ASSESSING THE IMPACT OF CLIMATE CHANGE ON FOOD AND NUTRITION SECURITY AT HOUSEHOLD LEVEL IN GARBA TULLA SUB-COUNTY

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DECLARATION

I declare that this dissertation is my original work and that it has not been presented in any university or institution for academic credit. Where other people's work or my own work has been used, this has properly been acknowledged and referenced in accordance with the University of Nairobi's requirements.

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ABSTRACT

The purpose of the study was to assess the Impact of climate change on food and nutrition security at household level in Garbatulla sub-county. The study was guided by four research objectives; namely to assess the health profile and availability and distribution of food at household level in three wards of Garbatulla sub-county, secondly to evaluate the level of nutrition and food security of households for women of reproductive age and children under five years old in Garbatulla Sub-County; thirdly to assess existing coping strategies and identify barriers and opportunities for improving food and nutrition security at household and community level in Garbatulla Sub-County; and fourthly to determine the temporal patterns of temperature and rainfall over the region of study. The study was designed as a cross sectional survey which investigated households food and nutrition status in the midst of the climate change. The study aimed at collecting information from respondents on their current food and nutrition status and adaptation strategies. Children aged 6 to 59 months were chosen because they are more vulnerable and serve as a proxy to nutritional status. Data in the study was collected using a set of four questionnaires; all build on questionnaires that were used in data collection for Quantitative analysis of data from HFIAS (Household Food Insecurity Assess Questionnaire). This was performed by using analytical computer package SPSS version 20.0 and Microsoft Office Excel 2003, from which univariate variables were obtained and used to identify linear correlation to find out the relationship between effects of climate change on food and nutrition security. Increased use of coping strategies, increasing food prices, increasing reliance on food aid and declining milk production are all indicative of a deteriorating food security and livelihoods situation. According to the study survey findings 279 of the households spent money on food, accounting for 53.86% of total expenditure across the surveyed households. However, other than food, each of the other reported types of expense account for relatively small percentages of the total expenditure. This indicates that households in the sub-county are vulnerable to increases in food prices as this would push up food expenditure even further relative to other items.

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ABBREVIATIONS AND ACRONYMS

ACCCRN	Asian Cities Climate Change Resilience Network
ACF	Action Against Hunger
ASAL	Arid and Semi-Arid Land
ALRMP	Arid Lands Resource Management Project
BMI	Body-Mass-Index
CAT	Content Analysis Technique
CMR	Crude Mortality Rate
CSQ	Coping Strategy Questionnaires
CGIAR	Consultative Group on International Agricultural Research
CVD	Cardiovascular Disease
DFID	Department for International Development
DFSSC	District Food security steering committees
ENA	Emergency Nutrition Assessment
FAO	Food and Agriculture Organization
4AR	Fourth Assessment Report
FGD	Focus Group Discussion
FIVIMS	Food Insecurity and Vulnerability Information and Mapping Systems
GDP	Gross Domestic Product per capita
GOK	Government of Kenya
HAZ	Height for Age z-score
HDI	Human Development Index
HFIAQ	Household Food Insecurity Assess Questionnaire
ICN	International Conference on Nutrition
IMAM	Integrated Management of Acute Malnutrition
IFPRI	International food policy research institute
IPCC	Inter-governmental Panel on Climate Change
KDHS	Kenya Demographic and Health Survey
KFSSG	Kenya Food Security Steering Group
KII	Key Informant Interviews
LTA	Long Term Average
MDGS	Millennium Development Goals
MUAC	Mid-upper-arm-Circumference
NCHS	National Centre for Health Statistics
NDMA	National Drought Monitoring Authority
NFSNP	National Food Security and Nutrition Policy
OVC	Orphans and Vulnerable Children
PHL	Post-Harvest Losses
PLWHIV	People Living With Human Immunodeficiency Virus

RUAF	Resources for Urban Agriculture Foundation
SCHMT	Sub-County and County Health Management Committee
SPSS	Statistical Package for Social Scientists
SSA	Sub-Saharan Africa
SMART	Standardized Monitoring and Assessment of Relief and Transition
UNPF	United Nations Population Fund
VCI	Vegetation Condition Index
WAZ	Weight for Age z-score
WFP	World Food Programme
WMO	World Meteorological Organization
WHZ	Weight for Height z-score

CHAPTER ONE

1.0 INTRODUCTION

1.1 Study Area Background Information

This chapter provides the study area background, problem statement, research questions, objectives, justification, study area and the study area climatology.

Garbatulla Sub-County is one of the two sub-counties in Isiolo County, one of the 47 Counties in Kenya. To the West it borders Isiolo zone, Northward Merti, Eastwards Garissa County and Southwards, Nyambene. According to 2009 National census the sub-county occupies 10,605 km^2 and boasts a population of 43,118 people. This comprised of a rural population of 34,384 persons of whom 18,863 are male and 15,521 are female; and urban populations of 8,734 of whom 4,451 are male and 4,283 are female. Besides that, the livestock population was reported at 5,932,331 which is definite of pastoralism culture among the Borana. Majority of the land in the area is categorized as community land which is held in Trust for the people by the County Government of Isiolo. In addition, close to 95% of the area is classified as semi-arid or arid and it is basically hot throughout the year with temperatures averaging at between 24 and 30 degrees Celsius. The average annual rainfall ranges between 150 and 350mm.

This territory, being rich in biodiversity, fringes the Ewaso Ngiro River, the Meru National Park, Bisan Adhi Game Reserve and the Cheffa Wetlands. By and by, the ecosystem is delicate and the regular assets are often confronting dangers to their reality, along these lines they require their protection. The area's atmosphere is dry, with inconsistent, untrustworthy rainfall cycles. It’s dominantly possessed by the Borana group, their main financial action is rising of domesticated animals and little levels of cultivating for the most part of Gafarsa and Kinna areas. Officially, the region is divided into 3 sections, specifically Sericho, Kinna and Garbatulla areas.

Garbatulla area falls under the Semi-Arid Land and Arid (ASALs) district of Kenya that involves more than 80% of the nation and has around 10 million individuals. The proportion of animals to man populace keeps on declining; dry spells, clashes and family sustenance instability are basic components. This locates as often as possible encounters intermittent dry spells and high rates of intense lack of healthy sustenance. As environmental change lingers all around, extraordinary climate occasions have officially

affected on pastoralists employments in a critical and questionable course similar to the case in northern Kenya. Pastoralists' people group living in dominating dry, semi-dry locale are enduring worst part of antagonistic results especially food instability because of dry spells, floods and domesticated animals diseases.

This is to a great extent because of the way that destitution stays settled in pastoralist's territories, neighborhood jobs depend on delicate biological communities, and nearby ability to adjust to environmental change is correspondingly weakest. Thus, pastoralists stay helpless against environmental change.

1.2 Problem Statement

The security of food circumstance in Kenya is ceaselessly checked by the KFSSG (Kenya Food Security Steering Group), a multi-organization team that holds regular gatherings and leads half-yearly appraisals of both long and short rain seasons. These evaluations are done by multidisciplinary and multi-office groups from the Kenyan government, UN offices (strikingly FAO, WFP, OCHA) and different NGOs situated in the nation. Understanding the particular effects of environmental change on food security is testing since vulnerabilities are unevenly spread over the world and at last rely upon the capacity of communities and nations to adapt to risks. With regards to food security, some areas of the world may encounter gains under environmental change, however developing nations are probably going to be adversely influenced.

While some advancement and crisis programs have attempted various studies on helplessness of pastoralists, they do this in a clumsy way or with less coordinated effort with other neighborhood, national and worldwide organizations. Thus, insufficient data on pastoralists' vulnerabilities, existing versatile techniques and complete displayed models in expectation of environmental change impacts are deficient.

The pastoral livelihood groups in Garbatulla Sub-County have suffered continuous food insecurity among other socioeconomic problems a condition similar to other arid areas in the Horn of Africa (HOA) region. Pastoral communities in arid lands have faced impacts of severe and unpredictable climatic variability among other challenges that have led to recurrent risk of food insecurity. Despite the amount of humanitarian aid and development interventions provided, traditional coping strategies and resilience of this livelihood group are questionable. Their vulnerability is not abating and their

socioeconomic conditions are deteriorating. In recent years, international and national plays brought the issue of change in climate and its effect to attention of international forums.

It is depicted as a noteworthy risk to improvement endeavors and a reason for the event of more incessant and serious humanitarian calamities. Pastoral people created more than a huge number of years a scope of work and adapting methodologies to adjust to cruel conditions. These procedures appear to be depleted for different climatic and non-climatic reasons. As of late, adjustment to environmental change has turned into the catch word being developed and humanitarian fields. This study aims to, investigate the profile of health, distribution, availability of food at family level, scrutinize the level of nutritional and security of food of households for ladies of reproductive age and children under 5 and check existing living strategies and identify hindrances and chances for improving nutrition, security of food at family and community juncture

1.3 General Objective

The study's main objective was to assess the effect of change in climate on nutrition and food security at family level at Garbatulla area

1.3.1 Specific Objectives

i.) To determine spatial, temporal variation in temperature and rainfall over the study area.

ii.) To determine profile of health, distribution and availability of food in family point in the three wards of Garbatulla sub-county

iii.) To evaluate the level of food security and nutritional of households for ladies of reproductive mature age and kids under five at Garbatulla Sub-County

iv.) To determine current coping methods and identify obstacles and chances of improving nutrition and security of food in community level and family at Garbatulla Sub-County

1.4 Research Questions

v.) What are the profile of health, distribution and availability of food in family point in the three wards of Garbatulla sub-county?

i.) What is the state of the nutritional and food security of households with respect to women of reproductive mature age and kids under five in Garbatulla Sub-County

ii.) What are the existing coping strategies, opportunities and barriers for improving nutrition and food security at family and community junctures in Garbatulla Sub-County

iii.) What are the major climate and climate change associated risks which they encounter and their impacts on the sustainability of traditional sources of livelihood?

iv.) What are the steps forward in order to support the coping and adaptation strategies and reduce vulnerability of the Garbatulla pastoral community?

1.5 Significance of the Study

Various worldwide agreements, for example, those come to in 1996 World Food Summit and the year 2000 Summit, have define objectives and particular goals for aggregate action in lessening the rate of hunger and food uncertainty. As a general rule there has been little advance towards accomplishing these objectives. What is considerably all the more stressing is the absence of late advance, when worldwide consideration has been particularly on battling nourishment frailty. The across the board event of nourishment frailty, the seriousness of the outcomes and deficient advance in diminishing the quantities of the sustenance unreliable all point to the requirement for advance earnest activity.

Decision-makers at all focuses require exact data on who is food uncertain, what number of, where they live and significantly, why they are food shaky. Additionally they have to comprehend the idea of the food uncertainty: the term and seriousness of the issue, and the defenselessness to future food

Information and data on the occurrence and nature of food frailty is exceedingly applicable to planning powerful strategies and project. In any case, this independent from anyone else is not adequate. So as to design suitable interventions decision makers additionally need to acknowledge why individuals are food uncertain, by understanding basic causes. Without this investigation there is the threat that reaction suggestions won't be fitting. The study seeks to check the impact of change in climate on nutrition and food security at family level in Garbatulla Sub-County. Main importance of this study is to determine the effect of change in climate at the deepening food and nutrition insecurity and reoccurrence of disastrous weather events such as droughts that has become an

excuse to the prevailing food insecurity, malnutrition, failing development and humanitarian interventions, and depleted community-based traditional coping strategies. It is an attempt to establish an understanding regarding importance of the significance of change in climate related hazards to livelihoods, separate it from impacts of other socioeconomic factors. Eventually, this study will provide a set of priority recommendations that shall inform all stakeholders' decisions and actions necessary to mitigating the impact of climate change

This study will recommend an approach that promotes socioeconomic development that will integrate risk management and incorporates change in climate adaptation. These findings shall be shared and discussed at Garbatulla Sub-County food security stakeholder meetings. This will help build capacity among the small scale farmers concerning household food insecurity and coping strategy issues. The findings will also be shared with the Ministry of Agriculture and Livestock to provide relevant input in policy making in the area of household food insecurity and small scale farming practices. The findings will provide relevant data to local NGOs in planning food aid support programmes. The findings will as well contribute to knowledge body in academia and may provide insights on food security gaps for further academic research.

1.6 Study limitations

Study limitations are factors that affect the study but which the researcher has no control over them (Mugenda & Mugenda, 2003). One of the limitations of this study is that it is difficult to control the attitudes of the respondents as they might give culturally acceptable responses. The researcher will however mitigate this by requesting the respondents to be truthful in responding to the questionnaire items.

It will not be possible to entirely exclude biases of communities and other stakeholders while collecting information about major hazards and their potential impacts. There is too much talk about impact of climate change that may affect people's perspectives and opinions. Therefore, the study will use several methods to triangulate the given information.

It will be challenging to isolate the impact of change in climate-related hazards from the impact of other socioeconomic events and natural threats. Therefore, the study will take

into consideration the interrelationship between climatic, socioeconomic and natural factors.

The infrastructure in Garbatulla is poor as most access roads are damaged making accessibility to some villages difficult and in case they are the ones sampled for data collection, it might be a challenge.

Interviews require much time and are resource intensive. In this case the interviewer is considered part of the measurement instrument thus making it a prerequisite to have interviewers well trained on how to respond to any contingency which may go beyond/overstretch the available resources

1.7 Assumptions

The following were the assumptions of the study:

i.) That the respondents will be honest in giving responses to the items in the questionnaires.

ii.) Respondents are aware of the impact of change of climate on nutrition and security of food at family level at Garbatulla south sub-county

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Food Security Concept

This part introduces review of literature. The part concentrates on idea of food security, status of urban farming in Kenya, fabricating stronger and food secure groups through protection agriculture, enhancement of rural crop production procedure for food security and climate change, contextual investigations on urban harvest production system, limitations to the advancement of urban food production technique and hypothetical structure of the present study.

The most generally acknowledged definition and idea of food security is the World Bank 1986 definition which is as per the following, "access by all individuals consistently to enough food for a dynamic and solid life"(FAO, 2007). This definition is broken down to availability, access, utilization and vulnerability. Nourishment security in Kenya has been handled distinctively by attempting to control the units of creation and primarily land and water. Numerous starvations on the planet happen not in light of absence of food but rather in poor circulation occasioned by poor government policies, perishability of the food also geological difficulties, for example, poor infrastructure and poor terrains. In 1943 Bengal had one of the greatest rice reap yet many workers starved to death. Poor people workers are powerless and do not have the security of occupation that will secure food (Department for International Development (DFID), 2004).

As indicated by the FAO, food instability exists when individuals are not able to secure access to a satisfactory and safe eating regimen which compels them from driving a dynamic and healthy life today. What's more, the individuals who are as of now food secure may end up noticeably defenseless against food uncertainty later on. Security of food is a case that prevails when people, consistently, have geographical, social and financial capacity to enough, sheltered and nutrients rich food which fulfills their nutrition requirements and food supplements towards a boosted healthy living.

2.1.1 Nutritional and nutrition level

Nutrition is a science which elucidates that piece of nutrients and food in the one’s body in the midst of development, improvement and upkeep of life. In its more broad setting, nutrition has in like manner been described as being worried about "... how nourishment

is created, prepared, taken care of, sold, arranged, shared, eaten and what occurs to sustenance in one's body - how it is processed, retained, utilized" (Burgess & King, 1993). Dietary conditions suggests that nutritious levels of body, as imparted by deductively attempted parameters, for instance, weight, stature, age, blends of these. Going by these measures, a person can be portrayed as incredible or poor nutritious status.

Nourishment sustainability is affected by a broad assortment of components that may incite insufficient or over the top nutrients admissions or may cripple nutrient use. Segments particularly affecting dietary levels are investigated under orders of sustenance, wellbeing, and learning and concern. Each of them is fundamental in achieving extraordinary healthful conditions, and they frequently interface with one another. To have perfect wholesome results, synchronous movement in each one of the three ranges is required, requiring not quite recently particularly sorted out attempts at family and group levels, also appropriate national improvement methodologies and strategies to help nearby endeavors. National improvement procedures, including macroeconomic and agricultural strategies, however generally prohibited in the region of nutrition, can in like manner influence nutritious prosperity.

2.2. Analytical Framework of Food security

The diagram below shows the FAO-FIVIMS mechanism.

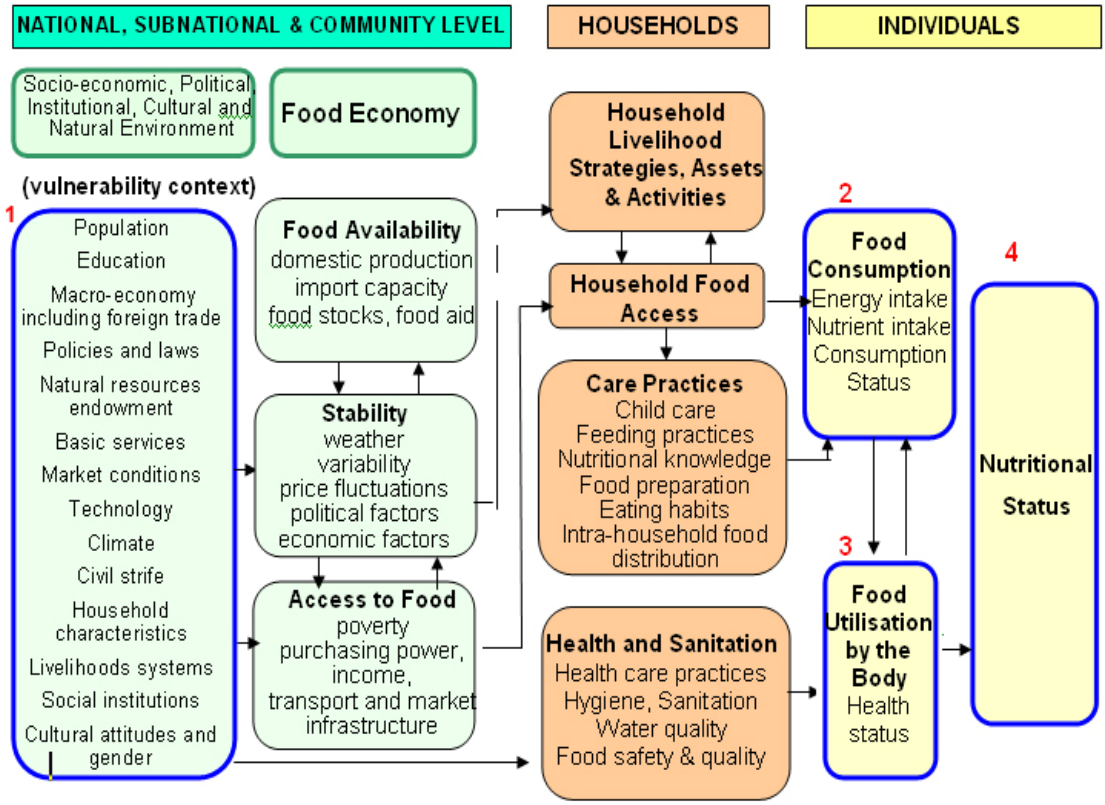


Figure 2.1: FIVIMS-Food insecurity and information and mapping systems

Source: FIVIMS (2000) guidelines for National FIVIMS

1. Political, Socio-Economic, Cultural, Institutional, and Natural Environment

FIVIMS chart shows the urge to consider relevant political, socio-economic, cultural, institutional, and natural issues, as they affect various areas of security of food (food access, food availability, food utilization, stability,), while also affecting care practices, in addition to conditions related to sanitation and health.

2. Consumption of food

Food utilization is indicated as reflected by the accompanying:

- Access to food at family unit level (as dictated by relative neediness/salaries, buying power, salary exchanges, and in addition the nature of transport and marker framework).
- Care works on (counting intra-family unit Food allotment, social practices and learning identified with nourishment planning).

3. Utilization of food

Gainful and critical food use by the body is comprehended to be chiefly dependent on a man's wellbeing status, which in this manner is liable to general wellbeing and sanitation conditions.

4. Nutritional status

- FIVIMS fragment depicts the connections and communications of the primary issues that influence a man's nutritional status.
- The nutritional results is comprehended to be subject to two primary sub factors:
- Food utilization (nutritional allow as far as vitality and supplements) and the organic usage of this sustenance (controlled by a person's wellbeing status

2.3 Nutrition and Food Security in context of crises

Strife and hunger majorly happen harmoniously. Strife is a standout amongst the most widely recognized reasons for intense food frailty. The greater part of the nations where undernourishment is most predominant experience strife. Then again, food frailty may prompt or fuel strife, especially when intensified by different stuns.

Natural events, basically dry season, additionally floods, are the primary driver of food emergencies. Huge numbers of the influenced nations have been tormented by extreme food deficiencies more than quite a long while, 10 years or more. E.g., dry spell has added to a few starvations in Africa with millions of individuals affected in the course of few years ago.

Hunger, malnutrition and suffering cause great concern at the context of natural disasters clashes and emergencies because of the media interest which they regularly attract. In any case, it is important to note that starvation and hunger in this setting are just a glimpse of a bigger challenge, and speak to just around 10% of malnourished individuals on the planet. The colossal lion's share of the affected individuals experience the ill effects of chronic forms of malnutrition and hunger – pretty much unnoticed and having no media and donor attention.

The methodologies of the performers of savagery and the victors of war progressively deny most of the number of dwellers in their premise of living and in this way increment economic and social defenselessness. The procedures hinder generation of, entrance to,

utilization and food use. These connections are depicted in and the accompanying connections can be observed:

a) Production of food

- Ceasing or diminishing of farm work because of the security circumstance,
- Seizure of farm by removal,
- Annihilation of farm via landmines
- Decimation of profitable foundation (water system frameworks, drinking water supply, neighborhood markets, seed banks and so on.),
- Lessening of farming work drive through (constrained) enrollments of young fellows and ladies, removal, wounds, mutilation, injury, and murdering,
- Relocation of workers and experts out of the contention influenced areas.

b) Access to food

- Constrained extension for development of the populace because of the security circumstance and along these lines decreased access to nearby markets
- Plundering of stocks and cash
- Extortion, abducting, accumulation of 'war charges' through equipped gatherings,
- Causing people starve as a result of war.

c) Utilization of food

- Plundering, demolition of health, training and also sanitation systems,
- Nonattendance, inadequacy of expansion and training administrations in the scenario of wellbeing and agriculture,
- Removal, wounds, traumatisation and assault of common populace prompting deficient utilize and use of food because of stress.

Under these conditions most of the populace tries to produce least measures of food for a living. This incorporates broadening of wages (subsistence farming, frivolous exchange, searching for a vocation and movement) and redistribution inside solidarity systems. Here and there individuals are compelled to diminish their advantages keeping in mind the end goal for survival, e.g., consumption of seeds and abuse of regular assets, which at that

point imperil the reason for their long haul nutrition and food security (FAO 2002, 22). Some methods for dealing with stress are not negative in essence, but rather prompt further weakness of the populace since they twist social principles. This established case is the beginning of conventional men undertakings by women. Nutrition, Security of food and helplessness to cataclysmic events are nearly interlinked through different immediate and backhanded impacts. As an outcome of floods, dry seasons or quakes, gathers and market framework can be devastated which prompts an intense lessening of nourishment accessibility and access to food? In the event that gainful framework is likewise influenced this decreases the agricultural harvests in the average term, along these lines lessening ranchers wage and potential outcomes to guarantee access to food. Individuals in urban and country zones relying upon non-cultivate openings for work is jeopardized through durable financial emergencies which can regularly be seen in the fallout of the natural disaster (FAO 2000, IV).

On the other hand, food and nutrition frailty, poverty and neediness catalyze the defenselessness to catastrophic events. Destute people are not ready to make arrangements for common disasters and regularly are compelled to work in chance zones. That, consequently, expands likelihood of given natural catastrophes, like floods and landslides.

2.4 Food security

Security of food is eventually connected with acquiring healthfully sufficient food of family, i.e. the capacity of families to get a nutritiously satisfactory eating routine constantly. It is vital to note at this phase the accomplishment of family unit nourishment security may not really bring about enhancements in the wholesome status of all family individuals. Access to healthfully sufficient food ensures neither satisfactory utilization by all people inside the family unit nor the suitable natural usage of the food consumed. How does family unit food security at that point identify with human nutritious levels, as communicated in physiological or biological terms?

The response that is appropriate is that family security of food can be converted into great healthful status if family individuals have food surety, a situation that consolidates:

- Access to healthfully satisfactory and food that is safe

- Adequate learning and aptitudes to gain, get ready and devour a nutritiously satisfactory eating regimen, especially those that fulfill unique desires of youthful kids;
- Wellbeing administrations access and sound situation to guarantee compelling organic usage of foods consumed

Genuine nutritional prosperity is then controlled by various interrelated elements, which other than security of food incorporates sanitation and health, satisfactory flow of clean water, guardians' education, time to prepare food and care of vulnerable people inside the family. Family unit security of food is along these lines one of the essentials for good nutritional levels. A mechanism of the components which decide wholesome nutritious result has been outlined in this Figure 2.2 beneath

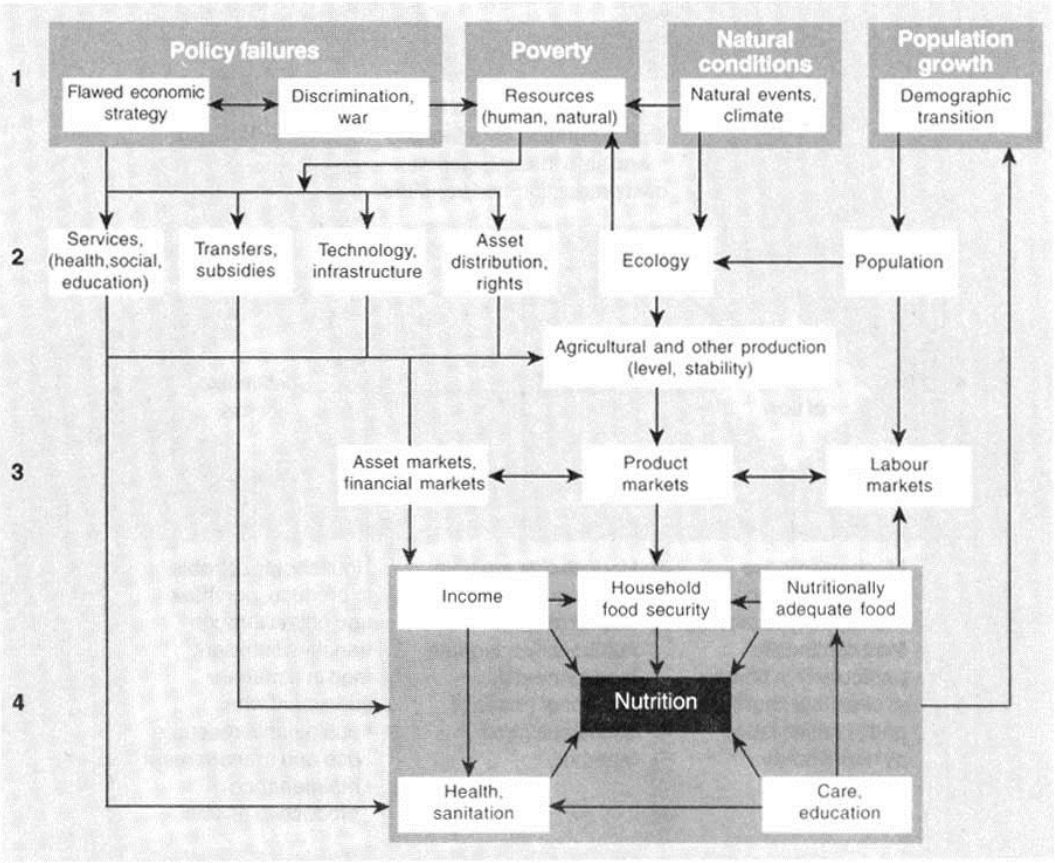


Figure 2.2: Determinants of Nutrition Security: Basic causes and Links

Source: FAO, 1996c

2.5 Poverty, Change in Climate and Security of Food

Environmental lapse will result to unmistakable estimations in security of food - food accessibility (creation and exchange), consistent quality of food generation, reach to food and utilization. Farm yields in growing countries are depended upon to diminish by 10-20% by 2080. Recent thought on the issue of overall natural change has focused on the potential agricultural impact and worldwide and provincial food security suggestions. Food supplies in littler nations are most likely going to be affected more by environmental change than those of the bigger nations.

2.6 Current Food Situation Analysis

Food security is a developing stress all through the under-developed countries, especially for children and poor women (CARE International (2011). In 2010, around 925 million people were undernourished. A flow provide details regarding the inevitable destiny of food and research perceived six drivers of progress affecting the world wide food framework : a creating overall masses; evolved diet, exceptionally interest for resource genuine meat things; food frameworks systems, including globalization of business segments, dies down and exchange limitations; rivalry for resources, especially land, water and vitality; customer esteems and morals, and effects of environmental change (CARE International, 2011). It is assessed that food production should increment by 50 percent by 2030 just to remain mindful of the solicitations of developing urban masses. Meanwhile, environmental change is foreseen to cause decreases in overall grain production of 1-7 percent by 2060, contingent on the atmosphere show results for the projection.

According to Anderson, Gundel and Vanni (2010), the threat of hunger from environmental change is as a result of both direct consequences for food structures, and of circuitous impacts that impact the unmistakable estimations of food security. Table 2.1 gives a layout of the potential direct aftereffects of key ecological change impacts for food systems. These are general case – the relationship between the atmosphere and the food system are confusing and move essentially in light of nearby conditions. In this way, both the environmental change impacts and their outcomes ought to be explored at the neighborhood level with a particular true objective to configuration fitting intercessions

2.6.1 Factors affecting food and nutrition security

There exist two classes of insecurity to food in Kenya - occasional (transitory) and chronic. Chronic insecurity of food, whose crucial reason is low access to creation resources, is expansive in the medium and high potential regions where people densities are high and beneficial land is not accessible. Infrequent malnutrition, then again, occurs on account of ecological and financial stunt. It to a great extent, impacts the dry and semi-dry zones that experience drought, happening into high livestock animals losses. It is assessed by the Ministry of Agriculture that around 2 million people encounter the evil impacts of chronic food instability.

A portion of the definitions behind food insecurity as highlighted by the Inter-Agency Task Force on the security of food in the Horn of Africa include:

- Ecosystems that are fragile
- poor agricultural productivity
- unstable knowledge and information systems;
- narrow base of occupation
- Low immunity;
- educational standards that are low

2.6.1.1 Environment and nutrition

This area features the agricultural nutritional linkages in connection to the idea of technology use. Previously, African farmers and pastoralists created cultivating frameworks as indicated by environment. The overwhelming types of farm utilize are shift cultivation at humid tropical areas and nomadic lifestyle in semi-parched zones. Results were poor, and generally vast zones expected to help little populace. Lately, we have seen fast development at populace and expanding venture into peripheral zones by which accessible resources are being extended as far as possible.

Families insecure to food don't purposely corrupt their resource base; despite what might be expected, they are typically completely mindful that security of food is at stake if their environment is debilitated. Populace development specifically builds consumption needs and forces many homestead families into marginal areas where preservation practices are basic. FAO has evaluated that half of African farmers live in conditions with an

exceptionally defenseless characteristic resource base. Such territories incorporate cleared forests soils of delicate structure, steeply inclining lands and dry land ranges with limited rainfall.

Furthermore, the expanded interest for fuel wood for cooking may leave peripheral terrains for all time exposed of soil cover and subject to erosion. Such loss of profitability in the resource base unavoidably diminishes food supplies and builds food insecurity and nutritious anxiety, especially among helpless groups. Reduction in the accessibility of fuel or time for cooking (as women need to walk further to gather wood) could likewise bring about arrangement of fewer cooked meals or inadequate reheating of foods, thus decreasing food consumption by children and increasing the risk of microbial contamination of food.

2.6.1.2 Impact of HIV/AIDS on security of food and household nutrition

Energy and nutrients inadequacies, regularly combined with infections and parasitic maladies, ruin grown-up physical execution and work capacity. The subsequent loss of productivity frequently involves genuine consequences' for the food security of affected families. Present mortality rates and morbidity reveals that in many countries AIDS is probably going to significantly affect the capacity of individuals to deliver, transport, and offer and purchase food. In rural areas HIV contamination has been assessed to surpass 30% for some age groups (UNAIDS 2003). Repetition of lack of healthy nutrition shall be controlled by the dominance of HIV in certain groups and the adequacy of group based adapting methodologies. For instance, in rural territories where women have a dynamic part in farming generation and up to 20% of ladies going to clinics are positive, a noteworthy decrease of quantity of grown-ups in workforce is inescapable (WHO 2003). In rural groups of sub-Sahara Africa, AIDS is currently bringing about work deficiencies to farm work. Other than lose of patient's work through disorder and ensuing demise, relatives need to redirect time to tend to the debilitated and subsequently disregard farming activities (FAO 2001). The outcome is loss of potential pay.

2.6.2 Policies and actions for nutrition security and household food

Information regarding fitting measures to curb malnutrition and hunger has uniquely expanded in the course of recent three decades. The International Conference on Nutrition (ICN) concentrate on nutrition, wellbeing, care and training factors is a piece of a

developing global accord concerning the reasons for unhealthiness and speaks to a change of emphasis of more limited supply of food methodologies of 1960s and70s.

Members at ICN examined wide scope of procedures, activities towards enhancing nutrition that are organized along lines of central point causing ailing health. These activities examined start at macroeconomic approaches to different farming and economic policies to particular nourishment projects and intercessions. It has been underscored that endeavors to enhance nutrition should from beginning tackle inconvenient strengthening connections among nourishment instability, ailment, improper sanitation, poor education and under nutrition.

2.6.3 Stabilizing Family Food Supplies in Semi-Pastoralist Societies

Semi-pastoralists who keep goats, sheep, and camels pick up an extensive level of adaptability in adapting to occasional food shortages. Camels and Goats are browsers and blossom with shrubbery land not appropriate to cows. They can use African shrubbery land plant species that hold their nutritive incentive into the dry season, when prairie scavenges is depleted. Goats and sheep give drain, obviously, however they are additionally the pastoralists' principle wellspring of meat. This dietary inclination represents the far reaching misguided judgment that African pastoralists abstain from slaughtering their stock, which is genuine fundamentally in regard of female cows (FAO/WHO, 1992a). They speak to a helpful store of reserve funds, effectively changed over into either grain or money. Surely, field perception has recommended that they constitute the primary choice for expanding the liquidity of family unit salary in most African settings where managing an account is not yet compelling. Little stock are frequently left under the control of ladies, and the likelihood of exchanging a goat or two could have an enormous effect in a family unit's food circumstance toward the finish of a long dry season. These points of interest clarify the perseverance and development of little stock creation even in conditions that are great to dairy cattle, (for example, at Ngorongoro in northern Tanzania).

The change of domesticated animals into grain remains a need for the survival of the African pastoralist. Indeed, even with blended crowds, the drain supply is to a great degree variable over the season. A genuinely generous herd must be aggregated before a family can maintain itself on domesticated animal’s items over the whole year.

The capacity to rely upon grain foods in the midst of the season of deplete deficiency is basic to producers with inadequate draining domesticated animals. Accepting, in any case, the standard customary deficiency connects into an essential dry season, creatures begin to fail miserably, costs dive, and grain supplies vanish from neighborhood markets. Thusly the very accomplishment of progress from minimal stock to grain in average seasons leaves creatures attendants overextended and powerless in genuine droughts (FAO/WHO, 1992a).

2.6.4 Policies by the Government

From independence, the Kenyan administration has been upholding for preservation and appropriate natural administration and food security. This has been explained in different approach explanations, government mandates, denouncements, the Seasonal papers and improvement designs. Inside the setting of the UNFCCC, A sum of 22 African Least Developed Nations (LDC) have overviewed their own adjustment needs and examined them into the National Adaptation Program of Action (NAPA). These archives characterize every African slightest built up nation's adjustment needs. They focused on farming, food security and water resource administration. Examination of the national adjustment projects of activity by minimum created nations in Africa demonstrates the sorts of agrarian research pertinent to the adjustment needs distinguished. It is vital to call attention to that the larger part of National Adaptation Program of Action (NAPA) distinguishes "learning sharing" as a key segment in environmental change adjustment, which demonstrates the nation’s assurance to go up against the difficulties, postured by environmental change. Moreover, there is the need to systematize existing Agriculture and Rural Development (ARD) yields as far as their pertinence to environmental change adjustment and alleviation.

Point 18. To energize the foundation of a store to compensate or give motivating forces to decreasing discharges through maintainable land-administration works on, including woodland protection, feasible timberland administration, the evasion of deforestation, a forestation and practical farming;

Point number 23. To coordinate change in climate, adjustment measures into national and regional advancement designs, approaches and systems and, where proper with a

view to guaranteeing sufficient adjustment to climate change, in such ranges as water assets, agriculture, health, foundation, biodiversity and biological communities, forests, urban administration, tourism, sustenance, land, condition and vitality security and administration of coastal front and marine assets, considering cross-sectional implications;

Point number 28. To concur that various mitigation moves being undertaken, for example, extra measures to supplement the UN Program on mitigating Emissions originating from Forest Degradation and Deforestation and in Developing nations, including aforestation and supportable horticulture and land-utilize administration, ought to be energetic, sensible and adaptable to ensure the successful interest of African nations, mainly small scale land users;

Point number 33. To involve sub regional, provincial and global associations to derive philosophies for estimating carbon sequestration in forestry, agriculture and agro-forestry service frameworks and bookkeeping strategies to be connected for ensuring proper benefits

2.6.4.1 Nutrition and Food Policies, Environment and Legislation

The Kenyan government has demonstrated a solid sense of duty regarding hunger and ailing health through various arrangements (Republic of Kenya, 1981, 1994, 2007). By and by, natural issues and food instability still persevere, as a portion of the strategies are never completely executed. Taking the arrangements from paper to endorsed strategy and from approach to financing and powerful projects is a testing multifaceted process requiring association from numerous administration and non-legislative groups that occasionally view themselves as irrelevant. In the most recent decade, the nation has created ecological approaches and ability to deal with the earth. At display, there is great comprehension of the idea of key condition issues. Nonetheless, the principle issue appears to originate from the ability to screen and uphold the current enactment, and to execute the current ecological approaches.

2.6.4.2 Relevant National Policies and Legislation pertaining to climate change in Kenya

The Kenyan Government strategies, policies, plans, and initiatives providing a critical system for implementing change in climate responses include:

The Kenya Constitution (2010) that gives room for the derivation of mitigation and adaptation legislation, policies, strategies by ensuring the right to healthy, clean climate under Bill of Rights.

Vision 2030, nation's growth roadmap revealing flagship projects, programs regarding approaches of mitigation and adaptation. These incorporate:

The Integrated National Transport Policy of 2010 accommodates transport approaches which have relevance to change in climate alleviation.

National Policy for Sustainable Development of Northern Kenya and other Arid Lands majors in atmosphere versatility demanding the Government to discover answers for deliver climatic challenges and to concoct moves to oversee dry seasons and fortify livelihood. The arrangement also concentrates on an empowering domain for quickened interests in "establishments" to diminish poverty and assemble growth and development.

Threshold 21 Kenya is dynamic activating instrument intended to extensively support, incorporated long term national advancement plan. This T21-Kenya mechanism was developed to integrate examination of various dangers and effects of environmental change over real segments in economy, societal and condition, keeping in mind the goal of illuminating cognizant national improvement measures which support maintainable advancement, poverty destruction, and expanded prosperity of poor individuals, particularly ladies and youths, under Vision 2030 settings.

2.7 Change in Climate, Nutrition and Food Security

Change in climate is starting at now influencing food security. Increments in temperatures in the environment structure has been unequivocal and also as it is right now clear from impression of augmentations in the worldwide ordinary ocean, air temperatures; no matter how you look at it condensing of snow- ice and rising sea level. Observational confirmation from all territory's and most oceans exhibits that various general systems are being affected by commonplace environment changes, particularly temperature grows: the typical temperature climbed by around 0.3℃ in the midst of the essential segment of the twentieth century, and by another 0.5℃ in the second half up to the begin of the 21st century (IPCC, 2007a). Much of observed increase of overall temperatures since mid-twentieth century is likely a result of the watched augment in anthropogenic GHG centers (IPCC, 2007a).As its effects turn out to be more articulated, environmental change will

make the test of accomplishing food security significantly harder. Its consequences for sustenance creation and dispersion may expand destitution and disparity, with subsequent impacts on occupations and nutrition.

Finally, effects could be associated to extreme climate occurrences that contribute to setbacks, household food uncertainty, and malady, impede, increased population disengagement and weakness.

In the long term, change in climate influences characteristic resources and consequently food accessibility and get to, also, ecological health and access to human services. In the most influenced zones these long haul impacts in the end can prompt short lived or perpetual movement, which mainly abandons families headed by females

Change in climate is consequently observed as a critical "yearning hazard multiplier". Truth be told, a few estimates envision 24 million extra malnourished kids by 2050 – half of these being in sub-Saharan. Lack of proper health and under-nourishment thus additionally undermine individuals' flexibility to climatic changes and its capacity towards adjustment.

Change in climate and inconstancy affect security of food and malnutrition. They are now prompting more exceptional and longer dry spells, and the recurrence of substantial precipitation occasions has expanded in numerous regions. Probably, warmth waves and substantial precipitation occasions will keep on becoming regular and that future tropical tornados and extreme climate occasions will turn out to be more serious. The danger of flooding may increment, from both ocean level ascent and expanded substantial precipitation in beach front regions. This is probably going to build the quantity of individuals presented to diarrheal and different infectious diseases, in this manner bringing limit of those people down to use food adequately. Dry spells and water shortage lessen dietary assorted qualities and decrease general food utilization and this may prompt malnutrition.

At long last, over the span of the 21st century, supplies of water put away in glaciers and snow areas are anticipated to decrease, lessening water accessibility in districts which are home to a sixth of the total populace. Deforestation, farming and livestock generation frameworks additionally quicken environmental change. The extension of domesticated animals and biofuel parts has a noteworthy part in degradation of land and deforestation.

Being prone to unfriendly impacts of environmental lapses contrasts by localities, biological system, populace groups and gender. The most vulnerable individuals will endure soonest and most, as they will be most constrained regarding methods for dealing with stress, protection and social security nets. The region liable to be unfavorably influenced is those officially most powerless against sustenance weakness and lack of healthy sustenance, strikingly in Africa. In occasionally dry, tropical areas, crop production is anticipated to diminish with little neighborhood temperature increments.

Climate change is as of now influencing food security. Observational proof from all mainland's and most seas demonstrates that numerous regular frameworks are being influenced by provincial atmosphere changes, especially temperature expands: the normal temperature ascended by around 0.3℃ amid the primary portion of the twentieth century, and by another 0.5℃ in second part up to start of 21st century (IPCC, 2007a). The majority of the observed increment in worldwide temperatures from the mid 20th century is because of the observed rise in anthropogenic GHG focuses (IPCC, 2007a).

As its affects turn out to be more articulated, environmental change will make the test of accomplishing food security significantly harder. Its consequences for sustenance creation and dispersion may expand destitution and disparity, with subsequent impacts on occupations and nutrition.

Anticipated change in climate exposures are truly going to affect health conditions of large number of people, especially them within low versatile limit, through:

expanded deaths, infection, damage because of climate related occasions – warm waves, floods, storms, fires and dry seasons;

- expanded hunger due to decrease in both quality and amount of nutrients admission;
- Expanded recurrence of cardio-respiratory ailments because of higher convergences of ground-level ozone identified with change in climate;
- Expanded and increased effect of diarrheal illnesses.

Malnutrition caused by extreme climatic occasions might be a standout amongst the most malevolent outcomes of environmental change. Food and nutritional security of many people worldwide might be influenced. Populaces facing the risk incorporate small scale

farmers, pastoralists, indigenous individuals, coastal population and fisher people (Jones and Thornton, 2003). In addition, the gender imbalance which right now bargains advancement in numerous poor nations could be exacerbated by atmosphere related poor climate. A considerable lot of world's most destitute individuals are ladies in the rural areas who rely upon subsistence agribusiness to feed their families.

2.8 Effects of Climate Change across Africa

In spite of the fact that change in environmental is a risk facing all nations, developing nations are most powerless. According to World Bank (2009) gauges that these should bear somewhere in the range of 75% to 80% of expenses of harms observed. A worldwide 2℃ rise in temperatures above modern temperatures can bring about lasting falls in GDP of 4% to 5% in Africa. The African mainland warmed by around 0.5℃ a century ago. This century normal yearly temperatures are anticipated to ascend by 3 to 4℃. Atmosphere models agree that numerous arid areas will end up noticeably drier and humid regions wetter.

The effects of environmental change crosswise over Africa will shift:

- At mid-to high scopes, production of crop may increment somewhat for nearby mean temperature increments of up to 1–3℃, contingent upon the yield, while at bring down scopes crop production is anticipated to diminish for even moderately little neighborhood temperature increments (1– 2℃) (IPCC, 2007).

About 66% of sub-Saharan Africans rely upon animals for some piece of their occupation. Environmental change will influence the efficiency of rain-cropped products and foliage, decrease water accessibility and increment broad water deficiencies, and change increment the seriousness and appropriation of noteworthy yield, livestock's and human diseases. Subsequently, real changes can be expected in livestock animal's frameworks, identified with animals species blends, crops crop and encourage resource and nourishing techniques.

2.8.1 Impact of Climate Change

Climatic change influences vulnerability to food security in the primary case through its biophysical impacts on yield, livestock animals, and farming framework profitability. Changes in temperature and rain implies and expanded changeability convert into changes in normal levels and inconstancy in food production, with take after on impacts

on salary for food makers and food moderateness for net buyers in rural territories and for urban shoppers. Expected increments in atmosphere inconstancy will bring about expanded changeability in agricultural production prompting more cost and wage vacillations.

Management of risk by all members in the food framework, from people and family units to countries, will be perpetually vital Climate change and an Earth-wide temperature boost is viewed as real dangers to farming and food generation.

2.8.2 Effects of change in climate on Agricultural Production

Numerous natural, financial anxieties, for instance, globalization, constrained accessibility of water assets, diminish of biodiversity, AIDS catastrophe and wars, are expanding affectability to change in climate and lessening flexibility in agriculture. Climatic lapses are therefore going to decrease dependability of water sources, water supplies, hence expanded wars for water. Water shortage thus hence may cause different antagonistic health results, for instance waterborne ailments, presentation to vector-borne maladies related to water-shortage and lack of healthy food.

2.8.3 Change in Climate and Family level food availability

Changes in climate influence the basic parts of production of food, i.e, water, soil, and biodiversity, adversely. Significantly, it affects every one of the four types of security of food measurements (FAO, 2008).

As a rule, change in climate is relied upon to cause quantity of people in danger from craving to develop. It is therefore difficult to keep up a persistent sustenance supply with occasional creation. Surges and dry seasons are a noteworthy danger to strength of nourishment and could bring about brief and perpetual food uncertainties. Both these events are expected to happen all the more every now and then, strongly and with less consistency due to changes in the atmosphere. Rustic territories that rely upon rains for farming, the adjustments in recurrence and measure of rain in a specific season will cause an unusual nearby food framework creation.

2.8.4 Effects of Change in Climate on Nutrition and Security of Food

Many highways exist at which change in climate and variability may affect nutrition and food security:

- expanded recurrence of outrageous climatic occasions;
- Ocean level ascent and flooding of waterfront lands, driving toor contamination of agricultural lands and water ;
- Effects of increment in the temperatures and shortage of water on plant and physiology of creature;
- Advantageous impacts to crop generation via CO2 "treatment";
- Impact on plant and domesticated animals illnesses and pest species and domesticated animals ailments;
- Harm to forest service, domesticated animals, fisheries and aquaculture; and
- Hindered supportability: financial, political/equipped clash and demographic impacts.

Climate change will influence every one of the four measurements of food security by means of these previously mentioned pathways. Farming yield in developing nations is relied upon to decrease by 10–20% by 2080. Internationally, food generation is anticipated to develop with increments in local normal temperature over a scope of 1–3°C, however over this it is anticipated to diminish. In regularly dry and tropical areas, even slight warming (1–2°C) diminishes yield. In this manner temperature increments of more than 3°C may cause nourishment costs to increment by up to 40%. Temperature increments are likewise prompting changes in the appropriation of marine fisheries. For instance, increments in barometrical CO2 are raising sea acridity.

Changes in patterns of extraordinary climate occasions influence stability of, and in addition access to supplies of food. Expanding recurrence in farming misfortune because of climatic stuns may consequently defeat constructive outcomes of direct temperature increments. As per forests, raised dangers of fires and insect outbreaks episodes and that of wind harm are anticipated. Nourishment frailty and jobs loss may additionally be increased by loss of developed land, nursery regions for fisheries through immersion and beach front disintegration in lowly territories.

Change in climate may influence health results and usage of food with extra outcomes for unhealthiness. Water shortage or on the other hand flooding is one way that this may happen. Populaces in water-rare locales are probably going to confront diminished water accessibility, in this manner expanding potential for poor cleanliness and sterile practices and additionally expanded utilization of non-consumable water for cooking and drinking.

In different territories, flooding, expanded rainfall and temperatures are probably going to build occurrence of irresistible and runs sicknesses. In the two situations, change in climate will disturb the horrendous synergism which exists amongst ailing health and irresistible infection. As change in climate is anticipated to build the weight of diarrhea ailments in low-paying localities by around 2–5% by 2020, an attendant ascent in ailing health is normal.

Another case of connection between change in climate, wellbeing results, food and security of nourishment is malaria. In long haul, topographical scope of malaria shall contract in ranges encountering desertification (because of diminished dampness and water required for mosquito rearing). Also, somewhere else, the parasite's range will grow and the transmission season may change and stretch. It's assessed, in Africa, environmental change shall build the quantity of individual long stretches of introduction to malaria from 16–28% by 2100. Greater transmission seasons will thusly diminish work profitability, hence influencing food and nutrition security. Longer transmission seasons might likewise build outright quantities of individuals experiencing malaria. Therefore, change in climate influences security of food and nutrition by compromising people's immune frameworks and also their capacity to utilize nutrients.

2.8.5 Social Effects of Change in Climate

Small-scale cultivating families in dry land regions are especially helpless against expanding recurrence and seriousness of dry seasons. Dry spells prompt harvest disappointment, expanded illnesses and mortality of animals, obligation, out-relocation and reliance on nourishment alleviation. Dry spells additionally contrarily affect human advancement markers, for example, wellbeing, nourishment and instruction. Dry season and the subsequent loss of jobs are likewise triggers for populace developments, especially country to urban relocation. Quick mass movement makes urban ghettos with high predominance of lack of healthy sustenance, and other communicable ailments.

Difficulties postured by urban ghettos are the absolute most squeezing on the planet. Urban areas are regularly unfit to adapt to the monstrous general medical problems they posture, and the issue is commonly aggravated by high rates of crime and violence. Environmental change may, in numerous nations, additionally exasperate circumstance. For instance, UN extends that nearly 50 million individuals will escape environmental worsening by 2020. A considerable lot of them will move to urban communities, where

they shall be helpless against water and food crises, sick wellbeing, ailing health and improved probability of brutality and conflict.

2.8.6 Climate Change impacts in Kenya

Potential effects of environmental change on food security incorporate both direct dietary impacts (changes in utilization amounts and composition) and livelihood impacts (changes in work openings and cost of obtaining sufficient nourishment). Environmental change can influence each of these measurements. Both biophysical and social helplessness are basic as one considers the effect of environmental change on nourishment security. Social powerlessness looks at the statistic, social, financial, and different qualities of the populace that influence their presentation to hazard and their capacity to react to and adapt to negative stuns. A social weakness focal point is basic to comprehend why certain people, families, or groups encounter contrasts in impacts notwithstanding when they are in the same geographic district.

Kenya's agricultural segment is one of the significant drivers of the nation's economy, yet it is very powerless against outrageous whether occasions, climatic stuns and more broad climatic changes and inconstancy. For instance, repeating dry seasons have made overwhelming misfortunes domesticated animals, compelling an expected 30% of animal’s proprietors out of pastoralist in the course of the most recent 20 years. Broadened times of dry season dissolve work openings and group strength in these territories; prompting undesirable adapting procedures that harm nature and impede family unit dietary status, additionally undermining long haul food security.

It is assessed that, in the vicinity of 2008 and 2011, dry spell, a noteworthy climatic danger in Kenya that is winding up noticeably more incessant, has caused misfortunes in domesticated animals and agribusiness that added up to 699.3 billion shillings (72.2% of aggregate misfortunes) and 121.1 billion shillings (12.5% of aggregate), individually. With the weakening climatic situations, and basically because of an Earth-wide temperature boost, yearly development rate in agricultural "esteem included" has been on the decrease. Historically, negative development files have been related with outrageous whether occasions (Figure 2.3).

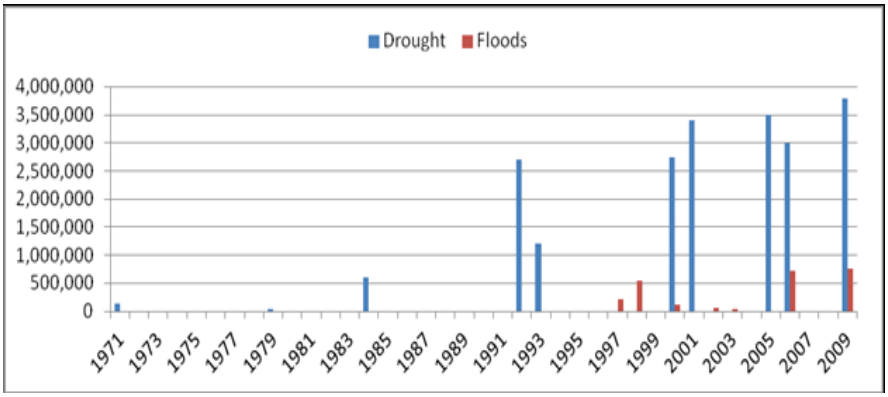


Figure 2.3: People in Kenya affected by flood and droughts disasters (starting1971 – ending2009)

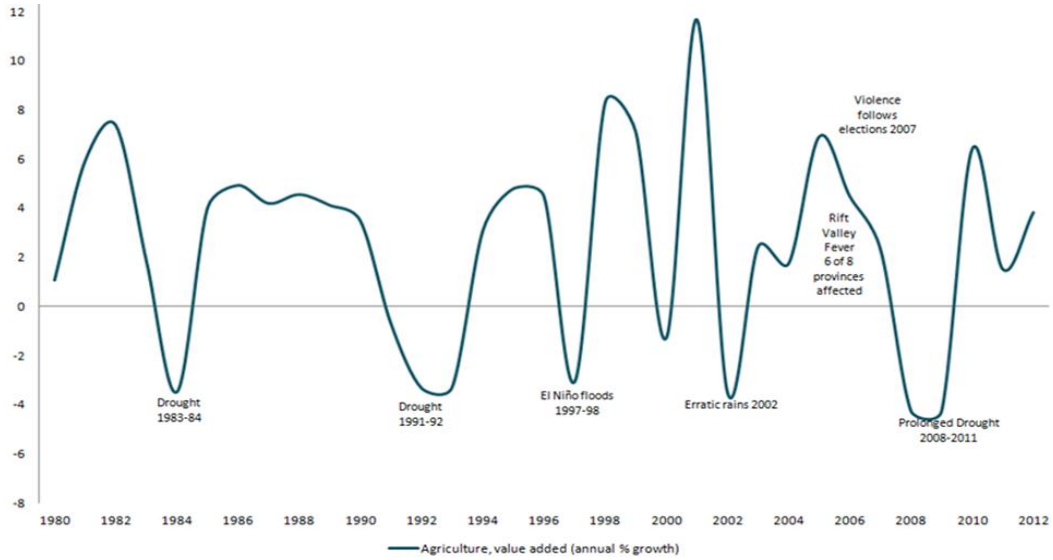


Figure 2.4: Farming Growth Index (1980 – 2012)

The focal part of climate and weather in Kenya's agricultural generation is best caught in the Kenya Economic Report of 2013: "The execution of the farming division was antagonistically influenced toward the start of 2012 when an extreme ice managed a hit to tea creation, while the postponement in the beginning of long rains prompted smothered rural generation. Be that as it may, enhanced and boundless downpours amid the second and third quarters of the year added to solid execution of the division." "Development in the agricultural segment decelerated in 2013 to 2.9 for every shilling from an overhauled development of 4.2 for each shilling in 2012 incompletely because of deficient rains got in some grain developing regions" (Economic study report 2014).

Climatic forecasts for Kenya feature various vulnerabilities, dangers and effects for the agricultural part, including higher temperatures (projections indicate temperature increments of 1ºC in 2020 and 2.3ºC in 2050 in particular locales changes in rainfall circulation, and successive outrageous occasions, for example, delayed dry season and flooding, adding to more regular water deficiencies and subsequently decrease in horticultural efficiency (Luedeling 2011). The warming pattern has additionally been prompting expanded spatial and fleeting inconstancy in precipitation and evapo-transpiration designs. Again, there is a positive pattern (increased rains) amid Short Rainy period of September to December, where short stormy season is stretching out to what is ordinarily hot, dry time of January to February (Figure 2.7 below)

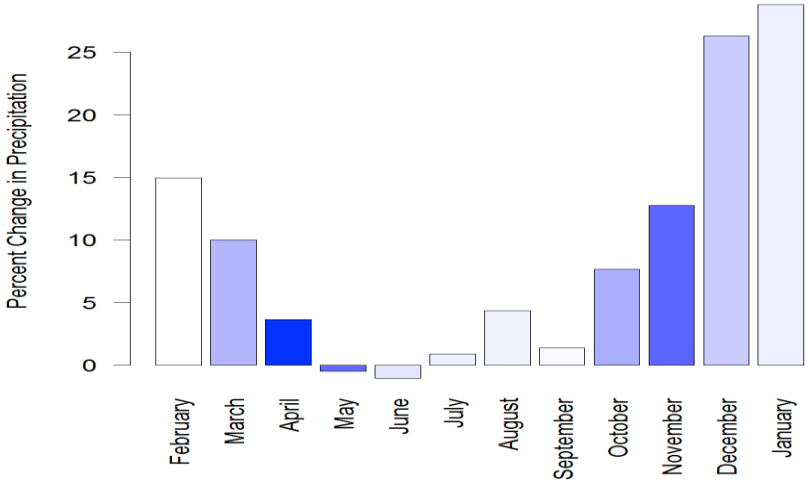


Figure 2.5: % change in precipitation in 2080 under the higher RCP 8.5 greenhouse gas emissions scenario based

The second rains (October November December downpours) are notwithstanding winding up noticeably more incessant and more extreme than some time recently, prompting regular event of serious floods. Regardless of the slight increment in absolute yearly rainfall, the recurrence and seriousness of dry seasons and floods have kept on expanding, given the fact that evaporation rates and rainfall intensity have likewise expanded. Now that more than 80% of the country is dry or semi-parched land regions, and that around 98% of the nation's agricultural frameworks are rain-sustained, rainfall

changeability has genuine ramifications on farming yields, as indicated by Our Changing Environment Atlas " (2009) and "Kenya: State of the Environment and Outlook" (2010). Much water deficiencies prompt a reduction in solid cropping days, higher occurrence of harvest disappointment and domesticated animal's passing's. What's more, changes in the planning of long and short rains will make it progressively hard to design sowing and reap times, causing lower edit yields in significant creation zones, and more noteworthy nourishment instability. Additionally, incremental changes in temperature and rainfall designs are relied upon to add to biodiversity misfortune and rise of new irritations and sicknesses. Harvest recreation comes about demonstrated that, as a rule, temperature rise caused by environmental change is the fundamental driver of product yield diminishes.
Be that as it may, a few crops are relied upon to encounter more positive developing conditions because of environmental change, for example, banana, cassava, dry beans, finger millet and groundnut. There is also additionally confirm that mango, pineapple, banana which demonstrates expanding appropriateness for all future atmosphere situations, and sugarcane production was discovered reasonable on many soil sorts yet constrained by water deficiency (Luedeling 2011).

2.8.7 The Conceptual framework for comprehending the influence of change in climate on security of nutrition and food

As concentrated on, environment change shall impact the major determinants for good heath: water, clean air, food, protection and control of infection. Honestly, climatic change is seen as the best overall prosperity danger of the 21st century, and is currently adding to the overall weight of affliction and sudden demise. More basic future examples for human prosperity fuse increases in the amount of people encountering downfall, sickness and harm from warm waves, floods, whirlwinds, blazes and dry seasons; powerful diseases; diarrheal infections; notwithstanding affecting psychological wellness of those influenced by climatic stuns.

Increments in recurrence as well as seriousness of floods and droughts will likewise directly affect general wellbeing: increased temperatures, diminished access to water by expanding vanishing rate of surface waters and dissolving ice sheets, which give water to many individuals over the world. Thusly, the absence of new water builds the danger of diarrheal infections, brings about dry spell and possibly even starvations. (WHO, 2009).

Climatic change as of now influences food security – and much more definitely later on, through various pathways that effect sustenance security, sanitation, water, sustenance wellbeing, maternal and youngster social insurance practices and destitution. Under nutrition could be a standout amongst the most huge results of environmental change because of sheer number of individuals that could be influenced, a considerable lot of whom are as of now poor and defenseless against nourishment instability (Confalonieri,2007).

With connection to effect of change in climatic on food, the effect is of a more indirect form than a portion of the immediate wellbeing impacts specified before. Climate change directly affects agriculture generation, by increasing temperatures, changing rains and seasons, that are anticipated to diminish trim yields and profitability of animals and increment dangers of harvest disappointment hence influencing food accessibility and get to. As demonstrated by FAO, climate impacts will impact a wide range of agricultural era and the jobs of poor and their passage to sustenance more genuinely. Different procedures in the nourishment framework are likewise prone to be influenced (e.g. handling, dissemination, stockpiling, planning and utilization) causing more prominent shakiness in the food supply and rural based livelihoods and also expanding food costs (FAO, 2008)
Hence climate change indirectly affects food insecurity and a more clear effect on food accessibility and certainty upon the sort of livelihood system individuals are depending on. Comprehending the connections between change in climate and nutrition and security of food well is outlined deeper in figure 2.9. The consideration of the impact of change on climate, security of nutrition and food depends on the applied framework by Crahay, P. et al. (2010) (see figure 2.6).

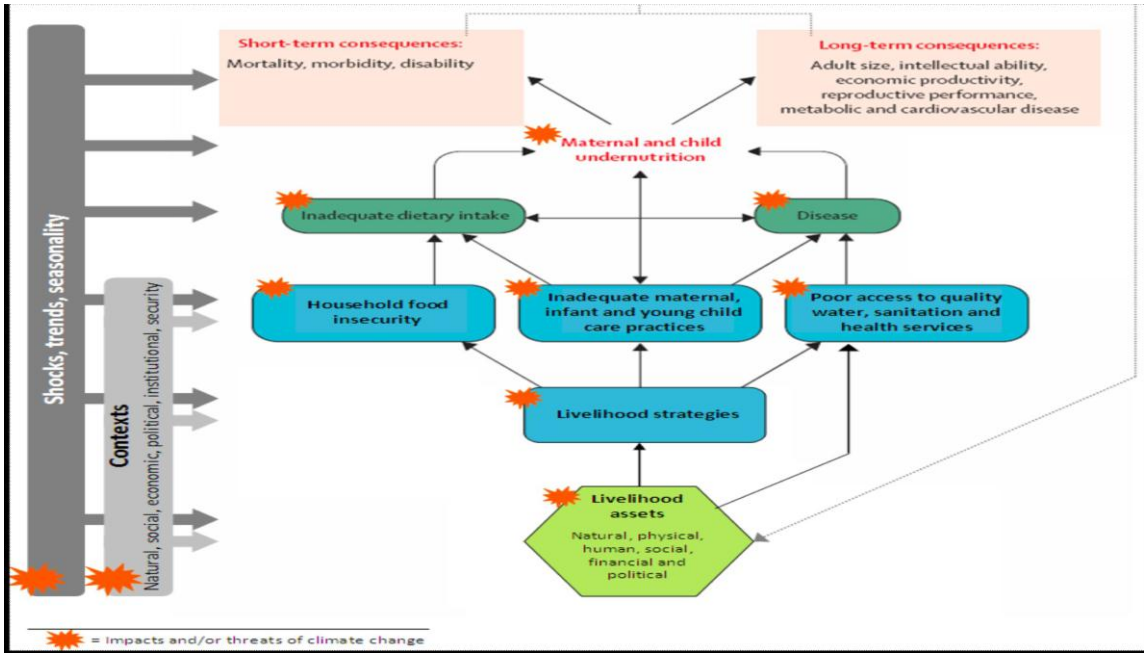


Figure 2.6: The Conceptual framework for comprehending the influence of change in climate on security of nutrition and food

Source:Cray.P.et al.(2010). WFP food and nutrition security framework

2.9. Inadequate food supply: key determinant of food insecurity

2.9.1.1: The Demand side

The constantly almost fixed food supply the world is confronting is being driven by total impact of several settled patterns influencing the worldwide supply and demand for food. On demand side, patterns incorporate proceeding with expansion of 70 million individuals for every year to Earth's populace and longing of approximately 4 billion individuals to climb natural food chain and expend high protein rich nourishments (domesticated animal's items).

2.9.1.2: The Supply side

On supply side, there is next to no new land to be put a work in progress unless it begins from clearing forests or changing over enormous leave zones like the Sahara neglect into beneficial land. Clearing of woods unquestionably has significant characteristic expenses, for instance, extended rainfall run-off and soil deterioration and might end disturbing a

ghastly condition notwithstanding with respect to natural change. On the other hand, changing over the deserts into gainful land requires generous capital hypothesis costs in kind of Rainwater procuring and related structures to empower water framework. This is by virtue of the wellsprings of water framework water are substantially scarcer than new land to cultivate. In the midst of the last half of the twentieth century, the worlds watered range about trebled, developing from 94 million hectares in 1950 to 276 million hectares in 2000. Starting now and into the foreseeable future, the immersed region per individual has been shrinking by 1% a year

To aggravate things even, prime cropland in numerous regions is being lost to both mechanical and private development and clearing route for streets, roadways, and parking garages for quickly developing vehicle armadas. It is in this way clear the worldwide supply of food is inadequate.

2.9.2 Low Yields by Small holder Farmers

Smallholder farmers in developing nations confront a portion of the world's most troublesome farming difficulties as they endeavour to develop sustenance. These difficulties incorporate whimsical and problematic rainfall because of changing climate designs because of environmental change, poor soils, low quality seeds among different information sources, limited access to farmer friendly credit facilities and poor access to modern agricultural technologies.

2.9.3 Post Harvest Loses by Small-scale Farmers

According to FAO, most of world's periodically hungry people are living in the rural areas and majorly depend on agriculture as their source of daily bread (FAO, 2004). However, despite their hard work, small-scale farmers, about 30-40% of their harvests are lost due to poor post- harvest management of farm produce including pests and diseases damage that they cannot control.

2.10 Consumption of Food and Trends in Nutrition

2.10.1 Levels of consumption of food

Basically, Kenya is a food deficient nation and a big shipper of food, bringing in around 20 for every shilling of its yearly cereal necessities even in a guard reap year. National wide, an expected 47% of the rural populace has lacking nourishment to meet their every

day vitality prerequisites. In spite of the fact that yields, domesticated animals and fisheries constitute Kenya's wicker bin of food security resources, as of now maize is the fundamental staple sustenance edit for larger part of Kenyans, delivered by lion's share of local family units in various parts of the nation.

Financial Review of Agriculture reports show that Kenya fares and imports maize and sugar, with the adjust for imports. Investigation, projections demonstrate that change in environmental would likely prompt expanded imports of food by Kenya. In meantime, expected rise in food costs will probably hose interest for sustenance, as moderateness of about all agricultural items, including essential staples and animals items, decays. Thus, per capita calorie accessibility in Kenya is probably going to decay, converting into increments in lack of healthy food, particularly of youthful kids. These impacts will exacerbate in regions of high powerlessness, to be specific parched and semi-bone-dry regions.

2.10.2 Nutrition trends

According to the 2008-2009 Demographic and Health Survey (KDHS), 35% of kids below age five are stunted, 16% being underweight and 7% squandered. The Figure 1 underneath demonstrates patterns of lack of healthy food among kids less than five years old years from 1993 to 2008/09. In Kenya today, an expected 2.1 million kids are hindered inferring that these kids shall never achieve full physical-mental potential. Local differences in nourishment pointers are huge with North Eastern territory having the most elevated extent of youngsters displaying serious squandering (8%) while Eastern region has largest amount of hindered kids (44%). Besides, the extent of squandered and underweight kids is contrarily corresponded with the level of training. There have been a few strategy and automatic endeavors by the Kenyan Government for attending to food issues in Kenya.

2.10.3 Family level security of food

Change in climate incites different sorts of weights on livelihoods, for example, lessened generation of food harvests and animals items in affected regions decreasing food get to and earnings from agricultural development. Increments in food costs bargain reasonableness and access to food, coming about because of less nourishment being created or less cash accessible to purchase more costly food. This essentially will affect

what individuals eat, both as far as quality and amount, e.g. influencing dietary assorted variety. As per International Food Policy Research Institute, the recurrence and seriousness of development setbacks are anticipated to increment because of climate change expanding future food costs considerably further, particularly on meat and staples.

2.10.3.1, Trends, Seasonality and Shocks

Stuns with relation to seasonality are a critical wellspring of worry in lives and occupations of destitute groups, and are increased by changes in climate, for example, absence of rain, even dry spell, fast changes in temperatures from hot to icy, and changes in seasons, which are the primary changes in climatic announced at Karakal pakstan. Changing regularity instigated by environmental lapse is probably going to prompt greater job weakness, occasional hunger and ailing health both as under-or potentially finished nourishment perhaps expanding dangers of non-transmittable ailments (e.g. CVDs).

2.10.3.2 Sanitation, health services and water

Accessing protected clean water and great sterile conditions is fundamental for a sufficient eating regimen. Water assets are anticipated to be firmly affected by environmental change with a huge number of individuals at danger of being presented to a developing shortage of water later on (Pachauri and Reisinger 2007). In Karakal pakstan, water issues are as of now happening.

Wellbeing administrations will later on be tested by increments in dismalness and mortality because of change in climate and its related health and food effects. The capacity of the health area and administrations to handle these difficulties is in this way vital. In Karakal pakstan and Uzbekistan when all is said in done the health framework has been rebuilt to reinforce the nature of medicinal administrations in essential human services by setting up provincial health focuses (SVPs) covering fundamental bundles of essential social insurance administrations. (IMF 2008). This is could be seen as a positive pattern as far as giving fundamental administrations to manage future climate change related horribleness.

2.10.3.4 Inadequacy in care practices (infant, young child and maternal)

Regarding care related practices, change in climate is connected in a roundabout way to lack of food that is healthy and projections of expanded frequencies of food and water

related illnesses because of atmosphere related changes in water accessibility and get to and expanding challenges in putting away food securely. Eating regimens could turn out to be less fluctuated as well as less nutritious because of absence of accessibility, increments in food costs and constraints in family sustenance generation, subsequently influencing maternal, newborn child and youthful tyke nourishment in the long run connected with various types of hunger to be specific under-sustenance, micronutrient insufficiencies.

The evaluation shall be founded on the measurements shown here of change in climate and food-nutrition effects.

2.11 Nutritional status Indicators at household level

Anthropometric files speak much to the total impact of access to nourishment, health, and environmental health status. Hence, nutrition status is an intense marker of food security and prosperity of a person and mirrors the nutritious and destitution circumstance of a family unit. Particularly the nutritious status of kids is a delicate pointer, since kids are most powerless against nutrition awkward nature. The most ordinarily utilized records are weight-for-tallness, stature for-age, weight-for-age and mid-upper arm outline. With the exception of the last mentioned, every anthropometric estimation taken are contrasted with a very much nourished reference populace, the NCHS reference populace. Cut-off focuses are communicated as z-scores or rate of middle. The z-score utilizes the standard deviation of middle of the reference appropriation for a given weight or stature as a unit. The record communicated as z-score speaks to the contrast between the watched esteem and the middle estimation of the reference populace. The rate of middle is ascertained by isolating the watched an incentive by the middle weight or stature of the reference populace and duplicated by 100. Both lists can be ascertained by utilizing reference tables or by utilizing proper PC programming (WHO 1996, WHO 1983, MSF 1995).

The **height-age index**, additionally called stunting, communicates the stature of a youngster in association with his age. In instances of nourishing anxiety, the rate of developing is backed off. Indeed, even during solid nourishment the development disappointment can't be remedied totally. Straight development is a decent reflection for general improvement, giving data on long haul changes in the earth and their nutritious repercussions. It demonstrates long haul hardship.

The **weight-height index** gives weight of the kid in connection to his stature. It shows if a child is thin or not. Be that as it may, it doesn't separate between 2 offspring of a similar tallness and weight, one being more established than the other one, and conceivably being too short for his age. The list, additionally called squandering, implies intense or current lack of healthy sustenance at the season of the review. The heaviness of a tyke can change immensely in a brief timeframe. A tyke presented to healthful anxiety may lose up to 20% of his body weight inside fourteen days and this can be redressed quickly if the wholesome circumstance makes strides. For crisis programs the weight-for-stature list is prescribed. Youngsters beneath - 2 z-score or underneath 80% of the middle are delegated being squandered. Kids who are beneath - 3 z-score or underneath 70 % of middle are at extreme hazard.

The **weight-age index** indicates weight of a kid in connection to age. This file doesn't separate between two offspring of a similar age and weight, one being tall and squandered and the other one being shorter and not squandered. The marker, additionally called underweight, is less capable to evaluate the nutritious status, since it likewise does not make any separation. In any case, it is anything but difficult to gauge and performs well for development observing at group level or centers, and is hence a decent approach to evaluate the healthful advancement of a person after some time (WHO 1996).

A low weight-for-tallness or weight-for-age list communicates a current clinical sign of serious lack of healthy sustenance, and is called Marasmus. It is one of the three types of genuine protein-vitality lack of healthy sustenance (PEM) for the most part in youthful kids at the season of weaning. These types of lack of healthy food are as often as possible related with infections, for the most part gastrointestinal diseases. Healthful Oedema, swelling of legs and feet, are a pointer for extreme dietary inadequacies over a drawn out stretch of time (Jelliffe 1989). Kids experiencing oedema, likewise called Kwashiorkor critically require treatment. Nutritious oedema in grown-ups just shows up amid extreme starvations.

The **Body-Mass-Index** (BMI) of grown-ups has progressively turned out to be more acknowledged as a vital pointer for good nutrition of grown-ups. Common estimations are weight and length, for the most part computed as body-mass-index (BMI: (weight in kg) separated by (length in meters squared)). A BMI more than 18.5 demonstrates

sufficient nutrition, a BMI beneath 16 plainly indicates constant health insufficiency. A BMI in the vicinity of 16 and 18.5 requires more definite data on nourishment utilization.

2.13 Mitigation and Adaptation Methods for Change in Climate

Intergovernmental Panel on Change in Climate (IPCC) characterizes adjustment as "alteration in normal or human frameworks because of genuine or expected climatic boosts or their belongings, which moderates mischief or endeavors gainful open doors." interestingly, IPCC characterizes mitigation as "an anthropogenic mediation to lessen the anthropogenic compelling of the climate framework; it incorporates techniques to diminish ozone harming substance sources and emanations and improving ozone depleting substance sinks" (IPCC 2007). Basically, adjustment systems work to counterbalance or exploit the effects of environmental change, though alleviation procedures address its underlying drivers by planning to diminish emanations and increment carbon sequestration.

Adjustment methodologies to change in climate for ensuring, advancing sustenance and nourishment security can be self-sufficient or arranged. Numerous self-sufficient adjustment choices are expansions or escalations of existing danger administration or generation improvement exercises. Utilizing inputs that are impervious to dry spell, adjusting manure rates, changing water administration works on, enhancing bug administration, keeping up isolate and observing projects and utilizing atmosphere gauging all can possibly balance negative environmental change effects and exploit positive ones. In any case, it is imperative to take note of that there are constraints to adjustment procedures.

To start with, adjustment strategies are not "sexual orientation sealed". Since adjustment procedures utilize business as usual to expand on existing frameworks, they may additionally compound sex imbalances identified with arrive get to, credit, expansion administrations and different information sources. Accordingly numerous ladies might be notable get to the banquet of adjustment tasks and projects.

Second, adjustment systems to change in climate for security of food and nutrition are mind boggling and regularly include exchange off. For instance, movements to yields, for example, cassava in nations that are extremely influenced by dry spells or AIDS should mull over the potential effect on diets and on nourishment. Cassava, while strong, simple to develop and dry season safe, is low in protein and thus can represent a risk to dietary

quality in the event that it is not expended as a major aspect of a sufficiently enhanced eating routine. Arranged adjustment endeavors to breed supplement rich nourishment harvests should therefore be coordinated with self-sufficient endeavors to breed edits that are dry spell safe and water-tolerant.

Third, adjustment potential depends entirely on smallholder limit. Expansion administrations, geography, level of financial improvement, regular assets, social setting, foundations, administration and innovation are quite recently a portion of the factors which can represent the deciding moment neighborhood endeavors to adjust to environmental change. For instance, the advantages of adjustment tend to increment with the level of environmental switch to around a 3°C temperature increment, and soon thereafter versatile limit in low scopes is surpassed, and relief procedures are required.

The fundamental alleviation capability of horticulture lies in enhanced harvest and brushing land administration to build soil carbon sequestration. Extra alternatives incorporate rebuilding of corrupted terrains, enhanced rice development and enhanced nitrogen compost administration to diminish outflows of the GHG nitrous oxide. Enter moderation techniques in domesticated animals incorporate decreasing discharges by means of enhanced weight control plans to lessen maturation in ruminants' stomach related frameworks and enhanced excrement and biogas administration.

As to the forestry service part, there is assertion and extensive confirmation that forest-related alleviation exercises utilizing financially accessible innovations can significantly diminish outflows and make collaborations with methodologies for adjustment and economical improvement (counting work and pay era, lessened poverty, biodiversity and watershed protection, and creating wellsprings of sustainable power source). Checking deforestation is a profoundly financially savvy technique for diminishing GHG emanations and has the potential for speedy effect.

2.14 Morbidity -Mortality Patterns

Data from the District Health Information System indicates that most prevalent diseases among both adults and Under-fives are Upper Respiratory Tract infections, skin diseases and malaria. In addition, pneumonia and diarrhea are prevalent among under-fives and urinary tract infections among adults. There is a decline in prevalence of these diseases when compared to a similar period last year, with cases of confirmed malaria among

under-fives reducing by 39 percent from 2,730 to 1,653 between January and June 2014 and 2015 respectively. Among adults, confirmed malaria reduced by 26 percent from 5,468 to 4,044 during the same period while skin diseases among under-fives also reduced by 17 percent from 2,556 to 2,125. There was one fatal case of cholera reported in the month of July 2015 in the county and preventive and control measures to contain possible outbreak have been put in place

2.15 Garbatulla Sub - County Health Profile

There are various health risks arising from climate change including but not limited to, water and food security, drought, vector-borne diseases, heat-related mortality, flooding and water-borne diseases. The recent integrated SMART survey conducted in February 2015 by Action Against Hunger (ACF) in collaboration other partners (National Drought Monitoring Authority (NDMA), world vision and Ministry of Health (MoH)) unveiled a serious Global Acute Malnutrition (GAM) prevalence of 13.2% (10.8-16.0 95% CI) and Severe Acute Malnutrition (SAM) prevalence of 1.7% (1.0- 3.0 95% CI).

As noted by Intergovernmental Panel on Change in Climate (IPCC), population growth is linked to change in climate vulnerability. An increase of individuals in areas that are poor in resources and affected by risks of climate will magnify harmful impacts, including those related to health. The NDMA early warning indicators for Isiolo County showed a worsening trend from May to October 2015. The situation started improving on November due to the positive impact of enhanced rainfall on the household food availability

2.15.1 Livelihood Support Systems in Garbatulla sub-county

The fundamental wellspring of livelihood in Garbatulla is pastoralist. Pastoralists are portable animal's herders who acquire than half of their pay from domesticated animals and animals items. They work on varying levels of portability, from inactive crowds that move inside a region, to migrant herders who move between specific areas all the time, to traveling herders who have high versatility without consistent patterns. Research confirms demonstrates that the pastoralist lifestyle is progressively getting to be noticeably unsustainable.

Various worldwide drivers, for example, climate change, populace weight and increments in conflicts are having especially stamped impacts on peaceful domesticated animal's herders. This is likewise the case in Garbatulla sub-area where pastoralist livelihood is

progressively getting to be noticeably delicate. The peaceful groups are especially defenseless against food uncertainty because of debasement of the normal asset base, developing awkwardness among human-domesticated animal's populace, deficient water and field; absence of access to market; missing or ineffectively created foundation and social administration offices, and arrangement condition that regularly disregard the particular needs and potential commitment of pastoralist groups. Thus, the business of the pastoralist groups has turned out to be more powerless against various natural and manmade shocks

Domesticated animals production and marketing is the main livelihood for a large portion of the family units in the investigation territory and furthermore one of the real wellsprings of wage for the occupant. Irrigated crop farming, small businesses which include exploitation of natural resources such as sand harvesting, mineral deposits, and natural vegetation. As indicated by World Vision Garbatulla assessment report 2010, the group have always referred to repeating dry spell as one of the real hazard that debilitate every one of their employments as more than 95% of them depend on livestock and crop production and marketing which are significantly interlinked with the others.

The major vulnerable group is poor and poorest households in the study area which constitute 74.1% of the total households (word vision Garbatulla evaluation 2010). Primary research indicated that the community lack support system for the vulnerable groups especially people living with HIV (PLWHIV), Disabled, Orphan and Vulnerable Children (OVC). The number of the vulnerable groups in the community as per community trend is increasing especially the OVC and PLWHIV due to rise in HIV prevalence contributing the community being more vulnerable.

Regular drought and disease outbreak, flash floods and conflicts are the main occurring stuns in Garbatulla. Poor production and yields of livestock, which is primarily caused by scarce and declining presence of pasture and water, is also another major setback in the area.

2.16 The Conceptual framework

Conceptual framework for a study presents the interrelationships among variables of the study. The framework shows that security of food and nutrition at family level in Garbatulla south sub-county is affected by various factors. These are profiles of health, availability, distribution of food at family level, level of security of food and nutrition,

coping strategies / barriers and opportunities and temporal patterns of temperature and rainfall.

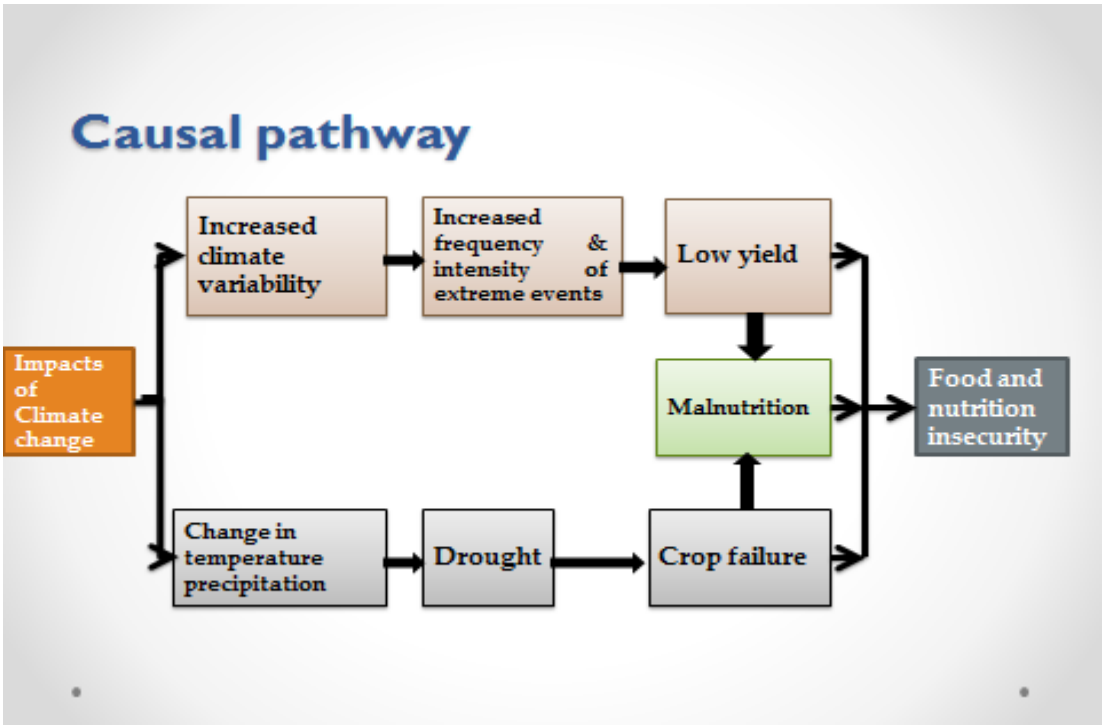


Figure 2.7: Conceptual framework

CHAPTER THREE

3.0 STUDY METHODOLOGY

3.1 Introduction

This section gives sources and type of data together with the methodology employed to address the specific objectives of this study. The procedures used in conducting this study are also outlined. This chapter also presents population, size of the sample, research design, and the sampling procedures, instruments validity and reliability, research instruments, data collection procedures and data analysis.

3.2 Location of the Area of Study

This study was led at Garbatulla Sub-Section of Isiolo County. The supervisory territories included Garbatulla, Kinna and Sericho wards. The essential concentration ranges were chosen in interview with Sub-County and County Health administration board (SCHMT) from the Department of Public Health (MoH). These were the targeted intervention areas for by the Study these areas were among those named 'hard to achieve territories'

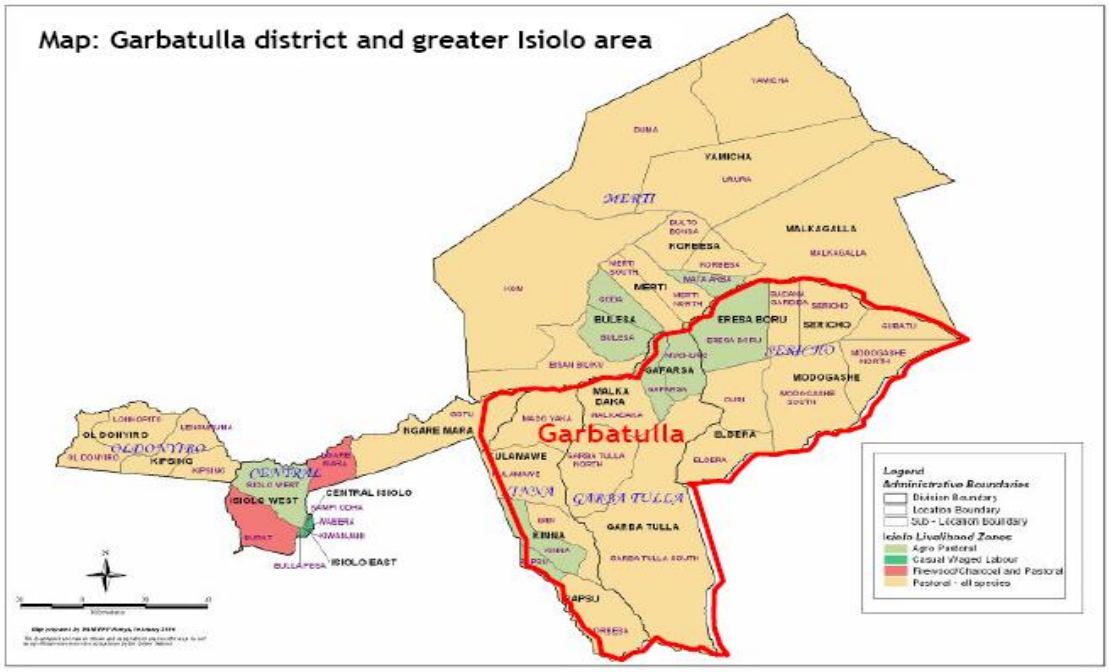


Figure 3.1: Garbatulla District Map and Greater Isiolo Region

Source: Garbatulla integrated nutrition, WASH and food security survey 2010 (ACF)

3.3 Study Methodology

An all encompassing mixed method was utilized to direct the examination review. Blended techniques look into is an orderly mix of quantitative and qualitative strategies in a solitary report for reasons for acquiring a more full picture and more profound comprehension of a phenomenon. Mixed method can be incorporated such that qualitative and quantitative strategies hold their unique structures and procedure. Methodical triangulation involving qualitative, quantitative and participatory evaluation techniques were employed to generate sufficient data necessary for an objective investigation of effect of change in climate on security of nutrition and food in the region. The study covered the three divisions of Garbatulla sub-county namely; Kinna, Garbatulla and Sericho Wards. Table 3.1 show the division, location, sub location and the number of household in the study area.

Table 3.1: Household distribution

Wards	**Location**	**Sub location**	**Households**
Garba Tulla	Garba tulla	Garba Tulla North	806
		Garba Tulla South	1082
	Gafarsa	Gafarsa	651
		Muchuro	314
	Malkadaka	Malkadaka	645
Subtotal			***3498***
Kinna	Kinna	Kinna	1203
		Bibi-Duse	275
	Rapsu	Rapsu	236
		Korbesa	330
	Kulamawe	Kulamawe	633
		Modoyaka	240
Subtotal			***2917***
Sericho	Sericho	Gubatu	224
		Sericho	675
	Modogashe	Modogashe North	132
		Modogashe South	472
	Iresa boru	Iresa Boru	421
		Badana Garadida	255
	Eldera	Eldera	135

Wards	Location	Sub location	Households
		Quri	134
Subtotal			***2448***
Total			**8,863**

Source: KNBS (2009). National Housing & Population Census

3.3.1 Design of Study

This study was undertaken through a survey design. Case scenarios were evaluated through beneficiary narratives. The focus of the study was on the impact of change in climate on nutrition and food security at family level.

The study targeted households, Anthropometric data for children aged 6 months-59 months, livelihood sections, CBOs, FBOs, and other relevant stakeholders in the sub-county. A mix of methods was used to collect both quantitative and also qualitative data. The researcher used primary and secondary information to evaluate the effect of change in climate on security of food and nutrition.

3.3.2 Sampling procedure and sampling size

Desired sample size was derived using the formula of Fisher *et al* (1991). Based on Equation 3.1 below, a sample frame of 8,863 (Table 3.1) would give a sample size of 368 households at 95% confidence level.

$$Sample\ Size = \left\{ \frac{\frac{z^2 p(1-p)}{e^2}}{1 + \left(\frac{z^2 p(1-p)}{e^2 N} \right)} \right\} - - - \ 3.1$$

Where:

z - z-score=1.96

p - Population proportion (=50%)

e - Margin of error=5%

N - Population Size (**2917** households at Kinna Division, **3498** Households at Garba Tulla division and **2448** households in Sericho Division)

In adjusting the sample size, the researcher has taken into consideration the Central Limit Theorem and consequently adopted 30 households per sub location to give a total of 570 beneficiary households to be evaluated. In order to take care of the spillover effects and

possible non response errors, Table 3.2 gives our adjusted sample size spread throughout the target sub locations.

Table 3.2: Summary of Sampling Plan by Sub-Location

Sub location	Target Sample
Garba Tulla North	30
Garba Tulla South	30
Gafarsa	30
Muchuro	30
Malkadaka	30
Kinna	30
Bibi-Duse	30
Rapsu	30
Korbesa	30
Kulamawe	30
Modoyaka	30
Gubatu	30
Sericho	30
Modogashe North	30
Modogashe South	30
Iresa Boru	30
Badana Garadida	30
Eldera	30
Quri	30
Total	**570**

3.3.3 Focus Group Discussions

In addition to the household survey, the researcher held a total of six (6) Focus Group Discussions. Table 3.3 provides the proposed number of Focus Group Discussions per division.

Table 3.3: Proposed Number of Focus Groups

Location	Number of Focus Group
Garba Tulla	2
Kina	2
Sericho	2
Total	**6**

3.4 Research Team Composition

The study was conducted under the overall leadership of the student researcher. The team for field was comprised of the student researcher, 3 translators and a host of 15 data enumerators. The translators and enumerators were sourced from the local community and conducted the exercise in pairs preferably both gender where feasible. The use of local personnel was to ensure effective communication between data collection team and the target respondents by eliminating language barriers and fear of mistrust with strangers.

3.5 Conducting the Study

Field assessment was conducted between 15th February 2016 and 26th February 2016. Primary data was collected from the sampled areas to make inferences with regard to the objectives of the study for a period of 10 days including the training days. Key activities that preceded the actual field work included development and review of data collection tools, recruitment and training of research assistance/enumerators.

3.6 Development of Tools for Collection of Data

Researcher developed data collection tools necessary to undertake this study. The tools developed included Household Questionnaires (presented in Appendix I), Key Informant Interviews (presented in Appendix II) and Focus Group Discussions (presented in Appendix III) of this document.

3.6.1 Data Collection Methods

The data was collected by means of semi structured questionnaires (Household Food Insecurity Assess Questionnaire (HFIAQ) and coping strategy questionnaires (CSQ), key informant interviews (KII), Focus group discussion (FGD) and anthropometric

measurements directed to mothers and children respectively at their households. The data to be collected included; weight, length/height age and information on past and present food security situation as well as data on coping strategy. The interviews were conducted to enhance content validity. Literature review and expert judgment was also performed to enhance content validity

Anthropometric data of the children were measured as outlined. Weight was taken by use of beam scales and stadiometer which was accurate up to 10kg. Together with weight measuring board, stadiometer was used to obtain length measurements by following standard procedures. The board was placed on a flat and hard surfaced table. Thereafter, children were requested to lie on it, and then their lengths were taken. These measurements were taken in duplicates and their average used for calculating z-scores. All the information concerning a single individual is linked through a unique identification number.

3.6.1.1 Household Questionnaire

Administration of household questionnaire was conducted by the trained enumerators. The researcher has learnt from experience that workload (number and length of study tools) versus time factor affects the quality of the study and reliability of the data. These in turn affects the analysis and reporting. Erroneous data can lead to misinformation regarding project outcomes. Wrong conclusions and recommendations affect future projects which rely on this study report. On these grounds the researcher has ensured that data collection tools are concise, accurate and objective. Enumerators were deployed in two to three different locations in each village cluster. Each of the enumerators took one direction and moved clockwise as directed by the field supervisors, based on identified interval. Interviews were conducted based on a drawn schedule and was administered on a one to one basis, to adults in charge of the household at the time of the visit. The interviews were held either in the house or at the entrance of the house. The location of the interview was important to ensure that the difference in gender between the enumerators and the respondents would not create any discomfort during the discussion. The data collection was through qualitative and quantitative approaches. Villages from the locations were randomly selected from the available list. Households were picked systematically from an identified central point picking every third household.

3.6.1.2 Key Informant Interviews

The researcher developed a Key Informant Interview guide for this purpose. Table 3.5 presents the stakeholders consulted for the KIIs during the study. The entire key stakeholder that participated in the area of nutrition and food security was involved in the study. The researcher has planned at least two (2) KIIs per division to be conducted during field data collection exercise.

Table 3.4 Key Informant Interview List

S/No	*Name of Stakeholder Group interviewed*
1.	District Food security steering committees (DFSSC)
2.	Department of Agriculture
3.	National drought monitoring Authority (NDMA)
4.	NGOs project staff (world vision, ACF, Red cross,)
5.	Department of Livestock Development
6.	Ministry of Water and Irrigation
7.	Peace committees
8.	Department of public health

The researcher facilitated the planned KIIs by ensuring that the staff and departments of the above organizations involved in nutrition and food security are notified in so as to be available and prepared for the interview sessions. The interviews were conducted by the researcher. The data collected were transcribed and used during the analysis.

3.6.1.4 Focus Group Discussions

FGD guide used was developed to conduct field level discussions with the stakeholders. Discussions involved the following farmers groups and/or associations. The study also engaged the NGOs, CBOs and livelihood Groups that are engaged in the field of livelihood diversification. Table 3.5 shows a list of the groups consulted for the FGDs during the study.

Table 3.5 Focus Group Discussion List

S/No	*Name of Stakeholder Group interviewed*
1.	Crop farmers
2.	Livestock producers
3.	Women groups
4.	Livestock traders Associations
5.	Commercial village group members
6.	Advocacy groups

A focus group discussion was conducted by a moderator who was trained on the study topics of interest. The moderator was a local expert who is conversant with the local language and culture. The facilitators were provided with FGD guidelines and writing materials for taking notes during the discussions.

3.7 Validity

As per Tromp and Kombo (2009), validity measures how well a test measures what it should quantify. The analyst utilized face validity to survey and build up a casual supposition in the matter of regardless of whether the test is measuring what it should gauge. Content validity then again was utilized by the University supervisor to check whether the things in the poll answer the exploration goals. The point of pre-testing was to measure the importance and lucidity of the instrument things with the aim that those things observed to be deficient for measuring factors were either disposed of or adjusted to enhance the nature of the examination instruments. This was to guarantee that the instrument catches all the required information. The supervisors who are specialists in the zone of concentrate approved the instruments through expert judgment (Kirk and Miller, 1986).

3.8 Data Analysis and presentation

The field work group gathered the information and set it up for analysis. Having finished data verification and entry the specialist set out on data cleaning and investigation of the family unit surveys. Different execution pointers were then assessed from the investigation data. Quantitative information was examined by a blend of data analysis

software including SPSS and MS Excel among others. The analyst likewise utilized Content Analysis Technique (CAT) to investigate subjective information lastly, utilize the triangulated information gathered from the polls and the subjective strategies to create this examination report.

Measurable investigation of anthropometric information utilizing ENA for SMART programming January 2015 rendition and quantitative information from house polls was performed by hand and furthermore by utilizing PC factual projects SPSS form 20.0. Microsoft Office Excel 2003 was likewise utilized from which univariate factors were acquired and used to distinguish direct connection to discover the connection between impacts of change in climate on food and nourishment security.

Age: The kid's inoculation card, birth endorsement or birth notice were the essential hotspot for this data. Without these archives, a nearby date-book of occasions created from exchanges with group individuals, enumerators and key witnesses. Age count outline was utilized for simplicity of recognizing age in months

Child's Sex: It was indicated as either '**m**' standing for male or '**f**' standing for female.

Weight: A seca11digital measuring scale was utilized to quantify the kids' weight. The electronic scales were aligned on regular schedule utilizing a standard weight to affirm estimations and any defective scales were supplanted. With a specific end goal to improve exactness and thus quality, of accentuation was arrangement of weight scale to a hard level surface insignificant or no development of the child and precise recording of estimations to the closest 0.1kg

Height: Prostrate length was taken for kids under 2 years old while those youngsters over 2 years old were measured holding up. A tallness board was utilized to quantify length/stature.

MUAC was measured on the left arm, at the center point between the tip of the elbow and the tip bear bone while the arm is at right-edge, at that point took after MUAC estimations of the arm while it is casual and hanging by body's side. MUAC was measured to the closest mm. In case of a handicap on the left arm or a left-gave kid, the correct arm was utilized. Of accentuation amid the activity was right identification of mid-point and correct tension upon placement of MUAC tape on arm.

3.8.1 Guidelines, Indicators, and Formulas to be used In Acute Malnutrition

Height- Weight index

It was assessed from a combination of the weight-tallness (WFH) file esteems (and additionally oedema) and by sex in view of WHO models 2006. This record was communicated in WFH lists in Z-scores, as indicated by the WHO 2006 reference principles.

Z-Score:

- Serious intense ailing health is characterized by WFH < - 3 SD or potentially existing reciprocal oedema,
- Direct intense ailing health is characterized by WFH < - 2 SD and >-3 SD and no oedema,
- Worldwide intense ailing health is characterized by WFH < - 2 SD and additionally existing reciprocal oedema.

MUAC investigation was likewise embraced to decide the nutrition status of tested kids and ladies of regenerative age (15-49 years). The accompanying MUAC criteria were connected.

The analyzed data was presented in charts, table and a graph. The results were used to describe population characteristics from the sample under the main four themes, climate change, nutrition status, food security and household food adaptation practices.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSIONS

4.1 Introduction

Results about different analysis of climatic factors and elucidation of assessment of effect of change in climate on security of nutrition and food at family unit level are presented in this chapter. The outcomes on the worldly examples of temperature and rainfall over the study region on the idea of inconstancy and moves in temperature and rainfall are given in Section 4.1. The rest of the chapter presents the demographic information of the respondents, the profile of health distribution and food availability at family level, evaluates the level of security of nutritional and food of households for ladies of reproductive mature age and kids below five. It also presents the security of food situation in Garbatulla Sub-County, household dietary diversity and also assesses the existing coping methods and identifies opportunities and barriers for improving security of food and nutrition at household and community level. The finding on the significance of security of food and nutrition related to change in climate impacts in comparison to other risks facing the community is also presented and discussed.

4.2 Results from Analysis of the Temporal Patterns of Temperature and Rainfall over the Region of Study

This subsection presents the discussion on rainfall patterns and variability, surface air temperature patterns, evidence of past climate change, and trends in rainfall, minimum and maximum surface air temperature for the study area.

4.2.1 Results from Analysis of Temporal Patterns of Rainfall

From Figure 4.1 it can be seen that the western part of the sub-county receive an annual rainfall of between 600-700mm but it decreases to between 150-250 mm over Sericho divisions (north eastern part of the sub-county). Figure 4.2 (left panel) shows that the annual rainfall variability is above 50 % over much of the county. From the right panel of Figure 4.2 it is observed that western part of Isiolo has experienced positive trend in annual precipitation while the eastern part has had negative trend. Thus over the area of study the annual precipitation has become less and variable. On seasonal basis (Figure

4.3) the MAM season has negative trend over much of the area while the OND season indicate positive trend.

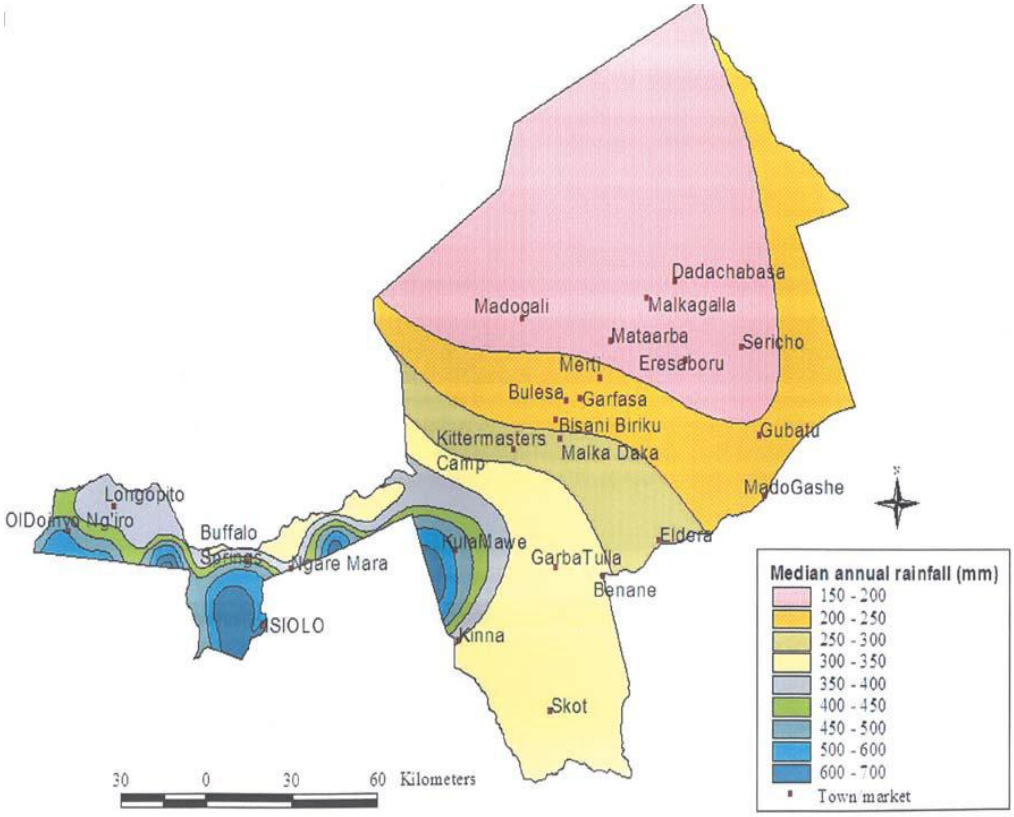


Figure 4.1: Rainfall distribution of Garbatulla sub-county

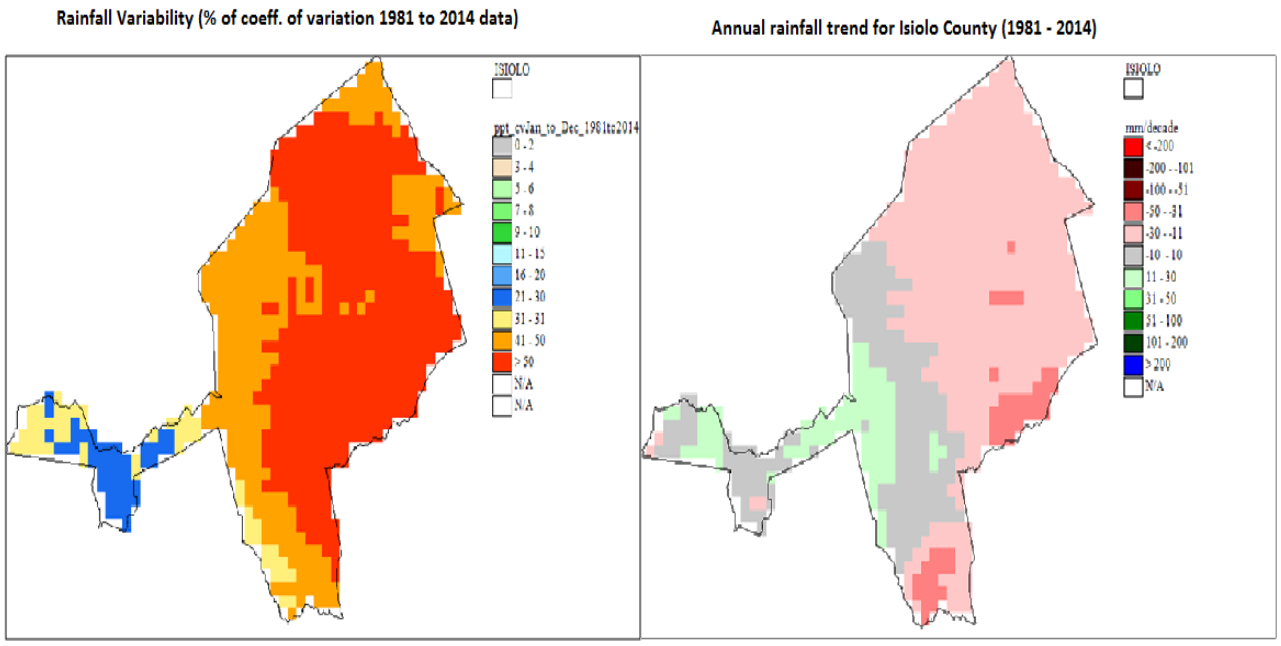


Figure 4.2: Trends and Variability of Rainfall Over Isiolo County

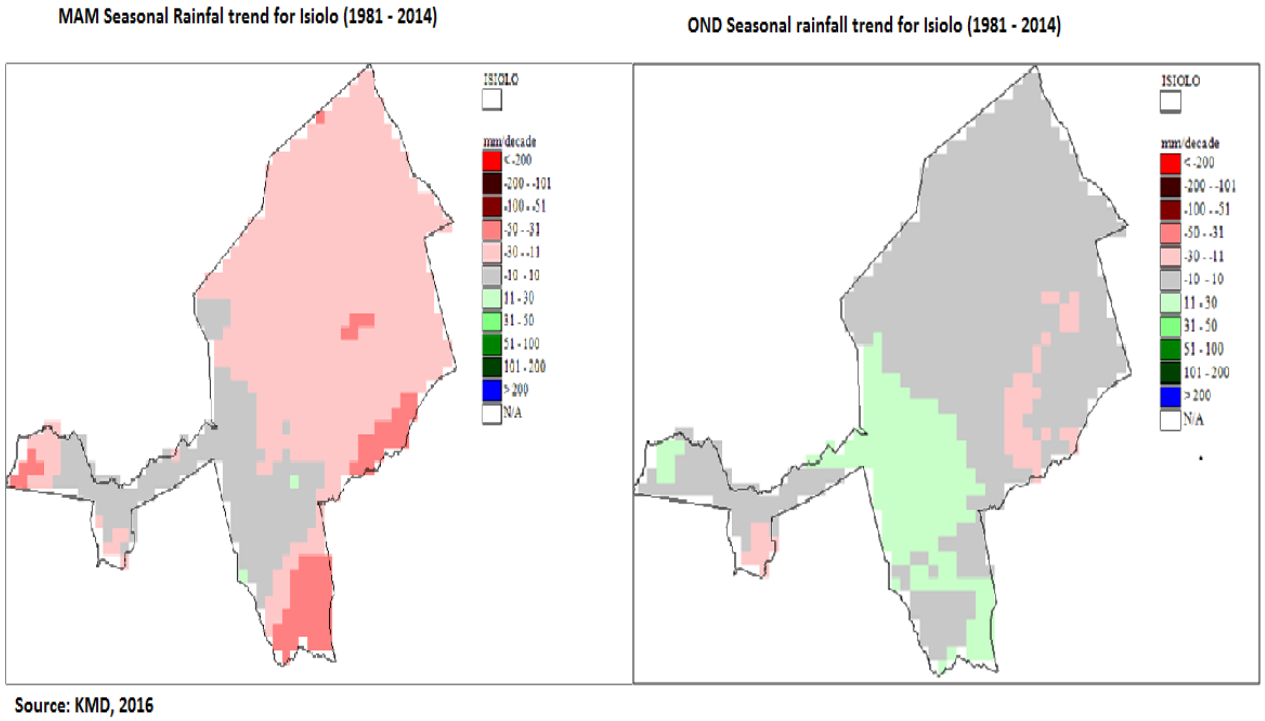


Figure 4.3: Trends in seasonal (MAM) and OND rainfall over Isiolo County

The investigation of the 32-year rainfall record (1980–2012) exhibited diminishing pattern of yearly rainfall aggregates, occasional rainfall adds up to and expanding yearly

temperatures (figure 4.8) in Marsabit County. The yearly rainfall aggregates, occasional rainfall sums, yearly temperature were dissected for straight patterns. Direct patterns were investigated by plotting every rainfall variable against the time arrangement (years) and the addition of an utilitarian pattern line. A declining pattern in yearly rainfall aggregates was seen over the 32-year time span (Figure 4.4).

Recuperation of long rains since 1980 is equal to what was before proposed by Dai (2004) for rainfall slant in African Sahel and account of upgraded precipitation in tropics. In spite of rainfall recuperating for long rains periods in vicinity of 1980 to 1991, the discoveries of this examination demonstrated huge abatement at blustery days and expansion of dry days amid a similar season. It thus demonstrates higher power and generally low dissemination of rains amid time of precipitation recuperation, a typical situation frequently ascribed to a dangerous atmospheric deviation.

Notwithstanding, this study demonstrated that recuperation of long rains period was very short, and also that a general pattern to aridity proceeded the year 1991, balancing this story of rainfall recouping and giving a situation inverse to projections of IPCC as regards rainfall patterns at eastern Africa.

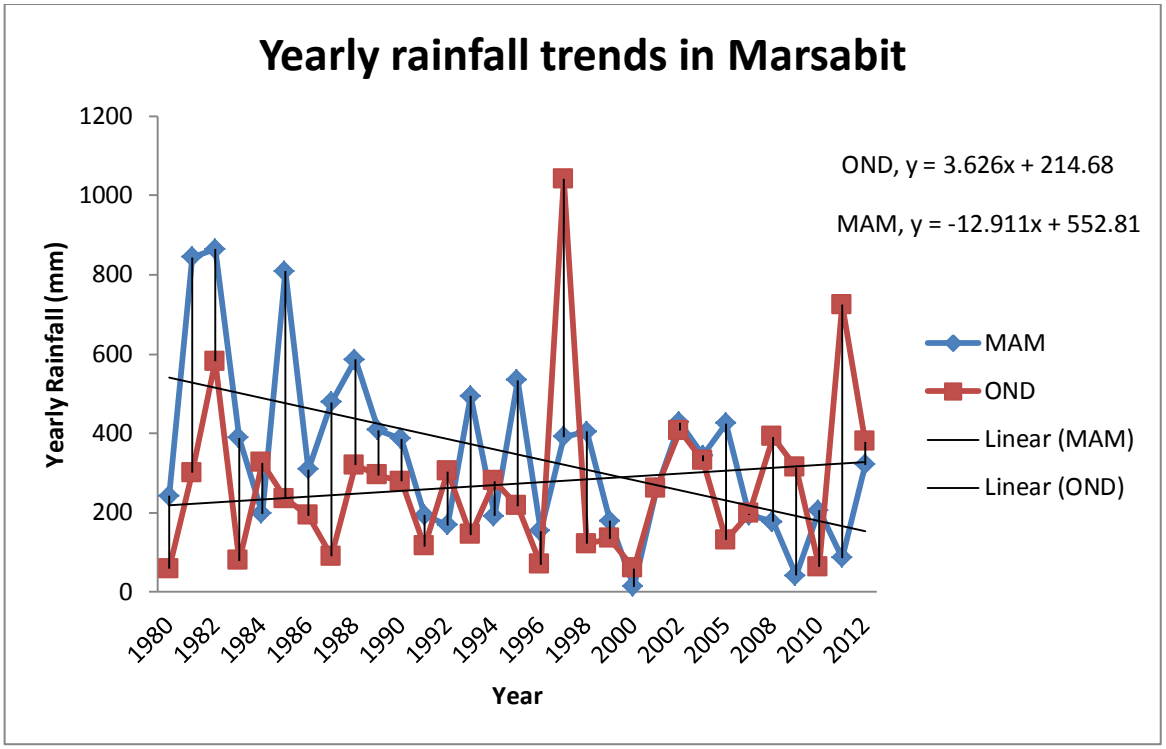


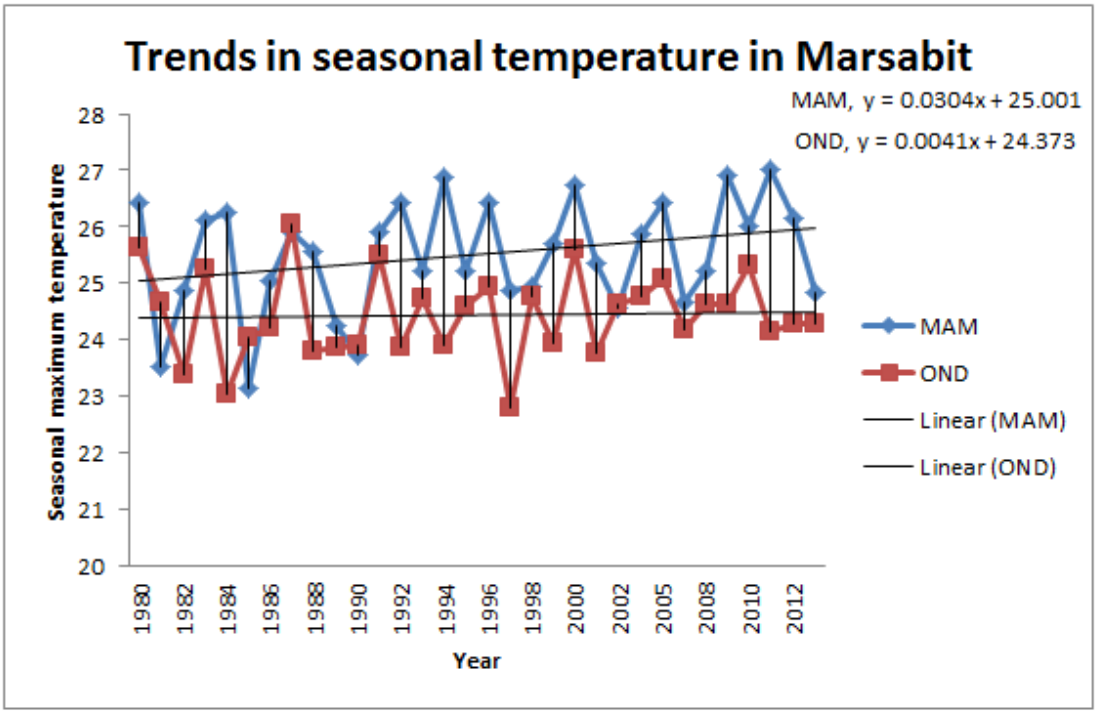
Figure 4.4: Yearly rainfall trends MAM and OND in Marsabit County

4.2.2 Results from Analysis of Temporal patterns of temperature

Figure 4.5 shows increasing yearly temperatures in the Marsabit county. This is in line with IPCC prediction that temperatures will continue to increase as climate change impact is experienced across the globe.

The results here indicated a significant increase of temperature at different regions over four nations in this study as indicated in figure 4.5

MAM and OND seasonal maximum temperature trends (1980 - 2012)

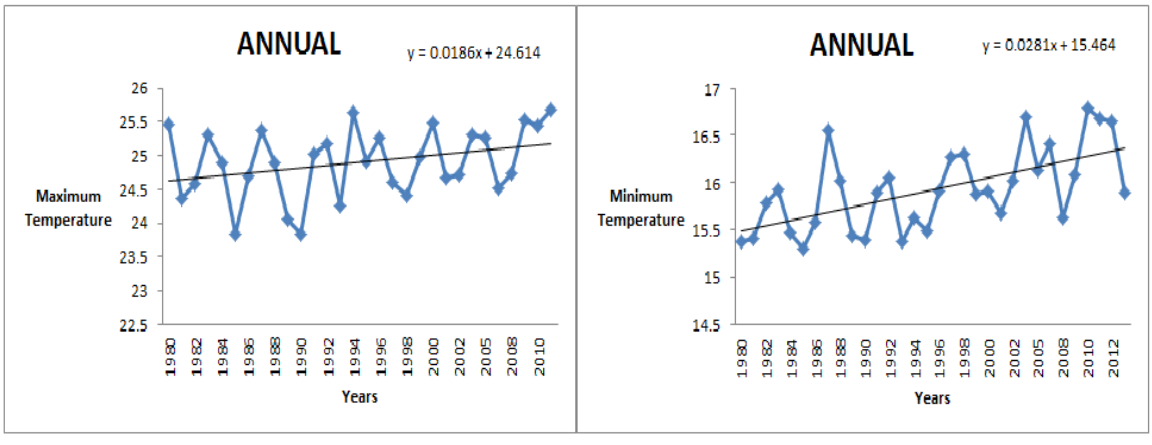


Author's field data analysis

Figure: 4.5 MAM and OND maximum temperature seasonal trends for Marsabit 1980-2012

Figure 4.6 below indicates increasing maximum and minimum annual temperatures for Marsabit. Rise of average temperatures and increasing frequency of extreme heat events may create greater risks of heated-related illness, ranging from mild discomfort to deaths.

Annual maximum and minimum temperature trends from 1980 to 2012 for Marsabit



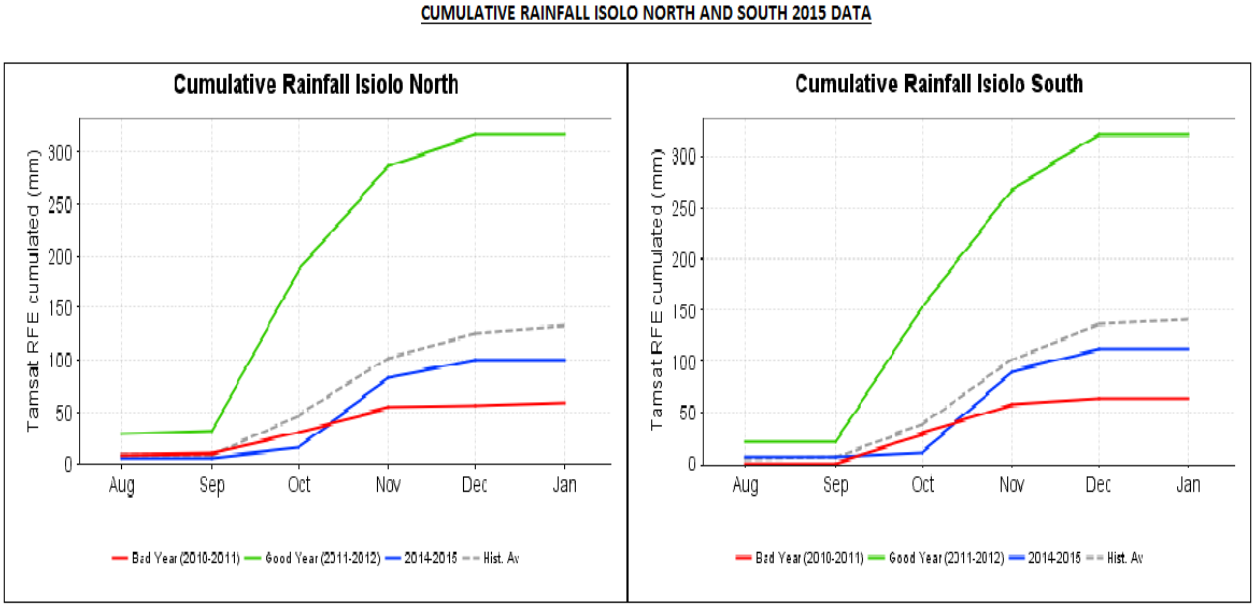
Author's field data analysis

Figure: 4.6 Annual maximum and minimum temperature trends for Marsabit 1980-2012

4.2.3 Rainfall performance for the selected years and the effects on the community.

The normal timing for the arrival of the short rains in Isiolo County is during the second dekad of October. However, in 2014 these rains arrived only during the first part of November, and reduced sharply during the second dekad. Although they picked up again, by the first dekad of December they were over, when usually they should last until the third dekad of January. Both the temporal and spatial distribution of rainfall was uneven. Sericho and Cherab (in the former Merti ward) received only 5 - 25 percent of the normal volume of rain (NDMA, 2015).

The most recent drought 'ended' in 2011, although its impacts were still being felt in 2014. The 2011 drought had resulted from an extended period of low rainfall, and was compounded by a range of other factors.. Figure 4.6 gives comparison of cumulative rainfall for Isiolo North and Isiolo South for the period 2011 to 2015. The figure indicates that 2010 to 2011 was a bad year while 2011 to 2012 was a good year in both North and South.



Source: NDMA, Isiolo North and South, 2015

Figure: 4.7 Cumulative rainfall for Isiolo County

According to FGD discussant, the common disasters that affect the community have been identified and summarized in table 4.1 and the vulnerabilities they have caused the community. The participants were asked to brainstorm on the common disasters affecting their community for a period of time. The findings indicate that there are four common disasters in the order of importance affecting the Garbatulla community, namely drought,

livestock diseases, flooding and conflict. All these four disasters are directly connected to the impact of change in climate. Drought can lead to serious hydrological imbalances and shortages of water and food, and potentially cause long-term environmental, socioeconomic and health impacts. IPCC projects that an increased risk of drought is likely in currently dry regions.

Table: 4.1 Community Disaster Timelines

Name of the disaster	When did it happen	Where did it happen	Who was affected	What was the impact
Drought	1984, 1998, 1995, 1996, 2003, 2006, 2009, 2010, 2011, 2012, 2013, 2014	GarbaTulla sub-county, Sericho ward, Kinna ward	Livestock, Children, Mothers (women),Elderly, Herders	• Loss of livestock • Loss of human life • Malnutrition of children • Family separation • Child mortality • Starvation • Influx of people • School drop outs • Loss of labour • Conflict/ insecurity • Water shortage
Livestock diseases	1989, 1995, 1996, 1997, 1998, 2002, 2006, 2008, 2009, 2010, 2011, 2012 2014,	Garbatulla, Gafarsa, Kinna, Malkadaka, Sericho	Livestock, Human beings	• Sleeping sickness • Abortion • Establish of tools fly nets • Disruption
Floods	1988, 1989,	Malkadaka,	Livestock,	• Loss of livelihoods

Name of the disaster	When did it happen	Where did it happen	Who was affected	What was the impact
	1992, 1997, 1998, 2012, 2013	Gafarsa Muchoro, Kombola Iresaburu, Parts of sericho	Children, Women, crops, infrastructure,	• Destruction of property • Deaths of animals • Transport disruption • Food shortages • Outbreak of diseases • Displacement of people
Insecurity (Tribal conflict)	1982, 1984, 1988, 1989, 1990, 1991, 1992, 1993, 1994,	Rapsu Malkadaka GarbaTulla Kula mawe Kinna	Livestock, Children, Women, Elderly	• Loss of lives • Loss of property • School drop out • High crime rates • Closure of schools

4.3 Characteristics of Target Households

4.3.1 Sample Coverage

This study sampled 518 households comprising 327 female households and 191 male households. All the sampled households successfully completed the interview giving a 100% rate of response.

4.3.2 Demographic information of respondents

Questionnaire administered for the study survey collected data on the demographic profile of the household members including age, sex, marital status and level of education attained. Table 4.2 shows that the biggest proportion 158(30.5%) of respondents was aged between 35 to 44 years. Data on sex of respondents indicated that 191(36.9%) were males while 327(63.1%) were females. The data shows that more females than males participated in the study. The reason for this is that most of energetic men are looking

after animals during this period of heighten drought. The 2009 census also indicates that there more women than men in this region. Only a small proportion of 9.5% was below the age of 34 years and further few 61(11.8%) were aged between 65 and 74 while 30(5.8%) were in the age category of between 75 and 84 years.

Majority 52.5% of the population interviewed was married and 41.1% mostly women while 21.4% were men who cannot read and write. This may imply that the majority of the community who were interviewed in Garbatulla (especially women) are not in a better position to make important decisions, which influence their livelihoods. Such decisions may include pursuing other economic empowerment pathways besides livestock keeping.

Table 4.2: Household characteristics by sex of respondents

Characteristics	***Sex of Respondent***				***Total***	
	Male		***Female***			
	Count	***%***	***Count***	***%***	***Count***	***%***
Age Group						
15-24	4	0.8%	10	1.9%	14	2.7%
25-34	31	6.0%	18	3.5%	49	9.5%
35-44	52	10.0%	106	20.5%	158	30.5%
45-54	30	5.8%	70	13.5%	100	19.3%
55-64	46	8.9%	60	11.6%	106	20.5%
65-74	14	2.7%	47	9.1%	61	11.8%
75-84	14	2.7%	16	3.1%	30	5.8%
Total	***191***	36.9%	***327***	63.1%	***518***	100.0%
Marital Status						
Single	8	1.5%	42	8.1%	50	9.7%
Married	109	21.0%	163	31.5%	272	52.5%
Divorced	14	2.7%	53	10.2%	67	12.9%
Widowed	44	3.1%	38	6.0%	82	9.1%
Separated	16	8.5%	31	7.3%	47	15.8%
Total	***191***	36.9%	***327***	63.1%	***518***	100.0%
Highest Education Level						
No formal Education	111	21.4%	213	41.1%	324	62.5%
Primary	42	8.1%	82	15.8%	124	23.9%
Secondary	36	6.9%	24	4.6%	60	11.6%

Graduate	1	0.2%	8	1.5%	9	1.7%
GCSE/O-level	1	0.2%	0		1	0.2%
Total	***191***	**36.9%**	***327***	**63.1%**	***518***	**100.0%**

Source: Field data (2016)

Data on education level of respondents revealed that 324 (62.5%) had non-formal education, 124 (23.9%) had primary education, 60 (11.6%) had secondary education while 9 (1.7%) were university graduates. The data shows that most of the people in the study had not received any formal education.

Data on the marital status of the respondents indicated that 275 (54.6%) were married, 70 (13.9%) were single where 48 (9.5%) were divorced, with 39 (7.7%) and 72 (14.3%) being separated and widowed respectively. The data demonstrates that larger part of the respondents was married.

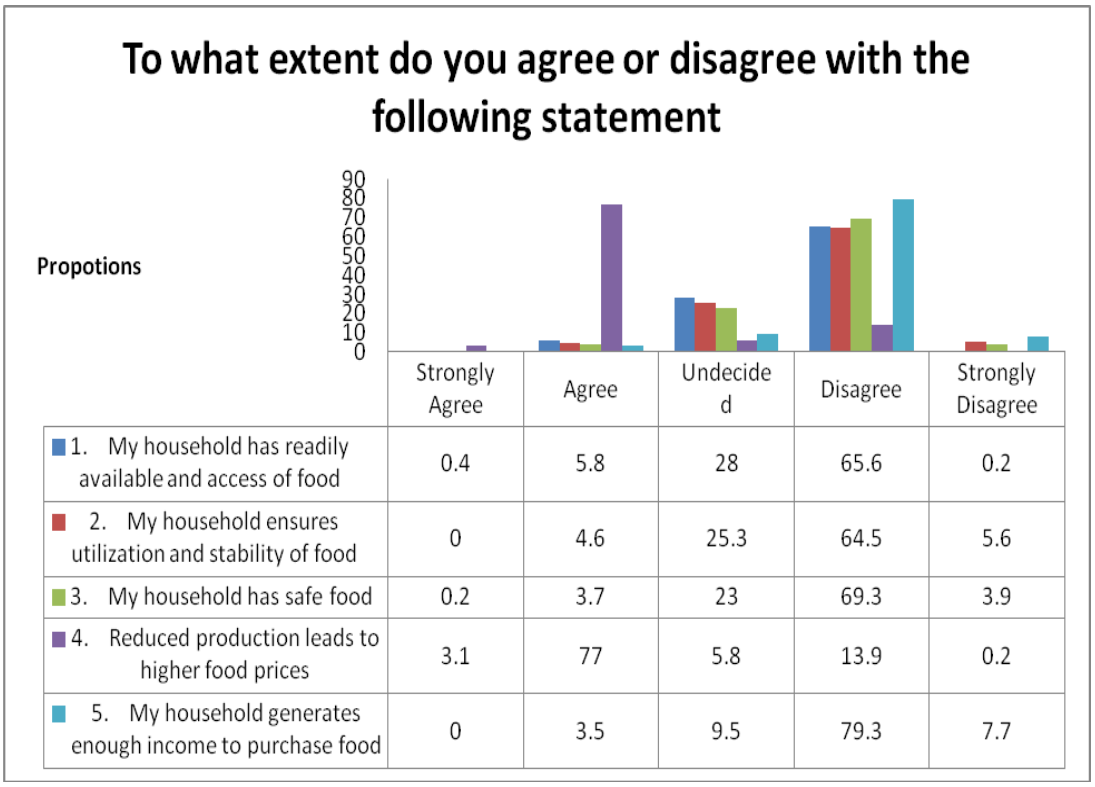
4.4 Determining the Profile of Health, Distribution and Food Availability at Family level in Garbatulla locality

4.4.1 Distribution and Availability of Food at Family level

Climate change compounds the current under-nourishment issue in Kenya and will additionally undermine current endeavors to lessen destitution and under-nutrition in ASAL areas. Under-nourishment thus undermines the strength of helpless populaces diminishing their capacity to adapt and adjust to the outcomes of change in climate and their capacity to develop financially. The present dry season in northern Kenya that activated starvation and impelled food emergencies is likely a sign of what may come all things considered episodes turn out to be more typical, with outrageous climate occasions having a higher likelihood of happening because of Climate change.

Respondents were asked how much they agree or can't resist repudiating the going with decree relating to nourishment availability, get to, utilization and dependability in their zones. The results are examined about in the figure 4.11 as illustrated. By far most of the respondents met vary that their family have instantly open and get to enough food (65.6%), their families ensure utilization and soundness of food (64.5%), their families have safe food (69.3%) and their families makes enough pay to purchase food (79.3%)

while 77% of the respondents agreeing decreased era prompts higher food costs.



	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
1. My household has readily available and access of food	0.4	5.8	28	65.6	0.2
2. My household ensures utilization and stability of food	0	4.6	25.3	64.5	5.6
3. My household has safe food	0.2	3.7	23	69.3	3.9
4. Reduced production leads to higher food prices	3.1	77	5.8	13.9	0.2
5. My household generates enough income to purchase food	0	3.5	9.5	79.3	7.7

Figure: 4.8 Household availability of food, access and utilization

4.5 Evaluating level of food and nutritional security analysis of families with ladies of reproductive mature age and kids below 5

4.5.1 Distribution by Sex and Age

The anthropometric study involved 460 children of 6-59 month old; with 245 boys and 217 girls involved in the final anthropometric results. The dispersion of the food study test by sex and age assemble demonstrates that the aggregate kid/young lady sex proportion of the study was inside as far as possible (0.8 - 1.2). Also, sex proportion inside the age bunches demonstrates a typical dissemination as appeared in table 4.3

Table: 4.3 Sex Distribution and sample age

	Boys		Girls		Total		Ratio
AGE (months)	no.	%	no.	%	no.	%	Boy: girl
6-17	59	58.4	42	41.6	101	21.9	1.4
18-29	70	52.6	63	47.4	133	28.8	1.1

	Boys		Girls		Total		Ratio
30-41	55	47.8	60	52.2	115	24.9	0.9
42-53	40	50.6	39	49.4	79	17.1	1.0
54-59	21	61.8	13	38.2	34	7.4	1.6
Total	245	53.0	217	47.0	462	100.0	1.1

4.5.2. Nutritional Status of Children 6-59 Months

This study used the WHO-GS 2006 growth Standards. These models portray the growth of sound kids living in very much developed conditions in six nations, including United States. The standard shows how babies and youngsters ought to grow as opposed to just how they do grow in a specific time and place. The WHO standard builds up breastfeeding as the organic standard and the breastfed newborn child as the standard for development and advancement. According to the study findings in Garbatulla sub-county, the presence of global acute malnutrition as per the WHO-GS was analyzed based on a sample of 460 kids and recorded a GAM prevalence of 12.4% (9.7-15.7 95% CI) and a SAM prevalence of 1.1% (0.5- 2.5 95% CI) the GAM prevalence is at serious levels while the SAM presence is at acceptable levels (low).

Acute malnutrition distribution and Oedema based on weight-for-height z-scores

There was no case of Oedema identified during the survey however, five children were classified as marasmic from Bula kati, Manyatta Kula, Darajani and Kambi ya Juu villages as shown in table 4.5 below

Table 4.5: Malnutrition Distribution and oedema based on weight-for-height z-scores

	<-3 z-score	>=-3 z-score
Oedema is present	Kwashiorkor(Marasmic) No. 0 0.0 %	Kwashiorkor No. 0 0.0 %
Oedema is absent	Marasmic No. 5 1.1 %	Not severely malnourished No. 457 98.9 %

Malnutrition Prevalence by MUAC

MUAC is used as a good indicator to identify malnourished children with a high risk of death and hence in need of treatment. In Kenyan context, GAM is a MUAC measurement <125mm and/or presence of bilateral Oedema, with SAM being a MUAC measurement < 115mm and/or presence of bilateral Oedema. Those children with a MUAC measurement of <125mm and >= 115 mm are moderately malnourished. This study unveiled a GAM prevalence in Garbatulla sub-county of 3.9% (2.5 - 5.9 95% C.I.) and a SAM prevalence of 0.4 % (0.1 - 1.6 95% C.I.) on the basis on MUAC measurements.

Underweight Prevalence by Weight-for-age (WFA) Z-scores

Prevalence of underweight in the study was 19.4 % (16.1 - 23.3 95% C.I.) while SAM prevalence was 3.1% (1.8 - 5.1 95% C.I.) as analyzed in table 4.6.

Table 4.6: underweight Prevalence based on weight-for-age z-scores by sex

	All no - 458	Boys no -244	Girls no - 214
Underweight Prevalence <-2 z-score	89- 19.4 % 16.1 - 23.3 95% C.I.	49- 20.1 % 15.5 - 25.6 95% C.I.	40- 18.7 % 14.0 - 24.5 95% C.I.
moderate underweight Prevalence <-2 z-score and >=-3 z-score	75- 16.4 % 13.3 - 20.0 95% C.I.	41- 16.8 % 12.6 - 22.0 95% C.I.	34-15.9 % 11.6 - 21.4 95% C.I.
Prevalence of severe underweight <-3 z-score	14- 3.1 % 1.8 - 5.1 95% C.I.	8- 3.3 % 1.7 - 6.3 95% C.I.	6-2.8 % 1.3 - 6.0 95% C.I.

Stunting Prevalence based on height-for-age z-scores

Stunted development mirrors a procedure of inability to achieve direct development potential because of problematic nutrition as well as healthful conditions. On a populace premise, large amounts of stunting are related with poor financial conditions and expanded danger of successive and early introduction to unfriendly conditions, for example, sickness as well as improper nourishing practices (Victoria CG 1992). So also, a decline in the national stunting rate is generally characteristic of changes in general

financial states of a nation. Stunting is a pointer used to get to constant lack of healthy food by contrasting child's tallness with standard stature of kids in a similar age

Further analysis was done on stunting per age category as shown in table 4.7. The analysis shows that children aged between 18 and 29 months were the most stunted. This could be attributed to poor complementary feeding and owing to the fact that breastfeeding usually stops during this age

Table 4.7: Stunting Prevalence based on height-for-age z-scores

		stunting(Severe) <-3 z-score		Stunting(Moderate) >= -3 and <-2 z-score		Stunting (Normal) > = -2 z score	
Age (mo)	Total Number	Number	percentage	Number	percentage	Number	percentage
6_17	98	1	1.10	14	14.03	83	84.7
18_29	128	16	12.5	27	21.1	85	66.4
30-41	112	4	3.6	17	15.2	91	81.3
42-53	76	2	2.6	9	11.8	65	85.5
54-59	34	0	0.0	5	14.7	29	85.3
Total	448	23	5.1	72	16.1	353	78.8

4.5.2 Household Food Security

Climate change instigates different sorts of weights on livelihood, for example, lessened production of food yields and domesticated animals items in influenced zones diminishing nourishment get to and livelihoods from rural generation. Increments in food costs trade off reasonableness and access to food, coming about because of less food being delivered or less cash accessible to purchase costly food.

Major global studies conducted by the IFPRI Mitchell and Ingco, (1993), the FAO Alexandratos, (1995), and World Bank Agcaoili and Rosengrant (1995) anticipate aggregate grain yield to increase by 1.5-1.7 percent per year for the foreseeable future, and the real prices of grain to remain constant or to decline.

4.5.3 Food frequency and household dietary diversity

4.5.3.1 Food Consumption Score (FCS)

The FCS is a good proxy estimator of family security of food based on consumption of a given food and its relative nutrition importance. FCS is measured at family level; it combines measurements of dietary diversity, the frequency with which different foods are consumed and the relative nutritional importance of various food groups. The household food consumption score indicated that most households lied on the acceptable food consumption threshold (>35.5) 72% while 24% of the household are lying within poor food consumption score (0-21). Only a small 4% of the household were within borderline food consumption score (21.5-35) as shown in the figure 4.9a. This is attributed to daily consumption of pulses, milk & milk products, sugars and oils (figure 4.9b)

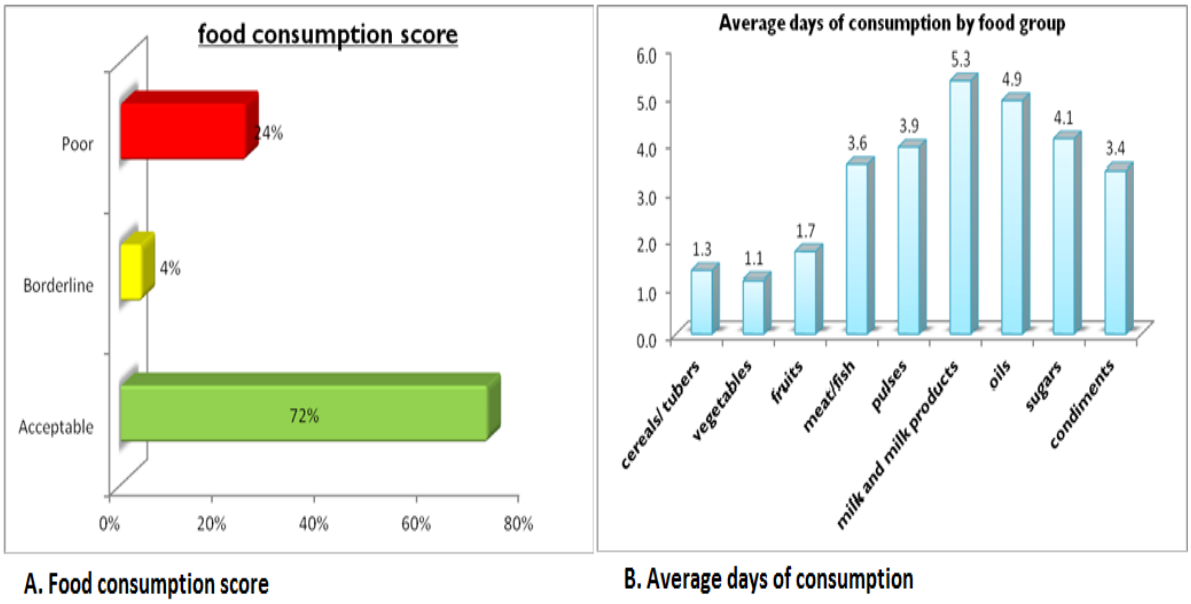


Figure 4.9: Food consumption score and average days of consumption

4.5.3.2 Household dietary diversity (HDD)

A solid eating routine contains adequate water, vitality, macronutrients and micronutrients to meet necessities. At the point when these conditions are reasonably met, the family can be thought to be food secure. Family food security guarantees a satisfactory individual dietary admission, which together with nutrition status impacts, healthful status. Family unit food security itself is impacted by family unit dietary assortment. In the event that this is poor, at that point food security will be traded off. An individual needs numerous supplements for ideal health. Lamentably, no one food

contains these supplements, consequently an assortment of food should be eaten to ensure the arrangement of supplements. Then again, an eating routine that is low in assortment is probably going to be inadequate in a few supplements and may bring about nourishment frailty and ensuing lack of healthy food.

As a subjective measure of food utilization, dietary assorted variety reflects family access in connection to food variety, in this way family dietary decent variety (HDDS) is utilized as an intermediary to gauge the financial capacity of families to get to an assortment of food. Decreases in dietary assorted variety scores have been seen because of rising food costs with diminished utilization of more costly food items (meat, poultry, eggs, angle, natural products, drain and vegetables) and expanded utilization of less expensive food and fats/oils (Ruel, M.T 2003). An analysis of family dietary diversity was done using a 24-hour recall period. Majority of households had poor dietary diversity with high consumption of low nutrient dense foods. The study result revealed that cereals (91%), oils and fats (88%) and milk and milk products (72%) lead in consumption while other nutritionally significant foods such as fish (8%), nuts and seeds (16%), legumes (27%), eggs (28%), sweets (29%) and tubers (32%) were consumed in relatively small quantities by some households as shown in figure 4.10. According to FGD discussants, factors hindering consumption include: cultural barriers/food taboos that limit consumption of certain foods, limited purchasing power and unavailability in the market.

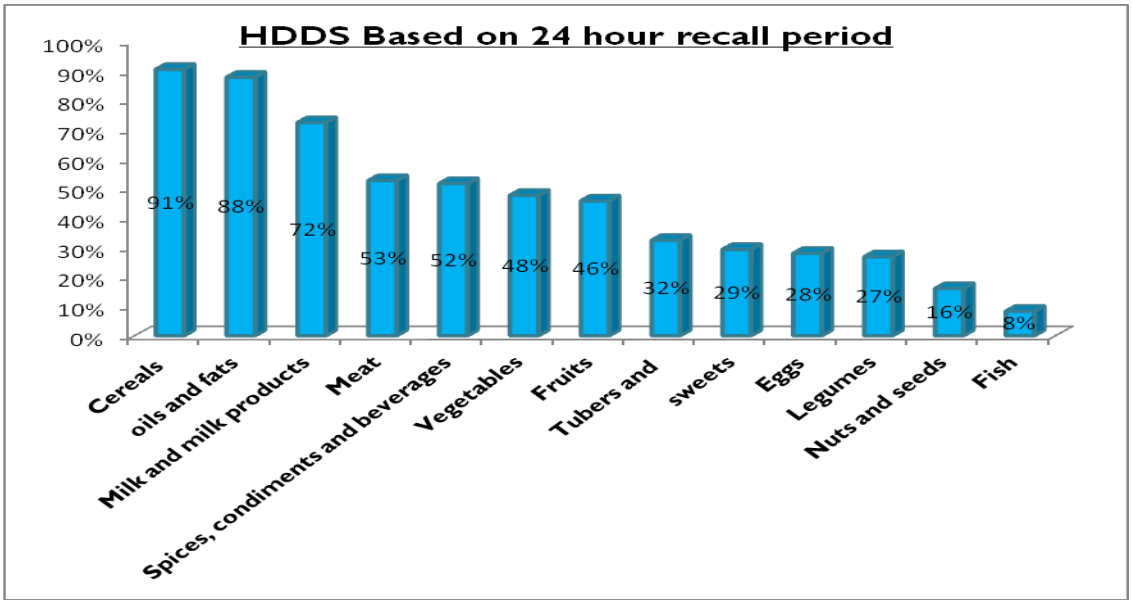


Figure: 4.10. Household Dietary Diversity

4.5.4 Household Income and Expenditure

4.5.4.1 Income Sources

The impacts of continuous climate changes and extraordinary weather occasions in the current past have undermined advance in the easing of destitution and food uncertainty, while additionally negatively affecting general improvement endeavors. Monetary divisions that generally rely upon climate conditions – either specifically or in a roundabout way – most prominently agriculture and fisheries are progressively subject to the effects of environmental change (IPCC, 2012). Additionally, the exhaustion of regular assets, because of expanded natural and statistic weights, has a tendency to bother the seriousness of climate change impacts

Respondents were requested to show their families' income sources in the 30 days before the study date. This showed some differences in income sources across the surveyed families, with food aid sales (14.0%), bush product sales and livestock sales accounting for largest numbers of families. Figure 4.11 represents both the percentage of families with each income source, along with the percentage of the total income to all respondents produced from each respective source. This showed that food aid sales (14.0%) was the greatest single source of income overall, followed by bush products sales such as charcoal and fire wood (13.9%), livestock sales (12.7%) and remittances from family (10.2%). Since there is no blanket food distribution, some families in the rural village are getting more than enough of the relief food. They then sell the surplus to people who have not been targeted for relief or to the well up people in urban centres in order to get cash to buy other items not provided as relief food such as sugar, detergents, salts and fruits.

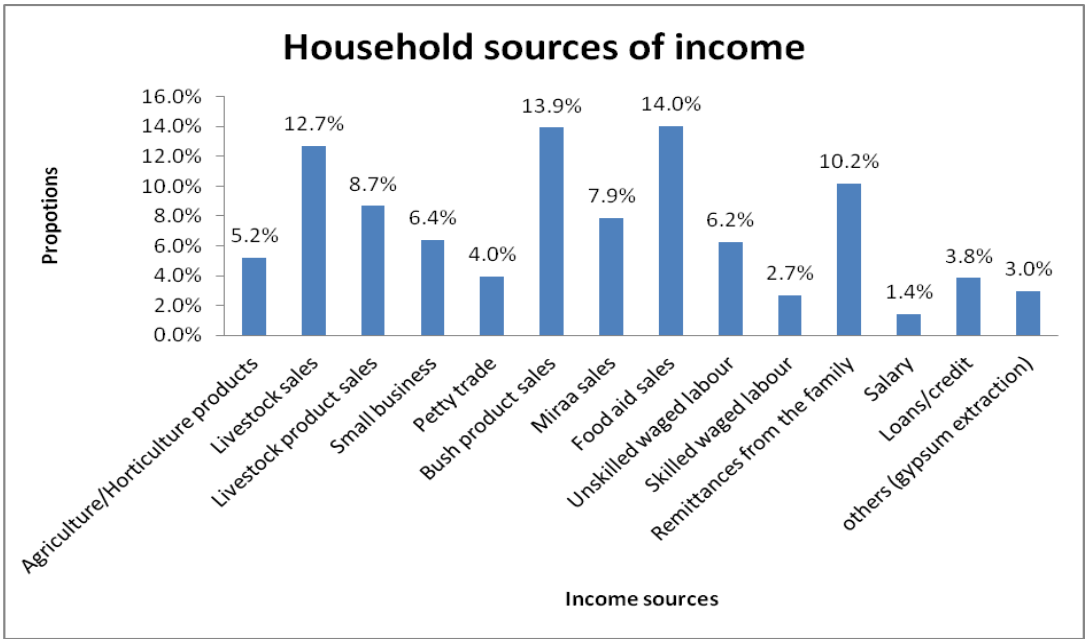


Figure: 4.11. Household income sources

4.5.4.2 Expenditure

One of the largest household expenditure items is food, and production (Agriculture) is a highly climate based field globally. Change in Climate therefore has the capacity to lead to major effects on the cost of living related to the price of this item. The future effects of climate change on food prices are, however, rather complicated to assess.

Changes in agricultural production involve rather complex transmission mechanisms through to the changes in prices that households are likely to experience under climate change. Much of the food purchased in the Garbatulla is part of global supply chains, and thus the consideration of how climate change impacts on these requires analysis of changes in production globally and the effects on trade. Food is a major household expenditure item and a core human necessity and low income families spend a greater portion of their family resources on food and non-alcoholic drink. The impacts of higher food prices will have a disproportionate impact on these groups. Food is also rather inelastic, i.e. families will still purchase similar quantities of food if prices go up, which in turn reduces their available income for other items.

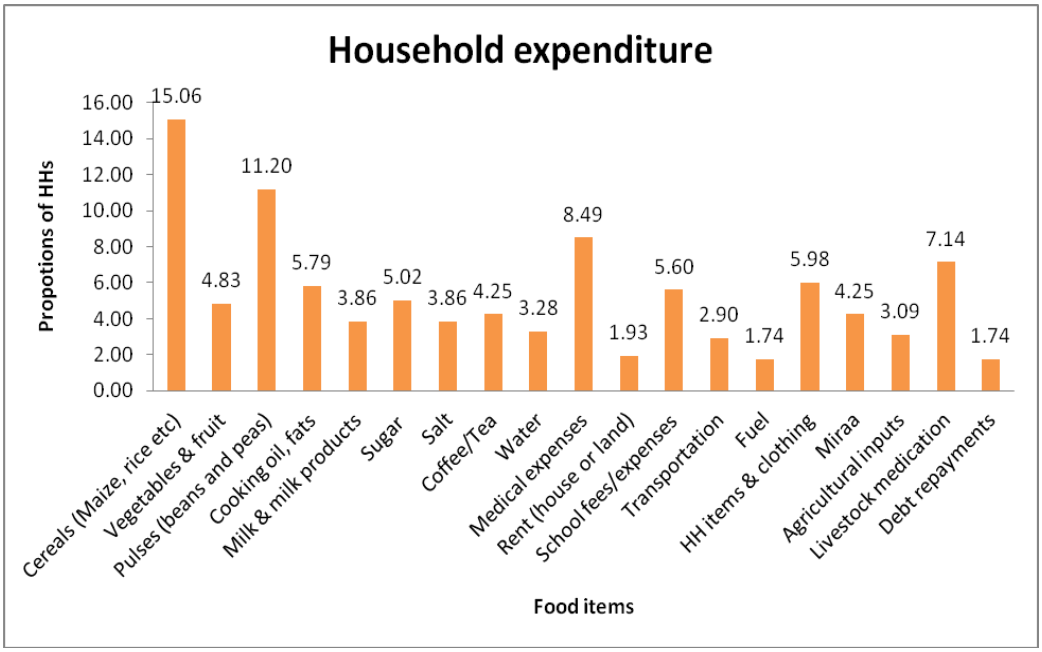


Figure: 4.12. Household expenditure

4.5.5 Shocks, Trends, Seasonality and Disaster Risk Reduction

Stuns in connection to seasonality are a vital wellspring of worry in livelihood of destitute groups, and are increased by climate shifts, for example, absence of rain, dry season, and quick drifts in temperatures from very hot to frosty, and shifts in seasons, which are the principle climatical shifts announced in Garbatulla. Change in seasons initiated by change in climatic is probably going to prompt greater livelihood instability, occasional hunger and lack of healthy food both as under-and additionally finished food perhaps expanding dangers of non-transferable illnesses (e.g. CVDs).The current shocks in Garbatulla include an ongoing dry spell which has led to water stress and deterioration of pastures and browse resulting in unusual livestock migration. During the assessment, the respondents were asked if in the last three (3) months their households have been affected by any shocks. 72% of the respondents indicated yes while a small 28% said no (figure 4.13) Insecurity and conflicts in parts of the region between neighboring communities is also hindering inaccessibility to some pastures and markets in Eskot, Kinna and some parts of Kula mawe.

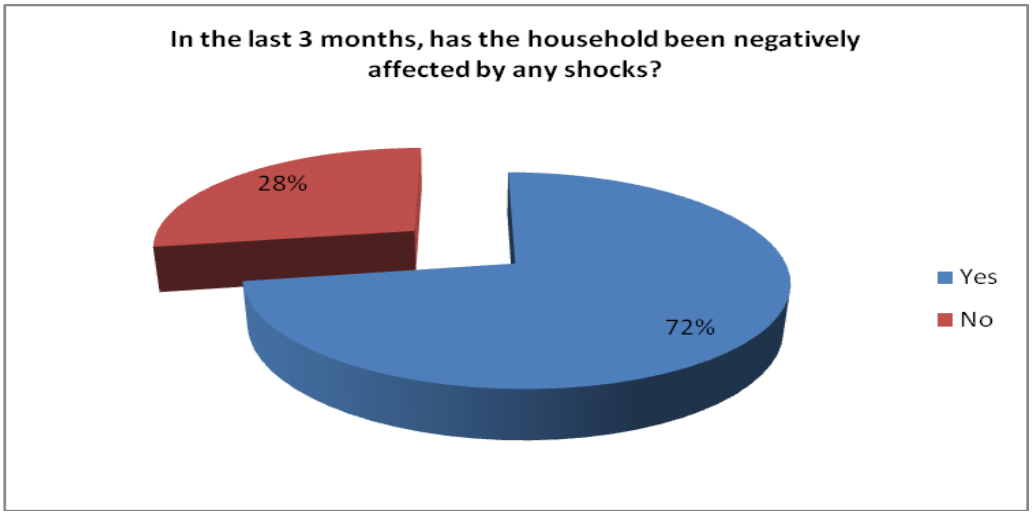


Figure: 4.13 Negative impact of shock at household level

The respondents were also asked to identify the most frequent shocks affecting them according to their importance. According to the respondents, unusual high level of human disease/illness 113(27.9%) was ranked the highest followed by unusual high level of livestock deaths 91(26.1%) and unusual low prices of livestock 116(28.6%) in the second and third position respectively (Table 4.8).

Table: 4.8 Household frequent shocks and trends

Rank the top three shocks affecting the households in order of importance	Highest		Second highest		Third highest	
	N	Percent of Cases	N	Percent of cases	N	Percent of Cases
Reduced water availability	90	22.2%	28	8.0%	57	14.1%
Reduction of pasture/ forage	28	6.9%	83	23.8%	31	7.7%
Unusually high level of livestock death	1	0.2%	91	26.1%	115	28.4%
Unusually high prices for food	85	21.0%	31	8.9%	28	6.9%
Unusually low prices for livestock	1	0.2%	29	8.3%	116	28.6%
Unusually high level of human disease/illness	113	27.9%	30	8.6%	85	21.0%
Reduced income	86	21.2%	28	8.0%	1	0.2%
Insecurity/conflict/Raiding	29	7.2%				
Crop failure			29	8.3%		

4.5.7 Resource based conflicts in Garbatulla sub-county

Climate change is progressively turning into a lasting agenda thing at numerous strategy making gatherings. There are three fundamental measurements to the security danger postured by Climate change. To start with, change in Climate could strengthen land-use clashes and trigger ecological movement by compounding existing natural emergencies, for example, dry spell, water shortage and soil corruption. Climate change is probably going to overpower neighborhood abilities to adjust to changing ecological conditions and strengthen the pattern towards general shakiness that as of now exists in numerous social orders and areas. Second, altogether new causal connections between natural conditions and the rise of contention may show up because of environmental change as ocean level ascent, flooding debacles and softening icy masses that undermine downstream water supplies.

Third, there is worry that if left unabated, global warming could pass certain tipping focuses where change in climate goes up against its very own energy and we see the development of expansive scale changes, (or 'non-straight occasions'), in the Earth's frameworks, for example, the crumple of the Amazon rain forest or the loss of the Asian rainstorm, which could have, "limitless outcomes for the societies concerned" (WBGU, 2007).

For a long time, the greater Isiolo County has been embroiled in a series of violent conflicts putting the different ethnic groups (Samburus, Boranas, Somalis, Turkanas. Merians) in the county against each other. The conflicts that gripped the County, as well as adjacent counties, between the years 1999 – 2001 was perhaps the most violent in which a number of lives were lost, property looted or destroyed and thousands of people internally displaced. This was the period Kenya was facing unprecedented pressure to open up democratic space by allowing multi-party democracy.

An interview with peace committees revealed that combination of factors has conspired to cause, trigger and fuel conflicts within the region. The following key issues could be considered as the key drivers and triggers of conflict in Garbatulla but not limited to climate change and drought, politics, culture/tradition of samburu morans, scare grazing resources as a result of unpredictable rainfall, small arms and light weapons and fencing of grazing areas by neighbouring community.

Climate change's impact on natural resources can also affect the livelihoods of many who earn an income from freshwater, agricultural, forest and ocean resources, potentially leading to protests and unrest.

Garbatulla community experiences both intra and inters community conflicts as narrated by the participants during assessment (figure 4.14). Inter conflicts arises from boundaries, grazing areas, water points and sometimes livestock theft and is between, Borana, Meru, Somalis and Samburus. Effects of climate shifts put additional pressures on social, economic, political systems and may be the catalyst for conflict. Climate change-related events can lower agricultural food productivity, which in turn can affect food security and increase food prices. Intra-conflicts manifested within the community are inter-clan rivalry in form of political inclinations amongst the clans, clan competitions on local and external resources allocations. 75.5% of the respondents reported that frequency of conflict in the area has been increasing compared to the previous 10 years while 68.1% of the respondents agreed that change in climate is the main reason for conflict as a result of scare resources (figure 4.14). Community identified Council of elders, chiefs, common religion, peace declarations, peace committees, common culture as their local capacity for peace. Currently within the area intra-community conflicts have been managed as result of peace declaration among the communities and Government effort to devolve services to the local level.

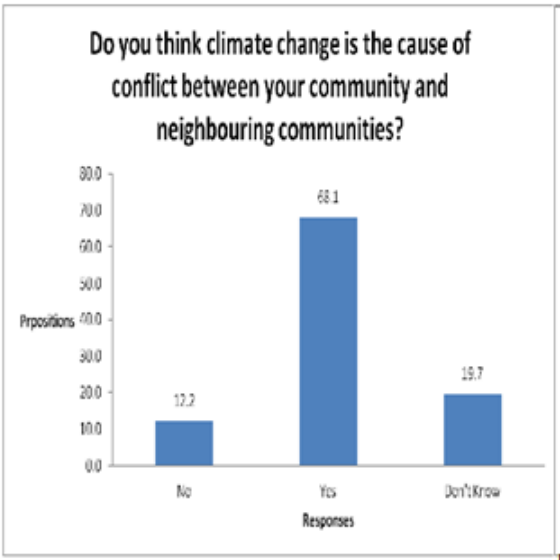


Figure 4.12: Climate Change as a cause of conflict

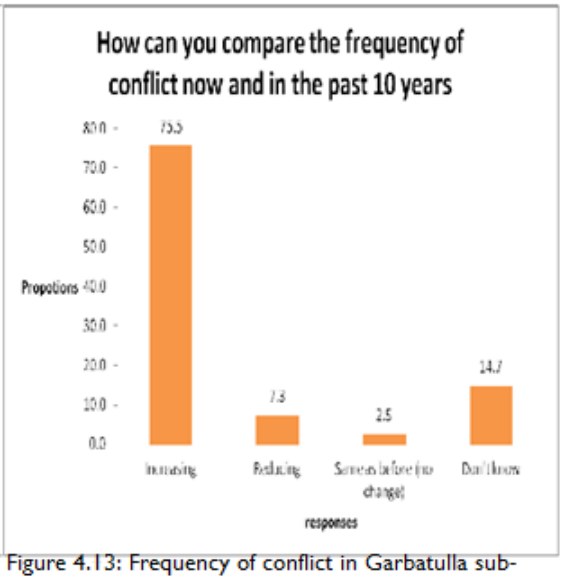


Figure 4.13: Frequency of conflict in Garbatulla sub-county

Figure: 4.14 Climate change as a cause of conflict and its frequency

From the analysis, the conflict is as a result of scare resources; fight over water and pasture 21.7% and historical land fights. Political influences 12.5% also play a greater role of fuelling conflict within the region. Environmental degradation 9.2%, unreliable rainfall 8.7% and high livestock population 4.6% contribute a great role in sustaining conflict in the region (Figure 4.15)

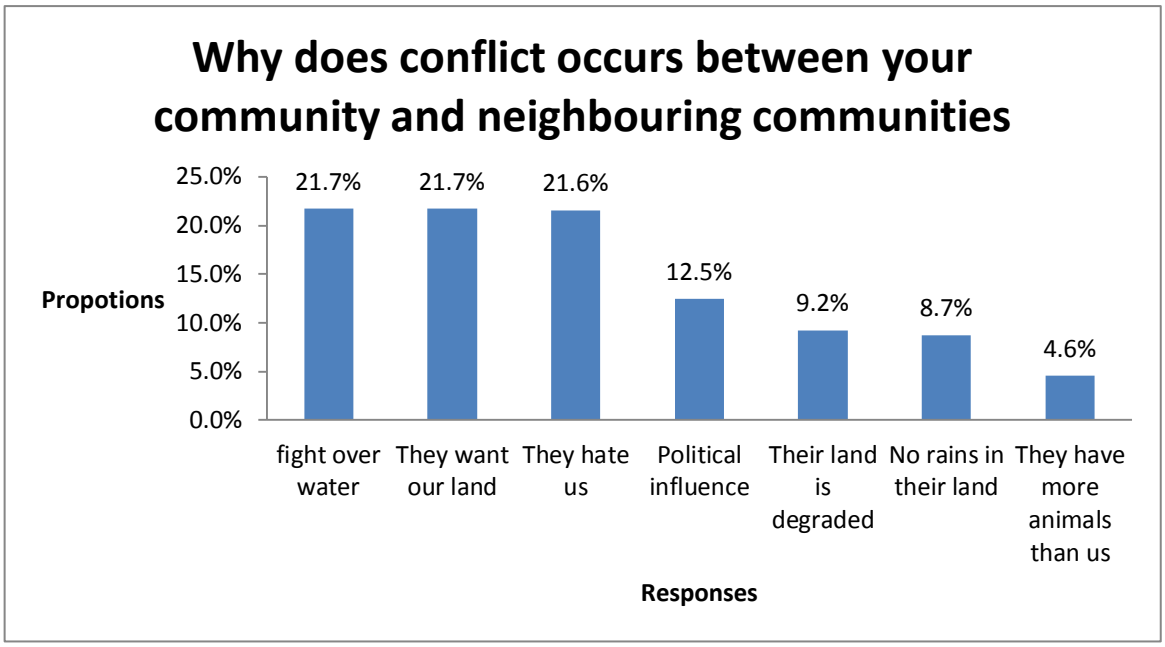


Figure: 4.15 Change in Climate as a cause of conflict and its frequency

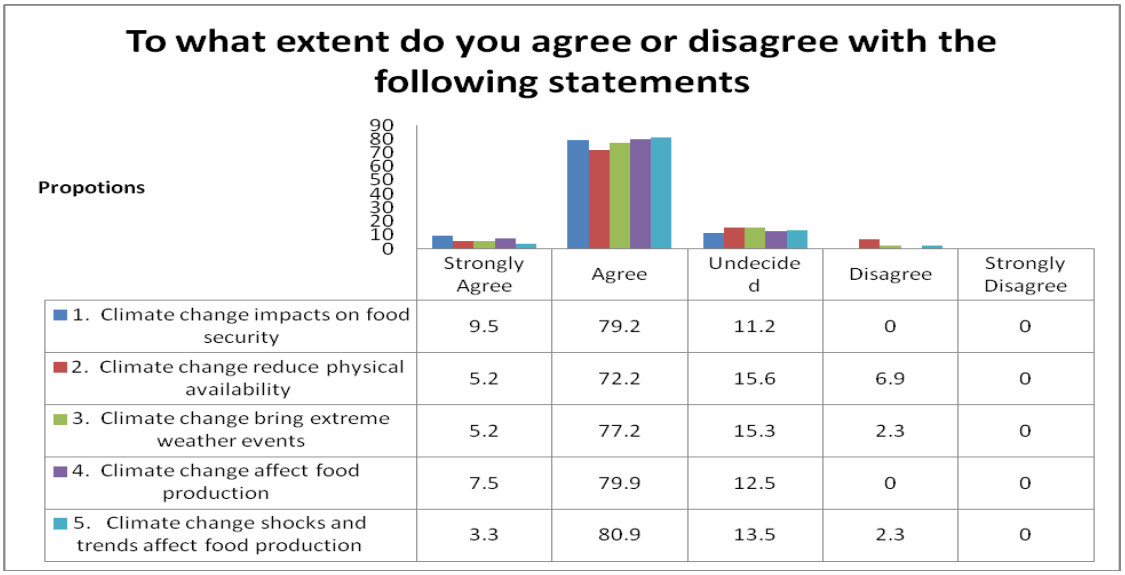
4.5.8 Climate Shifts Impacts and Household Vulnerability

4.5.8.1 Community's perception of climate change impact

The researcher used participatory methods to explore the extent of awareness and perception at community level about climate change impact. The field study revealed that the community has already realized that climate variations and changes are taking place. These changes also began to affect their livelihood, the long-standing coping strategies which they used over decades as of their continuous adaptation to the harsh environment and ecosystem. These strategies have been stretched, because of various reasons including the identified changes in climate variability among other things. From the focus group discussions (FGDs), it is obvious that the populace sees the change in climate as persistent patterns of expanding occasional and temperatures, hot, warm days amid year, diminished volume, and recurrence of rainfall. Individuals never again see these patterns as common climatic vacillations of temperature.

4.5.8.2. Climate Change Impact on Family Food Generation

Respondents were asked to what extent they disagree and agree with the statement on impacts of change in climate on security of food domains as illustrated in table 4.16. It's very clear from this analysis that change in climate affects all components of security of food (79.2% of the respondents agree that change in climate affect food security, 72.2% change in climate reduce physical food availability, 77.2% change in climate bring extreme weather events, 79.9% change in climate affects food production and 80.9% climate change stuns and trends affects food production).



	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
1. Climate change impacts on food security	9.5	79.2	11.2	0	0
2. Climate change reduce physical availability	5.2	72.2	15.6	6.9	0
3. Climate change bring extreme weather events	5.2	77.2	15.3	2.3	0
4. Climate change affect food production	7.5	79.9	12.5	0	0
5. Climate change shocks and trends affect food production	3.3	80.9	13.5	2.3	0

Figure 4.16 climate change Impact on food security areas

The respondents are all aware that change in climate is a worldwide issue which affects every sphere of livelihoods. Figure 4.17 illustrates the responses of the respondents and 76% of them acknowledge that weather pattern is change and a small 15% were unaware whether climate pattern is changing. 56% of the respondents also admit that climate change is affecting them. Interestingly, an overwhelming 59% of the respondents admit to know what to be done to tackle climate change (figure 4.18).

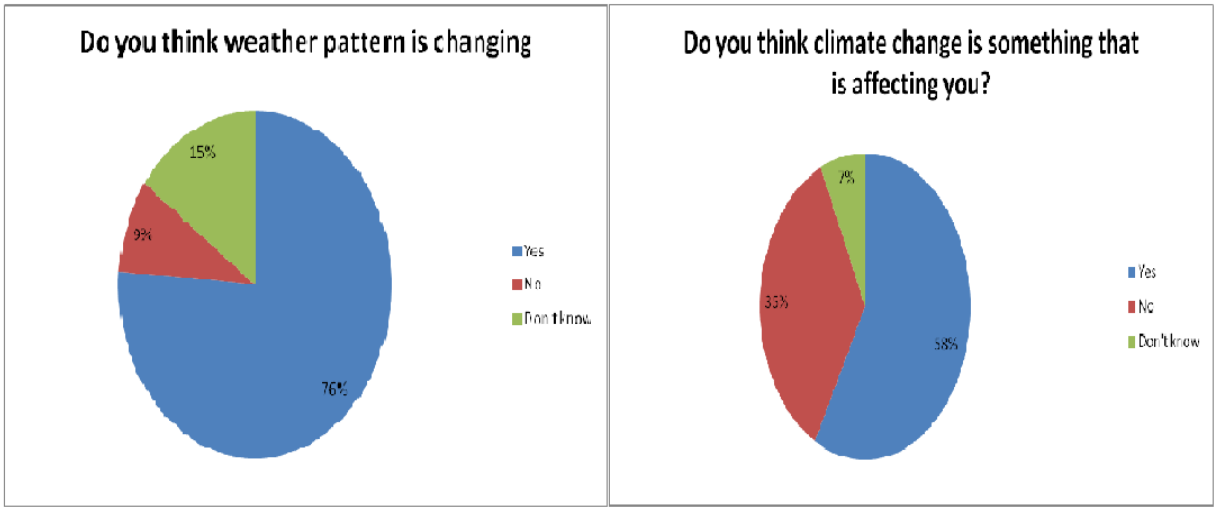


Figure: 4.17 Pattern and effect of climate change at household levels

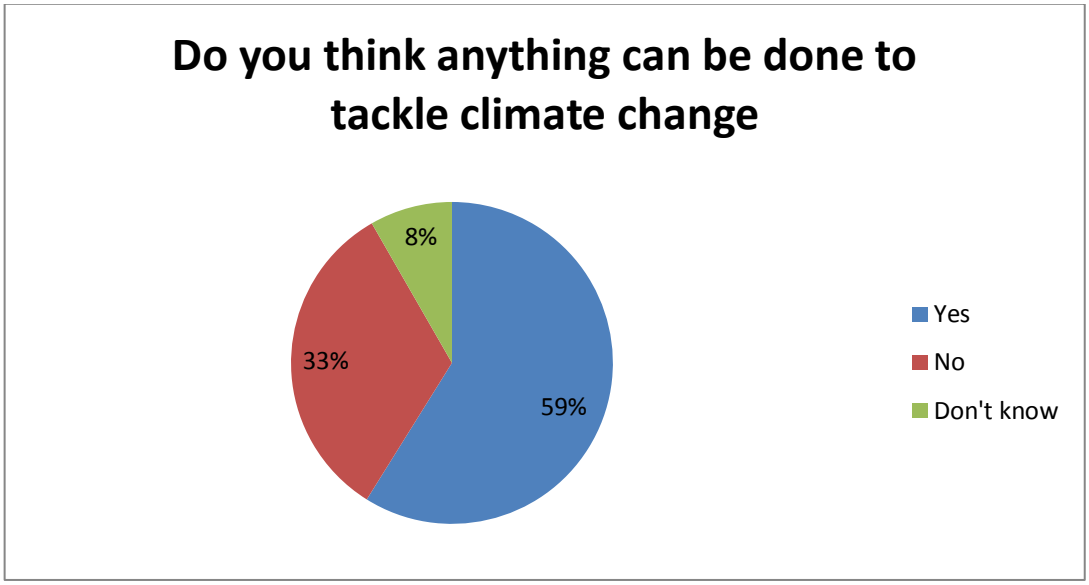


Figure: 4.18 Solutions to climate change

4.5.8.4 Main livelihood sources

The study findings on the main source of livelihood in Garbatulla are shown in Figure 4.19 below. Up to 52% of respondents showed that livestock keeping was their main livelihood source, 15% of the respondents depended on employment (Salaried), while 14% of the respondents depended on small business (petty trade), 10% depended on farm/own labour (crop farmers), 7% of the respondents relied on daily labour/waged labour and 2% relied on others.

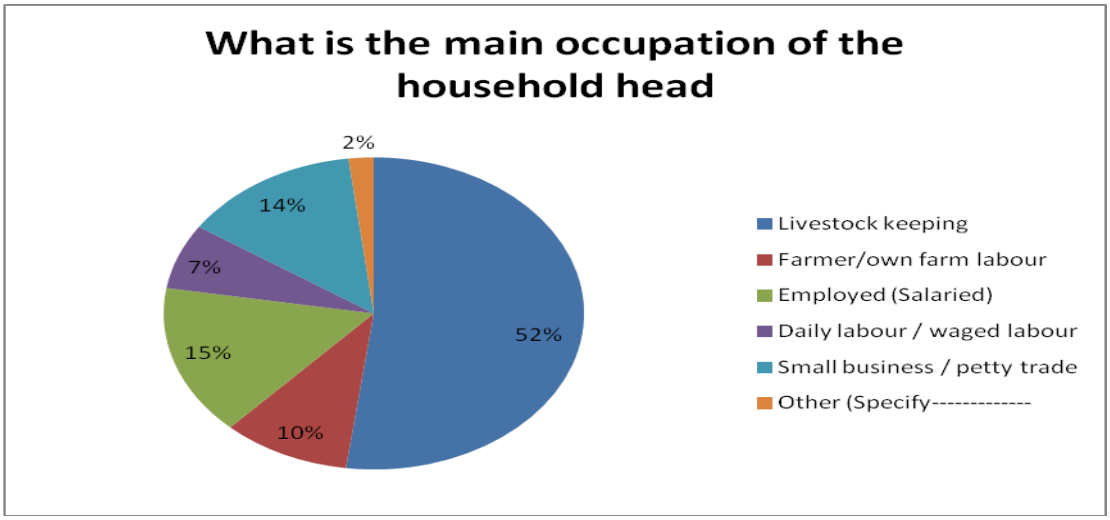


Figure 4.19: Family main sources of income

4.6 Assessing current strategies of coping and highlighting opportunities and barriers for boosting nutrition and food security at family and community level

4.6.1 Strategy of Coping Index

The strategy of coping index assesses how a household copes in times of food shortage or lack of food. Household were assessed based on six strategies which were then weighted based on their severity. A number of coping mechanisms were reported to have been applied by 518 of the sampled households in order to deal with food shortage for the past 2 months prior to the study (Figure 4.20) period. Most families relied on less preferred and cheaper food, and restricted consumption of food by adults for young children to eat. This was attributed to rise in prices of food affecting household reach to food since majority of families are highly dependent on purchases.

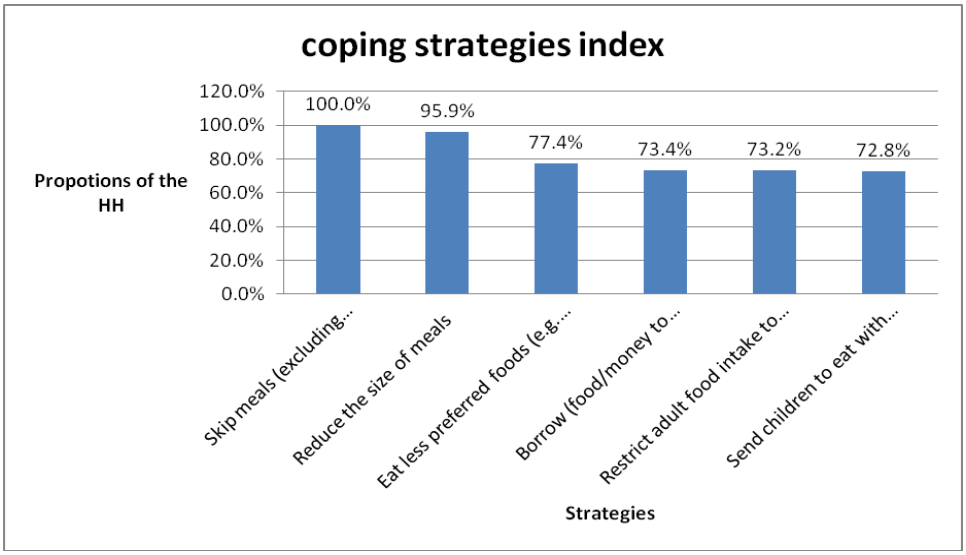


Figure: 4.20 Coping strategies index

During the FGD discussant, the members identify the following mechanism on how the communities have been coping with impeding threats as a change in climate result (table 4.9). The members were asked to discuss how the community has been coping with these threats in the past years and currently. The findings indicate that the community has been coping with the threats despite the adverse effects which are constantly increasing year by year. The findings have been analyzed in table 4.9 below.

Table: 4.9 Community coping mechanism

Threat	Who is most affected?	Why are they affected?	How are they affected?	How do they cope currently	What can be done to ensure they cope better in future
Drought	Children Women Elderly Herdsmen Sick people Animals	They are more vulnerable in the community Lack of enough food Old age	Malnutrition Diseases outbreak Body weakness Loss of property High expenditure Family breakups Conflict High rate poverty Human/livestock deaths	Relief food from GOK, UN Support from NGO Food for work/assets	Enhance Dedha system of grazing Capacity building on resource utilization Diversification of livelihoods Irrigation farming technologies Reafforestation programs Springs and wells protections Enhancing the community disaster preparedness plan Promote traditional coping mechanism
Flood	Children Elderly Women Herdsmen Sick people livestock	Low and weak coping mechanisms Low immunity Inhabit flood zone (high vulnerability)	Upper respiratory tract infections like pneumonia Loss of crops and food (hunger and Malnutrition) Diarrheal diseases Malaria Destruction of shelter and other household effects Loss of both human and livestock life School drop-out/disruption of	Live in makeshift structures bonfires to keep those affected warm/blankets use use of insecticide treated nets move to higher grounds temporarily seek humanitarian assistance (NFIs, food and medical	Seek permanent settlement/improved housing on flood –free zones) Restore the river course Stabilize and protect river banks (afforestation/ fruit trees planting) Gulley control (Use local materials-stone brushwood check dams) Proper design and layout of water conveyances for irrigation Improved farming system Avoid river

Threat	Who is most affected?	Why are they affected?	How are they affected?	How do they cope currently	What can be done to ensure they cope better in future
			learning	services) Construct temporary earth dykes Live with relatives Climbing of trees Avoidance of water catchment areas Digging canals	bank cultivation Infiltration channels/ditches to control and regulate spate flow where the lower ground breaks off to the higher ground, or improved drainage at Boji Earth Dykes establishment Awareness on improved nutrition: Food utilization and preservation; nutrition aspects of fish. Form a water Users Association to enhance irrigation water management Form environmental conservation committee Prepare flood disaster management plan enforce river bank protection Act Agric Act Experts to consult elders on Ewaso Nyiro river flood control feasibility study advocacy of sensitization early warning systems construction of gabions and terraces
Livestoc	Human		Level of poverty	Migrations	Capacity building

Threat	Who is most affected?	Why are they affected?	How are they affected?	How do they cope currently	What can be done to ensure they cope better in future
k diseases **Zoonotic diseases** **Bees extension**	beings Livestock bees	Use of animals products Loss of livestock products Prode to and parasite Trapped by tsetse fly Eating , touching No bee products	increased Loss of life Sickness Expensive treatment Loss of man power Loss of honey	Vaccinations Resistance Grants and relief foods Traditional medicine Modern treatment Proper handling and disposal of candaver Burning bush Buy bees	Improved on interventions of pest and parasite Empower the community with feasible projects Mass vaccination More research on bees farming
Conflict	Children Women Elderly Livestock Sick persons	They are vulnerable They are aged They are weak to fight or defend themselves. They have no control over community resources. All decisions are done by men	Loss of life Theft Displacement of people Malnutrition Psychological depression Economically dismantle	Sensitization through public barazas on peace Prayers through mosques and churches Peace conferences Early warning systems Migration Fleeing Fines Government and non-	Establishment of administrative boundaries Empowerment of vulnerable communities Empowerment of resource management and Deedha council Continuous sensitization on peace building and conflict mitigation Maintaining law and order Enforcement of

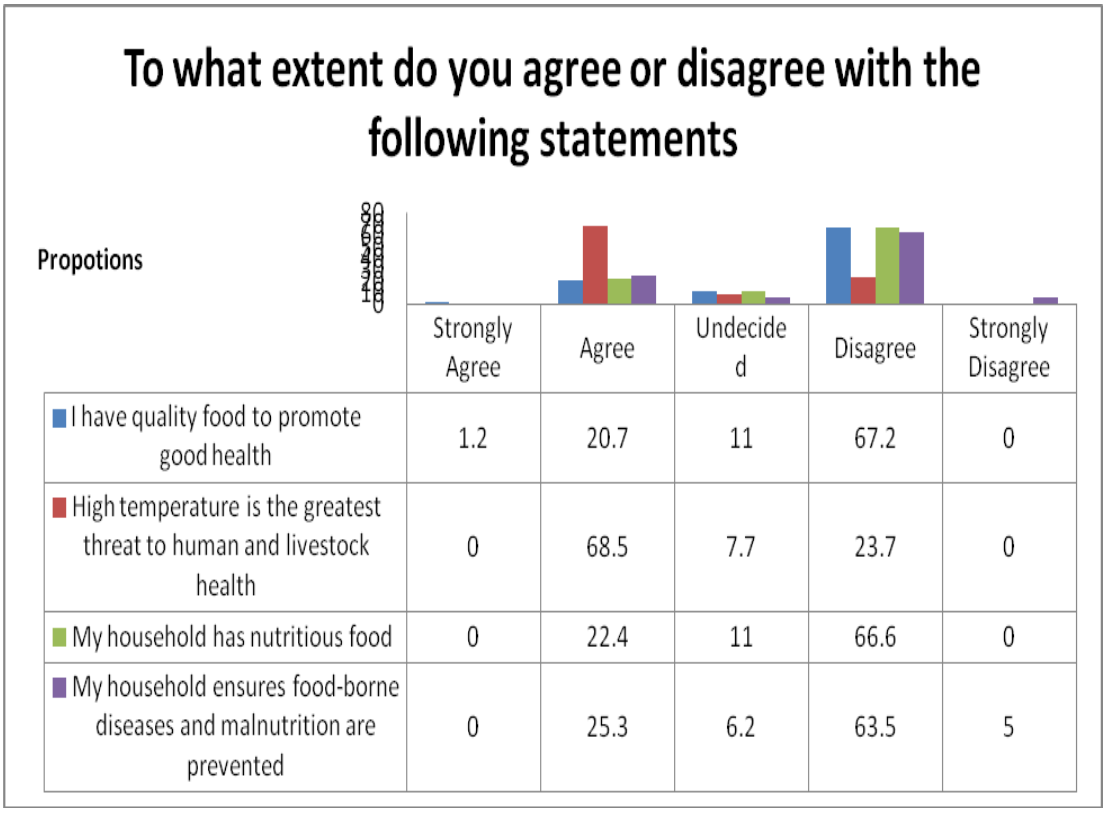
Threat	Who is most affected?	Why are they affected?	How are they affected?	How do they cope currently	What can be done to ensure they cope better in future
				governmental intervention Formation of vigilante groups	traditional bylaws for natural resource governance Undertaking supplementary or alternative income generating activities Harmonious existence amongst ethnic groups Continuous involvement of religious leaders for peace building

4.6.2 Opportunities and Barriers for boosting security of food and nutrition

Some of the barriers for improving security of food and nutrition include poor climatic conditions; this has greatly affected the household food and nutrition security across the sub-county hence resulting to increased levels of malnutrition and minimal recovery of the affected populations. According to the key informant interview (KII) with the department of health personnel, plans to scale up human resource gap in the county are underway hence necessitating capacity building initiatives for the recruited nutrition officers. The exercise will be geared towards enhancing improved quality service delivery of nutrition interventions.

Inadequate funding to health and nutrition services; the allocations for the health and nutrition services at the county mainly goes to recurrent costs giving little to the developmental strategies. This has resulted to delayed implementation and lack of support to key interventions to nutrition.

In Garbatulla sub-county there exists weak advocacy mechanisms and this calls for scale up of nutrition advocacy at county government and community level in so as to move nutrition agenda forward. Figure 4.21 present the discussion of the respondents. The respondents were asked to what extent they disagree or agree with the impediments affecting food security in the region. 67.2% of the respondents disagree having quality food to promote good health while 68.5% agree that high temperature is the greatest threat to human and livestock health. 66.6% of the respondents disagree with their households having nutritious food and 63.5% also disagree with their households ensuring food-borne diseases and malnutrition is presented.



	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
I have quality food to promote good health	1.2	20.7	11	67.2	0
High temperature is the greatest threat to human and livestock health	0	68.5	7.7	23.7	0
My household has nutritious food	0	22.4	11	66.6	0
My household ensures food-borne diseases and malnutrition are prevented	0	25.3	6.2	63.5	5

Figure: 4.21 Barriers and opportunities affecting food and nutrition security

CHAPTER FIVE

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

The study's purpose was to assess the impact of change in climate on food and nutrition security at household level, including the extent to which the interventions and barriers and opportunities translated into improvement in security of food and nutrition and reduction in the vulnerability of pastoral livelihoods in Garbatulla.

- The analysis of rainfall and temperatures over the region of study indicates that there has been decreasing trend of yearly rainfall and increasing temperatures. The observed trends have implications on local livelihoods and enhance aridity.
- According to this study finding, the area is highly dependent on food aid which is an indication of food insecurity in Garbatulla.
- Analysis of nutritional status in the region remains between the poor and serious, requiring proper attention which is an indication of deterioration in nutrition. These genuine levels of unhealthiness can be credited to; Poor dietary assorted variety with numerous family units devouring less of the most supplement thick nourishment and family sustenance uncertainty with a large number of the family unit honing at least one of the adapting methodology.
- The study found out that the respondents were using arrange of coping mechanism which are at border on survival rather than adequacy.
- The study findings also indicated a number of barriers hindering the community from consuming more nutritious foods such as fish, eggs and tubers. The major barriers were selective on culture that limits the range of food staff that the community can consume.

5.2 Recommendations

With a specific end goal to enhance the health, security of nutrition and food status of the populace when all is said and done and kids under five years old specifically from unfavorable effects of change in climate, the accompanying are recommendations in light of the study findings.

Spatial and temporal variation

- In view of the decreasing rainfall and increasing temperatures there should be enhanced efforts to use non-rain-fed agricultural technologies such as greenhouse, shade nets, agro-nets and on-farm water harvesting structures to increase diversification and food production

Health and Nutrition

- The study has found out that nutrition situation in the Sub-county is from poor to serious of GAM rates of 12.4 and SAM rates of 1.1. Its therefore recommended the up scaling the Integrated Management of Acute Malnutrition (IMAM) programs by health sector through mass screening, active case finding and also having a working surveillance mechanism of the whole population on Monthly basis in collaboration with non-state actors working in the region.

Food Security

There ought to be close observing and investigation of the food security circumstance in Garbatulla sub-area, including:

- Exhaustive analysis of observed, anticipated climatic change-related disasters and security of food and nutrition are deficient in the district. It is basic to grow such analysis and required instruments in rural regions, and in various delegate ecosystems systems and financial settings. The investigation should target which districts and populaces which are especially helpless against climate related risks concentrating on climate related stuns; seasonality; patterns and steady changes and obviously expressing local adapting and adjustment techniques are fitting.

Lessen people group and family powerlessness towards effects of dangers through risk management of disasters despite evolving climate:

- Give trainings and support to the creation and execution of group and sub-county DRM and group catastrophe readiness designs or emergency courses of action

Increment food accessibility in the Sub-County through enhanced and extended harvest generation:

- ✓ Increment vegetables and staples production in zones with access to water system sources

- ✓ Advance water sparing and accumulation strategies, including rain water gathering at family and group levels and trickle water system
- ✓ Advance dry season tolerant and privately adjusted seed assortments

Screen and investigate the cooperative energy openings and the dangers of change in environmental moderation measures on security of sustenance and nourishment

- The investigation and observing of cooperative energy openings and the risks of change in environmental alleviation measures on nourishment and sustenance security justify the thought of approach strategy researchers and specialists. The choice of promising ecological change alleviation methodology that bring co-advantage the extent that nourishment security is required: affirmation and affirmation that change in environmental balance frameworks can have critical points of interest for sustenance security offers the probability of system choices that are potentially both down to earth and socially engaging.

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7.0 ANNEXTURES

Annex 1: Household Questionnaires

Impact assessment of climate change on food and nutrition security at household level in Garbatulla sub-county

Study questionnaire

CONSENT: This questionnaire is intended to help in the assessment of the impact of climate change on food and nutrition security at household level in Garba Tulla Sub-county. You are kindly requested to complete the same by either writing or putting a tick [✓] where required. Your response will be confidential and will be strictly used for the purpose of this research only.

SECTION A: GENERAL DEMOGRAPHIC DATA

S/No.	***Question***		
		1=Male	***2=Female***
A.1	Sex of Respondent		
A.2	Please indicate the age bracket you are in:		
	1. 15 – 24 2. 25 - 34 3. 35 – 44 4. 45 – 54	5. 55 – 64 6. 65 – 74 7. 77 – 84 8. 85 or over	
A.3	What is your highest academic qualification ***(Tick Appropriate)***		
	1. No Education		
	2. Primary		
	3. Secondary		
	4. Undergraduate		
	5. Graduate		
	6. GCSE/O-Level		
A.4	Indicate your marital status ***(Tick Appropriate)***		
	1. Single		
	2. Married		
	3. Divorced		

	4. Separated	
	5. Widowed	

SECTION B: FOOD AVAILABILITY AND DISTRIBUTION AT HOUSEHOLD LEVEL

B.1	To what extent do you agree or disagree with the following statements ***(Tick Appropriate)***					
	Statement	**1=SA**	**2=A**	**3=U**	**4=D**	**5=SD**
B.1.1	My household has readily available and access of food					
B.1.2	My household ensures utilization and stability of food					
B.1.3	My household has safe food					
B.1.4	Reduced production leads to higher food prices					
B.1.5	My household generates enough income to purchase food					
Codes: SA = Strongly agree; U=undecided; A = Agree; D = Disagree SD =Strongly disagree						
B.2	From which sources do households obtain each of the food groups? ***(use the codes)***					
	1. Production					
	2. Market					
	3. Social networks e.g. gifts					
	4. Exchange and barter					
	5. Gathering wild foods and hunting					
	6. Food assistance					
B.3	Which factors limit your households from obtaining food from sources in B2? ***Include cultural norms which influence food choices.***					
	1. 2. 3. 4. 5					
B.4	How do households obtain their cash income? (**Tick appropriate)**					
	1. Household production & sale of crops, livestock or other products					
	2. Employment					
	3. Petty trade and commerce					
	4. Loans					
	5. Gifts and aid					
	6. Remittances					

B.5	What factors limit the ability of your households to obtain income from sources cited B4?
	1. 2. 3. 4. 5.
B.6	What factors limit your households from using their combined income to diversify household diet?
	1. 2. 3. 4. 5.

SECTION C: NUTRITIONAL AND FOOD SECURITY ASSESSMENT OF HOUSEHOLDS WITH WOMEN OF REPRODUCTIVE AGE AND CHILDREN UNDER 5

C.1	Indicate the extent to which you agree or disagree with the following statements					
	Statement	**1=SA**	**2=A**	**3=U**	**4=D**	**5=SD**
C.1.1	I have quality food to promote good health					
C.1.2	High temperature is the greatest threat to livestock health					
C.1.3	My household has nutritious food					
C.1.4	My household ensures food-borne diseases and malnutrition are prevented					
Codes: SA = Strongly agree; U=undecided; A = Agree; D = Disagree SD =Strongly disagree						

	C.2: Food Frequency and Household Dietary Diversity				
Sn.	Type of Food Group Consumed:	**C.2.1**: Did a member of your household consume any food from these food groups in the last *7 days?(food must have been cooked/served at*	**C.2.2** If **YES,** in C.2.1, how many days was the food consumed in the last 7 days?	If **YES in C.2.1**, in the last 24 hrs. did any member of your household consume any food from these food groups? ***1. Yes,*** *2.* ***No***	What is the main source of the dominant food Item consumed? (Use codes above)? **1. Own production** **2. Purchases** **3. Gifts from friends/families** **4. Food aid** **5. Traded or Bartered**

	C.2: Food Frequency and Household Dietary Diversity				
		the household) ***1. Yes*** *2.* ***No***			**6. Borrowed** **7. Gathering/wild** **88. Others, specify**
C.2.a	Cereals and cereal products (e.g. sorghum, maize, spaghetti, pasta, bread)?				
C.2.b	Vitamin A rich vegetables and tubers: Pumpkins, carrots, orange sweet potatoes				
C.2.c	White tubers roots and plantains: White potatoes, white yams, cassava, or foods made from roots, green bananas				
C.2.d	Dark green leafy vegetables: Dark green leafy vegetables, including wild ones + locally available vitamin A rich leaves such as traditional vegetables.				
C.2.e	Other vegetables (e,g, tomatoes, eggplant, onions)?				
C.2.f	Vitamin A rich fruits: Ripe mangoes, papayas + other				

	C.2: Food Frequency and Household Dietary Diversity				
	locally available vitamin A rich fruits				
C.2.g	Other fruits				
C.2.h	Organ meat (iron rich): Liver, kidney, heart or other organ meats				
C.2.i	Flesh meats and offals: Meat, poultry, offal (e.g. goat/camel meat, beef; chicken/poultry)?				
C.2.j	Eggs				
C.2.k	Fish: Fresh or dries fish or shellfish				
C.2.l	Pulses/legumes, nuts (e.g. beans, lentils, green grams, cowpeas)?				
C.2.m	Milk and milk products (e.g. goat/camel milk, milk powder)?				
C.2.n	Oils/fats (e.g. cooking fat or oil, butter, ghee, margarine)?				
C.2.o	Sweets: Sugar, honey, sweetened soda or sugary foods such as chocolates, sweets				
C.2.p	Condiments, spices and beverages:				

C.3	**Dietary Diversity, Food Sources and Coping Strategies**	
C.3.1	Please indicate the foods (meals and snacks) that you ate yesterday during the day and night, whether at home or outside the home. Start with the first food eaten in the morning.(*tick appropriate*)	
	1. Cereals (bread, noodles, biscuits, cookies or any other foods made from millet, sorghum, maize, rice, wheat)	
	2. Tubers and roots (white potatoes, white yams, cassava, or foods made from roots.)	
	3. Vegetables	
	4. Fruits	
	5. Meat	
	6. Eggs	
	7. Fish	
	8. Legumes	
	9. Nuts & seeds	
	10. Milk & milk products	
	11. Oils and Fat	
	12. Sweets	
	13. Spices, Condiments, Beverages	

C.4: What have been the sources of food for your household in the last 30 days? What percentage of the total came from each source?

Food Sources	**Tick**	**% income**
1. Own farm production (crops, vegetable, fruit)		
2. Own livestock production (livestock products – e.g. milk, eggs)		
3. Own livestock production (meat)		
4. Purchase		
5. Credit		
6. Food aid		
7. Gift		
8. Other (specify)		

5	**Coping strategies index**	
C.5	In the past 7 days, if there have been times when you did not have enough food or money to buy food, how often has your household had to: ***(ranging from "never" (0) to "every day" (7))***	
	1. Skip meals (excluding Ramadan)	
	2. Reduce the size of meals	

	3. Eat less preferred foods (e.g. wild foods etc.)	
	4. Borrow (food/money to purchase food) from relatives	
	5. Restrict adult food intake to allow children to eat	
	6. Send children to eat with relatives	
	88. Other (specify)	
C.6	**Household Income & Expenditure**	
C.6.1	Please list all of the sources of income for your household in the last 30 days. What percentage of your income came from each source? ***(Use proportional piling to calculate the percentages)***	
	1. Agricultural / Horticulture products sale	
	2. Livestock sales	
	3. Livestock products sales (milk, eggs, honey, hide, skin etc)	
	4. Small business (shop)	
	5. Petty trade (on adhoc basis)	
	6. Bush products sales (charcoal, firewood, etc.)	
	7. Miraa sales	
	8. Food aid sales	
	9. Unskilled wage labour	
	10. Skilled wage labour	
	11. Remittances from family/relatives	
	12. Salary	
	13. Loans/credit	
	14. Barter/exchange	
	88. Other (Specify)	

C.7	What has the household spent on the **following (only if bought with cash or on credit/bartered)** in the last 30 days		
	Item	**C.7.1** Percentage of expenditure on each item/type (use proportional piling to calculate percentages)	**C.7.2** How Item was Purchased (Main) **(1=Cash; 2=Credit; 3=Bartered item; 4=Other; 0=not purchased)**
	1. Cereals (Maize, rice etc)		
	2. Vegetables & fruit		
	3. Pulses (beans and peas)		
	4. Meat, Fish, Egg		
	5. Cooking oil, fats		

	6. Milk & milk products		
	7. Sugar		
	8. Salt		
	9. Coffee/Tea		
	10. Water		
	11. Medical expenses		
	12. Rent (house or land)		
	13. School fees/expenses		
	14. Transportation		
	15. Fuel		
	16. HH items & clothing		
	17. Miraa		
	18. Agricultural inputs		
	19. Livestock medication		
	20. Debt repayments		
	88. Other (specify)		

C.8 Shocks and Disaster Risk Reduction				
C.8.1	In the last 3 months, has the household been negatively affected by any shocks? (Tick Appropriate)			
	1. Yes			
	2. No			
C.8.2	**If yes,** please rank the top three in order of importance. Write ***1=highest, 2=second highest, 3=third highest*** *(If there were less than three, just rank the highest, second highest etc)*			
		1=Highest	**2=Second Highest**	**3=Third Highest**
	1. Reduced water availability			
	2. Reduction of pasture/ forage			
	3. Unusually high level of livestock death			
	4. Unusually high level of livestock diseases			
	5. Low level of livestock birth			
	6. Unusually high prices for food			
	7. Unusually low prices for livestock			
	8. Unusually high level of human disease/illness			
	9. Reduced income			
	10. Reduced/No access to credit			
	11. Reduced casual/wage earning opportunities			
	12. Crop failure			
	13. Insecurity/conflict/Raiding			
	88. Other			

For the 2 first main shocks above, please complete the following table using the codes. Please be consistent in the ranking, starting with the letter listed above for the rank 1, than rank 2

Problem (ranked as above)	**C. 8.3** Did the Shock create a decrease in your ABILITY to have enough water and food to eat **1=Yes** **2=No**	**C.8.4** Did the Shock create a decrease in income or a loss of assets? **1=Yes** **2=No**	**C. 8.5** What is/did the household **MAINLY** due to cope with/manage the impact of the shock? ***(Use the codes in the table below)***	**C.8.6** Has the household recovered from the impacts of the shock? **1=Yes** **2=No** **3 = Partially**
1.				
2.				

C.8.5 Codes:

5. Reduce amount eaten/eat less
6. Ask support (money or other) from Family/Friends (GIFT)
7. Sold small animals –poultry, goats, sheep
8. Begging
9. Spend less on food
10. Skipped days without eating
11. Ask support (money / other) from Family/Friends (BORROW)
12. Sold large animals – camel, cattle
13. Move to another location
14. Spend less on other non-food items
15. Additional HH members migrated
16. Purchase on credit / loan
17. Remove children from school
18. Alternative income source
19. Spend more money than usual on water
20. Spent savings
21. Sold HH articles
22. Rely on food aid

88. Other (describe)

CHILD HEALTH AND NUTRITON (ONLY FOR CHILDREN 6 – 59 MONTHS OF AGE; IF N/A SKIP TO THE NEXT SECTION

C. 9.1	CHILD ANTHROPOMETRY **Instructions**: The caregiver of the child should be the main respondent for this section *Please fill in all the details required below.*														
Child no.	**HH no.**	**Sex** F/M	**Age in Months**	**Weight** ##.# kg	**Height** ###.# *(cms)*	**Edema** (Y/N)	**MUAC** ##.# *(cms)*	**Age verified by** 1= Card 2= Recall	**In the last 1 yr, how many times has the child received** Vitamin A	**In the last 6 months; has the child received drug for intestinal worms** 0= No 1= Yes	**In the past two weeks did the child suffer from any sickness** 0=No 1= Yes	**If yes, which sicknesses**			
												Diarrhoea 0= No 1= Watery diarrhoea 2= Bloody diarrhoea	**Fever with chills like malaria** 0= No 1= Yes	**Fever, cough, difficult breathing** 0= No 1= Yes	**Other (specify)** 0= No 1= Yes
1															
2															
3															
4															
5															
6															

SECTION D: CLIMATE CHANGE AND HOUSEHOLD VULNERABILITY

D.1	Indicate the extent to which you agree or disagree with the following statements using the following key: **SA = Strongly agree; A = Agree; D = Disagree SD =Strongly disagree *(Tick Appropriate)***					
	Statement	**1=SA**	**2=A**	**3=U**	**4=D**	**5=SD**
	1. Climate change impacts on food security					
	2. Climate change reduce physical availability					
	3. Climate change bring extreme weather events					
	4. Climate change affect food production					
	5. Climate change shocks and trends affect food					

D.2	Do you think weather pattern is changing			
	Yes			
	No			
	Don't Know			
D.3	If yes, why do you think might be the reason			
D.4	How important is the issue of climate change to you personally? (Tick as many as you feels apply)			
	1. Very important			
	2. Important			
	3. Not very important			
	4. Not at all important			
D.5	What do you think causes climate change?			
D.7	What impacts, if any, do you think climate change may have?			
D.8	Do you think climate change is something that is affecting or is going to affect you, personally?			
	1. Yes			
	2. No			
	3. Don't Know			
D.9	If yes, in what way(s) is it affecting you, or is it going to affect you?			

D.10	Do you think anything can be done to tackle climate	
	1. Yes	
	2. No	
	3. Don't Know	
D.11	If yes, what do you think can be done to tackle climate change?	

SECTION E: EXISTING COPING STRATEGIES AND IDENTIFY BARRIERS AND OPPORTUNITIES FOR IMPROVING FOOD AND NUTRITION SECURITY AT HOUSEHOLD AND COMMUNITY LEVEL

E.1	Indicate the extent to which you agree or disagree with the following statements using the following key: **SA = Strongly agree; A = Agree; D = Disagree SD =Strongly disagree *(Tick Appropriate)***					
	Statement	**1=SA**	**2=A**	**3=U**	**4=D**	**5=SD**
	1. We have strategies for improving climate change at household and community level					
	2. food safety result from water pollution, increased temperatures and/or damage to stored					
	3. Garba Tulla Sub-county have barriers for improving food and nutrition					
	4. Garba Tulla Sub-county have opportunities for improving food and nutrition					
	5. We have strategies for improving food and nutrition security at household and community level					
E.2	Do you think climate change is the cause of conflict between your community and the neighbouring community?					
	1. Yes					
	2. No					
	3. Don't Know					
E.3	If yes, where in your community is conflict most experience?					
E.4	How can you compare the frequency of conflict now and in the last 10 years (has it reduced or increased? (*Tick the appropriate*)					
	1. increasing					
	2. reducing					
	3. same as before					

	4. don't know	
E.6	How often and when do you experience conflict in your community	
	Every day	
	During very dry spell	
	During rainy season	
	Whenever there is an influx of livestock to one region	
	Every year	
	Twice in a year	
E.7	Which hazards are more significant in this area in terms of impacting people's life and livelihoods? *(Tick appropriate)*	
	1. Diseases (both human and livestock) 2. Droughts 3. Conflicts 4. Floods 5. Environmental degradation 6. Earthquakes 7. Cyclones and typhoons 8. Fire	
E.8	Who is affected most among the community by the impact of climate related hazards? (Choose appropriate)	
	9. Children 10. Salaried people (Employed) 11. Pregnant mothers 12. Pastoralist 13. Lactating mothers 14. Elderly people 15. Orphans and vulnerable 16. Others (Specify)	

Annex 2: Focus Group Discussion

SECTION F: SPECIFIC RECOMMENDATIONS FOR THE HEALTH SECTOR FOR IMPROVING FOOD SECURITY AND NUTRITIONAL STATUS OF POPULATION IN GARBA TULLA SUB-COUNTY.

1. Indicate the recommendations you can give to the health sector for improving food security and nutritional status of population in Garbatulla Sub-county

   ……..……..……...

   ……..……..……...

2. What are the existing strategies or interventions that have been put in place to improve nutrition security in Garbatulla sub-County?

   ……

   ……

3. What are the strategies or interventions that can be used to improve climate change adaptations in Garbatulla Sub-County?

   ……

   ……

4. What are the strategies or interventions that can be used to improve food security in Garbatulla sub-county?

   ……

   ……

Annex 3: Key Informant Interview

1. What types of drought resistant crops are cultivated in Garbatulla Sub-county?
2. How does climate change reduce physical food availability?
3. How is your community utilizing available food?
4. How does less production leads to higher food prices?
5. How does climate change impact on food and nutrition security?
6. How does Climate-related animal and plant pests and diseases reduce food availability
7. What challenges have you experienced during the implementation of the food assistance plans?
8. What are the ways of improving food security and nutritional status of population in Garbatulla South Sub-county?
9. What is the government, non-state actors and research organization doing to assist people to strengthen and facilitate community adaptation process
10. What are the four most important interventions to be adopted/done by government (national and level), community and aid agencies in addressing food and nutrition security

Thank you for your Time.

God Bless you

*END

Annex 4: Consolidated five year block maximum and minimum temperatures for Marsabit, Meru, Garissa and Wajir counties from 1982 to 2013

Table: 4.12 consolidated maximum and minimum temperatures for four Counties

County	5 year Block	Maximum temperatures	Minimum temperatures
Marsabit	1982 - 1986	24.7	15.6
Marsabit	1987 - 1991	24.6	15.9
Marsabit	1992 - 1996	25.1	15.7
Marsabit	1997 - 2001	24.8	16.0
Marsabit	2002 - 2008	24.6	16.1
Marsabit	2009 - 2013	25.4	16.5
Meru	1987 - 1991	24.0	13.0
Meru	1992 - 1996	23.8	12.9
Meru	1997 - 2001	23.9	13.0
Meru	2002 - 2008	23.8	13.1
Meru	2009 - 2013	23.9	13.4
Garissa	1980 - 1984	35.1	22.5
Garissa	1985 - 1989	34.2	23.2
Garissa	1990 - 1994	34.4	23.1
Garissa	1995 - 1999	34.4	23.0
Garissa	2000 - 2007	34.8	23.3
Garissa	2008 - 2012	34.8	23.8
Wajir	1983 - 1987	34.0	22.9
Wajir	1988 - 1992	33.5	23.2
Wajir	1993 - 1997	33.7	22.9
Wajir	1998 - 2002	34.4	23.2
Wajir	2003 - 2007	34.4	23.3
Wajir	2008 - 2012	34.9	24.2

Source: Author's analyzed data from KMD, 2014

Annex 5: Consolidated five years block average, maximum and minimum rainfall for Marsabit, Meru, Garissa and Wajir counties from 1982 to 2013

Table: 4.13 consolidated average, maximum and minimum rainfall for four Counties

County	5 Year block	Average rainfall	Maximum rainfall	Minimum rainfall
Marsabit	1982 - 1986	70.82	122.46	43.14
Marsabit	1987 - 1991	63.31	84.64	34.15
Marsabit	1992 - 1996	51.88	71.16	26.68
Marsabit	1997 - 2001	56.26	120.32	8.30
Marsabit	2002 - 2008	55.46	74.58	40.14
Marsabit	2009 - 2013	59.18	93.04	32.56
Garissa	1982 - 1986	24.54	36.50	9.79
Garissa	1987 - 1991	34.63	58.32	14.81
Garissa	1992 - 1996	27.01	35.72	11.08
Garissa	1997 - 2001	38.13	79.20	13.44
Garissa	2002 - 2008	27.03	46.72	5.59
Garissa	2009 - 2013	21.12	27.21	8.60
Wajir	1981 - 1985	28.57	59.70	13.14
Wajir	1986 - 1991	22.41	48.08	10.02
Wajir	1992 - 1996	29.00	42.38	17.96
Wajir	1997 - 2001	32.50	92.58	6.71
Wajir	2002 - 2008	27.48	43.05	7.75
Wajir	2009 - 2013	42.69	70.79	19.52
Meru	1982 - 1986	110.96	164.97	78.45
Meru	1987 - 1991	109.69	130.59	55.76
Meru	1992 - 1996	114.95	130.80	81.16
Meru	1997 - 2001	109.80	184.99	49.85
Meru	2002 - 2008	109.07	152.10	76.85
Meru	2009 - 2013	112.11	121.96	100.53

Annex 6: Garbatulla Market Assessment Data for three Months

Table: 4.14 Market Assessment data

	Market Assessment					
	Months	December 2015	January 2016	February 2016	Price change	
Location	Description of food item	Unit prices/Kg/Ltr	Unit prices/Kg/Ltr	Unit prices/Kg/Ltr	Absolute difference	% change
Garba Tulla	Maize dry	30	20	25	5	25%
	Maize flour	60	38	59	21	55%
	Beans	80	90	70	-20	-22%
	Rice	75	80	75	-5	-6%
	Wheat flour	90	75	70	-5	-7%
	Sugar	100	100	95	-5	-5%
	Potatoes	75	70	60	-10	-14%
	Cooking oil/fat	180	105	135	30	29%
	Cow milk	40	40	52	12	30%
	Camel milk	40	40	48	8	20%
	Goats milk	40	40	54	6	15%
	Cow meat	170	200	180	-20	-10%
	Camel meat	170	180	158	-22	-12%
	Livestock market prices					
	Cattle male -3 years old	7,000	18,000	19,400	1,400	8%
	Cattle female -3 years old	8,000	20,000	22,800	2,800	14%
	Camel male -4 years old	10,000	30,000	37,600	7,600	25%
	Camel female -4 years old	18,000	40,000	34,000	-6,000	-15%
	Matured goat	2,500	5,000	3,960	-1040	-21%
	Matured sheep	1,500	4,000	3,000	-1,000	-25%