

# Climate Change Vulnerability Assessment

## Global Water Initiative-Kenya



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By

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**The Global Water Initiative**  
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## **1 Introduction**

The Howard G. Buffet Foundation Global Water Initiative was developed in September 2006 with the aim of “ensuring that vulnerable populations world-wide have reliable access to clean water in such a way that their dignity, rights, culture and natural environment are not negatively impacted”. The objectives of the initiative are to support integrated water management programs in identified countries, to develop a water constituency in those countries and regions, and to influence beyond this initiative for wider scale-up.

The initiative is being implemented in three geographic clusters namely: Central America (El Salvador, Guatemala, Honduras and Nicaragua), West Africa (Burkina Faso, Ghana, Mali, Niger, and Senegal) and East Africa (Ethiopia, Kenya, Tanzania and Uganda). In Kenya, the HGBF-GWI program is being implemented by CARE, Action Against Hunger, and Catholic Relief Services.

The GWI programme in East Africa has three strategic objectives:

SO1: Good Governance- Improved local and community governance and the enabling policy framework.

SO2: Sustainable Multiple Uses of Water - Efficient, effective and equitable domestic and productive uses of water, sanitation, hygiene, and watershed management.

SO3: Risk Management - Vulnerable rural communities and their environments have increased resilience to water-related shocks.

The results under SO3 include:

IR3.1 Community and local stakeholders’ capacity to plan, organize, manage and adapt to water related shocks and conflict over scarce water resources have improved.

IR3.2 Risk management initiatives are in place at regional and national levels to address water-related shocks in the context of global climate change.

Within this context it was decided to carry out a climate change vulnerability assessment using a combination of adaptation and participatory tools including CRiSTAL (Community-based Risk Screening Tool - Adaptation & Livelihoods) and the Climate Vulnerability and Capacity Analysis (CVCA) methodology to fulfill the results under SO3, as the tools enable project planners and managers to: (a) understand the links between local livelihoods and climate; (b) assess a project's impact on livelihood resources important for climate adaptation; and (c) devise adjustments to improve a project's impact on these key livelihood resources.

A workshop was convened in Garissa as a follow up to a climate change vulnerability assessment training of trainers’ workshop held in Lukenya in July 2009. The Garissa workshop involved mainly CARE staff along with representatives from government and local NGOs. The objectives of the workshop were:

1. To create awareness and share knowledge on climate change among participants.
2. To gain understanding and skills to carry out climate change vulnerability assessments at project sites using CVCA and CRiSTAL Tools.
3. To apply the vulnerability assessment tools to project sites to identify climate change impacts and adaptation options.
4. To facilitate a work plan for a way forward in integrating adaptation to climate change into the project sites.

This report covers the information provided in the workshop (sections 1-2) and the results from the climate change vulnerability assessment in Ohia and Modika including field data and data analysis (sections 3 to 6,). Feedback from the workshop is summarised in section 7. Section 8 plots a way forward for the project in applying the information so that project activities are more resilient to climate change impacts. The first day of the workshop consisted of reviewing climate change and the vulnerability assessment tools. The second day was spent collecting information in the field at Ohia. The third and fourth days were spent analysing the data and planning a way forward. The list of participants is in Appendix 1 and the programme for the workshop is in Appendix 2.

The vulnerability assessment carried out in Modika (also in Garissa district) took place after the workshop and was facilitated by the project team using the skills gained. However, this information is not as detailed as from Ohia.

## **2 Methodology and workshop**

### ***2.1 Workshop introduction***

The meeting was held at the CARE Kenya field office in Garissa. Following up on the climate change vulnerability assessment training in Lukenya, participants applied the adaptation tools in the field, specifically in Ohia village, Garissa district. The project team identified climate-related vulnerability in the Ohia community, as well as potential adaptation strategies to integrate into the GWI project as well as community and district development plans.

#### **2.1.1 Expectations**

Participants share their expectation at the beginning of the workshop and these included:

- Give participants confidence to apply the CVCA and CRiSTAL tools on their own.
- To analyse data and generate useful ways to move toward making project activities more resilient to climate change.
- To learn how communities can adapt to climate change.
- To learn about methodologies that can help project practitioners figure out how to adapt to climate change.
- To broaden their understanding of climate change adaptation and how this can be integrated into projects.

- To learn about and understand the difference between climate change and climate variability.

### **2.1.2 Ground Rules**

To facilitate good coordination of the process, it was agreed that everyone would observe punctuality, provide, constructive criticism, actively participate in all sessions, keep mobile phones on silent mode to avoid disruptions, uphold respect for each other, be flexible and avoid unnecessary movement in the meeting room.

## **3 Climate Change and Vulnerability Assessment Tools**

This section provides background on climate change and the assessment tools used during the workshop.

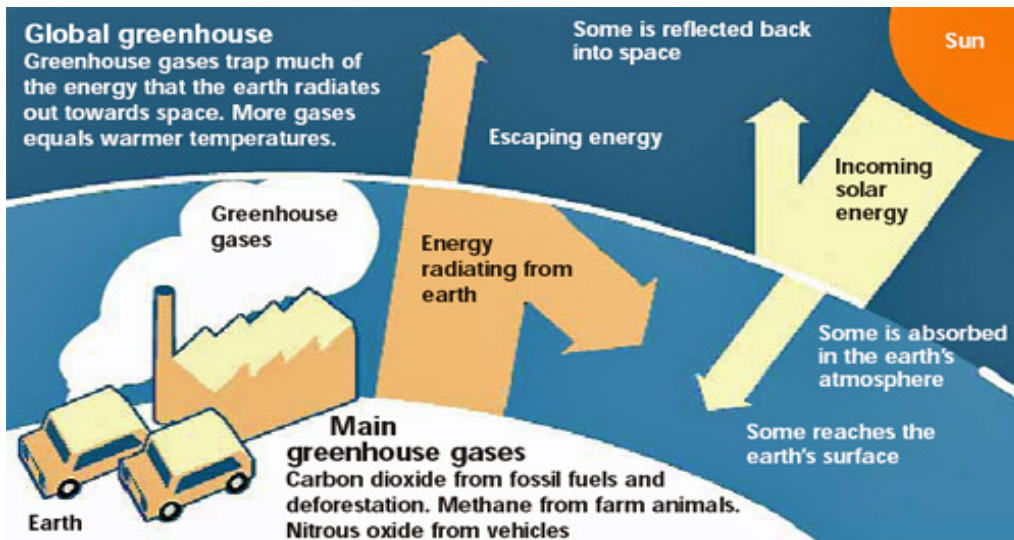
### ***3.1 Introduction to Climate Change***

Climate change is defined as any change in climate over time due to natural variability or human activities. Climate change is the gradual warming in the earth's average temperature that causes significant impacts on local climate and people. It is estimated that global average temperature may rise by 1.8°C to 4°C by 2100. This is an average for the whole world which means that over smaller geographical areas, the impacts may be more intense especially in tropical regions.

Its causes include increased amounts of greenhouse gases released into the atmosphere due to human activities. These gases include carbon dioxide, methane, nitrous oxide, Hydroflourocarbons (HFCs), Perfluorocarbons (PFCs) and Sulfur hexafluoride. Human activities that exacerbate climate change include burning of fossil fuels, deforestation, and land degradation among others.

Climate variability are the changes that are seen from season to season and climate change are the changes observed over and average of 30 year blocks. Long term climate change is based on long term climatic information and data. Climate change can be ascertained through scientific analysis of available data and information.

The greenhouse effect helps keep temperatures on the earth's atmospheric surface at tolerable levels, and how an enhanced greenhouse effect is contributing to increased warming of the earth's temperatures. An analogy can be drawn with greenhouses that are used for the flower farms. If the polythene bags used are too thick the flowers would be destroyed. Greenhouse gases are increasing by 10% every 20 years.



**Figure 1: The Greenhouse Effect**

### ***3.2 Integrating Climate Change Adaptation into Projects and Programmes***

It is important to integrate climate change adaptation into development activities because firstly, it increases sustainability of development activities. If crops are failing consistently due to climate hazards, and a community continues to plant the same crop species, then the same outcome is likely to continue. If the problems are properly analysed, then the community can prepare to deal with issues such as pest attacks, by using appropriate pesticides and, crop failure by practicing mixed cropping and planting drought resistant varieties. Secondly, integrating adaptation into projects avoids activities that inadvertently increase vulnerability - "maladaptation". For example, a project might be promoting agricultural activities that require high inputs and financial investments. If these crops fail, farmers are left even more vulnerable as they don't have resources to obtain food from other sources (maladaptation). Finally, integrating adaptation ensures that development activities reduce climate change vulnerability. For example, a project can advise on, and carry out land use planning that provides a buffer around rivers to reduce impacts of flooding. To do all this requires that we look at vulnerability through a "climate lens".

It is important to consider whether or not one's project needs to integrate adaptation. To do this, it is important to look at the context which the project is taking place; including livelihoods, resources, and socio economic activities. Examine the project holistically and determine if there are direct or indirect links with climate change. All climate sensitive projects such as agriculture, pastoralism, water resource management, etc should integrate adaptation. Non- climate-sensitive projects may not need to integrate adaptation. However, they need to be aware of the impacts of climate change and aim to maximize their contribution to empowering their target communities to adapt.

To assess whether a project is climate sensitive, the project team should answer the following questions:

- Does the project take place in a climate-sensitive location?
- Are the target groups for the project particularly vulnerable to climate change?
- Are the project activities sensitive to climate change?

Women in developing countries are seen to be more vulnerable to climate change due to their roles in society. For example, in Northern Kenya, when there is drought, the men migrate to seek employment in order to earn income. The women remain behind to take care of the children and homes. When drought becomes severe, they cannot easily move to other areas to access markets and resources needed for survival. Therefore, they are impacted very negatively.

Projects that are not directly impacted by climate change need to consider the implications of climate change on their target populations and investments. For example, if one is implementing an HIV/AIDS project, and the project area is experiencing extreme events, then people who are affected by HIV/AIDS may be worse affected by floods and drought due to their poor health and reduced mobility. Such a project could help the vulnerable groups adapt through access to, and use of early warning information to prepare accordingly. If a disaster has been predicted, the organization can work with the government and other agencies to move those affected by HIV/AIDS to safe areas of refuge e.g. health centers earlier, and provide the necessary materials and services.

### **3.3 *Climate Change Assessment Tools***

Most projects are not designed with an explicit consideration of climate risks and how they can affect local livelihoods. Even rarer are projects that take into account the longer-term implications of climate change and how project activities might (a) be affected by the impacts, and/or (b) influence local adaptive capacity.

#### **3.3.1 The Climate Vulnerability and Capacity Analysis (CVCA) Tool**

The Climate Vulnerability and Capacity Analysis (CVCA) Tool was developed by CARE International and helps gather data and information at different levels.

The main objectives of the CVCA are to:

1. Analyze vulnerability to climate change and adaptive capacity at the community level.
2. Combine local information with scientific data to yield greater understanding about the local impacts of climate change

The CVCA is a-toolkit of various approaches that one can use to obtain information on climate change and how communities can adapt. It can be used to conduct

analysis at individual/household; local government/community; and national levels. Information can be obtained through:

- Secondary research.
- Institutional mapping.
- Policy analysis.
- Key informant interviews.
- Participatory tools e.g. hazard mapping, seasonal calendars, historical timelines, rain calendar, vulnerability matrix, and the Venn diagram.

The CVCA guide contains guiding questions for the national level, community/local levels, individual/household level on different areas related to climate change adaptation including resilient livelihoods, disaster risk reduction, capacity development, and addressing the underlying causes of vulnerability. The methodology also brings out underlying causes of vulnerability. It focuses on climate change, communities and the enabling environment. It also analyzes conditions and hazards, and emphasizes multi-stakeholder analysis, collaborative learning and dialogue.

A copy of the CVCA handbook is available at [www.careclimatechange.org/cvca](http://www.careclimatechange.org/cvca)

### **3.3.2 The Community-based Risk Screening Tool: Adaptation and Livelihoods (CRiSTAL)**

The Community Based Risk-Screening Tool – Adaptation and Livelihoods (CRiSTAL) was developed by IISD, IUCN, SEI and Inter-Cooperation. It helps to analyse vulnerability assessment information gathered through the CVCA or other methods. It is a decision-support tool with the goal of promoting integration of risk reduction and climate change adaptation into community-level projects. The tool helps users to understand links between livelihoods and climate, and assess the impacts of projects on the community's ability to adapt.

It is a decision-support tool that aims to provide a logical, user-friendly process to help better understand the links between climate-related risks and peoples' livelihoods. In so doing, successful adaptation strategies can be developed and better supported at the local and regional level.

There are 2 modules in the CRiSTAL tool; the first examines what the climate change context is. It looks at impacts and coping strategies as well as the livelihood context. The second module looks at the impacts of projects on livelihood activities, and how project activities can be adjusted to reduce vulnerability and enhance adaptive capacity. While the process is not specific to resource management, the spreadsheets enable investigators to specify how livelihood, resources and community resiliency may be affected by projected climate change.

The CRiSTAL Tool and handbook are available at [www.cristaltool.org](http://www.cristaltool.org)

CRiSTAL incorporates elements of Environmental Impacts Assessments (EIA) but does not replace it. Therefore, it is important to conduct a full EIA and incorporate appropriate environmental conservation measures to mitigate against potential negative impacts of projects on the environment.

CRiSTAL combined with CVCA can be used to climate-proof projects as well as identify adaptation strategies. They help project teams use weather information that would help them think about, and devise adjustments such as planting trees around dams to reduce evaporation, or increase the size of the dam to hold more water when more intense rains that fall over short periods are predicted.

### ***3.4 Vulnerability assessment: Using the Rain Calendar and Vulnerability Matrix***

The field form (please see Appendix 3) outlines how to undertake the vulnerability assessments using the rain calendar, vulnerability matrix and additional participatory tools that are contained in CVCA.

Prior to carrying out the vulnerability assessment, the community will be informed of the purpose of the assessment and how the outputs will be used. This is reiterated again during the introduction. The community livelihood should be known beforehand and each assessment should concentrate on one livelihood (i.e. pastoralism, mixed farming, beekeeping, etc).

The first step in any field activity involving local communities is to introduce the project and facilitators. It is important to explain the exercises that will be carried out as part of the vulnerability assessment, how long it will take (about 3 hours depending on familiarity of the facilitators with the tools) and that the community would be split into smaller focus groups for the assessment.

Prior to starting the participatory activities, the community members are broken up into smaller focus groups usually consisting of old men, old women, young men and young woman. The age distribution is decided according to traditional definitions by the community. Division into these groups allows more focused discussion from different community sectors and also ensure that people speak more freely (especially women).

#### **3.4.1 Rain Calendar**

Once groups are established and the exercise has been explained, the next step is to complete the rain calendar. The rain calendar helps users to gather rainfall and temperature information for specific local areas from the communities. It also provides community members context for the subsequent discussion as the focus is on how the climate (specifically rainfall and temperature) is changing.

The objectives of the rainfall calendar tool is: to enable users understand what is “normal” and “abnormal” rainfall and temperature from the perspective of

community members; to examine changes in rainfall and temperature patterns; to brainstorm on future rainfall scenarios and potential responses; and to evaluate use of weather and climate information for planning.

The key information gathered includes onset and cessation of rainfall, its duration, distribution and quality; unusual temperature increase and decrease, major impacts of observed changes on livelihoods and major weather-related events. The exercise usually takes one hour to complete and while gathering information it is important to take notes on issues such as coping strategies, health, cultural and socio economic impacts.

When developing the rain calendar, the first action is to collectively decide on symbols that will represent normal and abnormal conditions. The focus group is then asked about rainfall and temperature over the past few years, and the impacts changes have had on their livelihoods. As mentioned above, the rain calendar is a good way to raise awareness on, and present climate variability and change.

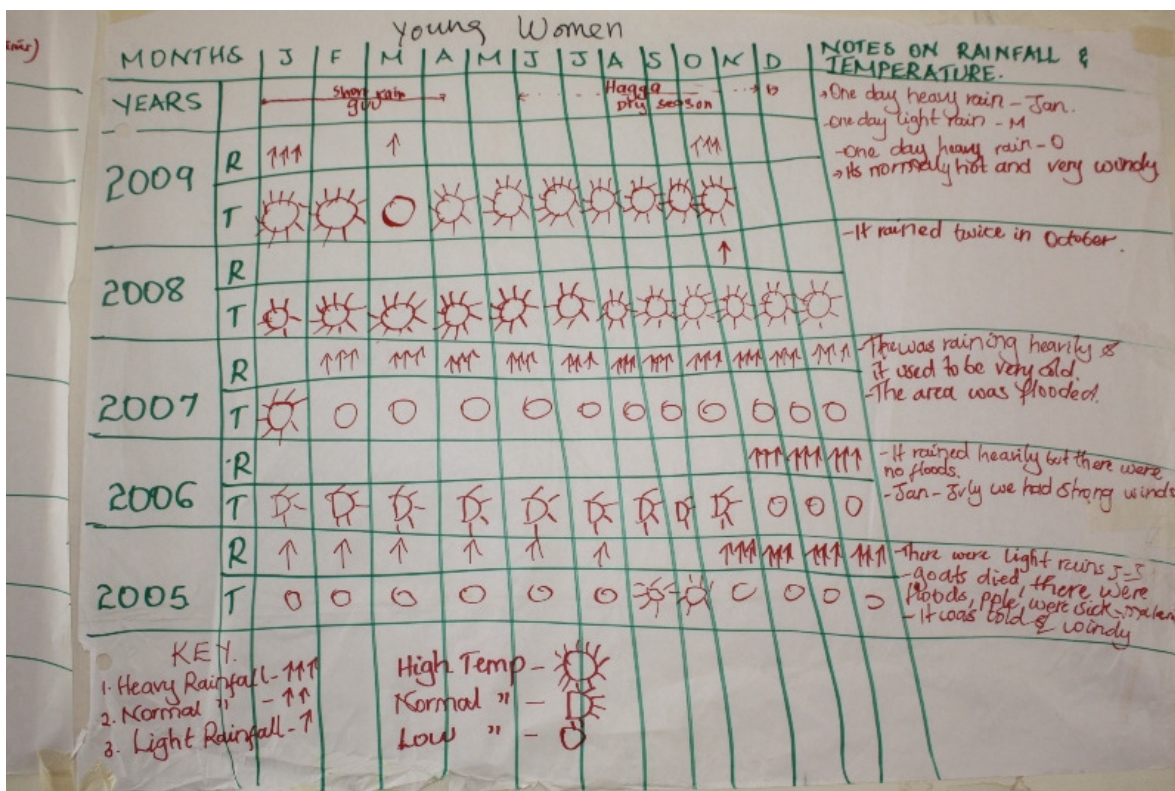


Figure 2: Example of Rain Calendar

### 3.4.2 Hazard Map

Hazard mapping was introduced as an option to enable more active community participation in the vulnerability assessment. Community members plot the position of their resources / risks and hazards. It enables communities to see and

analyse links, patterns and inter-relationships between risks, hazard locations, and resources. The mapping process is useful for completing the vulnerability matrix.



**Figure 3: Example of hazard mapping.**

### 3.4.3 Vulnerability Matrix

Following hazard mapping, the next step is to gather information on the main livelihood activities and the natural, physical, financial, human and social resources that support these activities. These can be extracted from the hazard map. Definitions of the different resource categories are available in section 6.1

Once all resources that are identified which are important to the livelihood, the top three resources under each category (natural, physical, financial, human and social) are ranked.

This is followed by identifying the most influential three climatic hazards on the community livelihood (i.e. floods, drought). For each hazard, the impacts on the livelihood are identified (i.e. crop failure, water shortage, disease). The top 3 impacts of each hazard are then identified. The most common current coping strategy is then recorded for each impact (i.e. when there is water shortage people walk long distances). The participants are asked whether the coping strategy is working and sustainable. If it is not, an alternative coping strategy that increases the

resilience of the community to the climatic hazard is identified along with the resources needed for implementation. If there is time, then the groups are asked to rank the level of influence of hazards on the livelihood resources. Other causes of the impacts should also be identified (e.g. overpopulation could result in water shortages).

Further discussion questions can be also asked including who has access and control over identified resources in the community, observed changes in the environment conditions, hazards and livelihoods, socio-political and other issues that affect vulnerability.

At the end of the exercise, facilitators summarise the process and outline the next steps and take time to ask the group what they learned. It is important to manage time, schedule the visit at an appropriate occasion (i.e. not during harvest season), provide refreshments, and energize the community.

During the Garissa workshop, prior to application in the Ohia community, participants tested the above tools using a hypothetical scenario (please see Appendix 4).

### ***3.5 Review of Field Guide***

Information was provided on key issues to take into account during planning for data collection in the field. Emphasis was placed on the need to plan carefully, obtain support from community leaders, adequate preparation, provision of relevant field research materials, management of community expectations and potential conflicts, balance participation by all, creation and maintenance of trust and finishing gracefully. This was followed by logistical preparations for the field visit to communities in Ohia sub-location where information would be gathered on their vulnerability to climate change.

The sections below provide a summary of the analysis using the information collected through application of the CVCA in the field and entered into the CRiSTAL tool. Additional information to support the analysis including presentations from the workshop, CRiSTAL worksheet, field forms, photos and background information are available in Appendix 5.

## **4 Project information**

### ***4.1 Project description and context***

*Project Description:* The project on Sustaining School Children's Access to Safe Water in Garissa District is being implemented as part of GWI in Kenya. The project in Garissa is focusing on construction of sanitation infrastructure and hygiene promotion. CARE Kenya is implementing this project in Ohia and Modika sub-locations in Garissa District.

*Project Context:* The main goal of the program in Kenya is to see poor rural communities in arid and semi-arid zones reduce their vulnerability to water related shocks and improve their quality of life through Integrated Water Resource Management in Garissa District in North Eastern Province of Kenya. The goal of the project is to realize a sustained reduction in the risk of diseases related to water and environmental hygiene among children and mothers in Balambala and Central Divisions of Garissa District. Its strategic objectives are:

1. Improved local and community governance and the enabling policy framework. The project aims to increase the capacity of institutions and community organizations to facilitate access to safe water (good governance).
2. Efficient, effective and equitable domestic and productive uses of water, sanitation, hygiene, and water shed management. (Sustainable Multiple Uses of Water).

## ***4.2 Livelihood***

The livelihood in Garissa centres mainly around livestock keeping, although there is some small scale farming close to water sources. Ohia and Modika have very minimal farming as they are far away from the river. Some people in both communities carry out petty trading to support themselves and families.

## **5 Climate Change Context**

### ***5.1 Regional Notes***

Current observations of climate change impacts from 1900 to 2005 in East Africa include increasing temperatures. Rainfall patterns show high spatial and temporal variability across the region. There are currently no records of significant trends in rainfall for the region. However, it has been generally observed that in the last 30 years, the frequency, intensity and severity of droughts have increased e.g. from 7 years, to 5 years to almost every other year (especially in the 1990s and 2000s). Future climatic projections for the region indicate that mean temperatures will increase further. In addition, it is expected that the region will become wetter (have increased rainfall quantities). However, the southern part of East Africa (from the Equator) is expected to experience reduced rainfall, while the northern part is expected to receive increased rainfall (that is likely to fall intensely over short periods). It should be noted that there are uncertainties in climate projections for East Africa's rainfall, since the seasonal weather in the region is highly influenced by the El Nino Southern Oscillation (ENSO) phenomenon. Therefore it is likely that high inter-annual variability will continue to be observed in the region.

### ***5.2 Country Notes***

In Kenya, an increase in temperatures has been observed. Between 1960 and 2003, mean annual temperatures have increased by 1.0 degrees centigrade per decade.

Daily temperature observations show significantly increasing trends in the frequency of hot days and a much larger increase in the frequency of hot nights. Between 1960 and 2003, the average number of hot days has increased by 57, and the average number of hot nights has increased by 113. The average number of cold days has decreased by 16, and the number of cold nights has decreased by 42 over the same duration. In terms of rainfall, there are no statistically significant trends observed. It has been observed that the proportion of rainfall occurring in heavy events is increasing since 1960 (though this is not statistically significant). Future temperature projections indicate that the mean annual temperature may increase by 1.0 to 2.8 degrees centigrade by 2060. The frequency of cold days and nights will continue to decrease. Mean rainfall is projected to increase by up to 48% by 2090s, and within this, the proportion of rainfall that falls within heavy events is projected to increase by 13% over the same duration.

### ***5.3 Ecological Zone Notes***

Garissa district falls within Kenya's Arid and Semi-Arid ecological zone. Past weather observations (including from the Ohia community) for the area show that temperatures have been increasing. Droughts have become more prolonged, frequent and intense. Rainfall has been highly variable across years and decades in the past. There were increases in rainfall from 1963 till 1970s. In mid 1980s, rainfall amounts reduced. They increased again in mid 1990s, and further reduced from 2002 to 2008. The number of short period, intense rainfall events is also increasing in the area, especially since 1997. It is projected that rainfall increase during 2011-2020. It is likely to reduce in the mid 2020s and slightly increase in 2030s. It should be noted that the district will continue to experience high inter-annual and inter-decadal variability in rainfall potentially, due to the ENSO phenomenon that influences East African weather. However, the trends show a general increase in mean annual rainfall in the area in the medium to long term.

Below are graphs of predicted rainfall trends in Garissa district for December, January, February (DJF - Figure 4), March, April, May (MAM - Figure 5), and October, November, December (OND- Figure 6).

Projected DJF seasonal Rainfall over Garissa

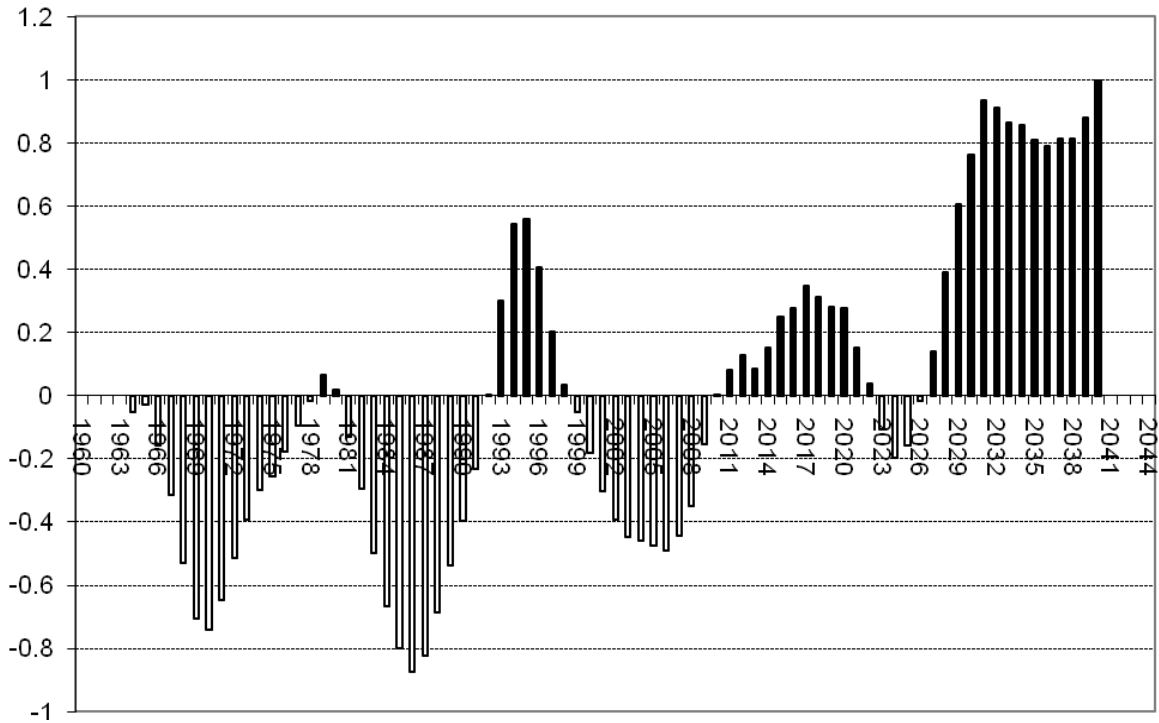


Figure 4. Projected December, January, February rainfall to 2015 in Garissa district.

Projected MAM seasonal Rainfall over Garissa

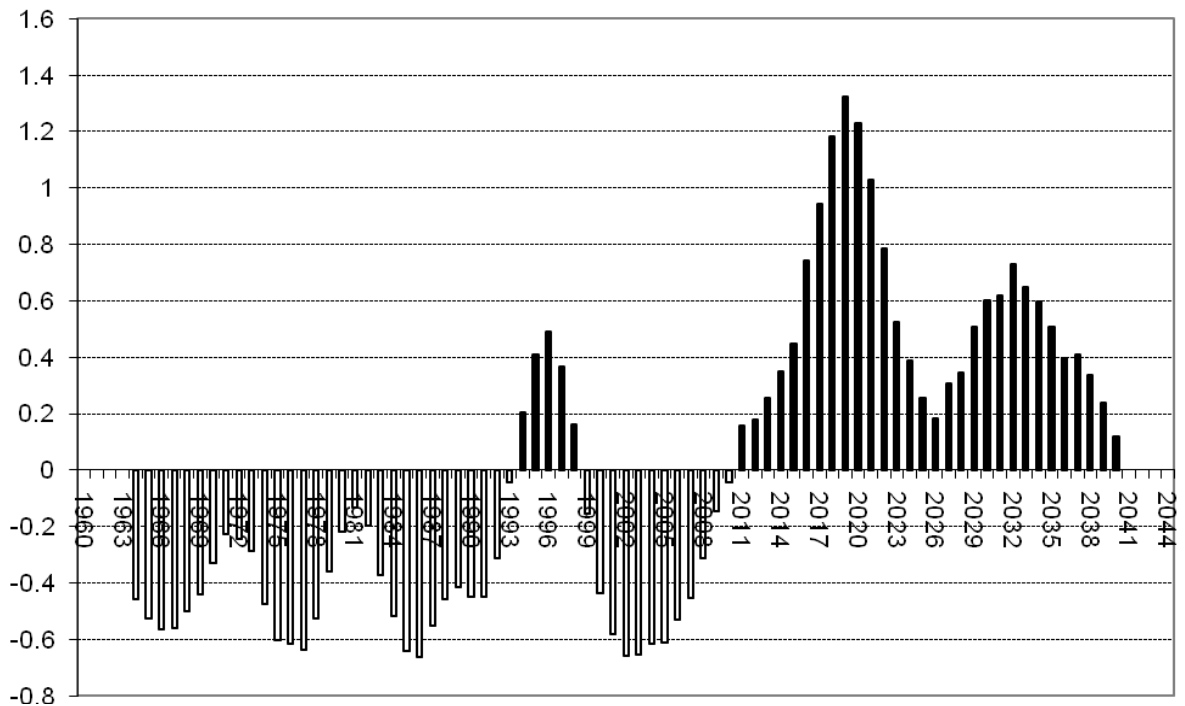


Figure 5. Projected March, April, May rainfall to 2015 in Garissa district.

Projected OND seasonal Rainfall over Garissa

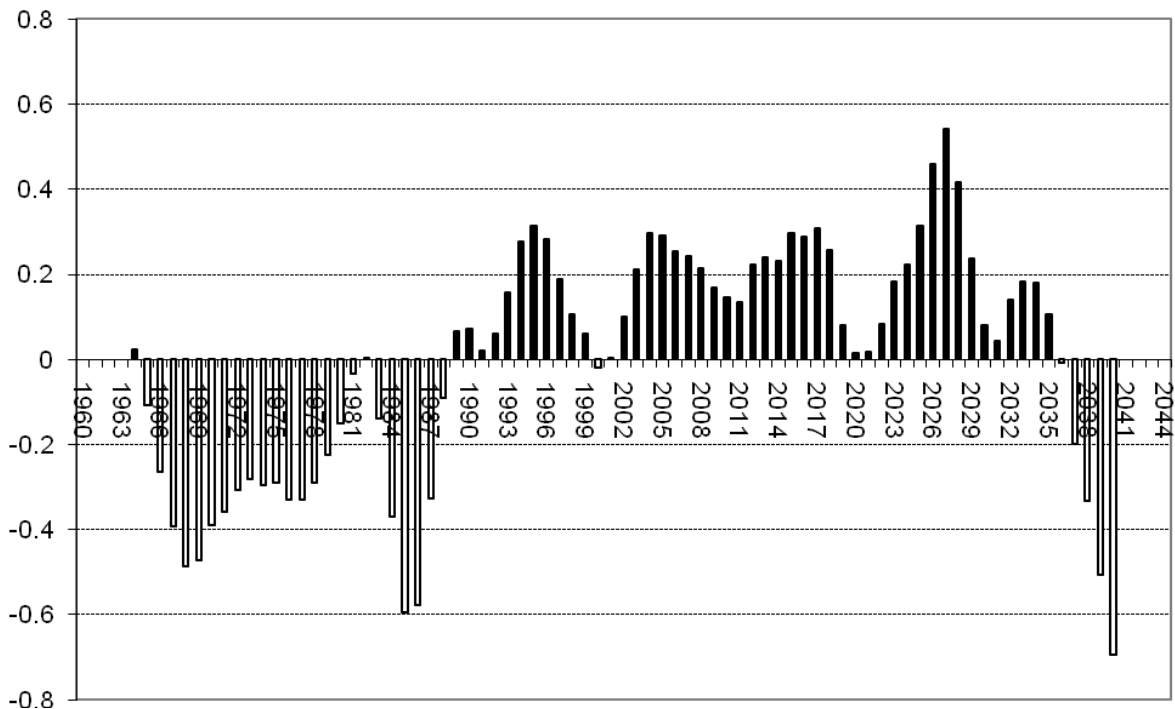


Figure 6: Projected October, November, December rainfall to 2015 in Garissa district.

#### 5.4 Rain calendar from Garissa

Rather than merging the information from the different rain calendars (old men, old women, young men and young women) as had been done in previous vulnerability assessments, it was decided to have a discussion around the groups produced and predicted rainfall in Garissa.

##### 5.4.1 Rain Calendar - Ohia

The Months of *Jilal* (long dry season) occur between January and March. The long rainy season, *Karan*, occur between March and May. *Hagga* (short dry season) occurs from mid may to October, and *Diraa* (short rainy season) from mid October to end of December. The community indicated that there are fewer days of more intense rainfall these days, and the rains often start late. Any time the long rains are light, more intense heat is felt during the long dry season.

There were slight variations in rainfall observations for 2009. All groups indicated that it rained in May but some said that it rained in January as well. Generally, high temperatures were observed from January to March 2009, however, they were cooler compared to 2008.

Nights are likely to get much warmer in the future. Wetter conditions are expected but rainfall may be unpredictable in the short term. This might result in flooding. There will be positive but also some negative impacts of these conditions. Pocket areas may receive more rainfall, but other may have less.

Rainfall changes have led to livestock diseases such as Rift Valley Fever, and with increased rainfall these conditions are likely to continue. This type of information can help improve livelihoods of community members. It could help identify and scale up relevant interventions such as capacity building on livestock health, construction and installation of water harvesting infrastructure, and promotion of rain water harvesting.

#### 5.4.2 Rain Calendar - Modika

A discussion of the rain calendars was not recorded for Modika. However, looking at the rain calendars, the following trends were noted. The past four years(2006-2009) have been hot throughout the year. Rainfall tends to e between October and November, and in April and May. The rains in April and May have not been consistent.

#### 5.5 Climate-related Hazards, Impacts and Coping Strategies

Developing a summary of climate-related hazards, their impacts on the community and existing coping strategies for these hazards is crucial in developing a community adaptation strategy. Additionally, the efficacy and sustainability of each coping strategy must be determined in order to identify where progress can be made for sustainable adaptation. The main climate-related hazards, their impacts and key current coping strategies identified in Ohia are indicated in Table 1a and those identified for Modika are in Table 1b.

**Table 1a. Climate context - Ohia**

Hazard	Impacts	Alternate Coping Strategy	Notes
Drought	Water shortage	Drill and maintain boreholes	Supplement water supply through trucking as need arises
	Livestock deaths	Hay making	Combine hay making with destocking of weak livestock
	Food shortages	Supplement rain fed agriculture with irrigation (water can be obtained from River Tana, Boreholes etc)	Need to conduct a hydro-geological assessment of available ground water potential
Extreme Heat	Livestock deaths	Destocking	Combine destocking with adjustment of grazing

Hazard	Impacts	Alternate Coping Strategy	Notes
			times for remaining livestock
	Water shortages	Piping water from River Tana and increasing the size of the water pan	
	Human diseases	Seeking alternative (modern treatment) e.g. from clinics (including mobile ones)	
Strong Winds	Destruction of houses and animal shelters	Plant trees to act as wind breaks	Improve the strength of building structures
	Respiratory diseases	Seeking alternative (modern) treatment from clinics (including mobile ones)	
	Destruction of trees	Planting more trees	Should be promoted in the area

In Ohia the main three climate related hazards were **drought, extreme heat** and **strong winds**. The risk of floods was also identified as a hazard but was not analysed.

**Table 1b. Climate Context – Modika**

<b>Hazard</b>	<b>Impacts</b>	<b>Alternate Coping Strategy</b>	<b>Notes</b>
Drought	Livestock deaths	Buying of animal feeds	They buy acacia pods which they feed to the animals
	Lack of Pasture	Destocking	They destock to get money to purchase livestock feeds
	Water shortage	Storing water in water storage reservoirs	Shortage of piped water
Extreme Heat	Drying up of Earth pans	Drilling boreholes in the area	A geo-physical survey should be carried out to check for feasibility of drilling a borehole
	Human diseases	Use of traditional medicine	Herbal medicine is used by the community members to treat minor ailments
	Reduced Human Activity	Working early in the morning or late in the evening	The pastoralists mainly herd the livestock in the morning and in the evening when there is extreme heat
Floods	Livestock deaths	Migration to higher grounds	This mainly affected them in 2006 when there was flooding in the area
	Destruction of houses	Putting temporary traditional houses	The community members use the locally available materials to construct the traditional houses
	Human/livestock diseases	Seeking hospital/veterinary services	They go to Garissa to seek medical attention. The Veterinary Officers carry out outreach services in the area

In Modika the main three climate related hazards were **drought, extreme heat and floods**.

### 5.5.1 Hazard 1

*Ohia* - The main impacts of **drought** are water shortages, livestock deaths and food shortages. Other impacts identified include migration and decreased vegetation. The current coping strategies consist of walking long distances to obtain water, buying animal feed to prevent livestock deaths and by selling off livestock in order to buy food for their families. While all current coping strategies are perceived to be working by the community, none of these strategies are sustainable in the long term. In order to prepare for future impacts alternative coping strategies proposed by the community include drilling and maintaining boreholes, making hay to feed livestock and supplementing rain fed agriculture with irrigation from the Tana River, boreholes, etc.

*Modika* – The main impacts of **drought** are water shortages, livestock deaths and lack of pasture for livestock. Current coping strategies include destocking of livestock, migration for better pasture areas and buying of water from water vendors. While all current coping strategies are perceived to be working by the community, none of these strategies are sustainable in the long term. In order to prepare for future impacts, alternative coping strategies proposed by the community include buying of animal feeds, destocking to prevent pasture degradation and storing of water in water storage reservoirs.

### 5.5.2 Hazard 2

*Ohia* - **Extreme heat** is also causing livestock deaths, water shortages and human diseases. Coping strategies that are currently being used include migrating toward rivers in order to keep livestock watered, trucking water to the community for household consumption and treating human diseases using traditional medicine. Again, the existing coping strategies appear to be working but are not sustainable. Alternative coping strategies that were proposed include destocking to minimize the effort needed to maintain livestock. In order to provide sufficient water for the community, water could be piped from the Tana River and the size of the existing water pan increased. Finally, to deal with the increasing and evolving burden of diseases, modern treatment techniques could be utilized. The number of clinics, including mobile clinics could be increased. However, this should go hand in hand with traditional treatment.

*Modika* – **Extreme heat** was identified as an important climate risk in Modika as well, resulting in drying up of earth pans, increased prevalence of human diseases and reduced human activity. Current coping strategies were identified as trucking in water, use of traditional medicine and working early/late to avoid the hot part of the day. Of these, trucking water is not seen as sustainable and drilling/maintaining boreholes was seen as an alternative coping strategy.

### 5.5.3 Hazard 3

*Ohia* - **Strong winds** have impacted Ohia by destroying houses and animal shelters, increasing the incidences of respiratory diseases, and causing the destruction of trees in the region. To cope with these impacts, the community construct (and reconstruct) houses using heavy stones and ropes to reinforce building structures. Planting trees and traditional medicine are the primary methods of dealing with the destruction of trees and the increased incidences of respiratory illness, respectively. As with the other two strategies, these methods have worked so far. Planting trees and reinforcing structures appear to be the best methods for continuing to deal with strong winds in future, and strategic placement of trees may further aid efforts to protect residential and animal shelters. As with increased disease from extreme heat, respiratory illness could be treated with more modern techniques in the future.

*Modika* – The third hazard identified in Modika was **flooding**, which impacted the community by destroying houses, causing death to livestock and increased prevalence of human and livestock diseases. The community is coping with these impacts through migration to higher grounds to avoid flooding, putting up temporary traditional houses and using herbal medicines for the treatment of diseases. In order to cope with future change in a sustainable manner, individuals recognized they need to seek hospital/veterinary services when they or their animals become ill.

## **6 Livelihood Context**

### ***6.1 Overview of Livelihood Resources Framework***

When analyzing a community's vulnerability to climate change, it is important to find out what resources are important to peoples' livelihoods in the project area. This will allow for better focus in determining which coping strategies are most important, and in what sequence to address the variety of potential climatic risks. To this end, the Livelihood Resources Framework places specific resources into five resource categories as described below:

*Natural Resources:* These are the natural resource stock upon which people rely both directly (i.e. for income or medicine) and indirectly (i.e. flood control or protection from storms). These should come from the surrounding environment such as trees or land.

*Physical Resources:* Those resources that make up the basic infrastructure and productive capital for transport, buildings, water management, energy and communications. Differing from natural resources, physical resources should come from man-made aspects of the surrounding environment.

*Financial Resources:* Encompassing not only the stocks or monetary savings of people within the community, financial resources also account for flows of money such as income and how that income is generated. This includes savings, cash, jewelry or remittances.

*Human Resources:* The skills, knowledge, capacity and good health that are important to the pursuit of positive livelihoods are the key aspects of Human Resources. They include traditional knowledge, education level and folk knowledge in arts and crafts.

*Social Resources:* Social Resources are those of the formal and informal relationships and institutions within a community, from which people draw upon support and knowledge. Examples would include church groups, farmer associations and political organizations.

### 6.1.1 Livelihood resources - Garissa

The following specific resources were identified as the most important to peoples' livelihoods in the Ohia and Modika communities:

**Table 2a. Summary of livelihood resources - Ohia**

Natural Resources	Physical Resources	Financial Resources	Human Resources	Social Resources
Water Land Trees	Water storage (pans and tanks) Roads Cattle dip	Selling of livestock Shops (local trading) Selling of traditional crafts (utensils)	Traditional weaving skills (for mats and house covers) Livestock keeping skills Education	Mosque Women's self help groups Chief's office
Additional resources identified				
Livestock	Houses School Livestock market	Selling of crops Hotels	Carving skills Traditional birth attendant Weaving skills	Bee keeping groups Youth groups Animal keeping groups Police post

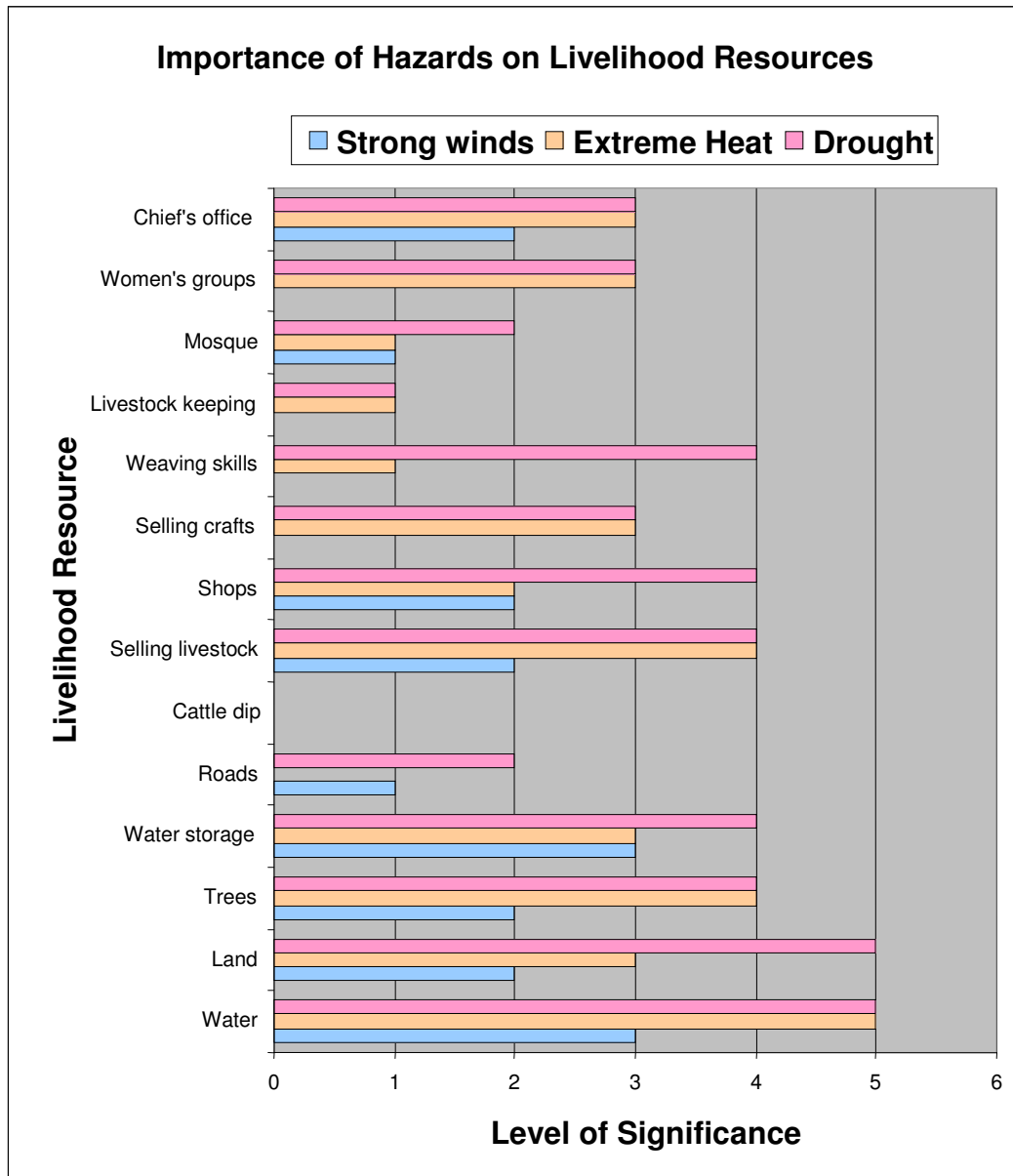
**Table 2b. Summary of Livelihood Resources - Modika**

Natural Resources	Physical Resources	Financial Resources	Human Resources	Social Resources
Land Trees Water	Roads Water storage Communication masts	Markets/shops Quarries Selling livestock	Education Traditional knowledge Livestock keeping skills	Mosques Baraza Schools
Earth pan Air Stones	Bus stage Houses	Hotels Petrol station Dams	Teaching skills Weaving skills	Police posts Political organizations Farmers associations Youth groups

### 6.1.2 Impacts of Climate-related Hazards to Livelihood Resources

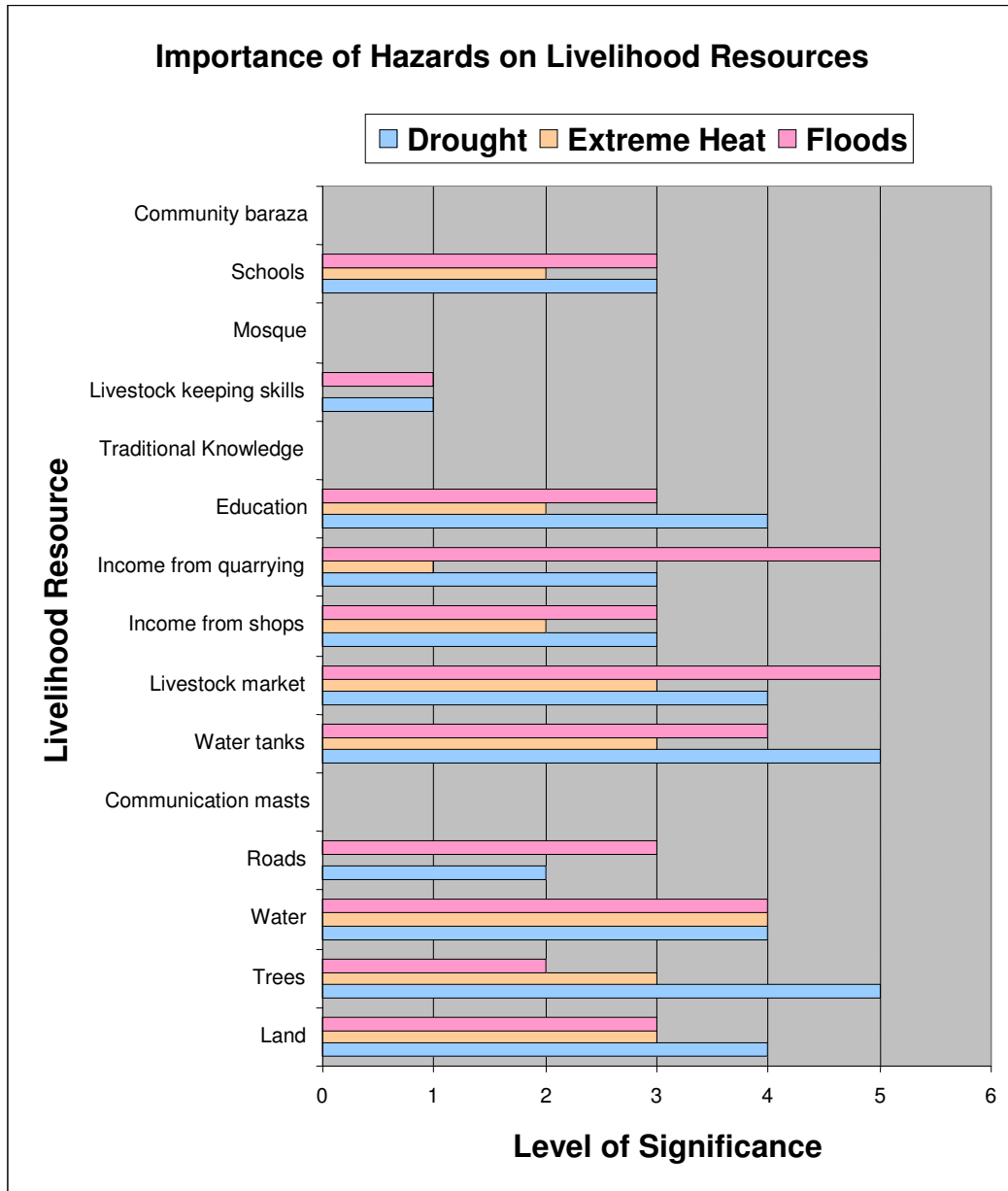
Upon identifying the climate-related hazards and the relevant livelihood resources within the project region, the next step is to determine the impact of these hazards on the livelihood resources in order to more effectively analyze current and possible coping strategies. The strength of this influence was indicated by entering a number between 0 and 5, with 0 = no influence, 3 = some influence, 5 = very strong influence. The following Figures 7 and 8 shows the importance of each hazard on the various livelihood resources identified in the Ohia and Modika vulnerability assessments, respectively:

**Figure 7: Importance of Climate-related Hazards on Livelihood Resources - Ohia**



Drought has a high impact on natural resources, as well as financial resources as these often rely on the outputs from water, land and trees. This is also reflected with extreme heat to a lesser extent. Both drought and extreme heat somewhat impact social resources, including women’s groups and the chief’s office. Strong winds has a lower impact on resources compared to the other hazards , as they likely have less overall impact on the community.

**Figure 8: Importance of Climate-related Hazards on Livelihood Resources – Modika**

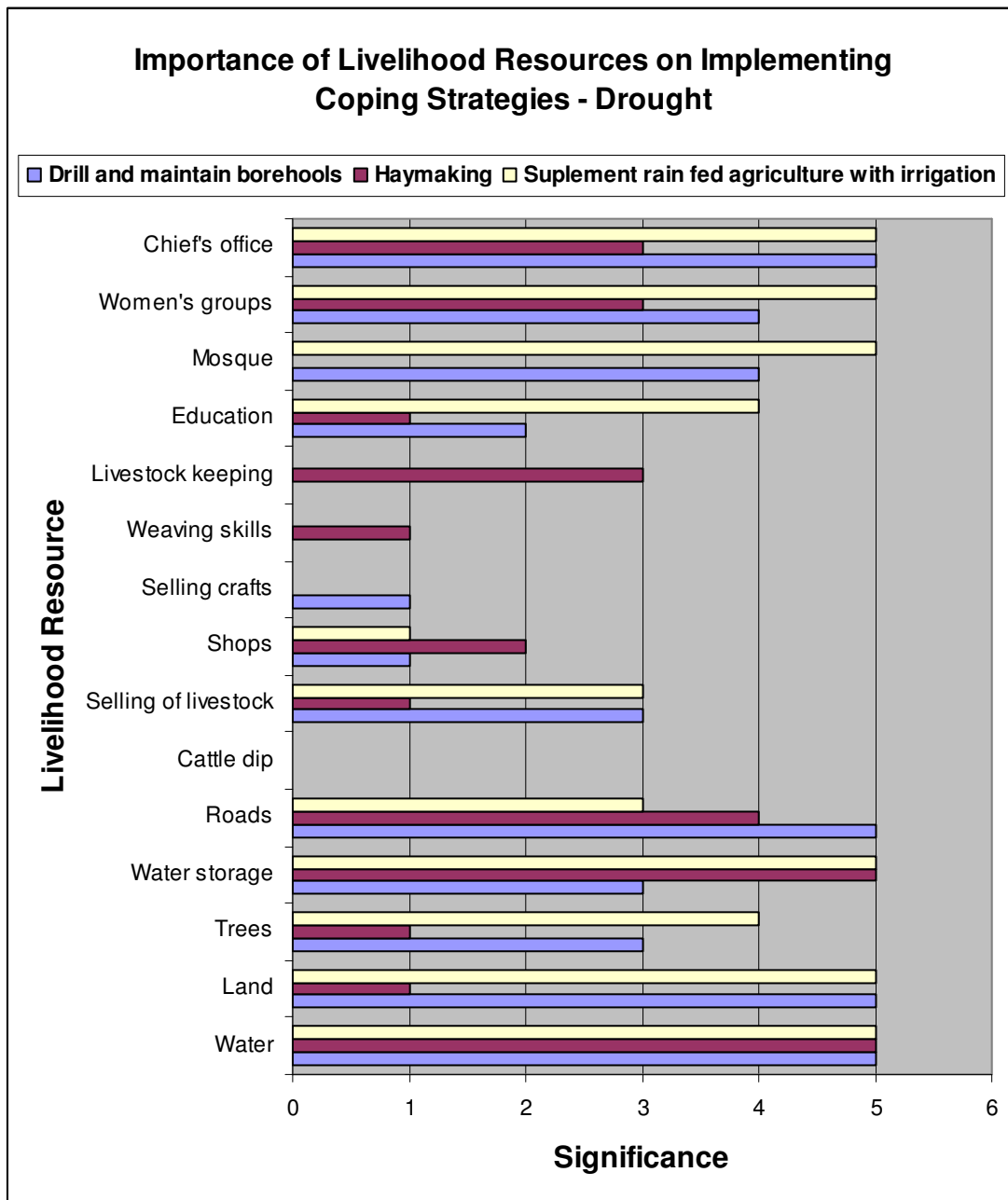


Drought and floods have high impact on natural resources, although it should be noted that floods were thought to positively impact tree and water resources through increasing the 'quantity of water in reservoirs such as earth pans and supporting the growth of trees.' The major impact to livelihood resources through extreme heat were associated with reduced activity and the consequent reduction in productivity.

### 5.1.3 Importance of Livelihood Resource on Implementing Coping Strategies

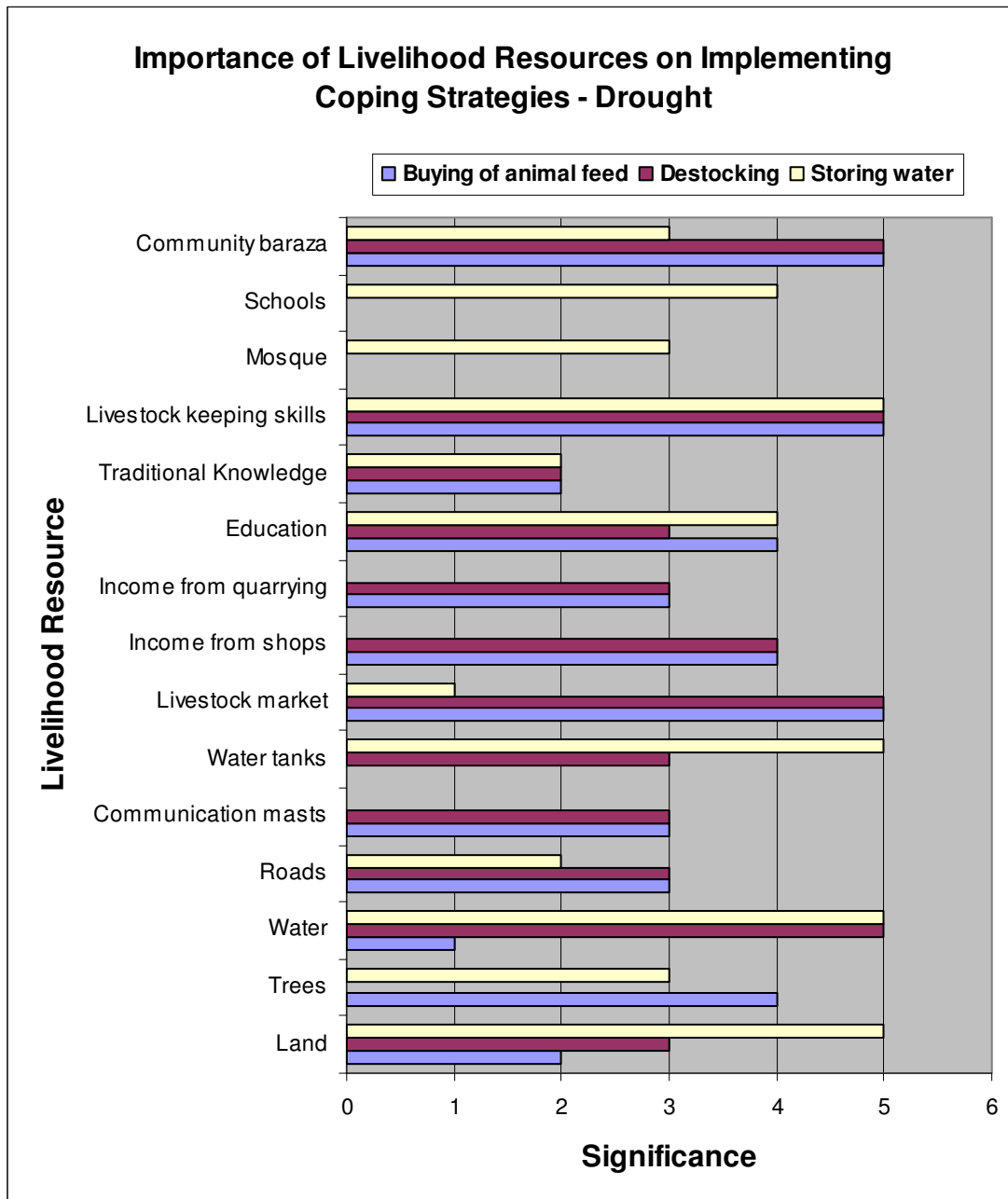
For each of the livelihood resources detailed earlier in this report, an analysis of their importance to implementation of sustainable coping strategies (existing or alternate) was done. This importance was indicated by entering a number between 0 and 5, with 0 = not important at all, 3 = somewhat important, 5 = very important. Figures 9 to 14 below detail these analyses within the context of each hazard for a) Ohia; and b) Modika:

**Figure 9: Importance of Livelihood Resources on Implementing Coping Strategies during Drought - Ohia**



The information above shows that social, natural and some physical resources are key requirements for successful implementation of irrigation, hay making and the drilling and maintenance of boreholes. The natural resources would provide key raw materials while the social resources are important for community mobilization into action and coordination. The existing human and financial resources were seen to play a lesser role, perhaps indicating that these resources would need to be sourced externally.

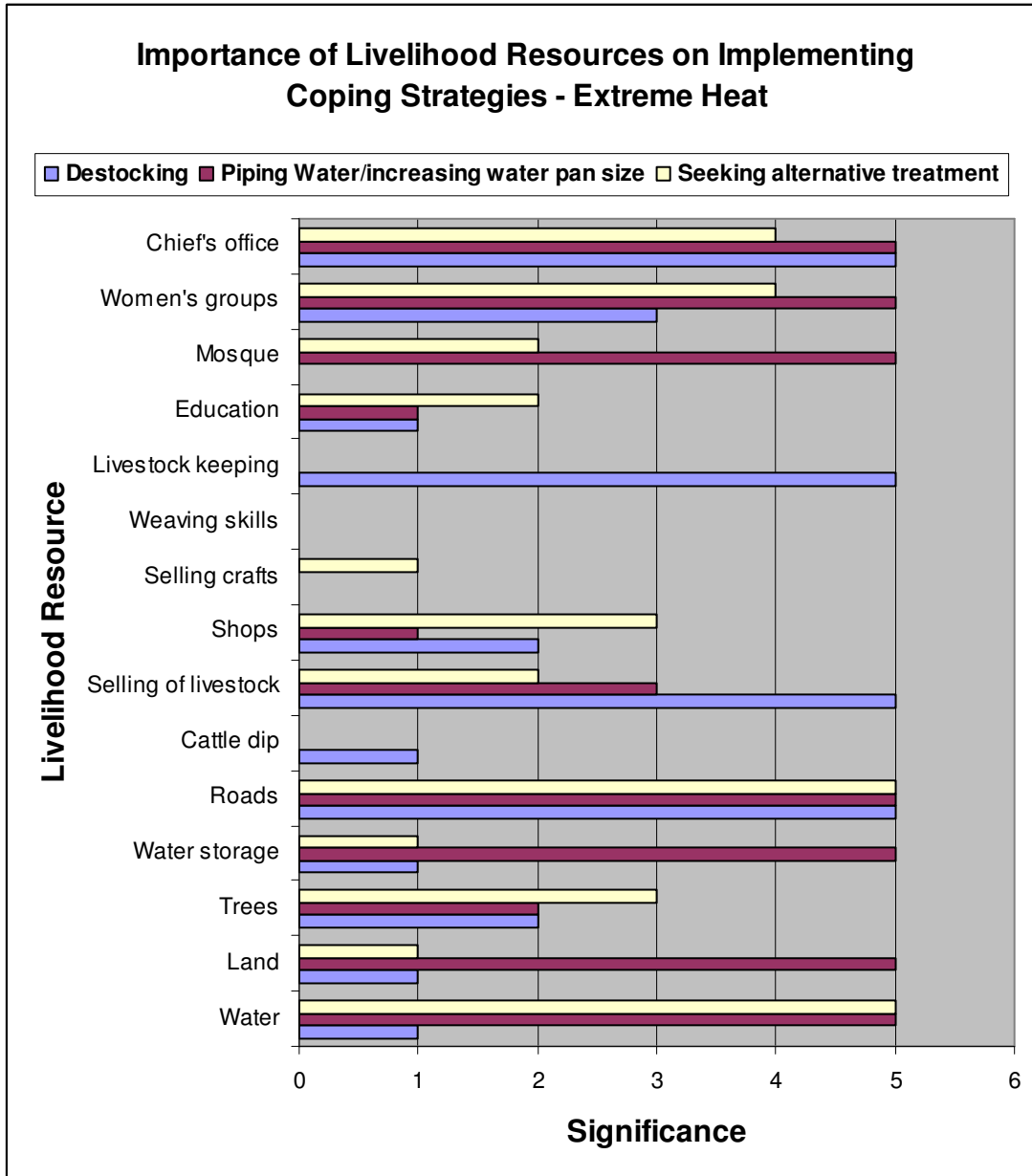
**Figure 10. Importance of Livelihood Resources on Implementing Coping Strategies during Drought - Modika**



The preceding information clarifies that the livestock market, community baraza and livestock keeping skills are most important for buying of animal feed, along with destocking. The natural resources and water tanks appear to be most important for

storing of water, and livestock keeping skills have some impact on this as well. Understandably, water tanks, land and water were identified as important for storing water and importance was also given to livestock keeping skills. Schools and education were thought to play an important role in storing water as well.

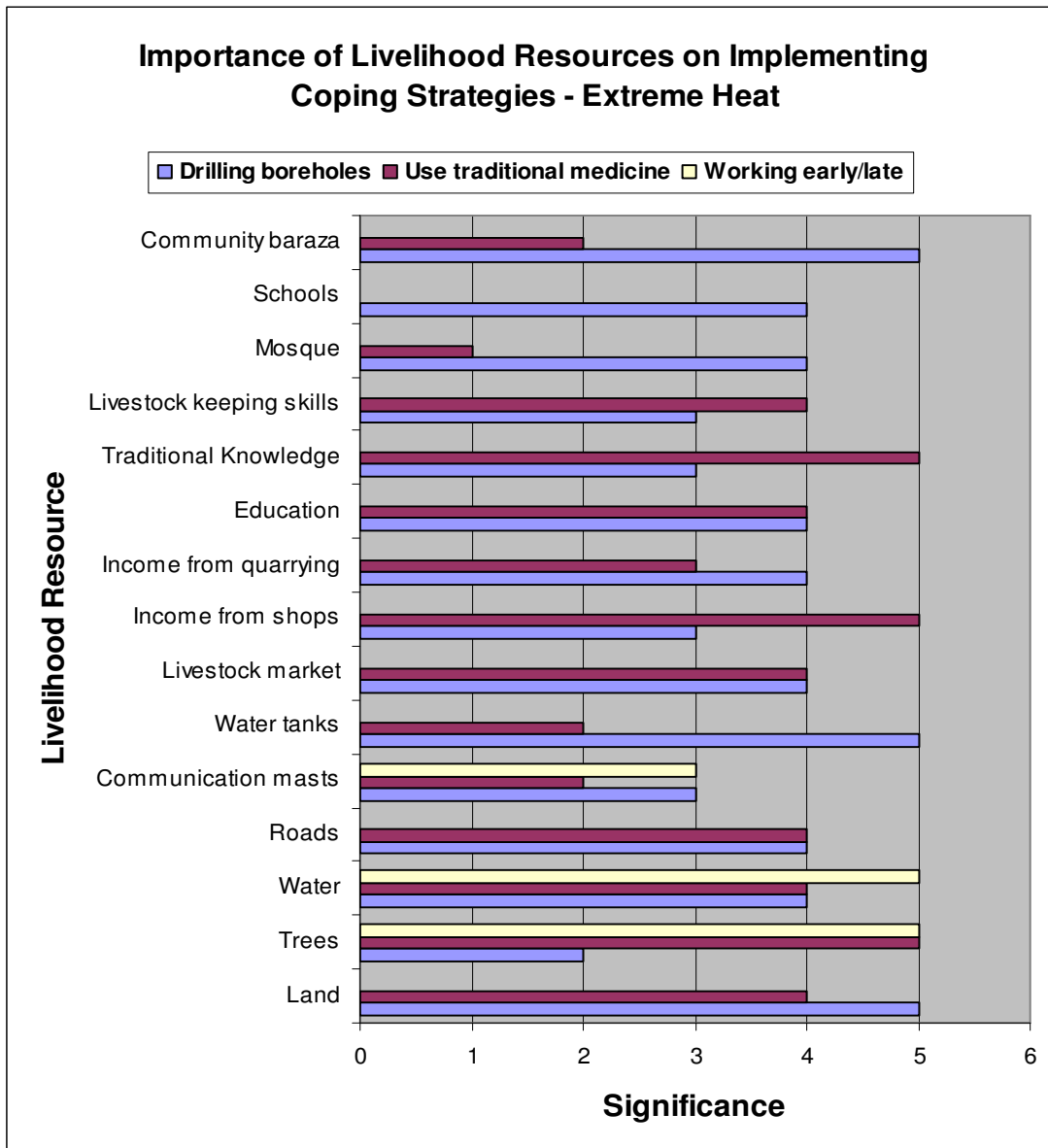
**Figure 11: Importance of Livelihood Resources on Implementing Coping Strategies during Extreme Heat - Ohia**



Water, roads, women's groups and the chief's office are important to the effective pursuit of alternative medical treatment for diseases. This is because water is useful for hygiene; roads enable easier access to medical centers as well as the transportation of medical supplies and personnel working in the mobile clinics. The chief's office and women's groups help create awareness about the availability of medical services and encourage the community to utilize the services. The success of de-stocking will also require good roads for faster transportation of livestock to

markets, income from the sale of livestock (which could act as an incentive) to de-stock, livestock keeping skills to enable the community to appropriately select animals to de-stock, and social resources to create awareness, facilitate market access and mobilize the community. Piping water from Tana River also requires social resources to mobilize labor and other resources, natural resources as well as water storage infrastructure and some funds.

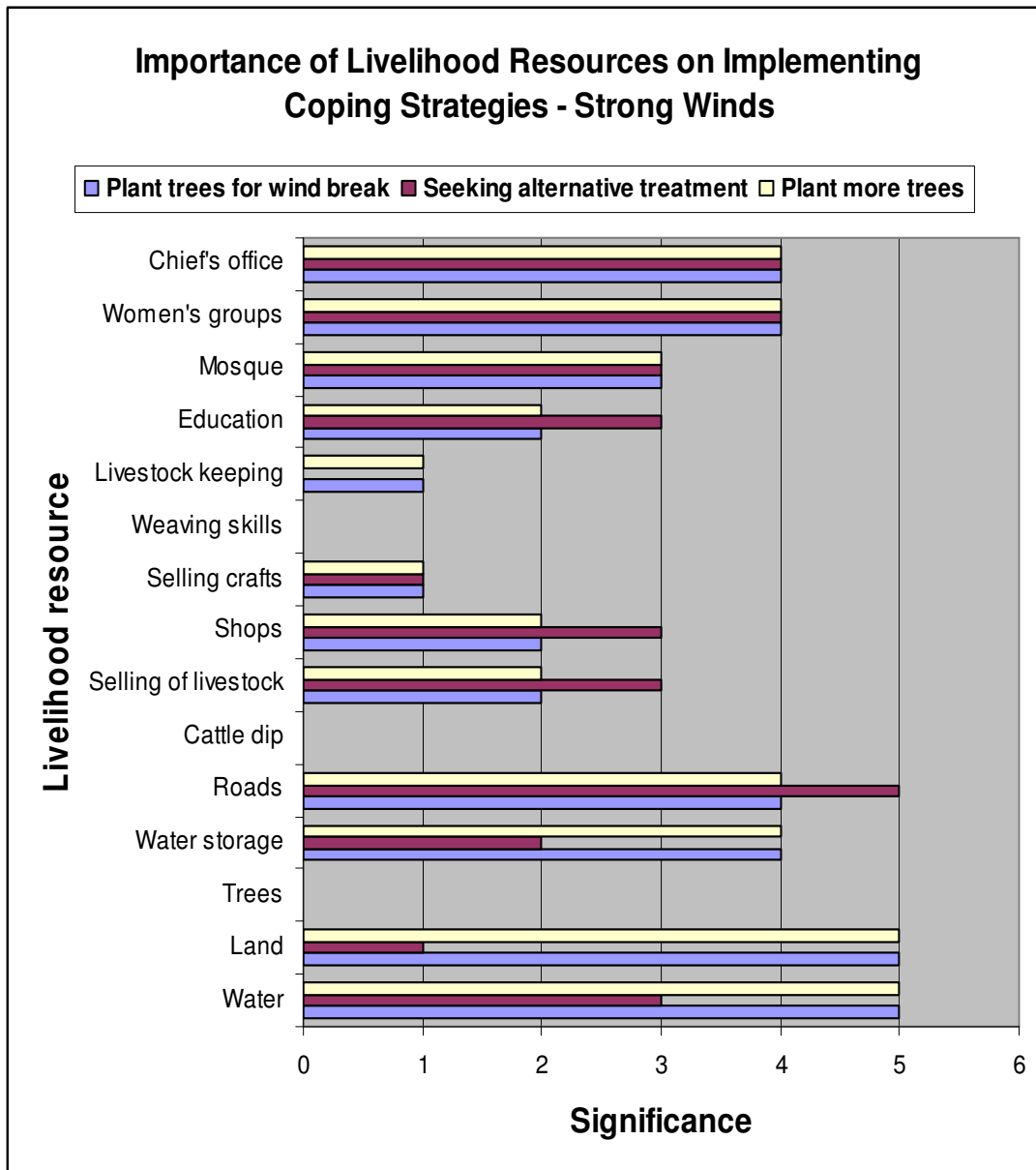
**Figure 12: Importance of Livelihood Resources on Implementing Coping Strategies during Extreme Heat - Modika**



The land, water tanks and community baraza of Modika were most important in the ability to drill boreholes, although this coping strategy was impacted across the various livelihood resources. Relatively minimal importance was given to livelihood resources on the ability to work early/late to avoid extreme heat, and was centered on tree cover and water availability. Trees, income and traditional knowledge were

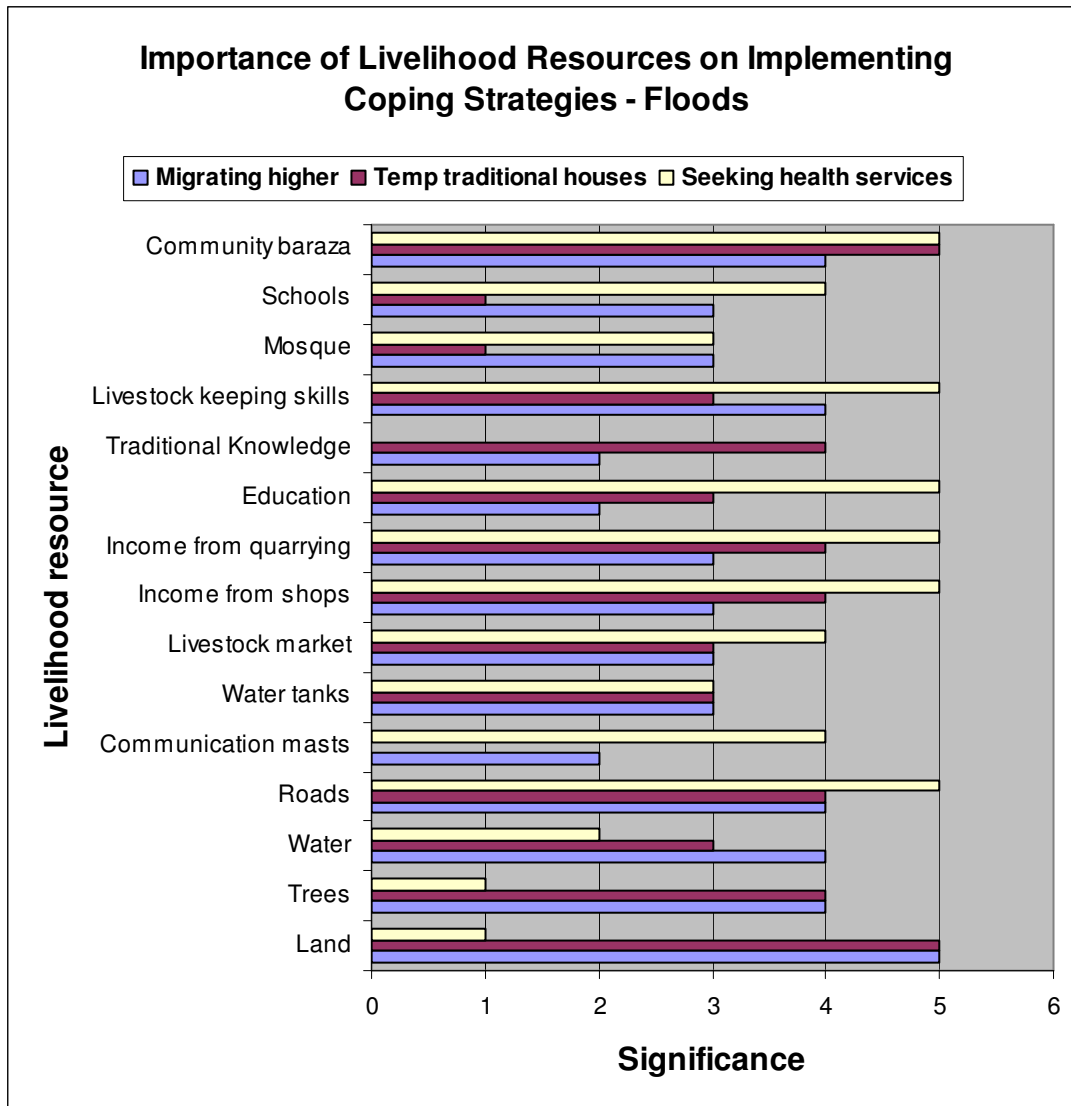
most important in use of traditional medicines, although some importance was given to nearly all livelihood resources.

**Figure 13: Importance of Livelihood Resources on Implementing Coping Strategies during Strong Winds - Ohia**



The chief's office, women's groups and mosque are important for mobilization of tree planting and pursuit of alternative, modern medical treatment. Land, water, water storage infrastructure and roads are also important resources for these activities. Financial and human resources (particularly education) are important but to a slightly lesser extent. This implies that the resources required for these activities would be supplemented by external sources.

**Figure 14: Importance of Livelihood Resources on Implementing Coping Strategies during Floods - Modika**



Education, roads and income were important livelihood resources identified in utilizing health services as a coping strategy for injuries and ailments stemming from flooding. Livestock keeping skills and the community baraza also were given importance to this coping strategy. In order to erect temporary traditional houses after a flooding event, the community baraza and available land were the most important livelihood resource, although traditional knowledge, income, roads and trees were also thought to be important. The most important resource to facilitate moving to higher ground during or after flooding occurs was identified as land. Some importance was given to the other natural resources, roads, livestock keeping skills and the community baraza.

## 7 Access and Control

In both Ohia and Modika, only the young women groups provided information on who has access and control to the resources that are important to the communities' livelihood.

Generally, both men and women have access to all resources. According to the group in Modika, women have both access and control of hotels and traditional knowledge, although it is likely that men also are involved. Unsurprisingly, women are the main controllers of women's groups and traditional birth attendants. Men seem to have more access to the mosque and chief's post. Education is more easily accessed and controlled by men. The control of resources such as the cattle dip is in the hands of men and this is likely due to men having ownership of the livestock. The government has control over some of the infrastructure such as roads and water tanks. In Modika, the perception is that they also have control over land.

*Ohia*

<b>RESOURCES</b>	<b>ACCESS</b>	<b>CONTROL</b>
Land	Both	Both
Earthpan	Both	Both
Forests	Both	Both
Roads	Both	Administration
Water Tanks	Both	Chief(Administration)
Cattle Dip	Men	Men
Shops	Both	Men
Women Groups	Women	Women
Hotels	Both	Both
Teaching Skills	Men	Men
Traditional Birth Attendants	Women	Women
Marketing Skills	Both	Both
Mosque	Men	Men
Chiefs Place	Men	Men
Police Post	Both	Government

*Modika*

<b>RESOURCES</b>	<b>ACCESS</b>	<b>CONTROL</b>
Land	Both	Government
Earthpan	Both	Men
Forests	Both	Men
Roads	Both	Government
Bus stage	Both	Men
Network posts/ communication masts	Men	Company
Shops	Both	Men
Hotels	Women	Women
Petrol Station	Both	Men
Education	Men	Both
Traditional Knowledge	Women	Women
Teaching skills	Both	Both
Mosque	Men	Men

Police post	Men	Government
Baraza place	Both	Men

## 8 Analysis of project activities

This section highlights the revisions made to incorporate climate change adaptation into GWI activities being implemented by CARE Kenya in Garissa. The aim of the revisions is to make these activities resilient to current climatic variability observed in Ohia and Modika, and to increase their sustainability. It is important to conduct similar assessments in future to help monitor progress towards increasing resilience and to also identify and appropriately deal with emerging climatic issues.

### 8.1 Revised Project Activities

Project activities identified for the GWI project in Ohia were screened to assess their impact on livelihood resources that are both strongly influenced by climate-related hazards and important to implementing sustainable coping strategies. The level of impact was rated as positive, negative or neutral and could be both positive and negative. For example, construction of low cost pit latrine's can have both a positive and negative influence on water as it can improve water quality by reducing the spread of waste but it could decrease water quality, through contamination if sited in a bad location. Project activities were revised in order to strengthen positive impacts from current project activities, minimize negative impacts and make positive impacts that are currently neutral (where appropriate). Column 2 of Tables 3a & 3b shows how activities were revised according to this analysis. These revised project activities were then screened to determine whether they were sustainable with the impacts of climate change. This is summarized in column 3 of Tables 3a & 3b.

**Table 3a. Summary of revised activities - Ohia**

Original Project Activities	Revised project activities	Revised Project Activities to reduce climate change impacts
Construction of low cost household latrines	Construction of low cost latrines away from water sources; encourage further construction of additional latrines, also replant trees to replace those used.	Construction of improved pit latrines such as pour flush latrines
Desiltation and ancillary works of the earthpan	Desiltation and ancillary works of earthpan, including planting of vegetation cover around the pan	Construct an infiltration well and pump water into the cattle troughs and washing area to minimise movement inside the water pan enclosure. Reinforce the fence using thorns to prevent wild animals from entering the water pan area

<b>Original Project Activities</b>	<b>Revised project activities</b>	<b>Revised Project Activities to reduce climate change impacts</b>
Hygiene promotion in the school and community.	Hygiene promotion in the school and community, which includes training of a school health club, water user association members and patrons on hygiene promotion.	Incorporate training on environmental conservation into hygiene promotion training, create awareness of climate change, include tree planting, drainage construction and rehabilitation, clearing of bushes etc.
Supplement rain fed agriculture with irrigation (water can be obtained from various sources)	Supplement rain fed agriculture with drip irrigation which is regulated by community to enhance water efficiency and minimize conflicts.	Improve water storage capacity to provide water for drip irrigation and plant crops and seed species that can withstand high temperatures and increased drought e.g. pawpaws, bananas, water melons.
Planting trees to act as windbreaks	Planting appropriate species of trees (i.e. drought resistant) to act as windbreaks and to improve water retention in catchment area.	Promote planting of beneficial, appropriate tree species e.g. fruit trees, gum trees, medicinal trees etc.
Drill and maintain boreholes	Drill and maintain boreholes which have protection around the water point, replant appropriate species of trees, form and strengthen a water user association to manage the borehole.	Water could be piped from the borehole. Water kiosks could be established to sell the water to the community. Training of local people in basic operation and maintenance of the borehole and monitor water levels in conjunction with the government
Roof catchment construction to catch rainwater to be used by the school	Roof catchment construction pilot to catch rainwater to be used by the school, then replicated in other buildings.	The water tanks could be enlarged or larger water tanks be installed. In addition, the tanks should be fenced and tap stations located near the classrooms to minimise overcrowding near the tanks. The tanks should be painted to strengthen them

**Table 4b. Summary of revised activities - Modika**

<b>Original Project Activities</b>	<b>Revised project activities</b>	<b>Revised Project Activities to reduce climate change impacts</b>
Construction of Gender sensitive and Child Friendly Sanitation Facilities	Construction of Block Latrines	Construction of block latrines and pit lining to strengthen the sub structures

Original Project Activities	Revised project activities	Revised Project Activities to reduce climate change impacts
Construction of 24CUM Rain Water Harvesting System and municipal piped water connection	Treatment of Water	SODIS water treatment can also be encouraged and the community members trained on how to use SODIS to disinfect their water.
Drip Irrigation Project	Training of 4K Club Members on drip irrigation and proper farming	Cross-learning of the 4K Club members in the two divisions so that the pupils can also learn from each other
Hygiene Promotion and Safe Water System Project	Additional Training for the School Health Club Members	The Use of PET Groups to disseminate information on Climate Change Issues.
Construction of Low Cost Household Latrines	Improving of the designs of the superstructures and the drainage	Murram should be placed around the slab to allow water drainage. We mobilize/encourage the community to line the superstructures with gunny bags.
Training of Slab Construction Artisans and Community monitors	Refresher Trainings on slab construction and hygiene promotion	Refresher trainings to include modules on climate change impacts on health and adaptation

## 8.2 Synergies and Barriers

The analysis in this section examines why the activities were revised and the synergies and barriers that could facilitate or hinder implementation.

### 6.2.1 Ohia

**Revised Activity 1.** Construction of low cost pit latrines away from water sources; encourage further construction of additional latrines, also replant trees to replace those used. This strategy is thought to be sustainable with Climate Change because the weak soil in the area may lead to collapse of pit latrines. The supra-structure raw materials may be washed away. However, the slab is portable so it can be moved from place to place. The comora (supra structure raw materials), are readily available and can be sustained through tree planting. Further revision of these activities would include construction of improved pit latrines such as pour flush latrines.

Barriers to implementing these activities include financial constraints, limited technical capacity (there are only two artisans in the community) and water scarcity (this could impede the proper use of pour flush latrines which require water). One potential synergy would be cooperation with the Public Health Department and UNICEF, who are implementing similar interventions in Kasha District.

**Revised Activity 2.** De-siltation and ancillary works of the earth pan, including planting of vegetation cover around the pan. This strategy is thought to be

sustainable with Climate Change because more water can be captured. Plant cover will reduce evaporation and siltation, and a fence will minimize interference by livestock etc. Further revision of these activities would be to construct an infiltration well and pump water into the cattle troughs and washing area to minimize movement inside the water pan enclosure. Additionally, the fence could be reinforced using thorns to prevent wild animals from entering the water pan area.

Some of the barriers to revised activity 2 include the required technical guidance from the Ministry of Water, and conflicting regulations from the National Environment Management Authority (NEMA) and the Northern Water Services Board. They are required to authorize the construction of infiltration well and the installation of the proposed pump. A few synergies include the reasonable cost of technical human resources (from the Ministry of Water), and the possibility to involve the Kenya Wildlife Service in plans to protect the earth pan from livestock damage by utilizing electric (possibly solar-powered) fencing.

**Revised Activity 3.** Hygiene promotion in the school and community; this will include training of a school health club, water user association members and patrons on hygiene promotion. The sustainability of this measure in the face of Climate Change lies in the ability of the community to use the knowledge and skills gained to improve hygiene in the area and teach others for the future. To further aid in climate change adaptation training on environmental conservation could be incorporated into the hygiene promotion. This would include the importance of tree planting, good drainage and clearing of bushes.

Several barriers present themselves in the form of financial constraints, insufficient progression in the school (poor classroom/teacher-student ratio), and few technically sound individuals available in the community (only 1 currently). One potential synergy would be to work with agricultural extension officers to gain technical knowledge on appropriate agricultural crops and seeds, and to work with the Ministry of Forestry to identify appropriate tree species and obtain seedlings. Another synergy would be to form 4K Clubs in schools for the dissemination of knowledge.

**Revised Activity 4.** Supplement rain fed agriculture with drip irrigation which is regulated by the community to enhance water efficiency and minimize conflicts. An increased knowledge and skill set concerning irrigation will aid the community in combating food shortages due to climate change. Water could be a constraint in light of the potential for increased temperatures and drought. In order for greater adaptation to Climate Change, improved water storage capacities will provide water for drip irrigation and increased knowledge about drought resistant crops and seed species will ensure crop yield is sufficient.

Barriers that have been identified include potential financial constraints to expand the water storage capacity, the need for assistance from Kenya Agricultural Research Institute (KARI) on technical issues of drip irrigation and building drip kits, and whether or not community is willing to participate in drip irrigation

activities. There could be a synergistic relationship built between the Farming Training Centre and KARI to obtain advice on suitable seed and crop species to be planted.

**Revised Activity 5.** Plant appropriate trees species (i.e. drought tolerant) to act as windbreaks and to improve water retention in the catchment area. Tree planting is sustainable in the face of Climate Change due to the trees' ability to retain water and provide shade from increasing temperatures. Planting of beneficial trees (financially, food providing, etc.) can further aid the community in preparing for future changes.

No barriers were identified in this phase of the project for activity 5, and the following synergies were determined through the CRiSTAL process: the ability to work closely with the Ministry of Forestry to identify and potentially supply the appropriate tree species; the empowerment of existing self-help groups for the development of tree nurseries to provide seedlings for planting locally; the agricultural extension officer could be worked with to train community members on development and monitoring of tree nurseries; the willingness of the community to participate in tree planting activities.

**Revised Activity 6.** Drill and maintain boreholes which have protection around the water point, replant appropriate species of trees, form and strengthen a water user association to manage borehole. Boreholes are sustainable because infiltration will increase when intense rainfall increases (expected with Climate Change). In addition, the boreholes would provide water for use during dry seasons. Potentially, water could be piped from the borehole and water kiosks established to sell water to the community. Finally, training of local people in the basic operation and maintenance of the borehole and to monitor water levels in conjunction with the government will further protect communities from water – related shocks.

There were no barriers identified in this round of the CRiSTAL process to developing revised activity 6. Many synergies are thought to exist and include: collaboration with the Ministry of Water and the Ministry of Social Services to register the Ohia Water Users Association as a water provider; the Ohia borehole will be drilled by the Ministry of Water; collaboration could be developed between the Arid Lands Resource Management Project (who will provide the pumps) and the generators for the boreholes (MOW); Water, Hygiene and Sanitation (WASH) partners in the area could facilitate training in the basic operation and maintenance of boreholes; and the water kiosk concept is acceptable to the community and will be supported if the tariffs are reasonable.

**Revised Activity 7.** Construct roof catchment pilot project to capture rainwater for use in the school, and then replicate this project at other facilities. Roof rain catchment results in greater rain harvests, a resource that is currently lost for the most part to runoff, and is sustainable as long as rain continues to fall. Additionally, the water catchment tanks could be enlarged or larger water tanks could be installed. All tanks should be fenced and all tap stations should be located near the

classrooms to minimize overcrowding near the tanks. Finally, painting the tanks will help to strengthen them for sustained use in the future.

Three barriers to development of this activity were identified and include the financial constraints surrounding the construction or purchase of large storage tanks, the limited technical expertise of community members and the lack of involvement from the community members. There is the possibility to partner with the Ministry of Education through the Constituency Development Fund, to construct additional classrooms in the school and install water tanks. Additionally, religious leaders could explore the possibility of installing water tanks and gutters at the Chief's office and Mosque accordingly.

### **6.2.2 Modika:**

**Revised Activity 1.** Construction of block latrines. This is thought to be sustainable because the block latrines will be able to withstand the effects of the climatic hazards affecting Modika. Given the loose soil conditions in the area, the pits will be lined to strengthen the sub structure. Additionally, construction of block latrines **and** pit lining to strengthen the sub-structures can be completed to further adaptation.

The primary barrier to development of revised activity 1 for Modika, could be financial constraints, due to the high cost of pit lining material. Potential synergies may stem from availability of CDF funds and support from other stakeholders such as Arid Lands and the Ministry of Public Health and Sanitation in the construction of facilities in schools.

**Revised Activity 2.** Construction of 24CUM Rain Water Harvesting System and municipal piped water connection along with water treatment. Water treatment ensures that the community members have access to safe water at all times, especially during floods and when they experience water shortages and have to buy water from water vendors. Sustainable development of water resources in this manner can be strengthened by encouraging SODIS water treatment and training the community members on how to use SODIS to disinfect their water.

One potential barrier to developing water resources may be acceptability of the SODIS water treatment process (community members may not be willing to take up this process), so community mobilization and awareness creation will need to be done. The Ministry of Water may be able assist in promoting the activity in the area given that the high temperatures in the area can support the SODIS water treatment method.

**Revised Activity 3.** Training of 4K Club Members on the drip irrigation project and proper farming. Sustainability of this project stems from the activities to engage the 4K Club members in the planting of trees and crops at the school to promote Environmental Conservation. Cross-learning of the 4K Club members in the two divisions, so that the pupils can also learn from each other will further this process.

Collaboration with the Agricultural Extension Officers in the area will provide potential for synergies in this area. One barrier may be due to the newness of the technology to the community and the need for awareness creation and monitoring of the project at the initial stages.

**Revised Activity 4.** Additional training for the school health club members on hygiene promotion and safe water system project. In order to further the activities of this project, the community ought to use PET Groups to disseminate information on climate change issues.

Due to lack of contracts with PET group members, they may seek other jobs and this will result in frequent re-training required to keep trained individuals in the

community. This could impede the process of hygiene promotion activities and dissemination of information on the climate change issues. No synergies were identified for this revised activity for Modika.

**Revised Activity 5.** Improving of the designs of the superstructures and the drainage for the construction of low cost household latrines. Additionally,

## **9 Feedback on climate change vulnerability assessment tools**

This section highlights the feedback provided, based on participants' experience with applying the CVCA and CRiSTAL tools.

### ***9.1 Testing of tools***

During the workshop, participants tested the tools using a scenario (see Appendix 4). Specific feedback was provided on the process and is outlined below.

The groups found that using a legend to describe different levels of temperature and rainfalls for the rain calendar was beneficial. A hazard map was used to identify different resources and hazards. This was useful to identify key livelihood resources. The process of assessing the impact of hazards on livelihood resources considered whether hazards had a negative or positive influence on different resources. Groups also took the extra step of analysing who had control and access of resources from the gender perspective.

### ***9.2 Field exercise and data analysis***

Participants visited the communities of Ohia and Modika in Garissa. The outputs of the field exercise are provided in Section 4 and 5 under the climate and livelihood context. This section outlines the feedback from the practical exercise.

#### **9.2.1 Feedback on field exercise**

Participants gave feedback on their experience collecting information using the CVCA tools in the community, and provided ideas on how to improve the assessment.

### **Feedback on the Field Work**

The participants who had previously undergone training on the tools felt more confident doing the data collection the second time. Participants found that it was a good approach to divide the community into groups because the young women's group was open and indicated that they would share their ideas. It was also important to mobilize the community early enough so they were ready. It was noted that in the groups with fewer participants there was better participation. On the other hand, there were lots of discussion but sometimes a lack of constructive alternatives to coping, and some domineering discussion among old men meant that it was difficult to get the majority view. Finally, when asked whether it was necessary to validate the information in a smaller group, participants stated it was not necessarily beneficial as some members (i.e. old men) will dominate.

## **Areas for Improvement**

Punctuality should be improved so that the process can start as scheduled. Participation by some community members' in a few of the groups wasn't equitable, and the exercise was a bit long for some of the participants. There should also be better communication among facilitators through better preparation. In regard to the logistics, it was recommended that the communities should prepare refreshments themselves rather than the facilitation team bringing in refreshments. Finally, it is best to have the closing first and then the provision of allowances to end the field exercise well.

### ***9.3 Application of CRiSTAL Tool***

The participants worked together to merge the information gathered in the community. They then analyzed the data to determine how to improve project activities and community vulnerability to climate change impacts.

#### **9.3.1 Feedback on data analysis**

Participants gave their feedback on the data analysis process. One of the questions asked was: How is it possible to incorporate new activities or adjusted activities identified using CRiSTAL? Some suggestions included incorporating them later in the project (i.e. Year 3) or during a review of activities and decide what could be incorporated. This can improve impact and sustain interventions

Participants noted that the process required critical thinking and allowed direct analysis by those who collected data. In addition, the tool is more detailed and provides solutions to challenges in comparison to other GWI tools. However, some of the logic was difficult to understand or did not make sense (for example. impact of resources such as trees on trees). Furthermore, some information was not used in the CRiSTAL tool such as access and control. Overall, participants felt confident to carry out future vulnerability assessments alone without facilitators.

## **10 Way Forward**

The final step in the CRiSTAL process is to complete a way forward assessment in which the efficacy and lessons learned from the CRiSTAL process are determined and documented for the particular project area. This will aid in future implementation of the CRiSTAL process as well as provide a summary of key points for the project area in question.

### ***8.1 Way Forward - Ohia***

For GWI in Ohia, the way forward has been developed as follows:

Current project activities whose results may be affected by the impacts of climate variability and climate change include: construction of pit latrines, construction of the earth pan, hygiene promotion and irrigation.

It was noted that the construction of sand dams and pipes to a reservoir are and will be more beneficial since people rely on them during drought. More intense rainfall, could help sand dams fill up faster.

Piping water from River Tana to a 90m<sup>3</sup> steel tank (2 or 3 tanks) for the schools in Balambala with kiosks to sell water would also be increasingly beneficial with more intense rainfall. The water would be stored and available for use during dry periods and could lessen the burden of fetching water during drought.

The project will also work on the rehabilitation of an earthpan in Ashadin, and incorporate revisions similar to the ones that will be done on the earth pan in Ohia. Other activities will include the rehabilitation of school latrines in Balambala, provision of a mobile pit latrine in Modika, construction of child friendly latrines in all beneficiary schools and undertaking theatre style training to convey key messages to community members.

To make these activities effective, the project team indicated that they could potentially incorporate climate change messages within the theatre style training to convey messages. They would also consider expanding the area for sand dam construction, depending on future rainfall. They need to consider the flow of the river, and the amount of water that can be abstracted. They would work with the existing water resource user association. The team would monitor rainfall over time to decide whether more tanks to hold water that need will be piped from River Tana to 90m<sup>3</sup> steel tanks for the schools in Balambala with kiosks to sell water. They will consider using solar or wind power to operate the water pump, though they acknowledge that these sources of energy could be expensive.

Potential barriers to the implementation of these changes include: potential conflict over abstraction of water if there is reduced flow; financial constraints due to the high initial capital costs of wind and solar power; clan conflicts in the area could disrupt activities; the existence of few artisans to support construction of pit latrines; and the attitude of dependency on CARE (and other aid agencies) for support.

In future, the team would like to incorporate other stakeholders (i.e. those that provide information on droughts and floods such as the Ministry of Water, Ministry of Agriculture, the Arid Lands Resource Management project, the Meteorological Department, and the Ministry of Health). The team is already engaging with these stakeholders and is seeking to strengthen partnerships in order to support the scaling up of revised interventions in future. The team would also like to appropriately mainstream climate change adaptation into other project activities.

- They indicated that undergoing a vulnerability assessment using CVCA and CRiSTAL could to some extent help them achieve the changes they want. This is because the process helps them to think critically about issues in a holistic way, and can lead them along the right path in making desired and beneficial changes.

Table 4 below provides a workplan of how CARE and partners plan to move forward with the information derived from the vulnerability assessment. A specific way forward document was not plotted for Modika.

<b>Table 5. Summary of Way Forward for Ohia</b>					
<b>What Do we want to do?</b>	<b>How do we want to do it?</b>	<b>When do we want to do it?</b>	<b>Who will do it?</b>	<b>Where?</b>	<b>Resources/ Requirements</b>
Carry out vulnerability assessment in Modika to represent urban areas	Using the vulnerability assessment tools (CVCA and CRiSTAL)	Q1	GWI staff	Modika	Budget and funds Vehicles and fuel Technical assistance (remotely)
Pour flush latrines away from water sources and tree planting	Through cost sharing with the community	Start in Q1	GWI staff and community	Central and Balambala divisions	Construction materials Labour Transport
Desiltation and ancillary works of earthpan – planting vegetation and fencing	Community members will carry this out	Start in Q1	Community	Ohia	Local available fencing materials Transplant existing vegetation Work with agricultural extension officer(s)
Hygiene promotion - Incorporate training on environmental conservation	Training on PHASE – contains environmental issues (including tree planting, drainage, clearing of bushes etc) Use of participatory educational theatre (can include information on impacts of climate change)	Q1 and Q2	Trained youth groups	Central and Balambala divisions	Consultants to carry out capacity building Consult with Cynthia on how to include climate change adaptation
Drip irrigation- which is regulated by community to enhance water efficiency and minimize conflicts, and includes planting crops and seed species that can withstand high temperatures and increased drought e.g. pawpaws, bananas, water melons	Use Improved drip kits Schools (4K Club) will put in labour	Start in Q1	4k clubs CARE Schools	Modika primary Balambala primary Bura primary	Drip kits Fencing materials Seedlings Agriculture extension officer
Planting appropriate and beneficial species of trees (i.e. drought resistant) to act as windbreaks and to improve water retention in catchment area	Community members with support from CARE Can combine with drip irrigation activity	Start in Q1, and will be ongoing	Communities with support from CARE	Central and Balambala divisions	Seedlings Agriculture and forestry extension officers Labour
Roof catchment construction pilot to catch rainwater to be used by the school	Use gutter system to connect to tank by the school Training on maintenance	Q2	CARE and schools	Ohia	Gutter Use CARE site engineers Labour

## Appendix 1. Participants list – Ohia Vulnerability Assessment

### *Ohia*

<b>Name</b>
Cynthia Awour
Mustafa Gure
Thomas Ihura
Suban Khalif
Sylvia Nyaga
Mohammud Hirmoge
Katharine Cross
Adow Abdullahi
David
Roselyne Okwiri
Sahara Siyat

### *Modika*

<b>Name</b>
Suban Khalif
Hirmoge M.A
Thomas Ihura
Adow Abdullahi
Phelix Okuta
Roselyne Okwiri
Sahara Siyat

## Appendix 2. Workshop programme - Ohia

Date	Time	Activity	Notes
<b>Day 1- Refresher Training on CVCA and CRiSTAL Tools</b>			
26/10/09	08:00-08:15	Registration of participants	Roselyne
	08:15-08:30	Participants introductions and objectives of the training	Jack
	08:30-09:00	Introduction to Climate Change, Adaptation & Integration	Cynthia
	09:00-09:30	Introduction to CVCA	Cynthia
	09:30-10:00	Introduction to CRiSTAL	Katharine
	<b>10:00-10:30</b>	<b>Break</b>	
	10:30-11:15	Introduction to the Rain Calendar, Hazard mapping, and Vulnerability Matrix	Cynthia and Katharine
	11:15-13:00	Practical exercises- Rain Calendar, Hazard mapping and Vulnerability matrix	Cynthia and Katharine
	<b>13:00-14:00</b>	<b>Lunch</b>	
	14:00- 15:00	Feedback on the Tools, review of the field guide	Katharine
	15:00-15:45	Review of the field guide in Somali language	Somali-speaking facilitators
	15:45-16:30	Plans for field data collection and logistics	Katharine and Roselyne
<b>Day 2- Field Data collection using CVCA Tools</b>			
27/10/09	07:30-09:00	Travel to Ohia	
	09:00-09:30	Introductions to the community members and objective of the field data collection	Jack Odongo and ALRMP representative
	09:30- 10:30	Data collection-Rain Calendar	All
	10:30-11:30	Data collection- Hazard mapping	All
	11:30-13:00	Data collection- Vulnerability matrix	All
	13:00-14:00	<b>Lunch</b>	
	14:00-16:00	Data collection-Vulnerability matrix cont. (community representatives to agree on priority resources, hazards and coping strategies)	All
	<b>16:00</b>	<b>Travel back to Garissa</b>	<b>All</b>
<b>Day 3- Data Analysis using CRiSTAL</b>			

<b>Date</b>	<b>Time</b>	<b>Activity</b>	<b>Notes</b>
28/10/09	08:30 – 09:30	Discuss information on rain calendar	Cynthia
	09:30-10:30	Data entry into CRiSTAL	Katharine and Cynthia
	<b>10:30-11:00</b>	<b>Break</b>	
	11:00-13:00	Data analysis on CRiSTAL	All
	<b>13:00-14:00</b>	<b>Lunch</b>	
	14:00-15:30	Data analysis on CRiSTAL	All
	15:30-16:00	Break	
	16:00-17:00	Data analysis on CRiSTAL (up to GWI Project activities)	All
<b>Day 4- Data Analysis using CRiSTAL</b>			
29/10/09	08:30-10:30	Data Analysis on CRiSTAL	All
	<b>10:30-11:00</b>	<b>Break</b>	
	11:00-13:00	Data Analysis on CRiSTAL	All
	<b>13:00-14:00</b>	<b>Lunch</b>	
	14:15:30	Data Analysis on CRiSTAL	All
	<b>15:30-16:00</b>	<b>Break</b>	
	16:00-17:00	Data Analysis on CRiSTAL	All
<b>Day 5- Review of activities and Recommendations</b>			
30/10/09	08:30-10:30	Review GWI year 2 activities against results of CRiSTAL analysis	Jack and Roselyne (with support from all)
	<b>10:30-11:00</b>	<b>Break</b>	
	11:00-12:30	Recommendations for Adaptation interventions that could be integrated into year 2 activities	All
	12:30-13:00	Plans for rollout in site 2 (Modika location)	All
	13:00-13:30	Conclusion	All

<b>Date</b>	<b>Time</b>	<b>Activity</b>	<b>Notes</b>
	13:30	Lunch followed by departure	

## Appendix 3. Field form

### 1. Introduction

- a. Brief of who you are, your organisation and why you have come to the community
- b. Brief on what climate change is (with the use of visual aids is preferable)
- c. Introduce the project
- d. Explain how you are going to collect information
- e. Explain why you are asking people to split up into groups (i.e. young men, young women, old men, old women)

### Facilitators

1	
2	
3	
4	
5	

### Group Information

<b>District</b>	
<b>Village</b>	
<b>Group interviewed (e.g. young men or women)</b>	
<b>No. of participants</b>	
<b>Date</b>	

### Names of Participants

1	
2	
3	
4	
5	
6	
7	
7	
8	
9	
10	
11	
12	

**2. Data collection in groups**

- a. Explain what are we doing very briefly and how the outputs will be used
- b. What is your main livelihood ( *Nolal Malmed*) (i.e. agriculture, livestock keeping, etc)?
- c. Seasonal calendar (see below)
  - i. Rain days
  - ii. Floods
  - iii. Temperature

**RAIN CALENDAR**

MONTHS														Notes on Rainfall and Temperature
YEARS														
Seasons														
Rainfall														
Temperature														
Rainfall														
Temperature														
Rainfall														
Temperature														
Rainfall														
Temperature														

### 3. Livelihood resources – name them then rank them immediately

#### *Livelihoods Brainstorm*

<p><b>Natural Resources</b> The natural resource stock upon which people rely both directly (i.e. for income or medicine) or indirectly (i.e. flood control, protection from storms). Examples: Trees, land, clean air, fish, water, wetlands</p>
<p><b>Physical Resources</b> The basic infrastructure and productive capital for transport, buildings, water management, energy and communications. Examples: Roads, water tanks, tools, machines, agricultural implements, bicycles.</p>
<p><b>Financial Resources</b> The stocks and flows of money that allow people to achieve their livelihood objectives. Examples: Cash, savings, jewelry, pensions, remittances, access to markets, liquid assets</p>
<p><b>Human Resources</b> The skills, knowledge, capacity and good health important to the pursuit of livelihoods. Examples: Traditional knowledge, weaving skills, education</p>
<p><b>Social Resources :</b> The formal and informal of social relationships and institutions from which people draw in pursuit of their livelihood. Examples: Church groups, farmer associations, political organisations</p>

4. Name climatic hazards (*Dibaitatha eykenta imilatha*) and rank them (just choose top 3)

Explain that climatic hazards are caused by the weather.

**Hazard** - Potentially damaging physical events or phenomena that result from weather or climate conditions (example: Desertification, drought, strong winds, floods, extreme cold, extreme heat)

5. Identify the impacts of each hazard on the livelihood(s) and rank them (choose the top 3).

**Impact** - The consequences of hazards on natural and human systems, and can include crop damage, income losses and reduced soil fertility.

6. Are there other causes of the impact (i.e. conflict, population changes)?

7. Identify the coping strategies of each impact for hazard 1 (just choose top 1)

**Coping strategies** - Methods for using existing resources to achieve beneficial ends during abnormal or adverse conditions (Casual labour, Crop shifting, Food rationing, Food storage, Gathering of wild food, Income diversification, Tree/Crop replanting, Water rationing)

8. Is the coping strategy working and is it sustainable?

9. What is an alternative coping strategy and what resources are needed to implement these coping strategies?

10. Repeat steps 5 to 9 for hazard 2 and 3

<b>Hazard (Top 3)</b>	<b>Impacts on the Livelihood (Top 3 for each hazard)</b>	<b>Coping Strategies (choose top 1)</b>	<b>Working?</b>	<b>Sustainable? (Rasmi?)</b>	<b>Alternate coping strategies and resources to achieve this</b>

\*If there is enough time continue with:

**11. Influence of hazards on Key Resources (0-5)**

*(Dibatatha u ugeysanayo kheirata jojtatha ah)*

0 = Hazard has no influence over the livelihood resource

1 = Hazard has minimal influence over the livelihood resource

3 = Hazard has some influence over the livelihood resource

5 = Hazard has a very strong influence on the livelihood resource.

	HAZARDS		
RESOURCES			
<b>Natural</b>			
<b>Physical</b>			
<b>Financial</b>			
<b>Human</b>			
<b>Social</b>			

**12. FURTHER DISCUSSION - If there is time**

- a. Who has control of resources and access to facilities and services?
- b. Social or political and other issues that may have implications for vulnerability
- c. Any other changes in environment, conditions, hazards, livelihoods

**13. Conclusions**

- a. Ask group what they learned
- b. Summarise the process and tell them the next steps

## **Appendix 4: Scenario**

### **Climate Vulnerability and Capacity Analysis (CVCA) and Community-Based Risk Screening: Adaptation and Livelihoods (CRISTAL) Training**

#### **Global Water Initiative and Partners, Garissa**

**26th October 2009**

#### **Community and Project Scenario**

##### **1. Background on Kasigau Zone**

Kasigau zone, is a semi-arid area that covers 2 Sub-locations named Kathambo and Linga. It is part of the Southern zone of country X. The zone covers an area of approximately 48.5KM<sup>2</sup> with a population of approximately 8,866 people in about 900 households.

Soil types in the zone vary from sandy and sandy loams in the plains of Linga, and deep red soils in the hilly Kathambo. The average land holding size is about 3 acres per household.

Major sources of water in the zone area are seasonal streams, sand dams, natural springs and wells. Generally, average distance to watering points is approximately 8 KM, round trip during dry spells. Rain water harvesting techniques are hardly used.

Generally, the infrastructure within the zone is poor in terms of road network, telephone and communication channels. Markets are sparsely distributed and the community relies largely on 2 external markets. There is only 1 health centre and 1 veterinary centre in the zone. There are 4 primary schools, 2 secondary schools, and 1 technical college. Only 5% of the households have access to electricity, and 15% have access to piped water.

##### **2. Livelihoods**

The main livelihood activities in the zone are mixed farming and livestock production.

Major cereals grown in the area include maize, sorghum and millet; while major pulses grown include beans, cow peas and pigeon peas, especially in Kathambo, where 55% of the population are farmers, and 45% farm and keep livestock.

In Linga, about 60% of the population is engaged in agro- Pastoralism, and 40% are pure pastoralists. Cows, goats, sheep and donkeys are the main livestock reared in the area. On average most of the pastoralists households own 20 heads of cattle, 30 goats, 20 sheep and 4 donkeys. Agro-pastoralists generally own fewer livestock: about 5 heads of cattle, 15 goats, 10 sheep, 2 donkeys and 15 chickens.

Men are mainly involved in livestock production including treatment of sick animals, and women are mainly engaged in farming activities, and take care of breeding and lactating livestock and their young ones.

The two main sources of food are the markets and household production. Market purchases account for most of the rice, wheat and barley, cooking fats and oils, (60%) meat in

Kathambo, (60%) vegetables in Linga, and milk and dairy products (40%) in both zones. The bulk of sorghums and millets, beans (70%), maize (85%), milk and dairy products (60%), and other pulses (80%) are acquired from household production in the two Woredas combined.

With regards to sources of income in the zone, food crop production provides the highest contribution (43%), closely followed by livestock production (39%). Casual waged labour and cash crop production contribute 4% each, while other income generating activities jointly contribute 10% to the total household income.

### 3. General Climate

The climate of Kasigau zone is characterized by a bimodal rainfall pattern comprising the short and long rainfall seasons. Generally, the long rainfall season begins in mid to late March and ends in mid- May, while the short rainfall season starts in late October and ends in late December. In between the two rainfall seasons are two dry seasons: the short dry season, which occurs from January to mid-March, and the long dry season, which starts in mid-May and ends in mid-October.

The short rains are more reliable and usually better distributed with about 40% of the annual rainfall received during long rains (late March to mid-May) and 60% received during short rains (late October to late December). About 70% of food and livestock production in the project area comes during the short rains season.

### 4. Recent Weather Observations

In the last 20 years, the weather in the zone has been unpredictable. Rainfall seasons are shifting, rainfall quantity and distribution have declined. The frequency, duration and intensity of drought has increased, and there are times when intense rains and floods occur in some parts of the zone.

A summary of weather observations for the last 5 years, and their effects in Linga and Kathambo are provided below:

Year	Rainfall	Temperature	Impacts
2009	7 days of light rains March - May  1 week of heavy rain October	Very warm temp. Jan to May. (33°C average)  Cool temp. Jun to Jul.(14 °C average)  Normal temp. Aug-Dec (25 °C average)	- Drought leading to crop failure and livestock deaths.  - Increase in respiratory diseases,  - soil erosion & crop damage, livestock diseases  - Landslides in Kathambo, floods in Linga  education disrupted.
2008	10 days normal rain Feb-May	Normal temp. Jan-March  Very warm temp. Apr-May	- Crop failure  - heat stress, increase in malaria

	No rain for the rest of the year	Cool temp. Jun-Jul Very warm temp: Aug-Dec	- Increase in Respiratory diseases - Drying up of seasonal water sources
2007	30 days normal rain- March-May 21 days normal rain- Oct-Nov	Normal temp all year	- 2 good harvests - Livestock and milk production good - Good health for people and livestock - 5 women self-help groups formed
2006	40 days intense rains Jan-May Heavy mist June-Aug 10 days light rain Sept-Nov	Cool temp. Jan-March - Cold temp. June-Aug - Normal temp. Sept-Dec	- Floods, loss of livestock through death and diseases - Cholera outbreaks – 10 deaths - Respiratory diseases, livestock diseases, crop damage (due to frost)
2005	5 days light rain March 7 days light Rain Oct-Nov	- Very warm temp all year	- drought - Crop pest outbreak

It is projected that over the next 10-20 years, Linga will experience warmer day and night time temperatures and decreased rainfall while Kathambo will experience warmer daytime and cooler night time temperatures and increased episodes of intense rainfall.

**Assignment:**

Discuss and develop a rain calendar and vulnerability Matrix.

**Group 1 -Linga**

**Group 2- Kathambo**

**Note:** please highlight particular vulnerabilities of men, women and children in both Woredas, in view of their livelihood activities, and the impacts of changes in weather.

## **Appendix 5: Supplementary materials**

Supplementary material to support this report contains the following information:

- CRiSTAL decision support tool for Ohia and Modika
- Field forms for community groups in Ohia and Modika
- Presentations
- Photos
- Background on climate change and tools