yes	No	
	Have you ever produced more food than the family can consume, surplus?	Yes	No	
	If yes, what did you do / do you do with the surplus?			

**b. Questionnaire – Horticulture farmer**

**KABPs Survey**



**BASELINE ASSESSMENT ON THE KNOWLEDGE, ATTITUDE, BEHAVIOUR AND PRACTICES (KABPs), AND ENHANCED LIVELIHOOD SURVEY, THROUGH SUSTAINABLE AGRICULTURE IN THE CROP GROWING REGIONS OF KAVANGO WEST, KAVANGO EAST AND ZAMBEZI (Horticulture Farmers)**

Questionnaire number:											
Interview Date											
Enumerator's Name											
GPS Coordinates				S _____ ° _____ ' _____ "							
				E _____ ° _____ ' _____ "							
Region											
Constituency											
Village Name		Distance from the road		Distance of crop field from the house							
Head of Household		Farmer's Name									
		Common Name									
Gender	Male	<input type="checkbox"/>	Female	<input type="checkbox"/>	Disability	Yes	<input type="checkbox"/>	No	<input type="checkbox"/>	Age	<input type="text"/>
Marital Status, Specify:											
If respondent is not the household head				Specify:							
Farming in the area since				Birth		If not since birth, year?					
Interview start – time		.....h.....		Interview end – time		.....h.....					

**Household Information & Gender Mainstreaming**

Age / Age group	Household members		Literacy				Education (Grade / Tertiary)				Employment + Income			
			Local language		English		<10	G10	G12	Tertiary (Specify)	No	Yes	If yes, Specify	Income e.g < 1,500
	Male	Female	Read	Write	Read	Write								
0 – 5 years														
5 – 10 years														

## SECTION 1: Current Farming Practices (Baseline)

1.1. Please fill in information

Farming Unit							
Size of Farming Unit (estimate)	Garden Size (estimate)	Fenced		Types of Crops / Variety, List from a – d, in-order of magnitude / staple food			
		Yes	No	a.	b.	c.	d.
_____ ha	_____ ha						
If fenced, is the fence livestock proof (fencing could be wire, branches, etc)							
Source of Seeds (e.g own harvest, DCP certified, etc)							
Activity		Type / Method, Specify:		Equipment Used		Challenges	
How do you do land clearing ?(e.g. raking and burning of stalk from previous harvest)							
What tillage/ cultivation method (s) do you use?							
Method of planting (specify which crops grown directly /indirectly )							
What cropping patterns/practices do you apply? Specify, e.g. Crop rotation, intercropping etc.							
Weeding							

## SECTION 2: VEGETABLE PRODUCTION

2.1. What type of vegetables do you grow? Please indicate order of preference and seed source.

Vegetable type	Preference ( 1 highly preferred)	Reasons for planting that specific vegetable (e.g. market, own consumption etc.)	Seed Source (where do you buy seed?)
Cabbages			
Tomatoes			
Green pepper			
Spinach			
Onions			

Butternuts			
Beetroot			
Mutete			
Carrots			
Maize			
Others			

NB. PLEASE DO NOT READ OUT THE POTENTIAL ANSWERS TO THE RESPONDENT

2.2. What is the source of water for your garden? Tick all that apply

Type of water supply	Rank the three most important	Water usage: Household=1 Livestock=2 Gardening=3 Others= 4	Indicate the distance to water source (km)
River (name)			
Piped water			
Borehole			
Wells			
Earth dam			
Rain-water harvesting			
Community water point <b>(Rural water supply, Namwater)</b>			
Other, please specify			

NB. PLEASE DO NOT READ OUT THE POTENTIAL ANSWERS TO THE IN RESPONDENT

2.3. What type of irrigation method(s) are you using and why?

Irrigation methods	Tick all that apply	Comments/reason for choosing the irrigation method being used
Bucket irrigation		
Micro-drip irrigation		
Flood irrigation		
Hose pipe		
Others		

NB. PLEASE DO NOT READ OUT THE POTENTIAL ANSWERS TO RESPONDENT

**2.4. How many years have you been a horticulture farmer?**

Years of experience	Tick appropriate
0-5 years	
6-10 years	
11-15 years	
16-20 years	
>20 years	

2.4. Have you ever experienced problems in vegetable production? 1= Yes  
0= No

If yes, what main constraints do you experience? Please tick *all* that apply.

	Type of constraint	Rank (See code below)	Comments
1.	Access to farm inputs		
2.	Pests and diseases		
3.	Lack of preservation and processing technologies		
4.	Lack of market access		
5.	Heat stress /High temperature		
6	Flood		
7	Other (specify).....		

Rank: 1= Most serious 2= Fairly serious 3= Least serious

**SECTION 3. GOOD AGRICULTURAL PRACTICES (GAPs)**

3.1. Do you apply fertilizer in your garden? Yes Or NO; 1= Yes, 0= No

If yes, which type of fertilizer do you apply?

	Fertilizer Type	Tick all that apply	Comment/Reasons why using that Manure Type	Source
Organic Fertilizer	Goat manure			
	Cattle Manure			
	Compost			
	Chicken manure			
	Others (Specify)			

Organic Fertilizer	NPK			
	Urea			
	MAP			
	Others (Specify)			

**NB. PLEASE DO NOT READ OUT THE POTENTIAL ANSWERS TO THE RESPONDENT**

3.2. What indigenous knowledge methods/practices do you know/ and practice to control pests and diseases in your garden?

Indigenous Knowledge Practice/Method	Description of application method	Source
E.g., Neem leaves		

3.3.. Do you use any chemicals to control diseases, pests and weeds in your garden?

If yes, kindly name them

Name of Chemical pesticides / Insecticides/Herbicides used	Description of application method	Source
1.		
2.		
3.		
4.		
5		

3.4. Do you produce for both own consumption and marketing? YES or NO  
If yes, where do you sell your garden produce?

Market	Tick <i>all</i> the markets
Open market	
Schools	
Health centers	
Local retailers	
AMTA	
Farm gate	
Road side	
Cuca shops	
Pension Pay Point	

<b>Market</b>	<b>Tick all the markets</b>
Others	

**NB. PLEASE DO NOT READ OUT THE POTENTIAL ANSWERS TO THE RESPONDENT**

3.5. How do you transport your fresh produce to the market?

<b>Transport (Tick all that apply)</b>	<b>Type of transport ( e.g. bakkie with a canopy)</b>	<b>What hygiene and safety measures have you put in place during the transportation of vegetables to the market?</b>
Own Transport		
Hire transport		
Public transport		
Other, specify		

3.6. What challenges have you experienced in your vegetable production business?

<b>Challenges</b>	<b>Please tick all that apply</b>	<b>Comments</b>
Access to inputs (manure, seeds, pesticides, fertilizers etc.)		
Labor (weeding) (hire additional labor?)		
Pests and diseases		
Access to extension services		
Access to implements & machineries		
Access to markets (e.g. legumes)		
Competing land uses ( crop residues for soil cover versus fodder)		
Others (specify)		

**NB. PLEASE DO NOT READ OUT THE POTENTIAL ANSWERS TO THE RESPONDENT**

3.7. Have you attended any training on vegetable production? Yes or NO  
If yes, which aspects of vegetable production were you trained on?

<b>Aspect</b>	<b>Tick all that apply</b>	<b>Comments</b>
Land Preparation		

Planting/sowing		
Weed Management		
Fertilizer application		
Pests and Disease Control		
Handling and storage		
Marketing		
Others (Specify)		

**SECTION 4. LIVELIHOOD**

4.1. On average, how much do you generate from vegetable sales per year?

N\$ \_\_\_\_\_

4.2. In what way has the garden impacted your household livelihood? Tick appropriate.

Livelihood aspects:	Increased	Constant	Decreased	Comment
Household income				
Household food availability & Nutrition				
Other (specify)				

**NB. PLEASE DO NOT READ OUT THE POTENTIAL ANSWERS TO THE RESPONDENT**

**END of Interview**

**Thank You Very Much for Your Time!**

c. Questionnaire – Key Informant

KABPs Survey



**BASELINE ASSESSMENT ON THE KNOWLEDGE, ATTITUDE, BEHAVIOUR AND PRACTICES (KABPs), AND ENHANCED LIVELIHOOD SURVEY, THROUGH SUSTAINABLE AGRICULTURE IN THE CROP GROWING REGIONS OF KAVANGO WEST, KAVANGO EAST AND ZAMBEZI**

**SECTION A**

Questionnaire number:	
Interview Date	
Enumerator's Name	
GPS Coordinates	<p>S _____ ° _____ ' _____ "</p> <p>E _____ ° _____ ' _____ "</p>
Region	
Constituency	
Town/ Village	
Name of Institution <u>Or</u> Name of traditional Authority	
Interview start – time	.....h.....
Interview end – time	.....h.....

1. What does climate change mean to you?

.....

.....

2. Are there any activities that your institution/ company engages in with the purpose of helping small-scale farmers to adapt to climate change?

.....

.....

.....

.....

3. What are other things you think your institution/company can do to lessen/mitigate the impact of climate change on small scale farmers?

.....  
.....  
.....

4. What activities have you noticed in your community that worsen effects of climate change?

.....  
.....  
.....  
.....

5. What is the extent of small-scale crop farmer's knowledge on climate change and its impacts on their livelihoods?

.....  
.....  
.....  
.....

6. What are the climate-smart agriculture (e.g. CA) practices currently adopted/practiced by the small-scale farmers?

.....  
.....

7. What are some of the things that you think hinders action from being taken by farmers to lessen the effect of climate change?

.....  
.....

8. What do you think should be done to help farmers adapt to climate change impacts?

.....  
.....

9. Kindly identify some of the cultural beliefs, knowledge gaps, behavioral patterns and practices that create barriers to practice sustainable agriculture.

.....  
.....

#### **d. Focus Group Interview Guide**

1. What does climate mean to you?
2. Has climate change affected you?
3. How would you say climate change affected your agricultural activities or livelihoods? Share some examples of things that have impacted crop farming activities as a result of climate change.
4. Do you have any knowledge on Climate smart agriculture?
5. What are some of the measures you have put in place to adapt to climate change?
6. What are your constraints to climate smart agriculture adaptation?
7. Do you think that adequate information is being shared on climate smart agriculture to crop farmers?
8. What are the major challenges you are experiencing in crop production?
9. What skills or knowledge do you think you are lacking in crop production?

#### **e. Terms of Reference**

##### **Specific tasks**

- (a) Measure the level of knowledge of those in small-scale crop farmers on the Good Agricultural Practices (GAP), Comprehensive Conservation Agriculture (CCA), Climate Resilient Agriculture (CRA) and livelihood diversification (or simply climate smart agriculture).
- (b) Identify to what extent do small-scale crop farmers understand climate change and its impacts on their livelihoods.

- (c) Explore knowledge and perception on climate change and climate smart agriculture practices.
- (d) Determine constraints' response of crop farmers to climate change effects.
- (e) Determine conservation agriculture practices currently used by the small-scale farmers.
- (f) Determine the food security of small-scale farmers at household level.
- (g) Identify the cultural beliefs, knowledge gaps, behavioral patterns and practices that create barriers to practice sustainable agriculture.

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