

**HUNTER-GATHERERS' COPING STRATEGIES ON CLIMATE CHANGE
IN IRAMBA AND MBULU DISTRICTS, TANZANIA**

BY

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**A DISSERTATION SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE OF MASTER OF ARTS IN RURAL
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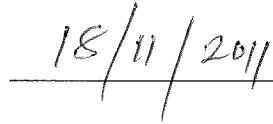
ABSTRACT

The study intended to establish the perceptions of community on climate change, identifying the Hadzabe' food insecurity coping strategies toward climate change and assessing the extent of food availability and stability. The study was conducted in five selected villages in Iramba and Mbulu Districts namely Kipamba, Munguli, Yaedachini, Mongo wa Mono and Domanga. The cross-sectional technique was used to collect data. Purposive and Simple random sampling methods were used to obtain 100 respondents. Both structured and unstructured questionnaire were used in data collection, supplemented by focus group discussion and key informants. Data were analyzed using computer programmes and content analysis method. The descriptive statistics such as frequencies, and percentages were computed. The finding from this study reveals that people have experienced the presence of climate change and hence lead to the chronic food insecurity. However, the Hadzabe have developed different coping strategies to mitigate the situation. The most used coping strategies included: relying food from government and NGOs, eating foods which have not been used before, migrating to the area with food, borrowing food and selling labour and engaging in petty business. The dependence on wild food and lack of food storage facilities and habit were identified as the main contributing factors to food insecurity to the Hadzabe. The study concluded that, there is a need for improving the coping capacity of the Hadzabe by strengthening their coping strategies and recognizing the importance of forest resource in supporting the Hadzabes' livelihoods to improve food availability and stability. It is recommended that long term development measures such as training on crops and animals' husbandry, modern beekeeping,

food processing and storage techniques should be provided to the Hadzabe so as to ensure food security in their households.

DECLARATION

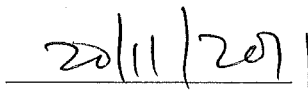
I, Seleman Shadrack do hereby declare to the Senate of Sokoine University of Agriculture that, this dissertation is my own original work and that it has neither been submitted nor being concurrently submitted for degree in any other institution.



Seleman Shadrack
(MA Candidate)

Date

The above declaration is confirmed



DR. Mwalilino, J.K
(Supervisor)

Date

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Finally, I will never forget to whom this study truly belongs to - it belongs to God, It is God who made me who I am in the depth of hardship, when nothing but hope and virtue could survive. I will always praise him and seek his Devine intervention when faced with problems beyond my capacity. To Him, my precious appreciation is due.

DEDICATION

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LIST OF ABBREVIATIONS AND ACRONOMY

ADHD	-	Attention-Deficit Hyperactivity Disorder
ASDP	-	Agriculture Sector Development Programme
ASDS	-	Agriculture Service Development Strategy
ASP	-	Agricultural Sector Policies
ASSP	-	Agricultural Services Support Programme
DADPs	-	District Agricultural Development Plans
DSI	-	Development Studies Institute
FAO	-	Food and Agriculture Organization
FMD	-	Foot and Mouth Disease
FARM-A	-	Food and Agriculture Research Management Africa
FSIT	-	Food Security Information Team
ILO	-	International Labour Organization
IDC	-	Iramba District Council
IPCC	-	Intergovernmental Panel on Climate Change
LGA	-	Local Government Authorities
MA	-	Master of Arts
MAFC	-	Ministry of Agriculture, Food Security and Cooperatives
MARD	-	Master Degree in Rural Development
MDC	-	Mbulu District Council
MDG	-	Millennium Development Goal
NBS	-	National Bureau of Statistics
NGO	-	Non-Governmental Organization
NSGRP	-	National Strategy for Growth and Reduction of Poverty

PMO	-	Prime Minister Office
PRSP	-	Poverty Reduction Strategy Paper
RD	-	Rural Development
SNAL	-	Sokoine National Agricultural Library
SPSS	-	Statistical Package for Social Sciences
SRS	-	Simple Random Sampling
SUA	-	Sokoine University of Agriculture
TAS	-	Tanzania Assistance Strategy
TDHS	-	Tanzania Demographic and Health Survey
UCLAS	-	University College of Land and Architectural Studies
UN	-	United Nations
UNDP	-	United Nations Development Programme
URT	-	United Republic of Tanzania
VAR	-	Vulnerability Assessment Report

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Since early 1980s, it has become apparent that our planet has been undergoing significant climatic change. The general opinion is what is taking place now is to great extent a result of human activities. Some regions of the world are considered to be more vulnerable to climate change than others. It is the less developed countries which belong to the most vulnerable part of the world to climate change. This is especially so because a large part of their economy depends on climate-sensitive sectors such as agriculture and local natural resources. Furthermore these countries adaptive capacity is often limited by inadequate human, financial and natural resources, and low institutional and technological capability (IPCC, 2007).

Evidence from literature (Paavola, 2005) has documented a myriad number of effects caused by climate change. Climate change has also affected livestock distribution and productivity, the prevalence of (vector-borne) livestock diseases as well as alteration of the quantity and quality of rangeland (IPCC, 2007). Millions of people in East Africa and horn of Africa (Somalia, Eritrea, Djibouti, Northern Kenya, Northern and Southern Sudan) face climate-related hunger as seasons shift and change, the shifting seasons are destroying harvests and causing widespread hunger, but this is just one of the multiple impacts of climate change taking its toll on the world's poorest people, with a warning that multiple climate impacts could reverse 50 years of the results of hard work achieved in ending poverty (Agrawala *et al.*, 2003). Tanzania as a country is witnessing one of the great impacts of climate change; the

melting of the icecap of Mount Kilimanjaro with the glacial retreat being observed on the mountain (Luhanga *et al.*, 1998). Apart from Kilimanjaro Mountain, other parts of Tanzania are also experiencing the effect of climate changes for example 1997/8 El Niño which led to drought and flooding, the skyrocketing of food price, and loss of cattle and crops (US National Drought Mitigation Center 1998). Another recent example is the tragic and massively destructive flood in Kilosa District in January 2010, which left a number of people dead and thousands of others without shelter and wreaked havoc on houses and infrastructure (Daily News, 2010).

Predicted changes in climate will have significant impacts on Tanzania's rain-fed agriculture and food production. Global warming will shorten the rain season, reduce water availability and increase crop losses caused by increase in diseases and pests. Therefore the changes will affect livelihood, health, and food security in Tanzania (Hunter-gatherers are included). Predicted changes in climate will increase the effect on forest resources, frequency and intensity of bush fires and induce shifts in geographic distribution of plant species and associations and thus land cover (Mwandosya *et al.*, 1998). Forests and woodlands are an important resource in Tanzania. Studies indicate that forest products accounts for 90% of total energy use in Tanzania (Paavola, 2005).

Moreover, forests are a source of poles and timber for construction, fodder and browsing for the livestock, as well as berries, tubers, medicinal plants, gums, and meat. Deforestation (farms expansion, timbers, firewood) carried out by rural people as a coping strategy would have significant adverse consequences for economic and

physical wellbeing in rural areas especially for hunter-gatherers. The current food and water scarcity is already aggravating tensions between local communities, such tensions may also have consequences for regional stability.

In Tanzania, there are three ethnic groups that fall in a category of hunter-gatherers namely, Sanjos in Ngorongoro and Serengeti Districts, Sandawe in Kondoa District and Hadzabe in Iramba, Mbulu, Karatu and Meatu Districts. The society of hunter-gatherers, whose mode of subsistence involves from hunting animals, fishing and gathering edible plants is characterized by relatively mobile kind of habitat due to their reliance upon the ability of a given natural environment to provide sufficient resources in order to sustain their life. Their population density tends to be lower than those of agriculturalist, since the cultivated land is capable of sustaining population densities by 60-100 times more than the land left uncultivated. Hunter-gatherers live in band of 10-30 individuals. Settlements may be either temporarily, permanently or a combination of two depending upon the mobility of the community. Hunter-gatherers societies also tend to have non-hierarchical, egalitarian social structures, thus such things as wars in hunter-gatherers societies are common and these are usually caused by grudges and vendettas rather and not for territory or economic benefits. Archaeological and ethnographic evidence reveals that hunting is a men's activity while gathering wild fruits and vegetables is women's gather responsibility. The exception of this general pattern is found among Aeta people of Philippine states where 85% of women do hunt and they hunt the same quarry as men. Hunter-gatherers are generally not able to store surplus food.

In Iramba and Mbulu Districts hunter-gatherers (Hadzabe) comprise about 0.3% of the population. Other ethnic groups in the study area are Nyiramba, Nyaturu, Taturu, Barabaig, Sukuma and Iraqw. Overall, 90% of the people in Iramba and Mbulu Districts live a subsistence lifestyle, depending on wild animals and fruits, food crops, livestock and crafts for food and income. The Hadzabe who are hunter-gatherers could be the most susceptible ethnic group to climate change impacts in the study area since they survive solely on fruit-gathering and hunting down wild animals for food. However, the sustainability of these food sources are highly at stake owing to the current climate change (Ihucha, 2008). In a food situational analysis report (IDC, 2007) on the effect of climate change to hunter-gatherers, people in Munguli village were reported to having been facing water and food shortage and were found to be eating food which was uncommon in the area due to climate change (IDC, 2007).

Various measures have been taken by communities or households to respond to events affecting normal life. These measure are called coping strategies. Coping to climate change and variability is a short time adjustment of a system to moderate the impacts of climate change and take advantage of new opportunities (IPCC, 2007). Coping refers to the action people take in response to, or in anticipation of, projected or actual changes in climate, to reduce adverse impacts or take advantage of the opportunities posed by climate change (Parry *et al.*, 2005). Thus, coping reduces communities' vulnerability or increases their resilience to climate shocks. In many cases coping activities are more local (i.e. District, regional or national) issues rather than international issues (Paavola *et al.*, 2005; Parry *et al.*, 2005). This is because

different communities in different geographical locations and scales possess different vulnerabilities and adaptive capabilities, and so they tend to be impacted differently, thereby exhibiting different adaptation needs. As a result, coping largely consists of uncoordinated action at household, firm and organisation levels (Paavola *et al.*, 2005).

Therefore, research on hunter-gatherer food coping strategies is important with the anticipation that, it will make local population well informed on local perception and coping strategies on climate change and therefore making an important contribution to reducing climate change proneness and ultimately to reducing food insecurity and increase income levels particularly those of hunter-gatherers.

1.2 Problem Statement

Regional report indicates that Tanzania suffers a loss of livestock and harvests, by 10% of its grain production because of drought and floods in some seasons (FSIT, 2005). According to Ihucha (2008), hunter-gatherers face food shortage every year since most of them depend on fruit-gathering and hunting down wild animals for food all of which are threatened by current climate change. The prominent climate change effect in Mbulu and Iramba include the shortened and erratic rain seasons in the District. For example in 1984, an increase of plant and animal diseases and drying of formal water sources and recurrent hunger were reported in Iramba (IDC, 2008). According to (MDC, 2009), the local government of Mbulu District is working hand in hand with village government and NGOs such as FARM-Africa to solve the problem of food insecurity and water shortage (drying main water source) in Yaeda valley.

Despite the efforts made by the government and NGOs in assisting hunter-gatherers to solve food and water shortages there is scanty information on hunter-gatherers (and specifically the Hadzabe) pertaining to awareness of climate change and wild food availability. Also little has been done to disclose the coping strategies used by hunter-gatherers with respect to climate. The call for undertaking this study comes from the fact that there is a continuous climate change while there is limited information on how hunter-gatherers are affected and how they overcome the adverse effect of climate change in Iramba and Mbulu Districts.

1.3 Justification of the Study

In Tanzania, a number of initiatives have been undertaken; policies, strategies and programmes were put in place to address environmental concerns due to climate change, food security and poverty reduction. These include the National Environmental Policy; the Environment Management Act, 2004; Rural Development Policy; the Agricultural Sector Development Strategy (ASDS), the Tanzania Assistance Strategy (TAS); the National Strategy for Growth and Reduction of Poverty (NSGRP); and the Tanzania Development Vision 2025 (Mwandosya *et al.*, 2006). All of the programmes mentioned above were concentrated on solving non-hunter-gatherers problems and leaving behind Hadzabe. Any empirical effort on the assessment of Hadzabe coping strategies on climate change in Iramba and Mbulu Districts will have a positive impact toward household food security, poverty reduction and environmental conservation, since it will not only generate comprehensive information but also it would document information on livelihood of Hadzabe during adverse climate conditions. Information on the problems

encountered and their possible solutions would be useful to the government, development partners and other relevant stakeholders in designing strategies for supporting and improving the local coping strategies, which will lead to the reduction of insecurity and poverty.

1.4 Research Objectives

1.4.1 General objectives

Generally the current study intends to assess Hadzabe coping strategies on climate change in Iramba and Mbulu District.

1.4.2 Specific objectives

Specifically the study set out

- i. To establish the perceptions of Hadzabe on climate change
- ii. To identify Hadzabe' food insecurity coping strategies toward climate change
- iii. To assess the extent of food availability and stability to Hadzabe

1.4.3 Research questions

The study was guided by the following research questions

- i. What are the Hadzabe's perceptions toward climate change?
- ii. What are the Hadzabe's food insecurity coping strategies toward climate change?
- iii. To what extent is the food available and stable to Hadzabe?

1.5 Conceptual Framework

The framework focused on the relationship between hunter-gatherers' coping strategies and climate impact (Fig.1).

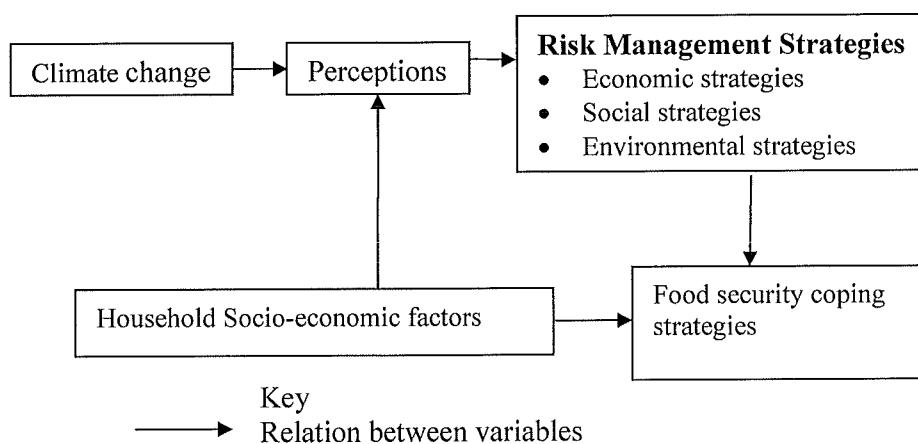


Figure 1: Conceptual framework of the study of Hadzabe coping strategies on climate change in Iramba and Mbulu District

The variables show the relationship between hunter-gatherers perception on climate change impact and coping strategies. (Table 1).

Table 1: Operational definitions of key variables

Variables	Operational definition
Demographic variables	Variables include age, sex, household size, marital status, and education level of respondent.
Food coping strategies	Activities to respond to shocks (droughts). Such as dependence on remittances, switching to non-hunting activities
Perception	Perception is a way of conceiving (an instant mental judgement) risks
Economical strategies	Diversification of activities such as, non-hunting supplements to household income.
Social strategies	Gift or loaning food, livestock, or cash; and some cases sending members of a distressed family to live with more fortunate relatives or friends
Environmental strategies	Different ecological potentials, which permit hunter-gathers diversify their activities or move their family from one area to another with response to the availability of food and water

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Overview of Climate Change

Historical data show that the globe is already undergoing climate change. This has serious implications for water resources, food security, and the spread of disease, the productivity of natural resources and desertification (IPCC 2001). Leichenko and O'Brien (2002) have estimated that the two severe droughts in the southern Africa region in 1992 and 1995 reduced the total cereal production by nearly half (12 555 000 against 22 848 000 metric tons) and one-third (19 192 000 against 27 838 000 metric tons) in the respective preceding years. The food shortage of 2003/2004 in Tanzania and which was caused by dry spell that occurred between mid-January and a third week of March in 2003 reduced crop yield by about 50-90%, particularly in dry areas. This dry spell left over two million people, most of them in rural dry land areas, severely food insecure and had to depend on relief food (FSIT, 2005).

The National Action Programme to adapt to Climate Change identifies the immediate and urgent climate change vulnerabilities as the main barrier to achieving the Millennium Development Goals (MDGs), as internationally agreed targets for reducing poverty, hunger, diseases and environmental degradation (Matari, 2006). It also strives to identify and prioritize the immediate and urgent needs that will be addressed both by the government and the international community in order to provide the required support to address these vulnerabilities. Also, according to Vulnerability Assessment Report (VAR) on climate change Disaster Vulnerability Assessment Phase II (PMO and UCLAS, 2003) showed that, Tanzania has

experienced several natural weather events that have been particularly severe. These events such as extreme drought in three quarters of the country in 2004 –2005 have had adverse effects on the natural and economic environments of the country. As a result of these changes, several sectors of the economy are vulnerable. These sectors include agriculture, water resources, health, forestry, grasslands, livestock, coastal resources and wildlife and biodiversity.

2.2 Impacts of Climate Change.

2.2.1 Impact of climate change on crop pests and diseases

According to government statistics, over a third of Tanzanians (36%) live below the basic needs poverty line and almost one in five (19%) survive below the food poverty line (URT, 2005). Agriculture and natural resources including livestock sectors are vulnerable to climate variability and change. Since majority (80%) of Tanzanians depend on agriculture and natural resources, excessive rains have direct bearing on crop diseases compared to drought, hence low yield thus food shortage. PMO and UCLAS (2003) showed that areas that grow many crops are reported to be prone to more pests and plant diseases due to climate change. However, there is no documented information on the effect of diseases on wild plants (used as food by Hadzabe) due to climate change.

2.2.2 Impact of climate change on livestock diseases

The impacts of climate change on livelihoods may be felt indirectly. For example, livestock distribution and productivity may be affected through changes in the prevalence of (vector-borne) livestock diseases, and in the quantity and quality of

rangeland (IPCC, 2007). Milk and meat production are also likely to fall as climate change reduces the livestock carrying capacity of the already over-stretched rangeland areas. Vulnerability Assessment Report (PMO and UCLAS, 2003) shows that in Tanzania Foot and Mouth Disease (FMD) is still on the top of the list, followed by East Coast Fever (ECF), Rabies, Anthrax, Rinderpest and Rift valley fever. The same reasons are given for the occurrence of livestock diseases; climatic change, prolonged heavy rains or dryness which favours the occurrence of diseases and insect pests due to both increased temperature and rainfall. The livestock diseases have no direct effect to Hadzabe daily life, simply because they neither keep animals nor eat domesticated animal meat. However, Hadzabe are surrounded by pastoralist and farmers (Barbaig, Iraqw, Nyiramba and Sukuma) and therefore any effect to livestock could lead to a trickle down effects (farm expansion) in wild resource which is a food reserve to Hadzabe.

2.2.3 Impact of climate change on water resources

The number of Africans living under water scarcity is predicted to double from 300 million people in 1990, to 600 million by 2025 (World Bank, 1995). Vulnerability Assessment Report (PMO and UCLAS, 2003) indicates that civil conflicts have been occurring between livestock keepers and farmers over pasture and water for the animals in Kilosa District, Mara and Kilimanjaro regions. According to Marlowe (2006), among the most serious problem to Hadzabe are land and water resources. The shortage of land and water for the Hadzabe are life threatening phenomena (Marlowe, 2007b). Shortage of rain leads to water scarcity which has adverse effects on wildlife and consequently on Hadzabe's lives.

2.2.4 Impact of climate change on forest resources

Climate change affects forests by altering the frequency, intensity, duration, and timing of fire, drought, insect and pathogen outbreaks, hurricanes, windstorms, ice storms, or landslide. These events cause large scale tree mortality and lead to community disturbances for those relying on agriculture and natural resources (Joshua, 2009). In Tanzania, global warming is having immediate and serious consequences. Mwandosya *et al.*, (2006) indicates that climate change is changing livelihoods, economies and even gender dynamics in families. For example, in Tanzania many cattle herders have switched to farming in the limited forest and wetter zones of savannah (Joshua, 2009). At first, the change was considered as a temporary remedy, but the increased frequency of the droughts has forced pastoralists to graze their livestock in farms leading to tensions resulting from encroachment of the land already occupied (Hatibu *et al.*, 2006).

2.3 Local Perception on Rainfall Variability

Perception is a way of conceiving (an instant mental judgement) risks (Hillson and Murray-Webster, 2004). Rural people have different pattern of perception because they thrive in varied contexts. According to Mutabazi (2007), certain people at specific place or time face different livelihood that a given risky hazard (e.g. drought, flood conflict) that occurs would be different from the one that might occur at another place or time. Moreover, Deressa (2007) reported that demographic variables such as age of the household head and education level, determines the level of perception of an individual to climate change. Since formal education plays a big role in awareness creation toward climate change only few Hadzabe do attend formal

education due to their nature of livelihood, the study thought to establish the relationship between perception on rainfall variability and education level.

2.4 Local Level Coping Strategy

Coping refers to shorter term actions and activities to respond to shocks (such as droughts) which take place within existing livelihood structures. Local level coping strategies to climatic shocks such as drought and floods vary across households and communities depending on the resources available and accessibility. These strategies may range from the collection of wild fruits, dependence on remittances from family members working in urban areas, switching to non-farming activities or in extreme cases, the sale of assets (Burton and Shohan, 1991).

The Hadzabe pursue semi-nomadic lifestyle characterized by hunting and gathering (Madsen, 2000). Hunter-gatherer societies livelihood depends primarily on subsistence method involving the direct procurement of edible plants and animals from the wild, foraging and hunting without significant alternative to the domestication of either crops or animals. Hadzabe obtain mostly from gathering up to 80% of the food is obtained by gathering rather than hunting (Marlowe, 2007a). Since there is a difference in livelihoods between farmers and Hadzabe, there is also a possibility of resemblance or disparity in the levels of local coping strategies because there is no literature explaining Hadzabe coping strategies on climate change.

2.4.1 Coping ability indicators

Coping ability indicators are referred to as indicators that reflect food access (Burton and Shohan, 1991). They include socio-economic variables that represent the degree of stress experienced by population as economic and social condition change and how the household respond to the changes. Recognizing that households are not passive to the stress, a major aspect of vulnerability to household food security is the ability of household to cope with the stress. These types of indicators which are narrated below, provides information on how the population affected by a shock or disaster withstand the effect. For example, those who live in the conditions that put their main source of income at recurrent risk tend to develop some self-insurance coping strategies to minimize risks of their household food insecurity and livelihoods (Longhurst, 1986; Corbett, 1988). Such coping strategies may involve dispersed grazing, change in cropping and planting practices, migration to towns in search of non-farm employment, increased petty commodity production, collection of wild foods, use of inter-household transfers and loans and use of credit from merchants and moneylenders.

Others may include migration to other rural areas for employment, rationing of current food consumption, sale of firewood and charcoal, sale of possessions (e.g. jewellery), consumption of food distributed through relief program, sale of productive assets, break-up of households and distress migration (Corbett, 1988). In the study area, there is no documented coping strategy shown for Hadzabe toward climate change.

2.4.2 Coping strategies against food insecurity

One aspect of the food crisis that has received relatively little attention from the policy makers is the role and status of local village-based strategies for coping with climate change (Zinyama, 1987). It is now recognized that between the emergence of the problem and the arrival of the external assistance, local people tend to employ a variety of strategies to mitigate the food shortage.

Coping strategies include activities which may appear insignificant and not identifiable from the overall rural food production system in years of plenty, but which assume increasingly greater importance in times of food deficits. Coping ways can be viewed as adaptive devices, which are culture specific, which people use to accommodate themselves to a given environment. Rural people under the guidance of their culture, have ways of minimising the impact of hunger. These ways are reflected in their dietary habits and livelihood practices. The main tool for developing these strategies is the indigenous knowledge possessed by these key actors (Katani, 1999). Nevertheless, due to difference in their socio-economic status, the coping strategies developed vary from region, community, social class, ethnic group, education of the head of the household, household size and the age of the head of the household (Deressa, 2007).

In real life, whenever food is scarce, people respond in various ways to reduce consumption. For example, taking one or two main meals per day instead of the normal three main meals per day (Katani, 1999), or taking the so-called inferior foods more frequently than before. Due to severe drought in 1998 people in some

parts of Tanzania including the Hadzabe area, were reported to be consuming food which is not used at normal food security. The types of strategies employed by household also tend to vary depending upon the severity and duration of the potentially disruptive condition (Zinyama, 1987). In the earliest stage of the crisis (stage one), households employ risks and loss minimising management strategies. This involves low commitment of domestic resources, enabling speedy recovery once the crisis has ceased. As the crisis persists, households are increasingly forced into greater commitment of domestic resources just to meet subsistence needs (stage two). There may be a gradual disposal of key productive assets making it harder to return to a pre-crisis state. At this stage, a household's vulnerability to food insecurity is extremely high. Stage three consequences include a failure to adapt to the crisis, usually involving destitution, and distress migration (Corbett, 1988). Food shortage in the study area occurs almost every year, where by relief food (grains) has to be sent to Hadzabe through emergency and disaster preparedness under Prime Minister Office (IDC, 2009).

2.4.3 Types of coping strategies

In a review of societal responses to natural hazards, Burton *et al.* (1978), cited by Mwangile (2001) views coping strategies as the totality of the societies' economic, social, and environmental resources reflecting their role as an integral component of the system. The described categories below are considered as the general responses to natural hazards to rural societies regardless of livelihood activity (i.e. hunter-gatherer, farmer, livestock keeper, etc.) performed by the society (Table 2).

Table 2: Traditional household coping strategies in the SADCC region

Environmental	Economic	Social
Stream bank Cultivation	Business	Extended family links (borrow food)
Gathering of wild food	Crafts	Pray to rainmakers
Hunting and fishing	Beer brewing	Raiding
Control access to water and pasture	Sale of livestock and household effects	Sharing, reduced meals, splitting herd
Mobility	Store food (grain and tubers)	Arranged marriage
Growing of drought resistance crops	Migration	Begging and stealing

Source: Ziyama(1986)

Hames and Draper (2005), identify four coping strategies that hunter-gatherers use to buffer against risk: prevention-of-loss, resource pooling, storage, and transfer-of-loss. These coping strategies are discussed categorically below.

2.4.3.1 Economic strategies

Economic strategies for coping with food insecurity include the diversification of activities in terms of animals hunted and berries gathered. Diversification also allows to some flexibility and allocation of household resources such as labour. Another economic strategy include the selling of household assets. Kajembe and Munyikombo (1998) have shown that, this type of income diversification is often a function of adaption to food insecurity. Anthropologists like Hames and Draper (2005) researched in Ju/'hoansi (hunter-gatherers in Kalahari Desert) community concluded that children as helpers, have been valuable workers during food in economic roles, i.e., children are engaged in agriculture while their parents are hunting and gathering. Also, Ju/'hoansi men were reported to have changed their

strategy by hunting large animals (i.e. after killing the meat is distributed to other hunters) because on return on the investment a hunter can expect to receive large meat from other hunters in the future. Intensive storage is an economic strategy that has been adopted in Ju/'hoansi community. Intensive storage that extends the availability of foods into periods of scarcity, and often it is employed by hunter-gatherer's who depend on resources with marked seasonal variations and gaps in availability (Rowley-Conwy and Zvelebil, 1989).

2.4.3.2 Social strategies

Social responses to food shortages are found in reciprocal arrangement based in membership in the institution such as family clan and age set (Zinyama, 1987). Social strategies include labour sharing (e.g. in tending for crop in the fields or caring animals); gift or loaning food, livestock, or cash; and in some cases sending members of a distressed family to live with more fortunate relatives or friends (Zinyama, 1987). Such strategies are reciprocal in that assistance given at any time may represent repayment of past kindness; or commitment on the part of those being helped to assist the help givers should they experience similar problems at the future time (Cashdan, 1985).

Resource sharing is a common social strategy used by hunter-gatherers in Kalahari Desert (Binford, 1991). Ideally the successes and failures of multiple foragers are spread among the larger group exploiting a diverse set of resources so that everyone has access to food each day. Also, transfer-of-loss that's shifting food from one group of people with food to another group of people with food shortage is used as a

coping strategy in hunter-gatherers community in Kalahari Desert, it is linked directly with variations in resource structure among groups of hunter-gatherers and it can take two forms. The first form is voluntary food supply, and the second form is raiding that result in involuntary transfer-of-loss. Resource sharing specifically food is a strategy used by Hadzabe during food scarcity (Marlowe, 2006).

2.4.3.3 Environmental strategies

Communities selectively use their physical resources base to reduce the likelihood of food shortage. Different localities, valleys, and hills provide different ecological potentials, which permit rural communities to diversify their activities and allow moving from one area to another where food and water are available (Ngana, 1983). Also, Cashdan (1992) identified environmental strategies in Ju/'hoansi community (Hadzabe in Kalahari Desert) called prevention-of-loss coping strategy which can occur over a very short to a longer time period. Prevention-of-loss coping strategies include changes in hunting weapons (use of a bow and arrows instead of a spear to shoot distant animals), transportation aides and information exchange among hunter-gatherers in places where food is available. The environmental coping strategies adopted in Kung community (hunter-gatherers) exploit resources by temporarily moving the residential camps to the food locations and bringing back food to the camp for the entire group (Kelly, 1983). Likewise, to Hadzabe whose derive their food from the jungle, negative effects caused by climate change on wild resource could lead to the reduction in wild food and affect Hadzabe life.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Description of the Study Area and Location

The study was conducted in Kirumi and Haydom Divisions in Iramba and Mbulu District Councils respectively in Tanzania. The study area lies between longitudes 34° and 35° and between latitudes 4° and 4°3". Eight Districts border the study area as follows. To the north are Karatu, and Meatu, to the east Babati and Hanang (Iramba District Council, 2009; Mbulu District Council, 2009).

Mwangeza ward in Kirumi Division and Yaedachini ward in Haydom Division were purposively selected for this study because these are the only Wards where the Hadzabe people live. Five villages, two from Mwangeza ward and three from Yaedachini ward were involved in the study. The villages are *Kipamba* and *Munguli* in Mwangeza ward and *Yaedachini*, *Mongo wa Mono* and *Domanga* in Yaedachini ward. Hadzabe ethnic group are click-speaking hunter-gatherers who mainly occupy an area within the lake Eyasi basin in northern Tanzania (Madsen, 2000). Their traditional territory extends over four administrative regions; namely; Arusha, Manyara, Singida and Shinyanga. In recent years, their coverage of the Yaeda Valley and Kideru Ridge above the valley in Iramba, Mbulu and Karatu Districts have increased in terms of numbers and density (Levin, 2005).

The area has geographically diverse landscapes. The Eyasi basin is typically arid and semi-arid with little rainfall (less than 400mm per year) with mean temperatures of 30°C and a terrain characterized by rocky and sandy soils that are very poor for

agriculture (Levin, 2005). The Hadzabe population ranges between 1,300 and 1,500, and their traditional area covers approximately 1,500 square kilometers (Madsen, 2000).

3.2 Research Design

A cross sectional design was used during data collection. According to Bailey (1994) and Babbie (1990), a cross sectional design allows data to be collected at a single point in time without repetitions from a sample selected to represent some large population and therefore using minimum time and resources. In this study, the design was favourable because of limited resources like time, labour (personnel) and transport.



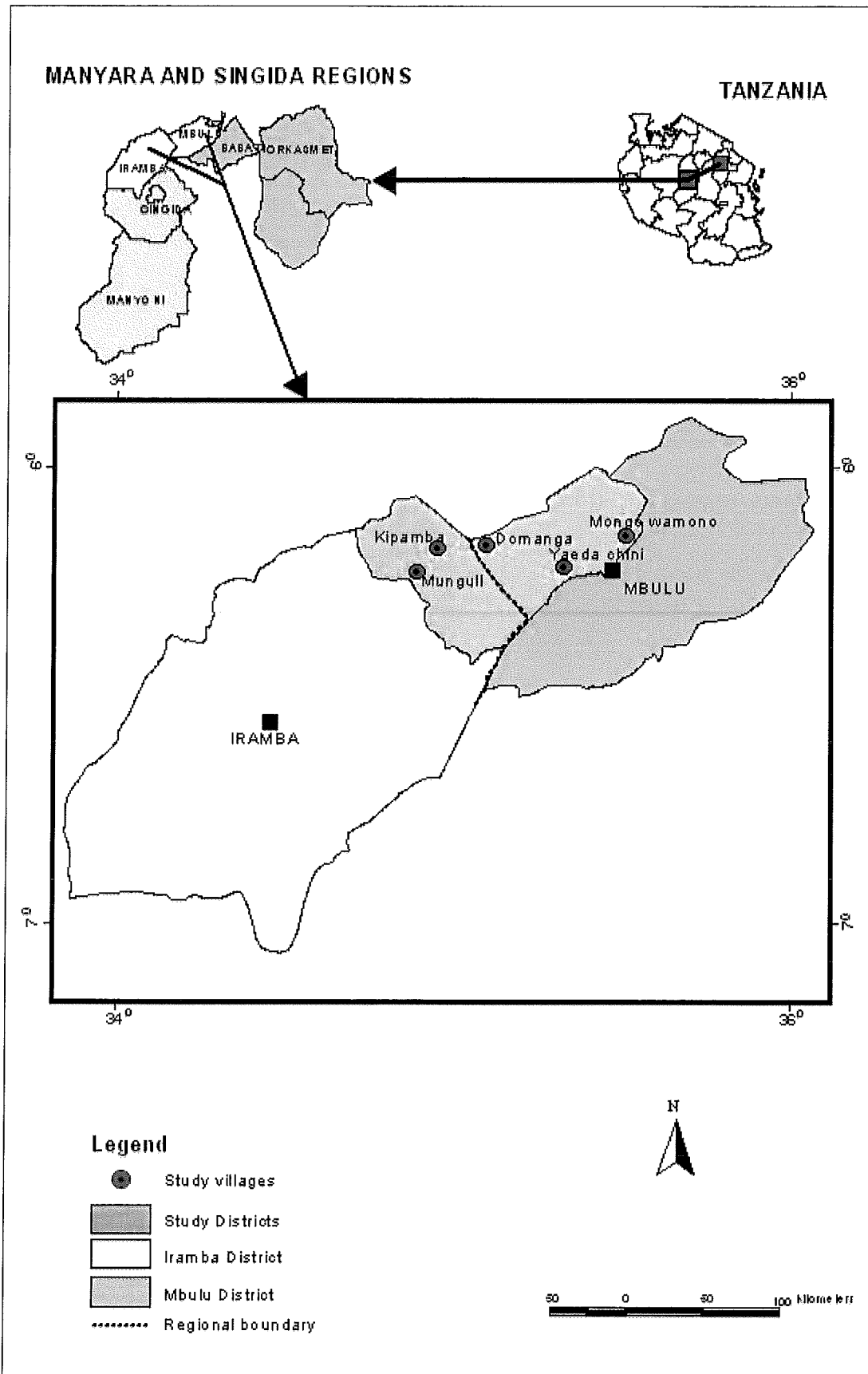


Figure 2: Map of Tanzania showing the study area

3.3 Sampling Procedure

3.3.1 Sampling unit

The population involved Hadzabe in Iramba and Mbulu Districts. The main target groups of sampling unit were the head of households because these are the most appropriate in assessing the level and standard of living of the society (Blackwood and Lynch, 1994). This provides substantial information related to the objectives of this study.

3.3.2 Sample size

The study sample comprised 100 respondents. Also 10 key informants were used to supplement the information.

3.3.3 Sampling method

The sampling methods used to get the required sample include purposive sampling and simple random sampling (SRS) techniques. The respondents were selected from the list of members using simple random technique. To obtain the desirable population, purposive sampling technique was used to obtain 5 villages, two villages from Iramba District and three villages from Mbulu District. This purposive technique has been generally recommended in social science research as it focuses directly on the area intended for the study (Kothari, 2006).

3.4 Data Collection Procedures

3.4.1 Primary data

A questionnaire with both open and closed ended questions and a checklist were used in the household survey, key informants interviews and focus group discussion.

Supplementary information, however, was collected through personal observation. The information gathered through key informants' interviews gave insights on the community-wide aspects of risks and coping strategies, and public responses to disasters.

3.4.1.1 Key informant interviews

Local and old people were involved in the research; the questions posed were reflected on perceptions on climate change and major climate change trend. Ten key informants were interviewed for every village

3.4.1.2 Focus group discussions

Discussions with focus group members were held around specific topics. These topics focused on coping strategies, sources of income or support, support networks, wealth ranking, environmental changes and hunting-gathering practices. The discussions allowed different groups of people (e.g. women, elderly, recent immigrants to the village) to express their views. The group of 5-6 persons was organised and considered appropriate for discussion. During wealth ranking in the study area, three major social-economic grouping were identified by the communities based on different assets and activities. These major social-economic groups include rich, medium and poor.

3.4.1.3 Individual interviews

Structured questionnaires and semi-structured interviews were conducted around a set of questions relating to livelihoods, coping strategies, informal institutions and

community interactions. Informal interviews lasted between one and two hours and were usually conducted in Kiswahili language at either respondent's compound or at the village compound. Some interviews were conducted using a translator from Hadza language (language spoken by Hadzabe) to Kiswahili.

3.4.1.4 Personal observations

This was conducted purposely with the assistance from one experienced or knowledgeable person in the village and who understand well the social settings, and different livelihoods performed in the village. This is a social and environmental method in understanding the distribution of households, resources and activities undertaken. Among the aspects involved in personal observations include the types of food eaten, housing and day to day activities.

3.4.2 Secondary data

Extensive review of secondary data especially previous studies/research and various reports on Hadzabe in Iramba District and Mbulu District were used. Secondary data were also collected through consulting different publications relevant to the study from Sokoine University of Agriculture National Library (SNAL), internet and informal discussion with staff and officials in Iramba and Mbulu Districts Council

3.4.3 Data management procedures

3.4.4 Data processing

Data from primary sources were summarized, edited and coded prior to entering in the computer.

3.4.5 Data analysis

Data analysis was done by using contents analysis and Statistical Package for Social Science (SPSS) programme. Notes taken during the interview were written up by a theme, as part of the analysis for each case. Descriptive statistics such as frequencies and percentages were described. The relations between some pairs of variables were determined through bivariate analysis including cross-tabulation.

The study objectives were analysed following analytical tool as follows: In establishing the perceptions of community on climate change, descriptive statistics was used; in identifying hunter-gatherers' food insecurity coping strategies toward climate change, descriptive statistics and cross-tabulation were used, and in assessing the extent of food availability and stability to hunter-gathers, descriptive statistics and cross-tabulation were used.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Background Variables of Respondents

This section discusses the background variables of the respondents. The variables involved are demographic which include age and sex, social ones, which include education, marital status, and household size. These variables were analyzed and discussed in the sub-sections as follows:-

4.1.1 Demographic variables of the respondents

4.1.1.1 Age

The age of an individual can influence productivity because the ability to carry out the daily economic activities, both farming and non-farming, will decrease with an increase of age. Therefore, age is an important demographic variable and is the primary basis of demographic classification in vital statistics, censuses, and surveys (NBS, 2005). The findings revealed that the age of the respondents ranged from 20 to 80 years old among the 100 respondents. Specifically about 75% were aged between 20 and 49 years old, 14% between 50 and 59 years old, and 11% between 60 and 80 years old (Table 3). According to Madulu (1996), the economically productive age range from 16 to 64 years old. The age groups below 16 and those above 64 are considered as a high dependency ratio age structure which is economically less productive. In Hadzabe village, age also plays a role in livelihood and coping strategies toward food security. It was reported that age between 18-40s years old is the best age for hunting and gathering. The age above 60 years old was reported to be the technical age for training young generation on hunting techniques. However,

children also were reported to contribute up to 10% of collected fruits at home during fruits season.

4.1.1.2 Sex

Sex is one of the basic and important characteristics of population for planning, labour division and administration purposes from household level to national level. The majority (68%) of the respondents in Hadzabe area were males and the remaining 32% were females (Table 3). This high proportion of males interviewed as opposed to female, was due to the fact that, in hadzabe tradition males are heads of household. Therefore, males were most likely to be interviewed simply because the head of household was the sampling unit and the males were the heads regardless of the fact that many activities were done by females. As Mushi (2000) observed that in cases where both a wife and a husband were available, the husband was interviewed because the researcher aimed at interviewing the head of the household.

Table 3: Distribution of respondents according to sex and demographic variables (n=100)

Variable	Male	Percentage	Female	Percentage	Total	Percentage
Age						
20-29	11	11	11	11	22	22
30-39	17	17	10	10	27	27
40-49	18	18	8	8	26	26
50-59	12	12	2	2	14	14
60-69	7	7	1	1	8	8
Above 70	3	3	0	0	3	3
Total	68	68	32	32	100	100
Marital status						
Married	57	57	25	25	82	82
Single	3	3	0	0	3	3
Widowed	7	7	6	6	13	13
Divorced	1	1	1	1	2	2
Total	68	68	32	32	100	100
Education level						
None	42	42	23	23	65	65
Standard 4	4	4	3	3	7	7
Standard 7	19	19	5	5	24	24
secondary school and above	3	3	1	1	4	4
Total	68	68	32	32	100	100

In the Hadzabe' area the pattern of gender roles was such that women dig tubers and gather fruits while men mostly hunt animals and collect honey. But due to climate change, some activities which used to be done by men only are currently done by women e.g. honey collection conversely some activities which were done by women only are currently also taken over by men e.g. fruits gathering. However, raising of kids is still done by women because of biological reason. This has been similarly

contended by Marlowe (2005a). Therefore many activities which are conducted near the homestead are left to women and hunting remains for men because of reduced animal availability near the homestead.

4.1.2 Socio-economic variables

4.1.2.1 Education

The level of education is an important factor in coping with climate change related disasters and particularly coping with risk and uncertainties related to food production. Regnar *et al.* (2002) considers the ultimate objective of education as to increase labour productivity and thus it is a productive force for human being and thus very important for their ability to utilize efficiently the advice and information offered by the extension service providers and other development agents. The proportion of the respondents with primary school education (standard 1-7), was 31% (Table 1). Very few (4%) of those interviewed had achieved a secondary school. Nevertheless 65%, of the respondents have not gone to school at all. The study findings revealed that most of households in the study area have no formal education, which is important in any innovations uptake for issues on good management practices/new technologies and for a fight against poverty and thus to raise household resilience toward hazard. The Hadzabe sluggishness in changing their life style could be attributed to lack of formal education among the residents in the study area.

4.1.2.2 Marital status

Marriage has an effect on the production process as it increases labour availability in the household through sharing of activities between husbands and wives and among

other family members (Mtama, 1997). The finding of this survey (Table 3) shows that, 82% of women were married. On the other hand the entire household heads were either, widowed, single, or divorced, representing 13%, 3% and 2% respectively. The proportion of the married respondents was greater than that of the other categories. Survey findings seem to be higher than those reported by National Bureau Statistics (NBS) and Tanzania Demographic and Health Survey (TDHS) (2005). According to these sources, about 66% of women in economic activities are married. This implies that the marriage has an influence on daily economic activities because of family commitment. The high percentage of married women in the study area as opposed to that reported by Tanzania Demographic and Survey could be a strategy imposed by Hadzabe to make sure that more food is brought home to cope during food shortage. The same result was reported by Marlowe *et al.* (2009b) who reveals that, Hadzabe who has a biological child ≤ 8 years old at home, and/or is married, takes back to camp significantly more daily kilocalories of food than does a single person without young biological children at home.

4.1.2.3 Household size

A household refers to a group of people either related or unrelated, who are answerable to one person, often regarded as the household head. Members of the household share a dwelling unit or structure and have the same housekeeping arrangements (Nduwamungu, 2001). Similarly URT (2005) defined a household as one or more persons who make himself or themselves provisions of essentials of living. The persons in the group may be related, unrelated or both. But usually this type of household includes a husband, the wife, children and other relatives.

Throughout this research, the household size was categorized into three groups (Table 4); below 5, between 5 and 10 and above 10 household members. About 35% of the respondents had household sizes ranging from below 5 household members, 63% between 5 and 10 and 2% above 10 household members. The minimum and maximum number of people observed per household was 2 and 10 respectively (Table 4) with average household size 5.

Table 4: Distribution of respondents according to village and household size (n=100)

Household size	Mongo					Total percentage
	Kipamba	Munguli	Yaedachini	wa Mono	Domanga	
Below 5	8	9	6	7	5	35
5-10	12	11	13	12	15	63
Above 10	0	0	1	1	0	2
Total	20	20	20	20	20	100

From the survey it was found that an average household size of 5 members, which is relatively smaller than the figure stated in the URT (2005) which puts the average of 5.1 members in Iramba District Council whilst the average household size in Tanzania stands at 4.9. This is consistent with ILO (2001) cited by Munyu (2006) where in rapid assessment undertaken suggested that a big family is that with more than 6 people. Nduwamungu (2001) reported that there is a strong relationship between household size and resource exploitation. Large household to a large extent over-exploits the natural resource in order to meet basic needs (Madulu, 1996). From the study area however it was revealed that household size has no impact on Hadzabe livelihood since the number of people per household is small and naturally the birth rate is very small hence there is no resources over-use.

4.2 Establishment of Perception on Observed Pattern of Rainfall Variability

In order to have a clear understanding on the perceptions of climate and climate change in the study area, group discussions and individual interviews were held. The major focus of the discussion was on how the people understand and define the extreme events (floods or droughts). The groups and individuals were supposed to give characteristics for the answers they were giving. Bad years in terms of weather have been reported to be in the rise, the reasons given include the desertification due to increased human activities (pastoralists and farmers) particularly forest clearing for the following reasons; (i) Expansion of agricultural activities and (ii) Increased grazing area (more livestock). On the other hand good years have been reported to be decreasing due to frequent and recurrent drought. The rain seldom comes on time. Furthermore, it has been stated that during prolonged rain season there is an increase in wild-fruit diseases, but this need to be examined so as to establish the linkage with climate variability. Below (Table 5) summaries the opinions of the focus groups members.

Table 5: Description of good and bad years and their characteristics

Season variables	Characteristics
Good year	
Rain start early and rains for a long time	There is no water shortage Vegetation/trees sprouting early leads to plenty food in the jungle
Absence of water shortage	Enough water for livestock and domestic use
Absence of severe diseases	People are healthy
High number of immigrants	More food in the village
Bad year	
Severe hunger in the village	Poor, few food in the jungle
Human diseases (Malaria, typhoid)	Very hot, much water
Water is scarce	Low rainfall, Very high temperature

The descriptions are given in terms of good and bad years; to the Hadzabe good year means rain is reliable, no severe diseases and the number of Hadzabe coming from other villages is high. Basically, a good year is characterized by plenty of food and water and people having healthy conditions. Bad year is characterized by severe hunger, prevalence of human diseases and water scarcity in water points. Hadzabe therefore, are aware of rainfall variability as shown in Table 5.

During bad years some households tend to sell their labour to either community works or to their neighbouring farmers (Sukuma and Iraqw) such as building schools, roads and agricultural activity. Also they sell their few assets so as to buy food. The assets which are sold mostly include radios, bicycles, and goats. Moreover it has been reported that during bad years some conflicts emerge due to the fact that some people do move in their area with their livestock in search of pasture land and for growing crops. This leads to conflicts between farmers and hunter-gathers because farmers clear the bush (food reserve) for crop production.

4.2.1 Local perceptions on climate and climate change

During discussion with Hadzabe, it was revealed that good years in terms of climate are becoming less. Generally, rainfall variability and the occurrence of extreme events are more pronounced in terms of onset and cessation of the rain season, the number of rain days, rainfall intensity, and the magnitude of drought and flood events. The results presented in Table 6 indicate that 94% of the respondents have experienced rain oriented problems, while 6% have not experienced any rain related problems. The most common rain variations experienced in the study area include a

decrease and delay in rain and early rain season. About 57% of the respondents indicated a decrease in rainfall per season, 38% of the respondents indicated a delay in rain season, 4% did not know anything on climate change, and only 1% indicated early onset of rains compared to past decades. In the study area, however, drought followed by flood was cited by 89% of the respondents as a serious problem and 11% of the respondents mentioning floods (Table 6).

Table 6: Trends and patterns of climatic events

Parameter	Frequency	Percentage
Perception on observed pattern of rainfall		
Variability		
Yes	94	94
No	6	6
Total	100	100
Mentioned climate change vents within 10		
Years		
Drought	89	89
Floods	11	11
The most common rainfall variation		
Experienced		
Delay in rain season	38	38
Early rain season	1	1
Little rainfall	57	57
Do not know	4	4
The impact experienced from Rain variation		
Problem		
Drought	62	62
Hunger	33	33
Early food recovery	1	1
Do not know	4	4

It was reported during discussion that floods as opposed to drought have little negative impact on Hadzabe in the study area, the reasons given include the fact that floods, increases the amount of water in the soil as well as water points (the place for trapping and ambushing animals). In the uplands, tubers increase in size, quantity, and quality because the moisture in the soil is enough thus tubers can not easily shrink and become bitter during dry season; also the trend makes some berry trees to

bear fruits twice a year. The result reveals that 94% of the respondents of different ages, education level and sex have experienced the climate change and its variability. Therefore age, education and sex of the household head, have no significant impact on people's perception of climate change simply because climate change variability to Hadzabe involves observation and feeling.

4.2.2 Description of major climatic events and their associated impacts in the study area

Based on the descriptions Tables 5 and 6, hunter-gathers were able to map out bad years in terms of climate and the associated impacts. Table 7 presents a summary of major climatic events obtained in the study area.

Table 7: Major climatic events and their associated impacts in the study area

Year	Event	Impact
1983-1984	Drought	Great famine. Wild animal shifted to water points. Many people died and migrated.
1998	Too much rain (El Nino)	Plenty tubers, specifically to uplands
2002	Early rain season	Early food recovery (tubers, fruits and honey).
2003	Drought	Hunger, people migrated to other places
2006 and 2009	Drought	Hunger, influx of pastoralists and farmers to our villages leads to often conflicts.

The most famous events which were remembered by Hadzabe include the great famine that occurred as a result of prolonged drought in 1983/1984 and heavy rainfall in 1998. These events represent the indicators of climate change in the study area. Table 7 shows the major impacts of climate change on livelihoods activities. The Hadzabe complained that their way of life has changed. More specifically, hunting and gathering have been affected. Wild food is increasingly becoming scarce

and unpredictable due to drought, hence people's movement to other places in search of food (foraging migration). The migration is sometime temporary since people tend to move during bad years and come back during good years. As it is shown in Table 7 above, hunger and diseases prevalence are escalated by extreme change in rain regime. Therefore, change in weather has a big impact on hunter-gatherers' livelihood.

4.3 Major socio- Economic Livelihoods

A number of studies have indicated that poverty levels among communities in the villages is well determined by social or wealth status of the groups and have a well established relationships in terms of livelihoods when the impacts associated with extreme events such as drought or floods occurs. According to Yanda *et al.* (2005) during food shortage, poor people in the villages normally sell labour to the rich people in order to sustain their livelihood in exchange with an income or a payment in kind. In this study, the identification of different socioeconomic groups per village was important in order to; (i) determine their vulnerability to climate change and variability and (ii) to establish how different social groups cope with climate change and variability.

The main socioeconomic undertakings in the study area are divided into three major groups namely; hunting and gathering, farm related activities, and non-farm related activities. All farm activities performed in the study area by Hadzabe were at rudimentary stage. Thus, modern animals and crops husbandry techniques were still neglected. Table 8: indicates that 54% of the respondents were still engaged in

hunting and gathering, 42% were farmer-hunters-gatherers, 3% were engaging in beekeeping and 1% of the respondents were working as civil servants.

Table 8: Distribution of activities performed in the study area (n=100)

Activity	Kipamba	Munguli	Yaedachini	Mongo wa Mono	Domanga	Total percent
Beekeeper	2	1	0	0	0	3
farmer-hunter	0	15	20	3	4	42
Hadzabe	18	3	0	17	16	54
Civil servant	0	1	0	0	0	1
Total	20	20	20	20	20	100

Due to social and physical constraints, there have been a number of other non hunting-gathering income generating activities in the study area. Minor activities which mentioned during group discussion include petty business (kiosk and selling honey) and engaging in cultural tourism for some villages in the study area. Cultural tourism is increasingly becoming a source for income to the community where by, Dorobo Safaris (Tourism Company) has established the temporary camps for tourists at Mongo wa Mono and Domanga villages. At these camps, Hadzabe are allowed to exhibit their culture and taking photographs with tourists on payment. Tourism sector nevertheless, is still seasonal and it is affected by a low level of tourists flow into the village.

According to village leaders and elders, immigration is more common than emigration in the study area. The immigrants are coming from different places and they are either permanently or temporal settled depending on the cause of their migration. It was revealed that Hadzabe from Meatu and Karatu Districts have been migrating to Kipamba and Mongo wa Mono village, the reason for migrating being

hunting and gathering due to the fact that their former domicile areas have been changed to either tourism hunting, game controlled area or other investments. Likewise, Sukuma, Nyisanzu and Iraqw have been coming and permanently settling in the area for the purpose of farming. These new ethnic groups were reported as the change agent for Hadzabe culture. Apart from that, Barbaig was mentioned as a native ethnic group in the study area for many decades, the only difference between the two groups reside on their livelihoods. While Barabaig are typical pastoralists, Hadzabe are hunter-gatherers.

4.4 Hadzabe's Wealth Status

The wellbeing of the head of the household reflects the resilience level against food shortage in rural area. Basically, classifying wellbeing of an individual is an arbitrary exercise and therefore, it depends on criteria set by a particular community. In the study area, three major social-economic groups were identified by the communities based on different assets and activities. A number of factors were considered in identifying the major socio economic groups and these include: i) the amount of livestock a person owns (chicken, goat or sheep); ii) the size of farm land a person owns and use; iii) food security situation (amount of food and sustainability); iv) the number and types of house(s) a person has; v) the number and types assets a person has (bicycle, mobile phone and radio); vi) the amount of money a person has at the time. During wealth ranking (Table 9), it was revealed that majority of the population own few resources. Therefore the types of activities (Plate 1) performed and assets owned by individual household are extremely weak to cope with climate change. Weak in asset resource to hunter-gatherer was explained by the fact that, to keep, no

any body is either allowed to keep or to eat domesticated animals because of taboo beliefs. And also to engage in agriculture and keeping animal was reported as tedious activities compared to hunting and gathering.

Table 9: Contemporary wealth status in the study area

Major criteria	Rich	Medium	Poor
Amount of livestock a person owns	3 goats and chicks	2 chicks	owns 0 livestock
Amount of money (Tshs.) a person has at a time	20 000	3 000	<2 000
The size of farm land a person use	2 acres	0.5 acres of farm land	Has no farm
Food security	Has food which suffice 10 months and above in the year	Has food for sufficing for 6 months	Has food, suffice only 3 months
Number and type of house(s) a person has	Has a house made by mud bricks roofed with mud (tembe) some time corrugated iron sheet	Has house made by mud	Owns a houses thatched entirely by grass.
Number and types assets A person has	1 bicycle, mobile phone and radio and hand hoe.	Has radio and hand hoe,	Arrows and Bows

4.5 Division of Labour Among Hadzabe

The Hadzabe are not territorial based and people are free to move wherever they please, though a core group of people tends to rotate through the same sites. During group discussion it was revealed that the Hadzabe women dig tubers and gather fruits while the men mostly hunt mammals and birds and collect honey and fruits. Also as for the nature of hunting and gathering it was observed that, normally girls along with their mothers collect wild fruits and vegetables, although occasionally also young boys may accompany their mothers and sisters and contribute a lot to family

food stock. As Kajembe and Munyikombo (1998) also, reported that a big proportional of women (46%) followed by children (28%) are involved in collecting wild food and men collects (19%). Few Hadzabe are trying to engage in agriculture, though is under poor performance (Plate 1). Since agriculture, is still a new activity to Hadzabe, there was no clear division of labour.

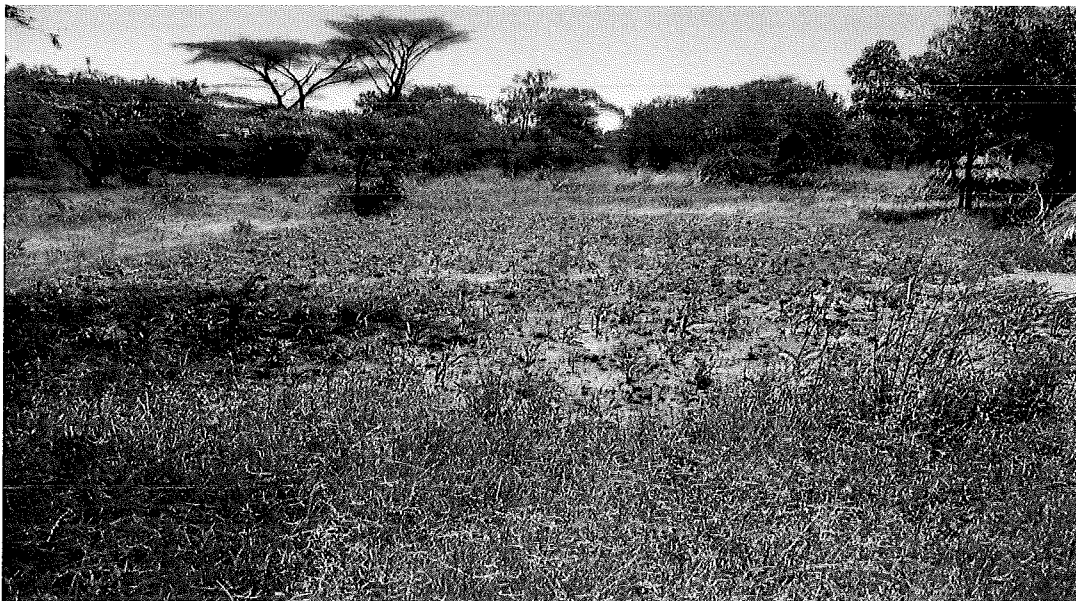


Plate 1: A poor maize farm managed, exemplifying the poor contribution of agriculture to Hadzabe's livelihoods

4.6 Status of food Insecurity in the Study Area

In the study area, chronic food insecurity was observed. Chronic food insecurity is a long-term or a persistent food shortage, it occurs when people are unable to meet their minimum food requirements over a sustained period of time and it is caused by extended period of poverty, lack of assets, and inadequate access to productive or financial resources (FAO, 2006). The types of food insecurity were determined by asking the respondents about the occurrence of food shortages. The results (Table 10) shows that 77% of the respondents reported their experience of food shortage as

being frequent, while 22% of the respondents indicated that food shortages were happening not every year and 1% respondent was food secured. Furthermore, 76% of the respondents face food shortage of between 3-5 months period per year, 16% and 8% showed food shortage of between 6-7 months and 0-2 months per year respectively. This food insecurity in the study area could be attributed to the fact that some households have a high level of dependency on natural resources which are affected by current climate change. The households which indicated to be food secure in the study area, were those whereby one of household members is either a civil servant or that the entire household is engaging in agriculture. The above findings suggest that the population in the study area has chronic food insecurity.

Table 10: Critical months of food shortages per year in the study area

Variables	Kipamba	Munguli	Yaedachini	Mongo wa Mono	Domanga	Total percent
Months of food shortages per year						
0-2		4	1	0	0	3 8
3-5		11	19	20	9	17 76
6-7		5	0	0	11	0 16
Total		20	20	20	20	20 100
Availability of food in the jungle						
Often		19	12	6	20	20 77
Sometime		1	7	14	0	0 22
Not at all		0	1	0	0	0 1
Total		20	20	20	20	20 100

Food security at household level is not only affected by the composition and quality of the daily meals but also, the quantity and seasonal availability of staple food in the jungle. Food shortage in the study area actually, starts in July and ends in February the following season. Most of the households which are prone to food shortage are

those which solely depend on hunting and gathering. The mentioned months of having food in plenty are March up to June every year. The reason given is that in March the berries start ripening while in May and June honey harvesting starts and reaches its peak in July. It was further reported that the honey sector is affected by climate change in two ways; firstly the honey harvesting time is altered because of unpredictable rain season and secondly the amount of honey has been declining over the past decades. The reduction in the amount of honey could literally be explained by the reduction in the amount of water and plant flowers which are the main honey ingredients.

4.7 Coping Strategies Against Food Insecurity

Coping strategies are the ability of the people, households, and communities of withstanding adverse circumstances. Food coping strategies are divided and discussed into three categories namely economical strategies, social strategies and environmental strategies. For every category the discussion is based on Table 11.

4.7.1 Economic Strategies

Economic strategies for coping with food insecurity include the diversification of activities in terms of hunting and gathering, animal owned, and both non-hunting and off-hunting supplements to household income. Petty business was another important off-hunting and gathering activity that was mentioned as a coping strategy for food shortage. The reported prominent petty businesses in the study area as shown in Table 11 involved the sale of honey and running small shops (kiosk 10%, and selling of assets (4%). The assets sold include small ruminant animals, chicken and cultural tools like bows and arrows which portrays their culture to tourists for payment. The

Hadzabe who conduct petty business are those living together with other ethnic groups (farmers), for example, in Yaedachini village the Hadzabe who live with other tribes, have adapted the culture of other ethnic groups. This association between Hadzabe and non-hunter-gatherers indicates that hunter-gatherer coping strategies depend on non-hunter-gatherers and therefore implies that it is difficult to isolate Hadzabe from other non-hunter-gatherers communities despite of the differences in their livelihood.

It was further noted that all of the fruit trees in the study area were indigenous. Baobab for example, was reported by hunter-gatherers from the study area to be a source of income, especially during the dry season. The same results were reported by Kajembe and Munyikombo (1998) who said that wild products play a direct and indirect role in food security. The direct role is by consumption and indirect role is by selling to generate income for other expenditure.

4.7.2 Social Strategies

Social response to food shortages include labour sharing; gift or loaning food, livestock, or cash; and in some cases sending members of a distressed family to live with more fortunate relatives or friends (Zinyama, 1987). About 52% of the respondents reported reliance on food from government and NGOs as a social strategy shown in Table 11. The NGOs and government have established a time frame which indicates the time when hunter-gatherer becomes prone to food shortages every year. Principally, food shortage in the study area starts in December and ends in February.

Table 11: Distribution of food coping strategies of hunter- gatherers toward climate change (n=100)

Coping with food shortages	Respondents	Percent
Relying food from government, NGOs, etc.	52	52
Eating food which have not used before	6	6
Migrate	17	17
Food borrowing from relatives and selling labour	20	20
All of the above	1	1
Selling of some of assets	4	4
Total	100	100

Borrowing in the context of this study is that kind of informal food loan among households. Food surplus households (non-Hadzabe households) give food to food deficient ones with the expectation of repayment. In the study area 20% indicated to be engaging in borrowing (Table 11). Basically, borrowing is done in agreement between Hadzabe and farmers. Depending on mutual agreement, generally repayment is done and most of the food used to repay back include wild meat and honey.

4.7.3 Environmental Strategies

Environment in this context means forest resource and its components. In rural Africa, wild foods provide a diversity of vitamins and minerals in the diet. Wild foods are important as a main and supplement to daily diet, and at times of food scarcity (Ngana, 1983). In addition, they provide an opportunity to generate income when they are collected and sold. Due to climate change, wild foods are used as coping strategy for rural communities in food shortage.

The Hadzabe in the study area depend on wild food, therefore, any change in wild food due to climate change has a big impact on the Hadzabe's daily life. Table 11 shows that 17% of Hadzabe people were reported to have migrated to the areas where there is enough wild food and 6% of the respondents reported to have been eating wild and other foods which they have not been used to before because of food scarcity resulting from climate change. The Hadzabe who migrated to the area first, went to demarcated villages for the Hadzabe in Mongo wa mono and Kipamba villages. These villages were purposively demarcated by the government as the sole villages for Hadzabe. In order to stress the importance of forest resource to hunter-gatherers, Marlowe (2006) contends that environment is a main source of food and it provides about 95% of food to the Hadzabe. Grains food for example, was among the mentioned food not eaten by Hadzabe for the past decades. However due to difficult circumstances faced. The Hadzabe are forced to eat such foods. Also, immature and pregnant animals, fishes, Amphibians and reptiles were not eaten when food was plenty due to customs reason, but nowadays these items are increasingly becoming common food. These provisions are usually eaten when there is a shortage and therefore demonstrate the Hadzabe coping strategies.

In environmental coping strategies, age was reported to play a big role. The active age for hunting was reported to be between 18-40s years old. The reason for this superb age of hunting could be due to the type of livelihoods performed by the Hadzabe which involves long distance scavenging for food in the jungle. According to Blurton *et al.*, (1989); grouping the population into economically active and inactive population is arbitrary and excludes a considerable number of children who

participate in the family's labour force. Old people (above 40s years old, Plate 2) were reported to be important specifically in teaching such techniques as ensnaring animals and identifying sites for hunting and gathering because of the experience they have. Therefore age of an individual plays a big role and it depends on the environmental support.



Plate 2: An old Hadzabe woman whose role is to teach scavenging techniques to young generation

In food coping strategies gender also was reported to play a big role. Although 32% of the Hadzabe interviewed (Table 3) were female, there was evidence of high responsibility of female in day to day household activities such as house building, children caring, collection of berries and baobab and other foraging activities except hunting which is done by males. Being a female in the study area plays big role in the family food collection. Nevertheless, the major determinant of gender role is essentially food accessibility in the forest.

4.8 Livelihood Activities Adapted

The Hadzabe to a certain extent, because of climate change have adapted to more new livelihoods now than was the case in late 1990s. This change does not mean that specific individuals or class of people specializes on a particular activity. An individual can undertake anything ranging from hunting to gathering, farm to non-farm activities. There are a number of non-hunting-gathering related incomes generating activities in the study area. Table 12 indicates that 63% of the respondents have at least participated in agriculture as a means of livelihood. 10% have been engaging in petty business, 10% in crop and livestock keeping, 9% never adopted any, 7% were keeping bee and only 1% adopted livestock keeping.

Table 12: Distribution of livelihood activities adapted by hunter-gatherers toward climate change (n=100)

Livelihood activities adapted	Respondents	Percent
Petty business	10	10
Small size farm (0.5 – 2 acres)	63	63
Livestock keeping	1	1
Beekeeping	7	7
Crop and livestock	10	10
Not adopted any	9	9
Total	100	100

An astounding observation from the study area was that, though Hadzabe don't like to eat and grow field crops, when there is food shortage in the jungle they do go out to sell their labour to nearby farmers (Sukuma and Iraqw) so as to get grain food for sustaining their families. Another amazing thing is that the Hadzabe are surrounded by cultivators and animal keepers, the majority of hunter-gatherer's have until

recently refused to take up agriculture on the grounds it would involve too much hard work. The question was posed to one of the Hadzabe about taking agriculture as a solution to food crisis, response was, “Why should we plant, when there are so many *ekwa* (*Vigna frutescens*) and *kongolobe* (*Grewia bicolor juss*) in the forest gifted by God?”

The observed slight changes from dependency on hunting and gathering to other non hunting activities could be attributed by climate change. The other reason could be the one explained in the Hartmann theory of “the hunter versus farmer” that most or all humans were nomadic hunter gatherers for many thousands of years, but this standard gradually changed as agriculture developed in most societies, and more people worldwide became farmers. Changes in human population, over killing of animals and environment change due to climate change and human activities caused a decline in the availability of wild foods; therefore, people adapted another way of food production (agriculture started). As the number and size of agricultural societies increased, they expanded into lands traditionally used by Hadzabe. Many groups of hunter-gatherer in the world have perpetually declined partly as a result of pressure from growing agricultural and pastoral communities. In the resulting competition for land use, hunter-gatherer societies either adopted these practices or moved to other areas.

Moreover, Hartmann speculates that transition from hunting and gathering to agriculture is not necessarily a one way process that people with attention-deficit hyperactivity disorder (ADHD) retained some of the older hunter characteristics. It

has been argued (Marlowe, 2005b; Winterhalder, 1981), that hunting and gathering represents a coping strategy which may still be exploited, if necessary, for instance when environmental change causes extreme food stress for agriculturalists, some agriculturalists may also regularly hunt and gather. Other people in the developed countries go hunting, primarily for leisure (Marlowe, 2005b; Winterhalder, 1981).

4.9 Assessment of Food Availability and Stability

In order to establish food availability and stability, the Hadzabe were asked to mention their food and rank it in the rank of food preference. Food preferences, regardless of how genetically or culturally influenced is an integral part of maintaining an adequate diet in any particular environment (Marlowe, 2006).

Table 13: Distribution of respondents' food preference and accessibility from gathering and non-gathering activities (n=100)

Variable	Kipamba	Munguli	Yaedachini	Mongowa Mono	Domanga	Total percent
Preferred staple food						
Baobab	0	0	0	1	2	3
Grain food	0	8	10	0	6	24
Wild tuber	6	0	1	1	4	12
Game meat	11	12	4	17	8	52
Honey	3	0	5	1	0	9
Ability to eat the preferred food						
Yes	0	17	12	2	5	36
No	20	3	8	18	15	64

The most preferred food is meat reported by 52% of the respondents, grain food 24%, wild tuber 12%, honey 9% and baobab 3%. (Table13). However the preferred food is not eaten frequently due to seasonal nature of its availability. Honey for example, is available only for 3 months a year that is from April to June. From the

Table 13 above, accessibility of food was reported to be another source of food shortage. About 64% (Table 13) responded that they never eat the preferred food frequently while 36% reported to have been eating the preferred food frequently. About 36% of the Hadzabe who reported above to eat food frequently, were those from villages which had adopted grain food. Therefore, the reason of poor accessibility of food could be explained by the fact that wild food is little and animals have shifted to far protected areas because of the effect of climate change.

4.9.1 Food availability

Food availability addresses the supply side of food security and it is determined by the level of food production and stock level (FAO, 2006).

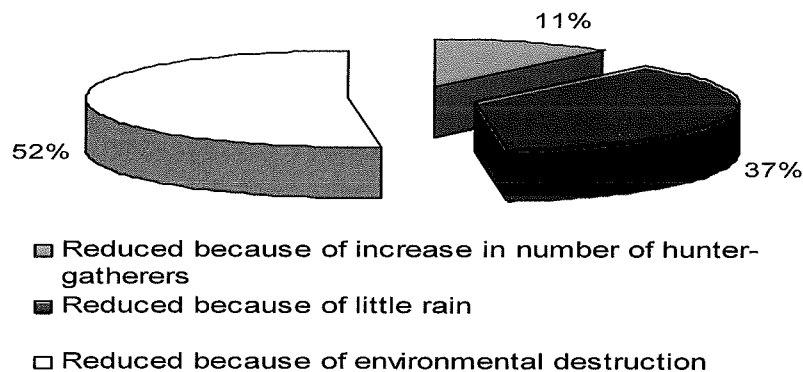


Figure 3: The main causes of food shortage in the forest

The findings from the study area show that, the wild food availability has been reduced and the reason of reduction in amount were given. About 52% of the respondents indicated an increase in number of Hadzabe competing for same resource, 37% thought the reason was little rain in the area and 11% (Figure 3) thought it was because of environment degradation by farmers and livestock keepers.

The reasons given for the reduction in the amount of food shown in Figure 3 indicated that large game animals, like buffalo and giraffe, have shifted to the protected game reserve such as Serengeti national park and Ngorongoro conservation area due to drought. Another reason is an increase in human population. According to hadzabe custom large animals' meat is used for paying dowry. Unavailability of large animals has not only affected food stability to hadzabe but it has also obliged the marriage system to change. Table 14 indicates that 40% of the respondents eat wild tuber frequently as opposed to other types of food, 19% eat baobab, 16% grain, 14% game meat and 11% eat honey as an alternative food. The percentage of food eaten as an alternative food articulates the level of food availability and accessibility to the Hadzabe. Therefore, the reason for little availability of food could be attributed to the fact that wild food is little and animals have shifted to far protected areas because of water shortage in the former territory which is exacerbated by climate change. Wild tubers because of biological facts of tolerating drought are increasingly becoming the main dish to the Hadzabe instead of meat and honey the reason being that such food items are available in abundance in the bush compared to other types of wild food.

Table 14: Distribution of respondents' alternative food eaten (n=100)

Alternative food eaten	Kipamba	Munguli	Yaedachini	Mongowa Mono	Domanga	Total percent
Honey	5	3	0	1	2	11
Wild tubers and berries	6	5	7	8	14	40
Baobab	3	4	3	9	0	19
Game meat	6	7	0	0	1	14
Grain food	0	1	10	2	3	16

4.9.2 Food stability

Stability refers to the availability of food to all people at all time. Figure 4 shows that there was food deficit in the study area. About 63% of the respondents faced food shortage of between 3-4 months, 26% faces food shortage of between 5-6 months, 7% faces food shortage of 1-2 months 3% faces food shortage of 7 and above months and 1% indicated not to have faced food shortage (Fig.4). Furthermore, food insufficiency was reported as a common phenomenon to the Hadzabe. This insufficiency of food explains instability status of food and was justified by 1% of the respondents reported to have been self sufficiency.



Figure 4: Level of food instability the hunter-gatherers area

According to FAO (2006) the main cause of food instability in the horn of Africa is persistence of drought caused by climate change. Food instability in the study area therefore, could be accelerated by the impacts of climate change and the nature of the Hadzabe livelihoods in that they depend on hunting and gathering. As Marlowe (2006) asserts about 80% of food (tubers, berries and honey) of the Hadzabe is obtained from gathering wild food and only 20% is from hunting. Food gathering

was reported to be seasonal biased and thus is highly affected by a change in the rain regime caused by climate change. During March to June (berries and honey) food is plenty while from August to February food insufficient. Additionally, the Hadzabe like other hunter-gatherers in the world neither preserve nor do they store food for future and this habit demonstrate food instability nature of the Hadzabe.

4.10 The Institutions and their Roles in the Study Area

During discussions and interviews major important institutions which operate in the study area were identified as shown in Table 15. The mentioned institutions play a big role for the Hadzabe coping strategies especially during unfavourable events. As shown in Table 15 however, villages in Mbulu District are more favoured by institutions than villages of Iramba District due to geographical features and position of the study area. The institutions which operate in Mbulu District are Olson Company, Oxfam Africa, Hay dom hospital, Dorobo safaris, religious institutions and Mbulu District council. In Iramba District two institutions were reported to be assisting the Hadzabe in the study area namely Iramba District council and Hay dom hospital. So, these institutions are the key players in Hadzabe' coping strategies.

Table 15: Major institutions and their roles in the study area

Institution	Major role
Olson company (Hay dom)	Deals with supply of food on behalf of government during critical periods
Iramba and Mbulu District Councils	Constructing primary and secondary schools and providing food during critical periods
Religious institutions Generally	Assist in spiritual matters
Dorobo safaris	Remitting food and clothes and cultural tourism to Hadzabe
Oxfam Africa Hay dom hospital	Remitting food and clothes. Health services to the community during diseases incidences

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

Overall, the major conclusion, that can be drawn from this study are as follows.

- It is Hadzabes' perceptions on climate and climate change that good years in terms of climate are becoming less. Generally, rainfall variability and the occurrence of extreme events are more pronounced in terms of onset and cessation of the rain season, the number of rain days, rainfall intensity, and the magnitude of drought and flood events.
- The most common cited serious problem by Hadzabe is drought. Flood was reported to have little negative impact to the Hadzabe compared to drought, the reasons given were that floods, increases the amount of water in the soil as well as water points (the place for trapping and ambushing animals). In the uplands, flood year is good for tubers quality and quantity.
- The Respondents with different age, education level and sex have experienced the climate change and its variability.
- Most people experience chronic food insecurity. This food insecurity in the study area could be explained by the fact that some households are prone to food insecurity due to their high level of dependency on natural resources which are affected by current climate change.

- Various coping strategies have been developed by Hadzabe. These coping strategies include the support from government and NGOs, eating foods which are unfamiliar to them, migrating to food endowed areas, food borrowing and selling of some of the assets. The study also reveals that some of the Hadzabe in the study area are engaged in some income generating activities like selling honey, game meat, small shops and cultural tourism.
- There is generally a reduction in food amount in the jungle. This is explained by the fact that wild food is little and animals have shifted to far protected areas because of water shortage in these former territories and this is exacerbated by climate change. Because of biological facts of tolerating drought, wild tubers are increasingly becoming the main dish to Hadzabe as opposed to other types of wild food hence low food stability per year.

5.2 Recommendations

Based on above conclusion, the following recommendations are put forward:

(a) Promoting livelihood.

There should be deliberate efforts from the government and other stakeholder to assist the vulnerable people who depend on natural resources to diversify their source of livelihoods. Diversification of source of livelihood can be achieved through promotion of other sources of income generating activities.

(b) Enforcing environmental by-laws.

The local government should strengthen its environmental by-laws so as to make sure that the demarcated forest for the Hadzabe is retained and

preserved from invasion by farmers and will be one of a solution to solve food crisis in the area.

(c) Promoting wild food.

Indigenous wild foods in the Hadzabe area should be documented and characterised for the future generation. Policies should be designed that focus on promoting the wild foods.

(d) Researching on plant diseases.

More research is called upon to identify important wild foods and the diseases which are associated with climate change.

(e) Focusing on income generating activities.

The Government, institutions and NGOs should focus on the capacity of households and how to sustain them rather than provision of free relief food during shortages when planning for rural food security.

(f) Exposing to financial institutes.

On other hand chronically food insecure Hadzabe may need more direct access to cash to enable them to raise their productive capacity and ultimately, food stability. Therefore this problem should be taken under consideration by government and other development stakeholder.

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APPENDICES

Appendix 1: Questionnaire for head of household**A. Identification variables**

Background information	Name/Number
Date of interview	
Questionnaire number	
Name of interviewer	
1 : Village Name	
2: Ward	
3 : Division	
4: District	
5: Region	

6: Were you born in this village? 1= Yes 2= No

7: In case you were not born in this village, fill in the following Table

Where migrated from (village, District)	Year of migration	Reason for migration

8: Reason for immigration

1= Marriage, 2 = hunting and gathering, 3 = searching water, 4 = farming 5=other(s)
specify

9. Provide the following information for the respondent

Gender	Age	Marital status	Education	Occupation

Code: Gender 1=Male, 2 =Female

Marital status 1= Married, 2 = Single, 3 = Widowed, 4= Divorced

Main occupation 1 = Beekeeper, 2=Farmer, 3 = hunter gatherers
4=others (specify)

Education level 1= none 2= std4 3= std7 4=secondary school
5=others specify

10. Number of children (age up 17 years old).....

11. Number of Adults.....

B: Establishment of perception on observed pattern of rainfall variability

12: In the whole time of your stay in this village have you experienced any rainfall oriented problem? 1=Yes [] 2=No []

13: What are the most common rainfall variation experienced in your village
(Circle the answer)

- (a) Delay in rainfall season.
- (b) Early rain season
- (c) Too much rainfall
- (d) Stormy rain
- (e) Little rain
- (f) no rainfall at all
- (g) Others (specify)

14: Mention any impact experienced from the above mentioned rainfall variation problem to your daily activities

.....

15: Have you changed your livelihood activity (ies) within 30 years period because of rainfall variability?

- (a) Yes []
- (b) No []

16: If yes mention them

.....

D: Hunter-gatherers' food insecurity coping strategies toward climate change.

17: Nature, effect and response to shocks, and livelihood situation by the household in the last five years

Nature, effect and response to shock			
Event/shock	When happened(date)	Effect of the event/shock	Response to event/shock

Event/ shocks: 1=drought, 2=floods, 3= illness, 4=strong wind/hurricane

Effect of event/shock: 1=hunger, 2= death of family members, 3= others specify

Response to event event/shock: 1=received relief (specify sources), remittance from relatives/friends, 3= borrow from relatives, spend cash savings, 4= household members migrated, 5= others (specify)

18: What is the most preferred staple food in the area among the following

1. Grain food
2. Wild fruits and roots
3. Wild animal meat
4. Fish
5. Honey
6. Others (specify)

19: Are you able to eat your preferred food frequently?

1. Yes
2. No

20: If no, what do you eat instead?.....

21: Have you ever faced with food shortages, say for the past 10 years

1. Yes
2. No

22: If yes, in which months did it happen.....

23: How does food shortages occur?

1. Often
2. Sometimes

24: What do you do if there is food shortage in your household?

1. Food borrowing
2. eating fruit which we not used before
3. migrate
4. relying on food relief from government.
5. Others (specify)

E: Assessment of food stability and availability

25: What are the major sources of food for household consumption?

- 1 Own hunting and gathering
- 2 From relatives
- 3 Others (specify)

26: Is there a change in of what eat you nowadays compared to what you used to eat say 10 years ago?

- 1 Yes
- 2 No

27: If, yes what are the changes?

28: What is the present situation in relation to the availability of the edible products from the bush compared to the past 10 years?

1. Increased
2. Reduced
3. Same
4. Fluctuates

29: Explain.....

30: What do you consider the important means of improving food availability and stability in general?

.....

31: Mention the drought resistance fruit trees you know.....

32: How do you preserve wild food that appears in the rain season

33: At what months of the year food is plenty?

34: If you have diversified your foods(could be wild fruits, animals or farm foods), please mention new foods you have introduced

(a)

(b)

(c)

35: Where do you go for hunting and gathering?

1=within the village, 2=nearby village, 3=in the protected area 4= to infinity,
5=others specify

Appendix 2: Questionnaire for key informants

Background information	Name/Number
Date of interview	
Questionnaire number	
Name of interviewer	
Village Name	

1: Were you born in this village? 1= Yes 2= No

7: In case you were not born in this village, fill in the following table

Where migrated from (village, District)	Year of migration	Reason for migration

2: Reason for immigration

B: Establishment of perception on observed pattern of rainfall variability

Hunter-gatherers responses to the observed pattern of rainfall variability.

3: In the whole time of your stay in this village have you experienced any rainfall oriented problem? 1=Yes [] 2=No[]

4: What are the most common rainfall variation experienced in your village

.....

5: Mention any impact experienced from the above mentioned rainfall variation problem to your daily activities

.....

6: Have you changed your livelihood activity (ies) within 30 years period because of rainfall variability?

7: If yes mention them.....

D: Hunter-gatherers' food insecurity coping strategies toward climate change.

8: Nature, effect and response to shocks, and livelihood situation by the household in the last five years

Nature, effect and response to shock			
Event/shock	When happened(date)	Effect of the event/shock	Response to event/shock

- 9: What is the most preferred staple food in the area ?
- 10: Are you able to eat your preferred food frequently?
- 12: If no, what do you eat instead?.....
- 13: Have you ever faced with food shortages, say for the past 10 years
- 14: If yes, in which months did it happen.....
- 15: What do you do if there is food shortage in your household?

E: Assessment of food stability and availability

- 16: What are the major sources of food for household consumption?
- 17: Is there a change in of what eat you nowadays compared to what you used to eat say 10 years ago?
- 18: If, yes what are the changes?
- 19: Explain the status of food availability in the forest.....
- 20: What do you consider the important means of improving food availability and stability in general?
.....
- 21: How do you preserve wild food that appears in the rain season
- 22: At what months of the year food is plenty?
- 23: If you have diversified your foods(could be wild fruits, animals or farm foods), please mention new foods you have introduced
 - (a)
 - (b)
 - (c)



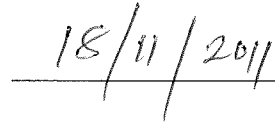
ABSTRACT

The study intended to establish the perceptions of community on climate change, identifying the Hadzabe' food insecurity coping strategies toward climate change and assessing the extent of food availability and stability. The study was conducted in five selected villages in Iramba and Mbulu Districts namely Kipamba, Munguli, Yaedachini, Mongo wa Mono and Domanga. The cross-sectional technique was used to collect data. Purposive and Simple random sampling methods were used to obtain 100 respondents. Both structured and unstructured questionnaire were used in data collection, supplemented by focus group discussion and key informants. Data were analyzed using computer programmes and content analysis method. The descriptive statistics such as frequencies, and percentages were computed. The finding from this study reveals that people have experienced the presence of climate change and hence lead to the chronic food insecurity. However, the Hadzabe have developed different coping strategies to mitigate the situation. The most used coping strategies included: relying food from government and NGOs, eating foods which have not been used before, migrating to the area with food, borrowing food and selling labour and engaging in petty business. The dependence on wild food and lack of food storage facilities and habit were identified as the main contributing factors to food insecurity to the Hadzabe. The study concluded that, there is a need for improving the coping capacity of the Hadzabe by strengthening their coping strategies and recognizing the importance of forest resource in supporting the Hadzabes' livelihoods to improve food availability and stability. It is recommended that long term development measures such as training on crops and animals' husbandry, modern beekeeping,

food processing and storage techniques should be provided to the Hadzabe so as to ensure food security in their households.

DECLARATION

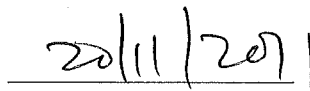
I, Seleman Shadrack do hereby declare to the Senate of Sokoine University of Agriculture that, this dissertation is my own original work and that it has neither been submitted nor being concurrently submitted for degree in any other institution.



Seleman Shadrack
(MA Candidate)

Date

The above declaration is confirmed



DR. Mwalilino, J.K
(Supervisor)

Date

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Finally, I will never forget to whom this study truly belongs to - it belongs to God, It is God who made me who I am in the depth of hardship, when nothing but hope and virtue could survive. I will always praise him and seek his Devine intervention when faced with problems beyond my capacity. To Him, my precious appreciation is due.

DEDICATION

The Dissertation is dedicated to my parents, Shadrack M. Musunga and Kang'wa Kalamji, who in their love, patience and subtle ways initiated and inspired to pursue my studies, my sister Sundi Shadrack as well as my beloved brother Gabriel Shadrack who have stood by my side through this study.

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LIST OF ABBREVIATIONS AND ACRONOMY

ADHD	-	Attention-Deficit Hyperactivity Disorder
ASDP	-	Agriculture Sector Development Programme
ASDS	-	Agriculture Service Development Strategy
ASP	-	Agricultural Sector Policies
ASSP	-	Agricultural Services Support Programme
DADPs	-	District Agricultural Development Plans
DSI	-	Development Studies Institute
FAO	-	Food and Agriculture Organization
FMD	-	Foot and Mouth Disease
FARM-A	-	Food and Agriculture Research Management Africa
FSIT	-	Food Security Information Team
ILO	-	International Labour Organization
IDC	-	Iramba District Council
IPCC	-	Intergovernmental Panel on Climate Change
LGA	-	Local Government Authorities
MA	-	Master of Arts
MAFC	-	Ministry of Agriculture, Food Security and Cooperatives
MARD	-	Master Degree in Rural Development
MDC	-	Mbulu District Council
MDG	-	Millennium Development Goal
NBS	-	National Bureau of Statistics
NGO	-	Non-Governmental Organization
NSGRP	-	National Strategy for Growth and Reduction of Poverty

PMO	-	Prime Minister Office
PRSP	-	Poverty Reduction Strategy Paper
RD	-	Rural Development
SNAL	-	Sokoine National Agricultural Library
SPSS	-	Statistical Package for Social Sciences
SRS	-	Simple Random Sampling
SUA	-	Sokoine University of Agriculture
TAS	-	Tanzania Assistance Strategy
TDHS	-	Tanzania Demographic and Health Survey
UCLAS	-	University College of Land and Architectural Studies
UN	-	United Nations
UNDP	-	United Nations Development Programme
URT	-	United Republic of Tanzania
VAR	-	Vulnerability Assessment Report

CHAPTER ONE

1.0 INTRODUCTION

1.1 Background Information

Since early 1980s, it has become apparent that our planet has been undergoing significant climatic change. The general opinion is what is taking place now is to great extent a result of human activities. Some regions of the world are considered to be more vulnerable to climate change than others. It is the less developed countries which belong to the most vulnerable part of the world to climate change. This is especially so because a large part of their economy depends on climate-sensitive sectors such as agriculture and local natural resources. Furthermore these countries adaptive capacity is often limited by inadequate human, financial and natural resources, and low institutional and technological capability (IPCC, 2007).

Evidence from literature (Paavola, 2005) has documented a myriad number of effects caused by climate change. Climate change has also affected livestock distribution and productivity, the prevalence of (vector-borne) livestock diseases as well as alteration of the quantity and quality of rangeland (IPCC, 2007). Millions of people in East Africa and horn of Africa (Somalia, Eritrea, Djibouti, Northern Kenya, Northern and Southern Sudan) face climate-related hunger as seasons shift and change, the shifting seasons are destroying harvests and causing widespread hunger, but this is just one of the multiple impacts of climate change taking its toll on the world's poorest people, with a warning that multiple climate impacts could reverse 50 years of the results of hard work achieved in ending poverty (Agrawala *et al.*, 2003). Tanzania as a country is witnessing one of the great impacts of climate change; the

melting of the icecap of Mount Kilimanjaro with the glacial retreat being observed on the mountain (Luhanga *et al.*, 1998). Apart from Kilimanjaro Mountain, other parts of Tanzania are also experiencing the effect of climate changes for example 1997/8 El Niño which led to drought and flooding, the skyrocketing of food price, and loss of cattle and crops (US National Drought Mitigation Center 1998). Another recent example is the tragic and massively destructive flood in Kilosa District in January 2010, which left a number of people dead and thousands of others without shelter and wreaked havoc on houses and infrastructure (Daily News, 2010).

Predicted changes in climate will have significant impacts on Tanzania's rain-fed agriculture and food production. Global warming will shorten the rain season, reduce water availability and increase crop losses caused by increase in diseases and pests. Therefore the changes will affect livelihood, health, and food security in Tanzania (Hunter-gatherers are included). Predicted changes in climate will increase the effect on forest resources, frequency and intensity of bush fires and induce shifts in geographic distribution of plant species and associations and thus land cover (Mwandosya *et al.*, 1998). Forests and woodlands are an important resource in Tanzania. Studies indicate that forest products accounts for 90% of total energy use in Tanzania (Paavola, 2005).

Moreover, forests are a source of poles and timber for construction, fodder and browsing for the livestock, as well as berries, tubers, medicinal plants, gums, and meat. Deforestation (farms expansion, timbers, firewood) carried out by rural people as a coping strategy would have significant adverse consequences for economic and

physical wellbeing in rural areas especially for hunter-gatherers. The current food and water scarcity is already aggravating tensions between local communities, such tensions may also have consequences for regional stability.

In Tanzania, there are three ethnic groups that fall in a category of hunter-gatherers namely, Sanjos in Ngorongoro and Serengeti Districts, Sandawe in Kondoa District and Hadzabe in Iramba, Mbulu, Karatu and Meatu Districts. The society of hunter-gatherers, whose mode of subsistence involves from hunting animals, fishing and gathering edible plants is characterized by relatively mobile kind of habitat due to their reliance upon the ability of a given natural environment to provide sufficient resources in order to sustain their life. Their population density tends to be lower than those of agriculturalist, since the cultivated land is capable of sustaining population densities by 60-100 times more than the land left uncultivated. Hunter-gatherers live in band of 10-30 individuals. Settlements may be either temporarily, permanently or a combination of two depending upon the mobility of the community. Hunter-gatherers societies also tend to have non-hierarchical, egalitarian social structures, thus such things as wars in hunter-gatherers societies are common and these are usually caused by grudges and vendettas rather and not for territory or economic benefits. Archaeological and ethnographic evidence reveals that hunting is a men's activity while gathering wild fruits and vegetables is women's gather responsibility. The exception of this general pattern is found among Aeta people of Philippine states where 85% of women do hunt and they hunt the same quarry as men. Hunter-gatherers are generally not able to store surplus food.

In Iramba and Mbulu Districts hunter-gatherers (Hadzabe) comprise about 0.3% of the population. Other ethnic groups in the study area are Nyiramba, Nyaturu, Taturu, Barabaig, Sukuma and Iraqw. Overall, 90% of the people in Iramba and Mbulu Districts live a subsistence lifestyle, depending on wild animals and fruits, food crops, livestock and crafts for food and income. The Hadzabe who are hunter-gatherers could be the most susceptible ethnic group to climate change impacts in the study area since they survive solely on fruit-gathering and hunting down wild animals for food. However, the sustainability of these food sources are highly at stake owing to the current climate change (Ihucha, 2008). In a food situational analysis report (IDC, 2007) on the effect of climate change to hunter-gatherers, people in Munguli village were reported to having been facing water and food shortage and were found to be eating food which was uncommon in the area due to climate change (IDC, 2007).

Various measures have been taken by communities or households to respond to events affecting normal life. These measure are called coping strategies. Coping to climate change and variability is a short time adjustment of a system to moderate the impacts of climate change and take advantage of new opportunities (IPCC, 2007). Coping refers to the action people take in response to, or in anticipation of, projected or actual changes in climate, to reduce adverse impacts or take advantage of the opportunities posed by climate change (Parry *et al.*, 2005). Thus, coping reduces communities' vulnerability or increases their resilience to climate shocks. In many cases coping activities are more local (i.e. District, regional or national) issues rather than international issues (Paavola *et al.*, 2005; Parry *et al.*, 2005). This is because

different communities in different geographical locations and scales possess different vulnerabilities and adaptive capabilities, and so they tend to be impacted differently, thereby exhibiting different adaptation needs. As a result, coping largely consists of uncoordinated action at household, firm and organisation levels (Paavola *et al.*, 2005).

Therefore, research on hunter-gatherer food coping strategies is important with the anticipation that, it will make local population well informed on local perception and coping strategies on climate change and therefore making an important contribution to reducing climate change proneness and ultimately to reducing food insecurity and increase income levels particularly those of hunter-gatherers.

1.2 Problem Statement

Regional report indicates that Tanzania suffers a loss of livestock and harvests, by 10% of its grain production because of drought and floods in some seasons (FSIT, 2005). According to Ihucha (2008), hunter-gatherers face food shortage every year since most of them depend on fruit-gathering and hunting down wild animals for food all of which are threatened by current climate change. The prominent climate change effect in Mbulu and Iramba include the shortened and erratic rain seasons in the District. For example in 1984, an increase of plant and animal diseases and drying of formal water sources and recurrent hunger were reported in Iramba (IDC, 2008). According to (MDC, 2009), the local government of Mbulu District is working hand in hand with village government and NGOs such as FARM-Africa to solve the problem of food insecurity and water shortage (drying main water source) in Yaeda valley.

Despite the efforts made by the government and NGOs in assisting hunter-gatherers to solve food and water shortages there is scanty information on hunter-gatherers (and specifically the Hadzabe) pertaining to awareness of climate change and wild food availability. Also little has been done to disclose the coping strategies used by hunter-gatherers with respect to climate. The call for undertaking this study comes from the fact that there is a continuous climate change while there is limited information on how hunter-gatherers are affected and how they overcome the adverse effect of climate change in Iramba and Mbulu Districts.

1.3 Justification of the Study

In Tanzania, a number of initiatives have been undertaken; policies, strategies and programmes were put in place to address environmental concerns due to climate change, food security and poverty reduction. These include the National Environmental Policy; the Environment Management Act, 2004; Rural Development Policy; the Agricultural Sector Development Strategy (ASDS), the Tanzania Assistance Strategy (TAS); the National Strategy for Growth and Reduction of Poverty (NSGRP); and the Tanzania Development Vision 2025 (Mwandosya *et al.*, 2006). All of the programmes mentioned above were concentrated on solving non-hunter-gatherers problems and leaving behind Hadzabe. Any empirical effort on the assessment of Hadzabe coping strategies on climate change in Iramba and Mbulu Districts will have a positive impact toward household food security, poverty reduction and environmental conservation, since it will not only generate comprehensive information but also it would document information on livelihood of Hadzabe during adverse climate conditions. Information on the problems

encountered and their possible solutions would be useful to the government, development partners and other relevant stakeholders in designing strategies for supporting and improving the local coping strategies, which will lead to the reduction of insecurity and poverty.

1.4 Research Objectives

1.4.1 General objectives

Generally the current study intends to assess Hadzabe coping strategies on climate change in Iramba and Mbulu District.

1.4.2 Specific objectives

Specifically the study set out

- i. To establish the perceptions of Hadzabe on climate change
- ii. To identify Hadzabe' food insecurity coping strategies toward climate change
- iii. To assess the extent of food availability and stability to Hadzabe

1.4.3 Research questions

The study was guided by the following research questions

- i. What are the Hadzabe's perceptions toward climate change?
- ii. What are the Hadzabe's food insecurity coping strategies toward climate change?
- iii. To what extent is the food available and stable to Hadzabe?

1.5 Conceptual Framework

The framework focused on the relationship between hunter-gatherers' coping strategies and climate impact (Fig.1).

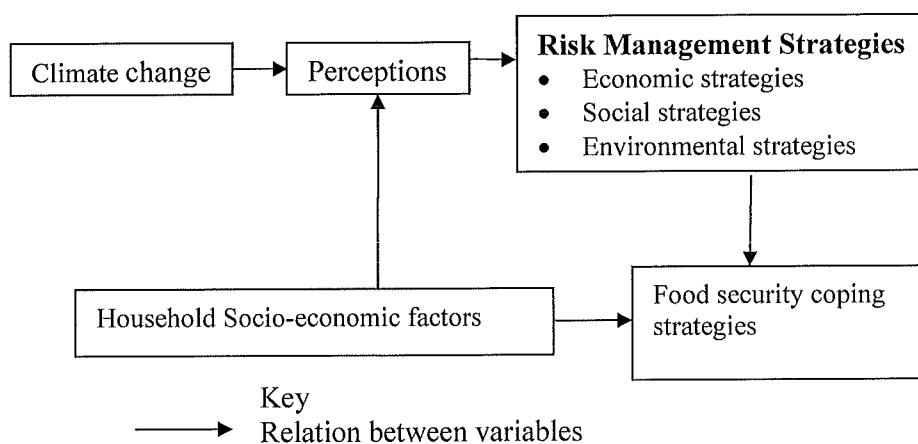


Figure 1: Conceptual framework of the study of Hadzabe coping strategies on climate change in Iramba and Mbulu District

The variables show the relationship between hunter-gatherers perception on climate change impact and coping strategies. (Table 1).

Table 1: Operational definitions of key variables

Variables	Operational definition
Demographic variables	Variables include age, sex, household size, marital status, and education level of respondent.
Food coping strategies	Activities to respond to shocks (droughts). Such as dependence on remittances, switching to non-hunting activities
Perception	Perception is a way of conceiving (an instant mental judgement) risks
Economical strategies	Diversification of activities such as, non-hunting supplements to household income.
Social strategies	Gift or loaning food, livestock, or cash; and some cases sending members of a distressed family to live with more fortunate relatives or friends
Environmental strategies	Different ecological potentials, which permit hunter-gathers diversify their activities or move their family from one area to another with response to the availability of food and water

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Overview of Climate Change

Historical data show that the globe is already undergoing climate change. This has serious implications for water resources, food security, and the spread of disease, the productivity of natural resources and desertification (IPCC 2001). Leichenko and O'Brien (2002) have estimated that the two severe droughts in the southern Africa region in 1992 and 1995 reduced the total cereal production by nearly half (12 555 000 against 22 848 000 metric tons) and one-third (19 192 000 against 27 838 000 metric tons) in the respective preceding years. The food shortage of 2003/2004 in Tanzania and which was caused by dry spell that occurred between mid-January and a third week of March in 2003 reduced crop yield by about 50-90%, particularly in dry areas. This dry spell left over two million people, most of them in rural dry land areas, severely food insecure and had to depend on relief food (FSIT, 2005).

The National Action Programme to adapt to Climate Change identifies the immediate and urgent climate change vulnerabilities as the main barrier to achieving the Millennium Development Goals (MDGs), as internationally agreed targets for reducing poverty, hunger, diseases and environmental degradation (Matari, 2006). It also strives to identify and prioritize the immediate and urgent needs that will be addressed both by the government and the international community in order to provide the required support to address these vulnerabilities. Also, according to Vulnerability Assessment Report (VAR) on climate change Disaster Vulnerability Assessment Phase II (PMO and UCLAS, 2003) showed that, Tanzania has

experienced several natural weather events that have been particularly severe. These events such as extreme drought in three quarters of the country in 2004 –2005 have had adverse effects on the natural and economic environments of the country. As a result of these changes, several sectors of the economy are vulnerable. These sectors include agriculture, water resources, health, forestry, grasslands, livestock, coastal resources and wildlife and biodiversity.

2.2 Impacts of Climate Change.

2.2.1 Impact of climate change on crop pests and diseases

According to government statistics, over a third of Tanzanians (36%) live below the basic needs poverty line and almost one in five (19%) survive below the food poverty line (URT, 2005). Agriculture and natural resources including livestock sectors are vulnerable to climate variability and change. Since majority (80%) of Tanzanians depend on agriculture and natural resources, excessive rains have direct bearing on crop diseases compared to drought, hence low yield thus food shortage. PMO and UCLAS (2003) showed that areas that grow many crops are reported to be prone to more pests and plant diseases due to climate change. However, there is no documented information on the effect of diseases on wild plants (used as food by Hadzabe) due to climate change.

2.2.2 Impact of climate change on livestock diseases

The impacts of climate change on livelihoods may be felt indirectly. For example, livestock distribution and productivity may be affected through changes in the prevalence of (vector-borne) livestock diseases, and in the quantity and quality of

rangeland (IPCC, 2007). Milk and meat production are also likely to fall as climate change reduces the livestock carrying capacity of the already over-stretched rangeland areas. Vulnerability Assessment Report (PMO and UCLAS, 2003) shows that in Tanzania Foot and Mouth Disease (FMD) is still on the top of the list, followed by East Coast Fever (ECF), Rabies, Anthrax, Rinderpest and Rift valley fever. The same reasons are given for the occurrence of livestock diseases; climatic change, prolonged heavy rains or dryness which favours the occurrence of diseases and insect pests due to both increased temperature and rainfall. The livestock diseases have no direct effect to Hadzabe daily life, simply because they neither keep animals nor eat domesticated animal meat. However, Hadzabe are surrounded by pastoralist and farmers (Barbaig, Iraqw, Nyiramba and Sukuma) and therefore any effect to livestock could lead to a trickle down effects (farm expansion) in wild resource which is a food reserve to Hadzabe.

2.2.3 Impact of climate change on water resources

The number of Africans living under water scarcity is predicted to double from 300 million people in 1990, to 600 million by 2025 (World Bank, 1995). Vulnerability Assessment Report (PMO and UCLAS, 2003) indicates that civil conflicts have been occurring between livestock keepers and farmers over pasture and water for the animals in Kilosa District, Mara and Kilimanjaro regions. According to Marlowe (2006), among the most serious problem to Hadzabe are land and water resources. The shortage of land and water for the Hadzabe are life threatening phenomena (Marlowe, 2007b). Shortage of rain leads to water scarcity which has adverse effects on wildlife and consequently on Hadzabe's lives.

2.2.4 Impact of climate change on forest resources

Climate change affects forests by altering the frequency, intensity, duration, and timing of fire, drought, insect and pathogen outbreaks, hurricanes, windstorms, ice storms, or landslide. These events cause large scale tree mortality and lead to community disturbances for those relying on agriculture and natural resources (Joshua, 2009). In Tanzania, global warming is having immediate and serious consequences. Mwandosya *et al.*, (2006) indicates that climate change is changing livelihoods, economies and even gender dynamics in families. For example, in Tanzania many cattle herders have switched to farming in the limited forest and wetter zones of savannah (Joshua, 2009). At first, the change was considered as a temporary remedy, but the increased frequency of the droughts has forced pastoralists to graze their livestock in farms leading to tensions resulting from encroachment of the land already occupied (Hatibu *et al.*, 2006).

2.3 Local Perception on Rainfall Variability

Perception is a way of conceiving (an instant mental judgement) risks (Hillson and Murray-Webster, 2004). Rural people have different pattern of perception because they thrive in varied contexts. According to Mutabazi (2007), certain people at specific place or time face different livelihood that a given risky hazard (e.g. drought, flood conflict) that occurs would be different from the one that might occur at another place or time. Moreover, Deressa (2007) reported that demographic variables such as age of the household head and education level, determines the level of perception of an individual to climate change. Since formal education plays a big role in awareness creation toward climate change only few Hadzabe do attend formal

education due to their nature of livelihood, the study thought to establish the relationship between perception on rainfall variability and education level.

2.4 Local Level Coping Strategy

Coping refers to shorter term actions and activities to respond to shocks (such as droughts) which take place within existing livelihood structures. Local level coping strategies to climatic shocks such as drought and floods vary across households and communities depending on the resources available and accessibility. These strategies may range from the collection of wild fruits, dependence on remittances from family members working in urban areas, switching to non-farming activities or in extreme cases, the sale of assets (Burton and Shohan, 1991).

The Hadzabe pursue semi-nomadic lifestyle characterized by hunting and gathering (Madsen, 2000). Hunter-gatherer societies livelihood depends primarily on subsistence method involving the direct procurement of edible plants and animals from the wild, foraging and hunting without significant alternative to the domestication of either crops or animals. Hadzabe obtain mostly from gathering up to 80% of the food is obtained by gathering rather than hunting (Marlowe, 2007a). Since there is a difference in livelihoods between farmers and Hadzabe, there is also a possibility of resemblance or disparity in the levels of local coping strategies because there is no literature explaining Hadzabe coping strategies on climate change.

2.4.1 Coping ability indicators

Coping ability indicators are referred to as indicators that reflect food access (Burton and Shohan, 1991). They include socio-economic variables that represent the degree of stress experienced by population as economic and social condition change and how the household respond to the changes. Recognizing that households are not passive to the stress, a major aspect of vulnerability to household food security is the ability of household to cope with the stress. These types of indicators which are narrated below, provides information on how the population affected by a shock or disaster withstand the effect. For example, those who live in the conditions that put their main source of income at recurrent risk tend to develop some self-insurance coping strategies to minimize risks of their household food insecurity and livelihoods (Longhurst, 1986; Corbett, 1988). Such coping strategies may involve dispersed grazing, change in cropping and planting practices, migration to towns in search of non-farm employment, increased petty commodity production, collection of wild foods, use of inter-household transfers and loans and use of credit from merchants and moneylenders.

Others may include migration to other rural areas for employment, rationing of current food consumption, sale of firewood and charcoal, sale of possessions (e.g. jewellery), consumption of food distributed through relief program, sale of productive assets, break-up of households and distress migration (Corbett, 1988). In the study area, there is no documented coping strategy shown for Hadzabe toward climate change.

2.4.2 Coping strategies against food insecurity

One aspect of the food crisis that has received relatively little attention from the policy makers is the role and status of local village-based strategies for coping with climate change (Zinyama, 1987). It is now recognized that between the emergence of the problem and the arrival of the external assistance, local people tend to employ a variety of strategies to mitigate the food shortage.

Coping strategies include activities which may appear insignificant and not identifiable from the overall rural food production system in years of plenty, but which assume increasingly greater importance in times of food deficits. Coping ways can be viewed as adaptive devices, which are culture specific, which people use to accommodate themselves to a given environment. Rural people under the guidance of their culture, have ways of minimising the impact of hunger. These ways are reflected in their dietary habits and livelihood practices. The main tool for developing these strategies is the indigenous knowledge possessed by these key actors (Katani, 1999). Nevertheless, due to difference in their socio-economic status, the coping strategies developed vary from region, community, social class, ethnic group, education of the head of the household, household size and the age of the head of the household (Deressa, 2007).

In real life, whenever food is scarce, people respond in various ways to reduce consumption. For example, taking one or two main meals per day instead of the normal three main meals per day (Katani, 1999), or taking the so-called inferior foods more frequently than before. Due to severe drought in 1998 people in some

parts of Tanzania including the Hadzabe area, were reported to be consuming food which is not used at normal food security. The types of strategies employed by household also tend to vary depending upon the severity and duration of the potentially disruptive condition (Zinyama, 1987). In the earliest stage of the crisis (stage one), households employ risks and loss minimising management strategies. This involves low commitment of domestic resources, enabling speedy recovery once the crisis has ceased. As the crisis persists, households are increasingly forced into greater commitment of domestic resources just to meet subsistence needs (stage two). There may be a gradual disposal of key productive assets making it harder to return to a pre-crisis state. At this stage, a household's vulnerability to food insecurity is extremely high. Stage three consequences include a failure to adapt to the crisis, usually involving destitution, and distress migration (Corbett, 1988). Food shortage in the study area occurs almost every year, where by relief food (grains) has to be sent to Hadzabe through emergency and disaster preparedness under Prime Minister Office (IDC, 2009).

2.4.3 Types of coping strategies

In a review of societal responses to natural hazards, Burton *et al.* (1978), cited by Mwangile (2001) views coping strategies as the totality of the societies' economic, social, and environmental resources reflecting their role as an integral component of the system. The described categories below are considered as the general responses to natural hazards to rural societies regardless of livelihood activity (i.e. hunter-gatherer, farmer, livestock keeper, etc.) performed by the society (Table 2).

Table 2: Traditional household coping strategies in the SADCC region

Environmental	Economic	Social
Stream bank Cultivation	Business	Extended family links (borrow food)
Gathering of wild food	Crafts	Pray to rainmakers
Hunting and fishing	Beer brewing	Raiding
Control access to water and pasture	Sale of livestock and household effects	Sharing, reduced meals, splitting herd
Mobility	Store food (grain and tubers)	Arranged marriage
Growing of drought resistance crops	Migration	Begging and stealing

Source: Ziyama(1986)

Hames and Draper (2005), identify four coping strategies that hunter-gatherers use to buffer against risk: prevention-of-loss, resource pooling, storage, and transfer-of-loss. These coping strategies are discussed categorically below.

2.4.3.1 Economic strategies

Economic strategies for coping with food insecurity include the diversification of activities in terms of animals hunted and berries gathered. Diversification also allows to some flexibility and allocation of household resources such as labour. Another economic strategy include the selling of household assets. Kajembe and Munyikombo (1998) have shown that, this type of income diversification is often a function of adaption to food insecurity. Anthropologists like Hames and Draper (2005) researched in Ju/'hoansi (hunter-gatherers in Kalahari Desert) community concluded that children as helpers, have been valuable workers during food in economic roles, i.e., children are engaged in agriculture while their parents are hunting and gathering. Also, Ju/'hoansi men were reported to have changed their

strategy by hunting large animals (i.e. after killing the meat is distributed to other hunters) because on return on the investment a hunter can expect to receive large meat from other hunters in the future. Intensive storage is an economic strategy that has been adopted in Ju/'hoansi community. Intensive storage that extends the availability of foods into periods of scarcity, and often it is employed by hunter-gatherer's who depend on resources with marked seasonal variations and gaps in availability (Rowley-Conwy and Zvelebil, 1989).

2.4.3.2 Social strategies

Social responses to food shortages are found in reciprocal arrangement based in membership in the institution such as family clan and age set (Zinyama, 1987). Social strategies include labour sharing (e.g. in tending for crop in the fields or caring animals); gift or loaning food, livestock, or cash; and in some cases sending members of a distressed family to live with more fortunate relatives or friends (Zinyama, 1987). Such strategies are reciprocal in that assistance given at any time may represent repayment of past kindness; or commitment on the part of those being helped to assist the help givers should they experience similar problems at the future time (Cashdan, 1985).

Resource sharing is a common social strategy used by hunter-gatherers in Kalahari Desert (Binford, 1991). Ideally the successes and failures of multiple foragers are spread among the larger group exploiting a diverse set of resources so that everyone has access to food each day. Also, transfer-of-loss that's shifting food from one group of people with food to another group of people with food shortage is used as a

coping strategy in hunter-gatherers community in Kalahari Desert, it is linked directly with variations in resource structure among groups of hunter-gatherers and it can take two forms. The first form is voluntary food supply, and the second form is raiding that result in involuntary transfer-of-loss. Resource sharing specifically food is a strategy used by Hadzabe during food scarcity (Marlowe, 2006).

2.4.3.3 Environmental strategies

Communities selectively use their physical resources base to reduce the likelihood of food shortage. Different localities, valleys, and hills provide different ecological potentials, which permit rural communities to diversify their activities and allow moving from one area to another where food and water are available (Ngana, 1983). Also, Cashdan (1992) identified environmental strategies in Ju/'hoansi community (Hadzabe in Kalahari Desert) called prevention-of-loss coping strategy which can occur over a very short to a longer time period. Prevention-of-loss coping strategies include changes in hunting weapons (use of a bow and arrows instead of a spear to shoot distant animals), transportation aides and information exchange among hunter-gatherers in places where food is available. The environmental coping strategies adopted in Kung community (hunter-gatherers) exploit resources by temporarily moving the residential camps to the food locations and bringing back food to the camp for the entire group (Kelly, 1983). Likewise, to Hadzabe whose derive their food from the jungle, negative effects caused by climate change on wild resource could lead to the reduction in wild food and affect Hadzabe life.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Description of the Study Area and Location

The study was conducted in Kirumi and Haydom Divisions in Iramba and Mbulu District Councils respectively in Tanzania. The study area lies between longitudes 34° and 35° and between latitudes 4° and 4°3". Eight Districts border the study area as follows. To the north are Karatu, and Meatu, to the east Babati and Hanang (Iramba District Council, 2009; Mbulu District Council, 2009).

Mwangeza ward in Kirumi Division and Yaedachini ward in Haydom Division were purposively selected for this study because these are the only Wards where the Hadzabe people live. Five villages, two from Mwangeza ward and three from Yaedachini ward were involved in the study. The villages are *Kipamba* and *Munguli* in Mwangeza ward and *Yaedachini*, *Mongo wa Mono* and *Domanga* in Yaedachini ward. Hadzabe ethnic group are click-speaking hunter-gatherers who mainly occupy an area within the lake Eyasi basin in northern Tanzania (Madsen, 2000). Their traditional territory extends over four administrative regions; namely; Arusha, Manyara, Singida and Shinyanga. In recent years, their coverage of the Yaeda Valley and Kideru Ridge above the valley in Iramba, Mbulu and Karatu Districts have increased in terms of numbers and density (Levin, 2005).

The area has geographically diverse landscapes. The Eyasi basin is typically arid and semi-arid with little rainfall (less than 400mm per year) with mean temperatures of 30°C and a terrain characterized by rocky and sandy soils that are very poor for

agriculture (Levin, 2005). The Hadzabe population ranges between 1,300 and 1,500, and their traditional area covers approximately 1,500 square kilometers (Madsen, 2000).

3.2 Research Design

A cross sectional design was used during data collection. According to Bailey (1994) and Babbie (1990), a cross sectional design allows data to be collected at a single point in time without repetitions from a sample selected to represent some large population and therefore using minimum time and resources. In this study, the design was favourable because of limited resources like time, labour (personnel) and transport.



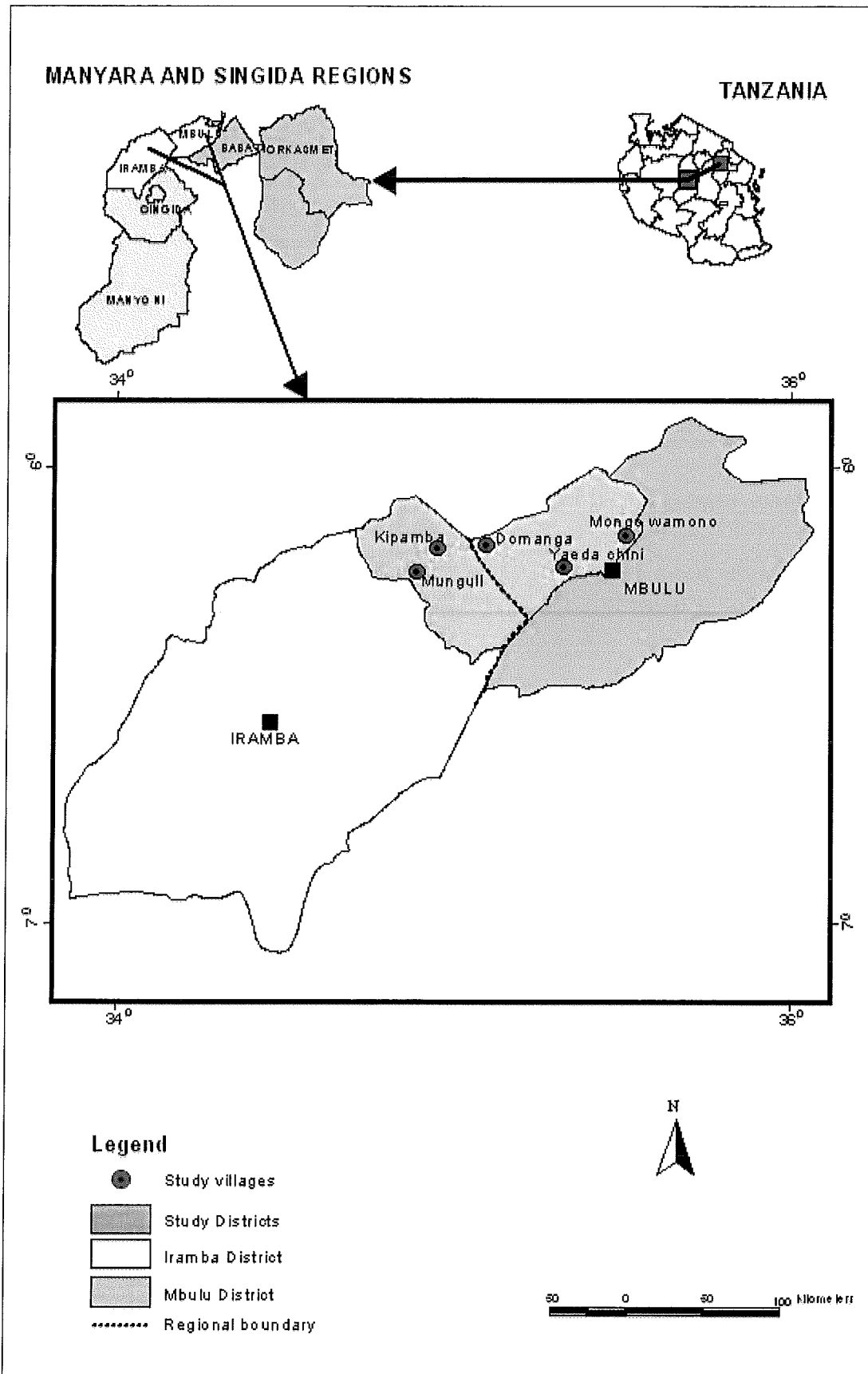


Figure 2: Map of Tanzania showing the study area

3.3 Sampling Procedure

3.3.1 Sampling unit

The population involved Hadzabe in Iramba and Mbulu Districts. The main target groups of sampling unit were the head of households because these are the most appropriate in assessing the level and standard of living of the society (Blackwood and Lynch, 1994). This provides substantial information related to the objectives of this study.

3.3.2 Sample size

The study sample comprised 100 respondents. Also 10 key informants were used to supplement the information.

3.3.3 Sampling method

The sampling methods used to get the required sample include purposive sampling and simple random sampling (SRS) techniques. The respondents were selected from the list of members using simple random technique. To obtain the desirable population, purposive sampling technique was used to obtain 5 villages, two villages from Iramba District and three villages from Mbulu District. This purposive technique has been generally recommended in social science research as it focuses directly on the area intended for the study (Kothari, 2006).

3.4 Data Collection Procedures

3.4.1 Primary data

A questionnaire with both open and closed ended questions and a checklist were used in the household survey, key informants interviews and focus group discussion.

Supplementary information, however, was collected through personal observation. The information gathered through key informants' interviews gave insights on the community-wide aspects of risks and coping strategies, and public responses to disasters.

3.4.1.1 Key informant interviews

Local and old people were involved in the research; the questions posed were reflected on perceptions on climate change and major climate change trend. Ten key informants were interviewed for every village

3.4.1.2 Focus group discussions

Discussions with focus group members were held around specific topics. These topics focused on coping strategies, sources of income or support, support networks, wealth ranking, environmental changes and hunting-gathering practices. The discussions allowed different groups of people (e.g. women, elderly, recent immigrants to the village) to express their views. The group of 5-6 persons was organised and considered appropriate for discussion. During wealth ranking in the study area, three major social-economic grouping were identified by the communities based on different assets and activities. These major social-economic groups include rich, medium and poor.

3.4.1.3 Individual interviews

Structured questionnaires and semi-structured interviews were conducted around a set of questions relating to livelihoods, coping strategies, informal institutions and

community interactions. Informal interviews lasted between one and two hours and were usually conducted in Kiswahili language at either respondent's compound or at the village compound. Some interviews were conducted using a translator from Hadza language (language spoken by Hadzabe) to Kiswahili.

3.4.1.4 Personal observations

This was conducted purposely with the assistance from one experienced or knowledgeable person in the village and who understand well the social settings, and different livelihoods performed in the village. This is a social and environmental method in understanding the distribution of households, resources and activities undertaken. Among the aspects involved in personal observations include the types of food eaten, housing and day to day activities.

3.4.2 Secondary data

Extensive review of secondary data especially previous studies/research and various reports on Hadzabe in Iramba District and Mbulu District were used. Secondary data were also collected through consulting different publications relevant to the study from Sokoine University of Agriculture National Library (SNAL), internet and informal discussion with staff and officials in Iramba and Mbulu Districts Council

3.4.3 Data management procedures

3.4.4 Data processing

Data from primary sources were summarized, edited and coded prior to entering in the computer.

3.4.5 Data analysis

Data analysis was done by using contents analysis and Statistical Package for Social Science (SPSS) programme. Notes taken during the interview were written up by a theme, as part of the analysis for each case. Descriptive statistics such as frequencies and percentages were described. The relations between some pairs of variables were determined through bivariate analysis including cross-tabulation.

The study objectives were analysed following analytical tool as follows: In establishing the perceptions of community on climate change, descriptive statistics was used; in identifying hunter-gatherers' food insecurity coping strategies toward climate change, descriptive statistics and cross-tabulation were used, and in assessing the extent of food availability and stability to hunter-gathers, descriptive statistics and cross-tabulation were used.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Background Variables of Respondents

This section discusses the background variables of the respondents. The variables involved are demographic which include age and sex, social ones, which include education, marital status, and household size. These variables were analyzed and discussed in the sub-sections as follows:-

4.1.1 Demographic variables of the respondents

4.1.1.1 Age

The age of an individual can influence productivity because the ability to carry out the daily economic activities, both farming and non-farming, will decrease with an increase of age. Therefore, age is an important demographic variable and is the primary basis of demographic classification in vital statistics, censuses, and surveys (NBS, 2005). The findings revealed that the age of the respondents ranged from 20 to 80 years old among the 100 respondents. Specifically about 75% were aged between 20 and 49 years old, 14% between 50 and 59 years old, and 11% between 60 and 80 years old (Table 3). According to Madulu (1996), the economically productive age range from 16 to 64 years old. The age groups below 16 and those above 64 are considered as a high dependency ratio age structure which is economically less productive. In Hadzabe village, age also plays a role in livelihood and coping strategies toward food security. It was reported that age between 18-40s years old is the best age for hunting and gathering. The age above 60 years old was reported to be the technical age for training young generation on hunting techniques. However,

children also were reported to contribute up to 10% of collected fruits at home during fruits season.

4.1.1.2 Sex

Sex is one of the basic and important characteristics of population for planning, labour division and administration purposes from household level to national level. The majority (68%) of the respondents in Hadzabe area were males and the remaining 32% were females (Table 3). This high proportion of males interviewed as opposed to female, was due to the fact that, in hadzabe tradition males are heads of household. Therefore, males were most likely to be interviewed simply because the head of household was the sampling unit and the males were the heads regardless of the fact that many activities were done by females. As Mushi (2000) observed that in cases where both a wife and a husband were available, the husband was interviewed because the researcher aimed at interviewing the head of the household.

Table 3: Distribution of respondents according to sex and demographic variables (n=100)

Variable	Male	Percentage	Female	Percentage	Total	Percentage
Age						
20-29	11	11	11	11	22	22
30-39	17	17	10	10	27	27
40-49	18	18	8	8	26	26
50-59	12	12	2	2	14	14
60-69	7	7	1	1	8	8
Above 70	3	3	0	0	3	3
Total	68	68	32	32	100	100
Marital status						
Married	57	57	25	25	82	82
Single	3	3	0	0	3	3
Widowed	7	7	6	6	13	13
Divorced	1	1	1	1	2	2
Total	68	68	32	32	100	100
Education level						
None	42	42	23	23	65	65
Standard 4	4	4	3	3	7	7
Standard 7	19	19	5	5	24	24
secondary school and above	3	3	1	1	4	4
Total	68	68	32	32	100	100

In the Hadzabe' area the pattern of gender roles was such that women dig tubers and gather fruits while men mostly hunt animals and collect honey. But due to climate change, some activities which used to be done by men only are currently done by women e.g. honey collection conversely some activities which were done by women only are currently also taken over by men e.g. fruits gathering. However, raising of kids is still done by women because of biological reason. This has been similarly

contended by Marlowe (2005a). Therefore many activities which are conducted near the homestead are left to women and hunting remains for men because of reduced animal availability near the homestead.

4.1.2 Socio-economic variables

4.1.2.1 Education

The level of education is an important factor in coping with climate change related disasters and particularly coping with risk and uncertainties related to food production. Regnar *et al.* (2002) considers the ultimate objective of education as to increase labour productivity and thus it is a productive force for human being and thus very important for their ability to utilize efficiently the advice and information offered by the extension service providers and other development agents. The proportion of the respondents with primary school education (standard 1-7), was 31% (Table 1). Very few (4%) of those interviewed had achieved a secondary school. Nevertheless 65%, of the respondents have not gone to school at all. The study findings revealed that most of households in the study area have no formal education, which is important in any innovations uptake for issues on good management practices/new technologies and for a fight against poverty and thus to raise household resilience toward hazard. The Hadzabe sluggishness in changing their life style could be attributed to lack of formal education among the residents in the study area.

4.1.2.2 Marital status

Marriage has an effect on the production process as it increases labour availability in the household through sharing of activities between husbands and wives and among

other family members (Mtama, 1997). The finding of this survey (Table 3) shows that, 82% of women were married. On the other hand the entire household heads were either, widowed, single, or divorced, representing 13%, 3% and 2% respectively. The proportion of the married respondents was greater than that of the other categories. Survey findings seem to be higher than those reported by National Bureau Statistics (NBS) and Tanzania Demographic and Health Survey (TDHS) (2005). According to these sources, about 66% of women in economic activities are married. This implies that the marriage has an influence on daily economic activities because of family commitment. The high percentage of married women in the study area as opposed to that reported by Tanzania Demographic and Survey could be a strategy imposed by Hadzabe to make sure that more food is brought home to cope during food shortage. The same result was reported by Marlowe *et al.* (2009b) who reveals that, Hadzabe who has a biological child ≤ 8 years old at home, and/or is married, takes back to camp significantly more daily kilocalories of food than does a single person without young biological children at home.

4.1.2.3 Household size

A household refers to a group of people either related or unrelated, who are answerable to one person, often regarded as the household head. Members of the household share a dwelling unit or structure and have the same housekeeping arrangements (Nduwamungu, 2001). Similarly URT (2005) defined a household as one or more persons who make himself or themselves provisions of essentials of living. The persons in the group may be related, unrelated or both. But usually this type of household includes a husband, the wife, children and other relatives.

Throughout this research, the household size was categorized into three groups (Table 4); below 5, between 5 and 10 and above 10 household members. About 35% of the respondents had household sizes ranging from below 5 household members, 63% between 5 and 10 and 2% above 10 household members. The minimum and maximum number of people observed per household was 2 and 10 respectively (Table 4) with average household size 5.

Table 4: Distribution of respondents according to village and household size (n=100)

Household size	Mongo					Total percentage
	Kipamba	Munguli	Yaedachini	wa Mono	Domanga	
Below 5	8	9	6	7	5	35
5-10	12	11	13	12	15	63
Above 10	0	0	1	1	0	2
Total	20	20	20	20	20	100

From the survey it was found that an average household size of 5 members, which is relatively smaller than the figure stated in the URT (2005) which puts the average of 5.1 members in Iramba District Council whilst the average household size in Tanzania stands at 4.9. This is consistent with ILO (2001) cited by Munyu (2006) where in rapid assessment undertaken suggested that a big family is that with more than 6 people. Nduwamungu (2001) reported that there is a strong relationship between household size and resource exploitation. Large household to a large extent over-exploits the natural resource in order to meet basic needs (Madulu, 1996). From the study area however it was revealed that household size has no impact on Hadzabe livelihood since the number of people per household is small and naturally the birth rate is very small hence there is no resources over-use.

4.2 Establishment of Perception on Observed Pattern of Rainfall Variability

In order to have a clear understanding on the perceptions of climate and climate change in the study area, group discussions and individual interviews were held. The major focus of the discussion was on how the people understand and define the extreme events (floods or droughts). The groups and individuals were supposed to give characteristics for the answers they were giving. Bad years in terms of weather have been reported to be in the rise, the reasons given include the desertification due to increased human activities (pastoralists and farmers) particularly forest clearing for the following reasons; (i) Expansion of agricultural activities and (ii) Increased grazing area (more livestock). On the other hand good years have been reported to be decreasing due to frequent and recurrent drought. The rain seldom comes on time. Furthermore, it has been stated that during prolonged rain season there is an increase in wild-fruit diseases, but this need to be examined so as to establish the linkage with climate variability. Below (Table 5) summaries the opinions of the focus groups members.

Table 5: Description of good and bad years and their characteristics

Season variables	Characteristics
Good year	
Rain start early and rains for a long time	There is no water shortage Vegetation/trees sprouting early leads to plenty food in the jungle
Absence of water shortage	Enough water for livestock and domestic use
Absence of severe diseases	People are healthy
High number of immigrants	More food in the village
Bad year	
Severe hunger in the village	Poor, few food in the jungle
Human diseases (Malaria, typhoid)	Very hot, much water
Water is scarce	Low rainfall, Very high temperature

The descriptions are given in terms of good and bad years; to the Hadzabe good year means rain is reliable, no severe diseases and the number of Hadzabe coming from other villages is high. Basically, a good year is characterized by plenty of food and water and people having healthy conditions. Bad year is characterized by severe hunger, prevalence of human diseases and water scarcity in water points. Hadzabe therefore, are aware of rainfall variability as shown in Table 5.

During bad years some households tend to sell their labour to either community works or to their neighbouring farmers (Sukuma and Iraqw) such as building schools, roads and agricultural activity. Also they sell their few assets so as to buy food. The assets which are sold mostly include radios, bicycles, and goats. Moreover it has been reported that during bad years some conflicts emerge due to the fact that some people do move in their area with their livestock in search of pasture land and for growing crops. This leads to conflicts between farmers and hunter-gathers because farmers clear the bush (food reserve) for crop production.

4.2.1 Local perceptions on climate and climate change

During discussion with Hadzabe, it was revealed that good years in terms of climate are becoming less. Generally, rainfall variability and the occurrence of extreme events are more pronounced in terms of onset and cessation of the rain season, the number of rain days, rainfall intensity, and the magnitude of drought and flood events. The results presented in Table 6 indicate that 94% of the respondents have experienced rain oriented problems, while 6% have not experienced any rain related problems. The most common rain variations experienced in the study area include a

decrease and delay in rain and early rain season. About 57% of the respondents indicated a decrease in rainfall per season, 38% of the respondents indicated a delay in rain season, 4% did not know anything on climate change, and only 1% indicated early onset of rains compared to past decades. In the study area, however, drought followed by flood was cited by 89% of the respondents as a serious problem and 11% of the respondents mentioning floods (Table 6).

Table 6: Trends and patterns of climatic events

Parameter	Frequency	Percentage
Perception on observed pattern of rainfall		
Variability		
Yes	94	94
No	6	6
Total	100	100
Mentioned climate change vents within 10		
Years		
Drought	89	89
Floods	11	11
The most common rainfall variation		
Experienced		
Delay in rain season	38	38
Early rain season	1	1
Little rainfall	57	57
Do not know	4	4
The impact experienced from Rain variation		
Problem		
Drought	62	62
Hunger	33	33
Early food recovery	1	1
Do not know	4	4

It was reported during discussion that floods as opposed to drought have little negative impact on Hadzabe in the study area, the reasons given include the fact that floods, increases the amount of water in the soil as well as water points (the place for trapping and ambushing animals). In the uplands, tubers increase in size, quantity, and quality because the moisture in the soil is enough thus tubers can not easily shrink and become bitter during dry season; also the trend makes some berry trees to

bear fruits twice a year. The result reveals that 94% of the respondents of different ages, education level and sex have experienced the climate change and its variability. Therefore age, education and sex of the household head, have no significant impact on people's perception of climate change simply because climate change variability to Hadzabe involves observation and feeling.

4.2.2 Description of major climatic events and their associated impacts in the study area

Based on the descriptions Tables 5 and 6, hunter-gathers were able to map out bad years in terms of climate and the associated impacts. Table 7 presents a summary of major climatic events obtained in the study area.

Table 7: Major climatic events and their associated impacts in the study area

Year	Event	Impact
1983-1984	Drought	Great famine. Wild animal shifted to water points. Many people died and migrated.
1998	Too much rain (El Nino)	Plenty tubers, specifically to uplands
2002	Early rain season	Early food recovery (tubers, fruits and honey).
2003	Drought	Hunger, people migrated to other places
2006 and 2009	Drought	Hunger, influx of pastoralists and farmers to our villages leads to often conflicts.

The most famous events which were remembered by Hadzabe include the great famine that occurred as a result of prolonged drought in 1983/1984 and heavy rainfall in 1998. These events represent the indicators of climate change in the study area. Table 7 shows the major impacts of climate change on livelihoods activities. The Hadzabe complained that their way of life has changed. More specifically, hunting and gathering have been affected. Wild food is increasingly becoming scarce

and unpredictable due to drought, hence people's movement to other places in search of food (foraging migration). The migration is sometime temporary since people tend to move during bad years and come back during good years. As it is shown in Table 7 above, hunger and diseases prevalence are escalated by extreme change in rain regime. Therefore, change in weather has a big impact on hunter-gatherers' livelihood.

4.3 Major socio- Economic Livelihoods

A number of studies have indicated that poverty levels among communities in the villages is well determined by social or wealth status of the groups and have a well established relationships in terms of livelihoods when the impacts associated with extreme events such as drought or floods occurs. According to Yanda *et al.* (2005) during food shortage, poor people in the villages normally sell labour to the rich people in order to sustain their livelihood in exchange with an income or a payment in kind. In this study, the identification of different socioeconomic groups per village was important in order to; (i) determine their vulnerability to climate change and variability and (ii) to establish how different social groups cope with climate change and variability.

The main socioeconomic undertakings in the study area are divided into three major groups namely; hunting and gathering, farm related activities, and non-farm related activities. All farm activities performed in the study area by Hadzabe were at rudimentary stage. Thus, modern animals and crops husbandry techniques were still neglected. Table 8: indicates that 54% of the respondents were still engaged in

hunting and gathering, 42% were farmer-hunters-gatherers, 3% were engaging in beekeeping and 1% of the respondents were working as civil servants.

Table 8: Distribution of activities performed in the study area (n=100)

Activity	Kipamba	Munguli	Yaedachini	Mongo wa Mono	Domanga	Total percent
Beekeeper	2	1	0	0	0	3
farmer-hunter	0	15	20	3	4	42
Hadzabe	18	3	0	17	16	54
Civil servant	0	1	0	0	0	1
Total	20	20	20	20	20	100

Due to social and physical constraints, there have been a number of other non hunting-gathering income generating activities in the study area. Minor activities which mentioned during group discussion include petty business (kiosk and selling honey) and engaging in cultural tourism for some villages in the study area. Cultural tourism is increasingly becoming a source for income to the community where by, Dorobo Safaris (Tourism Company) has established the temporary camps for tourists at Mongo wa Mono and Domanga villages. At these camps, Hadzabe are allowed to exhibit their culture and taking photographs with tourists on payment. Tourism sector nevertheless, is still seasonal and it is affected by a low level of tourists flow into the village.

According to village leaders and elders, immigration is more common than emigration in the study area. The immigrants are coming from different places and they are either permanently or temporal settled depending on the cause of their migration. It was revealed that Hadzabe from Meatu and Karatu Districts have been migrating to Kipamba and Mongo wa Mono village, the reason for migrating being

hunting and gathering due to the fact that their former domicile areas have been changed to either tourism hunting, game controlled area or other investments. Likewise, Sukuma, Nyisanzu and Iraqw have been coming and permanently settling in the area for the purpose of farming. These new ethnic groups were reported as the change agent for Hadzabe culture. Apart from that, Barbaig was mentioned as a native ethnic group in the study area for many decades, the only difference between the two groups reside on their livelihoods. While Barabaig are typical pastoralists, Hadzabe are hunter-gatherers.

4.4 Hadzabe's Wealth Status

The wellbeing of the head of the household reflects the resilience level against food shortage in rural area. Basically, classifying wellbeing of an individual is an arbitrary exercise and therefore, it depends on criteria set by a particular community. In the study area, three major social-economic groups were identified by the communities based on different assets and activities. A number of factors were considered in identifying the major socio economic groups and these include: i) the amount of livestock a person owns (chicken, goat or sheep); ii) the size of farm land a person owns and use; iii) food security situation (amount of food and sustainability); iv) the number and types of house(s) a person has; v) the number and types assets a person has (bicycle, mobile phone and radio); vi) the amount of money a person has at the time. During wealth ranking (Table 9), it was revealed that majority of the population own few resources. Therefore the types of activities (Plate 1) performed and assets owned by individual household are extremely weak to cope with climate change. Weak in asset resource to hunter-gatherer was explained by the fact that, to keep, no

any body is either allowed to keep or to eat domesticated animals because of taboo beliefs. And also to engage in agriculture and keeping animal was reported as tedious activities compared to hunting and gathering.

Table 9: Contemporary wealth status in the study area

Major criteria	Rich	Medium	Poor
Amount of livestock a person owns	3 goats and chicks	2 chicks	owns 0 livestock
Amount of money (Tshs.) a person has at a time	20 000	3 000	<2 000
The size of farm land a person use	2 acres	0.5 acres of farm land	Has no farm
Food security	Has food which suffice 10 months and above in the year	Has food for sufficing for 6 months	Has food, suffice only 3 months
Number and type of house(s) a person has	Has a house made by mud bricks roofed with mud (tembe) some time corrugated iron sheet	Has house made by mud	Owns a houses thatched entirely by grass.
Number and types assets A person has	1 bicycle, mobile phone and radio and hand hoe.	Has radio and hand hoe,	Arrows and Bows

4.5 Division of Labour Among Hadzabe

The Hadzabe are not territorial based and people are free to move wherever they please, though a core group of people tends to rotate through the same sites. During group discussion it was revealed that the Hadzabe women dig tubers and gather fruits while the men mostly hunt mammals and birds and collect honey and fruits. Also as for the nature of hunting and gathering it was observed that, normally girls along with their mothers collect wild fruits and vegetables, although occasionally also young boys may accompany their mothers and sisters and contribute a lot to family

food stock. As Kajembe and Munyikombo (1998) also, reported that a big proportional of women (46%) followed by children (28%) are involved in collecting wild food and men collects (19%). Few Hadzabe are trying to engage in agriculture, though is under poor performance (Plate 1). Since agriculture, is still a new activity to Hadzabe, there was no clear division of labour.

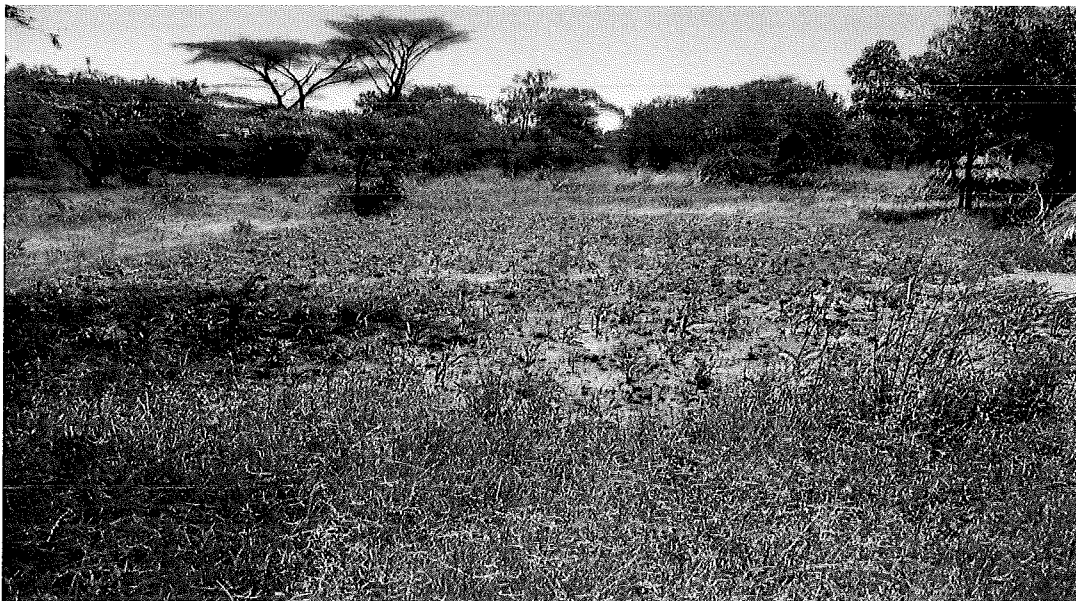


Plate 1: A poor maize farm managed, exemplifying the poor contribution of agriculture to Hadzabe's livelihoods

4.6 Status of food Insecurity in the Study Area

In the study area, chronic food insecurity was observed. Chronic food insecurity is a long-term or a persistent food shortage, it occurs when people are unable to meet their minimum food requirements over a sustained period of time and it is caused by extended period of poverty, lack of assets, and inadequate access to productive or financial resources (FAO, 2006). The types of food insecurity were determined by asking the respondents about the occurrence of food shortages. The results (Table 10) shows that 77% of the respondents reported their experience of food shortage as

being frequent, while 22% of the respondents indicated that food shortages were happening not every year and 1% respondent was food secured. Furthermore, 76% of the respondents face food shortage of between 3-5 months period per year, 16% and 8% showed food shortage of between 6-7 months and 0-2 months per year respectively. This food insecurity in the study area could be attributed to the fact that some households have a high level of dependency on natural resources which are affected by current climate change. The households which indicated to be food secure in the study area, were those whereby one of household members is either a civil servant or that the entire household is engaging in agriculture. The above findings suggest that the population in the study area has chronic food insecurity.

Table 10: Critical months of food shortages per year in the study area

Variables	Kipamba	Munguli	Yaedachini	Mongo wa Mono	Domanga	Total percent
Months of food shortages per year						
0-2		4	1	0	0	3 8
3-5		11	19	20	9	17 76
6-7		5	0	0	11	0 16
Total		20	20	20	20	20 100
Availability of food in the jungle						
Often		19	12	6	20	20 77
Sometime		1	7	14	0	0 22
Not at all		0	1	0	0	0 1
Total		20	20	20	20	20 100

Food security at household level is not only affected by the composition and quality of the daily meals but also, the quantity and seasonal availability of staple food in the jungle. Food shortage in the study area actually, starts in July and ends in February the following season. Most of the households which are prone to food shortage are

those which solely depend on hunting and gathering. The mentioned months of having food in plenty are March up to June every year. The reason given is that in March the berries start ripening while in May and June honey harvesting starts and reaches its peak in July. It was further reported that the honey sector is affected by climate change in two ways; firstly the honey harvesting time is altered because of unpredictable rain season and secondly the amount of honey has been declining over the past decades. The reduction in the amount of honey could literally be explained by the reduction in the amount of water and plant flowers which are the main honey ingredients.

4.7 Coping Strategies Against Food Insecurity

Coping strategies are the ability of the people, households, and communities of withstanding adverse circumstances. Food coping strategies are divided and discussed into three categories namely economical strategies, social strategies and environmental strategies. For every category the discussion is based on Table 11.

4.7.1 Economic Strategies

Economic strategies for coping with food insecurity include the diversification of activities in terms of hunting and gathering, animal owned, and both non-hunting and off-hunting supplements to household income. Petty business was another important off-hunting and gathering activity that was mentioned as a coping strategy for food shortage. The reported prominent petty businesses in the study area as shown in Table 11 involved the sale of honey and running small shops (kiosk 10%, and selling of assets (4%). The assets sold include small ruminant animals, chicken and cultural tools like bows and arrows which portrays their culture to tourists for payment. The

Hadzabe who conduct petty business are those living together with other ethnic groups (farmers), for example, in Yaedachini village the Hadzabe who live with other tribes, have adapted the culture of other ethnic groups. This association between Hadzabe and non-hunter-gatherers indicates that hunter-gatherer coping strategies depend on non-hunter-gatherers and therefore implies that it is difficult to isolate Hadzabe from other non-hunter-gatherers communities despite of the differences in their livelihood.

It was further noted that all of the fruit trees in the study area were indigenous. Baobab for example, was reported by hunter-gatherers from the study area to be a source of income, especially during the dry season. The same results were reported by Kajembe and Munyikombo (1998) who said that wild products play a direct and indirect role in food security. The direct role is by consumption and indirect role is by selling to generate income for other expenditure.

4.7.2 Social Strategies

Social response to food shortages include labour sharing; gift or loaning food, livestock, or cash; and in some cases sending members of a distressed family to live with more fortunate relatives or friends (Zinyama, 1987). About 52% of the respondents reported reliance on food from government and NGOs as a social strategy shown in Table 11. The NGOs and government have established a time frame which indicates the time when hunter-gatherer becomes prone to food shortages every year. Principally, food shortage in the study area starts in December and ends in February.

Table 11: Distribution of food coping strategies of hunter- gatherers toward climate change (n=100)

Coping with food shortages	Respondents	Percent
Relying food from government, NGOs, etc.	52	52
Eating food which have not used before	6	6
Migrate	17	17
Food borrowing from relatives and selling labour	20	20
All of the above	1	1
Selling of some of assets	4	4
Total	100	100

Borrowing in the context of this study is that kind of informal food loan among households. Food surplus households (non-Hadzabe households) give food to food deficient ones with the expectation of repayment. In the study area 20% indicated to be engaging in borrowing (Table 11). Basically, borrowing is done in agreement between Hadzabe and farmers. Depending on mutual agreement, generally repayment is done and most of the food used to repay back include wild meat and honey.

4.7.3 Environmental Strategies

Environment in this context means forest resource and its components. In rural Africa, wild foods provide a diversity of vitamins and minerals in the diet. Wild foods are important as a main and supplement to daily diet, and at times of food scarcity (Ngana, 1983). In addition, they provide an opportunity to generate income when they are collected and sold. Due to climate change, wild foods are used as coping strategy for rural communities in food shortage.

The Hadzabe in the study area depend on wild food, therefore, any change in wild food due to climate change has a big impact on the Hadzabe's daily life. Table 11 shows that 17% of Hadzabe people were reported to have migrated to the areas where there is enough wild food and 6% of the respondents reported to have been eating wild and other foods which they have not been used to before because of food scarcity resulting from climate change. The Hadzabe who migrated to the area first, went to demarcated villages for the Hadzabe in Mongo wa mono and Kipamba villages. These villages were purposively demarcated by the government as the sole villages for Hadzabe. In order to stress the importance of forest resource to hunter-gatherers, Marlowe (2006) contends that environment is a main source of food and it provides about 95% of food to the Hadzabe. Grains food for example, was among the mentioned food not eaten by Hadzabe for the past decades. However due to difficult circumstances faced. The Hadzabe are forced to eat such foods. Also, immature and pregnant animals, fishes, Amphibians and reptiles were not eaten when food was plenty due to customs reason, but nowadays these items are increasingly becoming common food. These provisions are usually eaten when there is a shortage and therefore demonstrate the Hadzabe coping strategies.

In environmental coping strategies, age was reported to play a big role. The active age for hunting was reported to be between 18-40s years old. The reason for this superb age of hunting could be due to the type of livelihoods performed by the Hadzabe which involves long distance scavenging for food in the jungle. According to Blurton *et al.*, (1989); grouping the population into economically active and inactive population is arbitrary and excludes a considerable number of children who

participate in the family's labour force. Old people (above 40s years old, Plate 2) were reported to be important specifically in teaching such techniques as ensnaring animals and identifying sites for hunting and gathering because of the experience they have. Therefore age of an individual plays a big role and it depends on the environmental support.



Plate 2: An old Hadzabe woman whose role is to teach scavenging techniques to young generation

In food coping strategies gender also was reported to play a big role. Although 32% of the Hadzabe interviewed (Table 3) were female, there was evidence of high responsibility of female in day to day household activities such as house building, children caring, collection of berries and baobab and other foraging activities except hunting which is done by males. Being a female in the study area plays big role in the family food collection. Nevertheless, the major determinant of gender role is essentially food accessibility in the forest.

4.8 Livelihood Activities Adapted

The Hadzabe to a certain extent, because of climate change have adapted to more new livelihoods now than was the case in late 1990s. This change does not mean that specific individuals or class of people specializes on a particular activity. An individual can undertake anything ranging from hunting to gathering, farm to non-farm activities. There are a number of non-hunting-gathering related incomes generating activities in the study area. Table 12 indicates that 63% of the respondents have at least participated in agriculture as a means of livelihood. 10% have been engaging in petty business, 10% in crop and livestock keeping, 9% never adopted any, 7% were keeping bee and only 1% adopted livestock keeping.

Table 12: Distribution of livelihood activities adapted by hunter-gatherers toward climate change (n=100)

Livelihood activities adapted	Respondents	Percent
Petty business	10	10
Small size farm (0.5 – 2 acres)	63	63
Livestock keeping	1	1
Beekeeping	7	7
Crop and livestock	10	10
Not adopted any	9	9
Total	100	100

An astounding observation from the study area was that, though Hadzabe don't like to eat and grow field crops, when there is food shortage in the jungle they do go out to sell their labour to nearby farmers (Sukuma and Iraqw) so as to get grain food for sustaining their families. Another amazing thing is that the Hadzabe are surrounded by cultivators and animal keepers, the majority of hunter-gatherer's have until

recently refused to take up agriculture on the grounds it would involve too much hard work. The question was posed to one of the Hadzabe about taking agriculture as a solution to food crisis, response was, “Why should we plant, when there are so many *ekwa* (*Vigna frutescens*) and *kongolobe* (*Grewia bicolor juss*) in the forest gifted by God?”

The observed slight changes from dependency on hunting and gathering to other non hunting activities could be attributed by climate change. The other reason could be the one explained in the Hartmann theory of “the hunter versus farmer” that most or all humans were nomadic hunter gatherers for many thousands of years, but this standard gradually changed as agriculture developed in most societies, and more people worldwide became farmers. Changes in human population, over killing of animals and environment change due to climate change and human activities caused a decline in the availability of wild foods; therefore, people adapted another way of food production (agriculture started). As the number and size of agricultural societies increased, they expanded into lands traditionally used by Hadzabe. Many groups of hunter-gatherer in the world have perpetually declined partly as a result of pressure from growing agricultural and pastoral communities. In the resulting competition for land use, hunter-gatherer societies either adopted these practices or moved to other areas.

Moreover, Hartmann speculates that transition from hunting and gathering to agriculture is not necessarily a one way process that people with attention-deficit hyperactivity disorder (ADHD) retained some of the older hunter characteristics. It

has been argued (Marlowe, 2005b; Winterhalder, 1981), that hunting and gathering represents a coping strategy which may still be exploited, if necessary, for instance when environmental change causes extreme food stress for agriculturalists, some agriculturalists may also regularly hunt and gather. Other people in the developed countries go hunting, primarily for leisure (Marlowe, 2005b; Winterhalder, 1981).

4.9 Assessment of Food Availability and Stability

In order to establish food availability and stability, the Hadzabe were asked to mention their food and rank it in the rank of food preference. Food preferences, regardless of how genetically or culturally influenced is an integral part of maintaining an adequate diet in any particular environment (Marlowe, 2006).

Table 13: Distribution of respondents' food preference and accessibility from gathering and non-gathering activities (n=100)

Variable	Kipamba	Munguli	Yaedachini	Mongowa Mono	Domanga	Total percent
Preferred staple food						
Baobab	0	0	0	1	2	3
Grain food	0	8	10	0	6	24
Wild tuber	6	0	1	1	4	12
Game meat	11	12	4	17	8	52
Honey	3	0	5	1	0	9
Ability to eat the preferred food						
Yes	0	17	12	2	5	36
No	20	3	8	18	15	64

The most preferred food is meat reported by 52% of the respondents, grain food 24%, wild tuber 12%, honey 9% and baobab 3%. (Table13). However the preferred food is not eaten frequently due to seasonal nature of its availability. Honey for example, is available only for 3 months a year that is from April to June. From the

Table 13 above, accessibility of food was reported to be another source of food shortage. About 64% (Table 13) responded that they never eat the preferred food frequently while 36% reported to have been eating the preferred food frequently. About 36% of the Hadzabe who reported above to eat food frequently, were those from villages which had adopted grain food. Therefore, the reason of poor accessibility of food could be explained by the fact that wild food is little and animals have shifted to far protected areas because of the effect of climate change.

4.9.1 Food availability

Food availability addresses the supply side of food security and it is determined by the level of food production and stock level (FAO, 2006).

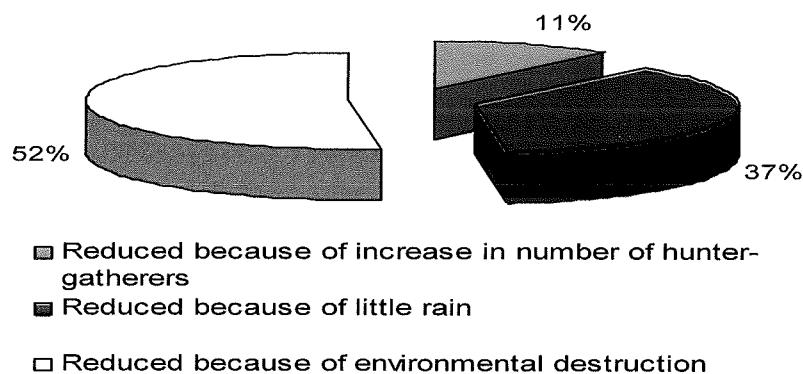


Figure 3: The main causes of food shortage in the forest

The findings from the study area show that, the wild food availability has been reduced and the reason of reduction in amount were given. About 52% of the respondents indicated an increase in number of Hadzabe competing for same resource, 37% thought the reason was little rain in the area and 11% (Figure 3) thought it was because of environment degradation by farmers and livestock keepers.

The reasons given for the reduction in the amount of food shown in Figure 3 indicated that large game animals, like buffalo and giraffe, have shifted to the protected game reserve such as Serengeti national park and Ngorongoro conservation area due to drought. Another reason is an increase in human population. According to hadzabe custom large animals' meat is used for paying dowry. Unavailability of large animals has not only affected food stability to hadzabe but it has also obliged the marriage system to change. Table 14 indicates that 40% of the respondents eat wild tuber frequently as opposed to other types of food, 19% eat baobab, 16% grain, 14% game meat and 11% eat honey as an alternative food. The percentage of food eaten as an alternative food articulates the level of food availability and accessibility to the Hadzabe. Therefore, the reason for little availability of food could be attributed to the fact that wild food is little and animals have shifted to far protected areas because of water shortage in the former territory which is exacerbated by climate change. Wild tubers because of biological facts of tolerating drought are increasingly becoming the main dish to the Hadzabe instead of meat and honey the reason being that such food items are available in abundance in the bush compared to other types of wild food.

Table 14: Distribution of respondents' alternative food eaten (n=100)

Alternative food eaten	Kipamba	Munguli	Yaedachini	Mongowa Mono	Domanga	Total percent
Honey	5	3	0	1	2	11
Wild tubers and berries	6	5	7	8	14	40
Baobab	3	4	3	9	0	19
Game meat	6	7	0	0	1	14
Grain food	0	1	10	2	3	16

4.9.2 Food stability

Stability refers to the availability of food to all people at all time. Figure 4 shows that there was food deficit in the study area. About 63% of the respondents faced food shortage of between 3-4 months, 26% faces food shortage of between 5-6 months, 7% faces food shortage of 1-2 months 3% faces food shortage of 7 and above months and 1% indicated not to have faced food shortage (Fig.4). Furthermore, food insufficiency was reported as a common phenomenon to the Hadzabe. This insufficiency of food explains instability status of food and was justified by 1% of the respondents reported to have been self sufficiency.

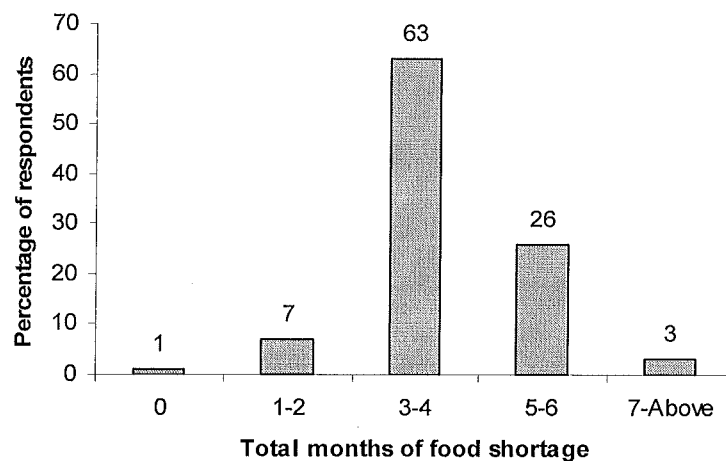


Figure 4: Level of food instability the hunter-gatherers area

According to FAO (2006) the main cause of food instability in the horn of Africa is persistence of drought caused by climate change. Food instability in the study area therefore, could be accelerated by the impacts of climate change and the nature of the Hadzabe livelihoods in that they depend on hunting and gathering. As Marlowe (2006) asserts about 80% of food (tubers, berries and honey) of the Hadzabe is obtained from gathering wild food and only 20% is from hunting. Food gathering

was reported to be seasonal biased and thus is highly affected by a change in the rain regime caused by climate change. During March to June (berries and honey) food is plenty while from August to February food insufficient. Additionally, the Hadzabe like other hunter-gatherers in the world neither preserve nor do they store food for future and this habit demonstrate food instability nature of the Hadzabe.

4.10 The Institutions and their Roles in the Study Area

During discussions and interviews major important institutions which operate in the study area were identified as shown in Table 15. The mentioned institutions play a big role for the Hadzabe coping strategies especially during unfavourable events. As shown in Table 15 however, villages in Mbulu District are more favoured by institutions than villages of Iramba District due to geographical features and position of the study area. The institutions which operate in Mbulu District are Olson Company, Oxfam Africa, Hay dom hospital, Dorobo safaris, religious institutions and Mbulu District council. In Iramba District two institutions were reported to be assisting the Hadzabe in the study area namely Iramba District council and Hay dom hospital. So, these institutions are the key players in Hadzabe' coping strategies.

Table 15: Major institutions and their roles in the study area

Institution	Major role
Olson company (Hay dom)	Deals with supply of food on behalf of government during critical periods
Iramba and Mbulu District Councils	Constructing primary and secondary schools and providing food during critical periods
Religious institutions Generally	Assist in spiritual matters
Dorobo safaris	Remitting food and clothes and cultural tourism to Hadzabe
Oxfam Africa Hay dom hospital	Remitting food and clothes. Health services to the community during diseases incidences

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

Overall, the major conclusion, that can be drawn from this study are as follows.

- It is Hadzabes' perceptions on climate and climate change that good years in terms of climate are becoming less. Generally, rainfall variability and the occurrence of extreme events are more pronounced in terms of onset and cessation of the rain season, the number of rain days, rainfall intensity, and the magnitude of drought and flood events.
- The most common cited serious problem by Hadzabe is drought. Flood was reported to have little negative impact to the Hadzabe compared to drought, the reasons given were that floods, increases the amount of water in the soil as well as water points (the place for trapping and ambushing animals). In the uplands, flood year is good for tubers quality and quantity.
- The Respondents with different age, education level and sex have experienced the climate change and its variability.
- Most people experience chronic food insecurity. This food insecurity in the study area could be explained by the fact that some households are prone to food insecurity due to their high level of dependency on natural resources which are affected by current climate change.

- Various coping strategies have been developed by Hadzabe. These coping strategies include the support from government and NGOs, eating foods which are unfamiliar to them, migrating to food endowed areas, food borrowing and selling of some of the assets. The study also reveals that some of the Hadzabe in the study area are engaged in some income generating activities like selling honey, game meat, small shops and cultural tourism.
- There is generally a reduction in food amount in the jungle. This is explained by the fact that wild food is little and animals have shifted to far protected areas because of water shortage in these former territories and this is exacerbated by climate change. Because of biological facts of tolerating drought, wild tubers are increasingly becoming the main dish to Hadzabe as opposed to other types of wild food hence low food stability per year.

5.2 Recommendations

Based on above conclusion, the following recommendations are put forward:

(a) Promoting livelihood.

There should be deliberate efforts from the government and other stakeholder to assist the vulnerable people who depend on natural resources to diversify their source of livelihoods. Diversification of source of livelihood can be achieved through promotion of other sources of income generating activities.

(b) Enforcing environmental by-laws.

The local government should strengthen its environmental by-laws so as to make sure that the demarcated forest for the Hadzabe is retained and

preserved from invasion by farmers and will be one of a solution to solve food crisis in the area.

(c) Promoting wild food.

Indigenous wild foods in the Hadzabe area should be documented and characterised for the future generation. Policies should be designed that focus on promoting the wild foods.

(d) Researching on plant diseases.

More research is called upon to identify important wild foods and the diseases which are associated with climate change.

(e) Focusing on income generating activities.

The Government, institutions and NGOs should focus on the capacity of households and how to sustain them rather than provision of free relief food during shortages when planning for rural food security.

(f) Exposing to financial institutes.

On other hand chronically food insecure Hadzabe may need more direct access to cash to enable them to raise their productive capacity and ultimately, food stability. Therefore this problem should be taken under consideration by government and other development stakeholder.

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APPENDICES

Appendix 1: Questionnaire for head of household**A. Identification variables**

Background information	Name/Number
Date of interview	
Questionnaire number	
Name of interviewer	
1 : Village Name	
2: Ward	
3 : Division	
4: District	
5: Region	

6: Were you born in this village? 1= Yes 2= No

7: In case you were not born in this village, fill in the following Table

Where migrated from (village, District)	Year of migration	Reason for migration

8: Reason for immigration

1= Marriage, 2 = hunting and gathering, 3 = searching water, 4 = farming 5=other(s)
specify

9. Provide the following information for the respondent

Gender	Age	Marital status	Education	Occupation

Code: Gender 1=Male, 2 =Female

Marital status 1= Married, 2 = Single, 3 = Widowed, 4= Divorced

Main occupation 1 = Beekeeper, 2=Farmer, 3 = hunter gatherers
4=others (specify)

Education level 1= none 2= std4 3= std7 4=secondary school
5=others specify

10. Number of children (age up 17 years old).....

11. Number of Adults.....

B: Establishment of perception on observed pattern of rainfall variability

12: In the whole time of your stay in this village have you experienced any rainfall oriented problem? 1=Yes [] 2=No []

13: What are the most common rainfall variation experienced in your village
(Circle the answer)

- (a) Delay in rainfall season.
- (b) Early rain season
- (c) Too much rainfall
- (d) Stormy rain
- (e) Little rain
- (f) no rainfall at all
- (g) Others (specify)

14: Mention any impact experienced from the above mentioned rainfall variation problem to your daily activities

.....

15: Have you changed your livelihood activity (ies) within 30 years period because of rainfall variability?

- (a) Yes []
- (b) No []

16: If yes mention them

.....

D: Hunter-gatherers' food insecurity coping strategies toward climate change.

17: Nature, effect and response to shocks, and livelihood situation by the household in the last five years

Nature, effect and response to shock			
Event/shock	When happened(date)	Effect of the event/shock	Response to event/shock

Event/ shocks: 1=drought, 2=floods, 3= illness, 4=strong wind/hurricane

Effect of event/shock: 1=hunger, 2= death of family members, 3= others specify

Response to event event/shock: 1=received relief (specify sources), remittance from relatives/friends, 3= borrow from relatives, spend cash savings, 4= household members migrated, 5= others (specify)

18: What is the most preferred staple food in the area among the following

1. Grain food
2. Wild fruits and roots
3. Wild animal meat
4. Fish
5. Honey
6. Others (specify)

19: Are you able to eat your preferred food frequently?

1. Yes
2. No

20: If no, what do you eat instead?.....

21: Have you ever faced with food shortages, say for the past 10 years

1. Yes
2. No

22: If yes, in which months did it happen.....

23: How does food shortages occur?

1. Often
2. Sometimes

24: What do you do if there is food shortage in your household?

1. Food borrowing
2. eating fruit which we not used before
3. migrate
4. relying on food relief from government.
5. Others (specify)

E: Assessment of food stability and availability

25: What are the major sources of food for household consumption?

- 1 Own hunting and gathering
- 2 From relatives
- 3 Others (specify)

26: Is there a change in of what eat you nowadays compared to what you used to eat say 10 years ago?

- 1 Yes
- 2 No

27: If, yes what are the changes?

28: What is the present situation in relation to the availability of the edible products from the bush compared to the past 10 years?

1. Increased
2. Reduced
3. Same
4. Fluctuates

29: Explain.....

30: What do you consider the important means of improving food availability and stability in general?

.....

31: Mention the drought resistance fruit trees you know.....

32: How do you preserve wild food that appears in the rain season

33: At what months of the year food is plenty?

34: If you have diversified your foods(could be wild fruits, animals or farm foods), please mention new foods you have introduced

(a)

(b)

(c)

35: Where do you go for hunting and gathering?

1=within the village, 2=nearby village, 3=in the protected area 4= to infinity, 5=others specify

Appendix 2: Questionnaire for key informants

Background information	Name/Number
Date of interview	
Questionnaire number	
Name of interviewer	
Village Name	

1: Were you born in this village? 1= Yes 2= No

7: In case you were not born in this village, fill in the following table

Where migrated from (village, District)	Year of migration	Reason for migration

2: Reason for immigration

B: Establishment of perception on observed pattern of rainfall variability

Hunter-gatherers responses to the observed pattern of rainfall variability.

3: In the whole time of your stay in this village have you experienced any rainfall oriented problem? 1=Yes [] 2=No[]

4: What are the most common rainfall variation experienced in your village

.....

5: Mention any impact experienced from the above mentioned rainfall variation problem to your daily activities

.....

6: Have you changed your livelihood activity (ies) within 30 years period because of rainfall variability?

7: If yes mention them.....

D: Hunter-gatherers' food insecurity coping strategies toward climate change.

8: Nature, effect and response to shocks, and livelihood situation by the household in the last five years

Nature, effect and response to shock			
Event/shock	When happened(date)	Effect of the event/shock	Response to event/shock

- 9: What is the most preferred staple food in the area ?
- 10: Are you able to eat your preferred food frequently?
- 12: If no, what do you eat instead?.....
- 13: Have you ever faced with food shortages, say for the past 10 years
- 14: If yes, in which months did it happen.....
- 15: What do you do if there is food shortage in your household?

E: Assessment of food stability and availability

- 16: What are the major sources of food for household consumption?
- 17: Is there a change in of what eat you nowadays compared to what you used to eat say 10 years ago?
- 18: If, yes what are the changes?
- 19: Explain the status of food availability in the forest.....
- 20: What do you consider the important means of improving food availability and stability in general?
.....
- 21: How do you preserve wild food that appears in the rain season
- 22: At what months of the year food is plenty?
- 23: If you have diversified your foods(could be wild fruits, animals or farm foods), please mention new foods you have introduced
 - (a)
 - (b)
 - (c)



Appendix 3: Checklist

Background information	Name/Number
Date of interview	
Questionnaire number	
Name of interviewer	
Village Name	

1: Trend of major climate change syndromes and evolution of community coping strategies

Year (up to recall limit)	Major impact of the disaster to the community	Responses by the institution of the society	Responses by the institutions of the state	Major coping strategy by the community we see today

3: What is the present situation in relation to the availability of the edible products from the bush compared to the past 10 years?

4: Do all household members go for fruit, roots collection or hunting?

5: When is that usually done (Month).

6: For each of the bellow category mention 5 preferred wild food

- i. Berries
- ii. Leaves
- iii. Tubers
- iv. Animals

7. Asset owned by the household in the study area

Major criteria	Rich	medium	Poor

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12
553