Disaster Risk Management in Support of Community-based Adaptation to Climate Change Impact in North Turkana District of Kenya

By

Mohammed KHALED

Student # 2007094341

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Supervisor: Mr Andries Jordaan

Study leader: Dr. Charles Ehrhart

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DECLARATION OF ORIGINALITY

I, Mohammed Khaled, hereby present for consideration by the Disaster Risk Management Training and Education Centre for Africa (DIMTEC), within the Faculty of Natural and Agricultural Science at the University of the Free State (UFS), my dissertation in partial fulfilment of the requirements for the degree of Masters in Disaster Management.

I sincerely declare that this dissertation is the product of my own efforts. No other person has published a similar study from which I might have copied, and at no stage will this work be published without my consent and that of the Disaster Risk Management Training and Education Centre for Africa (DIMTEC).

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Executive Summary

This is study intended to analyse the risk of climate change impact on the pastoral community of Turkana, particularly on their source of livelihood. Climate change is claimed to influence other climatic ad no-climatic risks in the district. The researcher undertook a community-based disaster risk assessment to assess whether communities perceive climate change impact as a risk, and whether it is significant in their context. Moreover, a review and analysis of historical meteorological data and climate change projections were undertaken. The study found that all sources converge to the conclusion that there are indications (trends) that confirm the community perception of climate change impact.

The researcher analysed the added value of the Turkana livelihood and its contribution to the local and national interests. In addition, a review of traditional livelihood strategies and coping mechanisms of Turkana was done. This was necessary to analyse the community's current vulnerabilities, capacities and adaptive capacities to climate change. Vulnerability and access models were applied to inform the adaptive capacity analysis, which was conducted by using a community-based capacity and vulnerability analysis to climate change.

The analysis concluded that the current vulnerabilities are rooted at various levels from national central to household and individual levels. There are long-term socioeconomic factors at all these levels which are shaping the current vulnerability of Turkana to climate change and its future adaptation.

The study provided recommendations that are based on the output of the analysis of various aspects of Turkana community. In short, it is necessary to undertake an integrated approach, which mainstreams disaster risk reduction and incorporates climate change impact. A mix of long-term and relief activities are necessary to strengthen the adaptation capacity in Turkana, with particular emphasis on addressing acute and chronic vulnerabilities and poverty.

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DEDICATION

To My best friends (children); Samier and Yasmien, for their patience while I was preparing this study.

And

To all those who dedicated their efforts to protect human dignity

CONTENTS

Boxes

Tables

Figures

Maps

CHAPTER ONE: Methodological Introduction

1.1 Introduction

The ineffectiveness of aid interventions and government policies is evident from the increasing scale of human suffering when drought or other types of crisis occur. The Turkana pastoral community is increasing facing deterioration in its livelihood, environment, socioeconomic conditions, food security and conflicts. Climate change impact seems to be a contributing factor that may exacerbate these conditions, while the current vulnerable conditions may hinder community adaptation to climate change impact. A community-based disaster risk management approach is envisaged in this study to analyse and eventually support the adaptive capacity of the Turkana pastoral. This approach suggests an integrated approach of socioeconomic development that mainstreams disaster risk reduction and climate change adaptation at all levels. Thus, for the pure pastoral livelihood (livestock) to fulfil its social, environmental and economic role, disaster risk reduction which takes climate change impact in consideration must be integrated in the development process. This study intended to investigate and support this argument.

1.2 Turkana district and community of Kenya

1.2.1 Population and location

The Turkana are the second largest group of pastoralists in Kenya. These nomadic people roam the dry northwest corner of Kenya, primarily Turkana District which has three constituencies: Turkana North, Turkana Central and Turkana South. It is located along the west side of the Lake Turkana, which is a source for fish and tourisms. See annex (1) map of Turkana. According to the primary results of the 2009 population census in Kenya, the Turkana population is 700,050 people among those about 78,500 people live in urban and semi-urban settings. With nearly 77,000 km², Turkana is the largest district in Kenya, and population density varies between 7 to 45 people/km sq.

1.2.2 Turkana pastoral lifestyle and livelihood

Turkana pastoralists are mainly nomadic and semi nomadic intimately familiar with their landscape and environment. This familiarity is manifested in their knowledge of when

and where to move for specific needs, such as where to graze milking goats, where to collect medicinal plants, where to find weapons of defense, or where to find safety from bandits. Moves are highly strategic and planned according to specific factors, including the availability of pasture, water and trees, areas of insecurity, and market opportunities. They have learned to survive by taking advantage of every opportunity that comes their way, including expansion into non-Turkana areas. The Turkana are aware of the limitations and difficulties imposed by a harsh environment and they follow appropriate social and pastoral techniques to deal with them. They have lived in harsh conditions that grew even harsher in the extended and repeated droughts since late 1970s (Daystar University, 2007). The repeated droughts and other non-climatic hazards including animal diseases and other socioeconomic and political factors may have affcted their capacities and choices.

Livestock is central to the Turkana culture and all aspects of their social, political, and economic life revolve around the livestock. Cattle, camels, sheep, and goats are vital to their lives and are the primary source of food. Livestock also play an important role in payment for bride-price, compensation for crimes, fines, and as gifts. Livestock is a sign of wealth, where for Turkana men who lead polygamous lifestyles, the size of their herd or livestock wealth determines their social status and number of wives each can negotiate for and support. Turkana rely on their animals for milk, meat and blood, the common local diet. They trade with other communities for maize and vegetables, and buy tea, sugar and other basic commodities from towns. In the morning people eat maize porridge with milk, while for lunch and dinner they eat plain maize porridge with a stew when is available. Camel meat and fish are rarely eaten. Hunting of wide animals and gathering honey is common especially during hunger periods and scarcity of milk (Daystar University, 2007). Table (1) below shows the number of livestock in Turkana.

Table 1 – Turkana district livestock population

YEAR	CATTLE	GOATS	SHEEP	CAMEL	DONKEY
2008	197,900	2,021,000	1,054,400	172,400	35,640

Source: Collected from local administration offices and district veterinary department

1.3 Research structure

1.3.1 Problem statement

The pastoral livelihood group in Turkana district of Kenya has been facing persistent food insecurity among other socioeconomic problems. A conditions that is similar to other arid areas in the Horn of Africa (HOA) region. Pastoral communities in arid lands have been facing impacts of severe and unpredictable climatic variability among other challenges that have lead 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, national and international actors brought the issue of climate change and its impact to the attention of international forums and institutions. It is portrayed as a major threat to development efforts and a cause of the occurrence of more frequent and severe humanitarian disasters. Pastoral communities developed over thousands of years a range of livelihood and coping strategies to adapt to harsh conditions. These strategies seem to be exhausted for various climatic and non-climatic reasons. Recently, adaptation to climate change has become the new “BUZZ” or the catch word in development and humanitarian arenas. It may lead to disguising other disaster risks and causes of vulnerability. This study attempts to, clarify communities’ perception to impacts of climate change and sever variability as threats to their livelihoods and coping strategies compared with other threats, identify community-based adaptation measures and level of support required from national and aid agencies.

1.3.2 Aim of the study

The aim of this study is to investigate whether impact of climate change is a main threat and factor that is affecting traditional coping strategies and driving livelihood adaptation of the Turkana pastoralist group. Eventually suggest a framework of action to support the livelihoods adaptation process.

1.3.3 Objectives

1.3.3.1 Primary objectives

1. Investigate the importance of pastoralism as the main livelihood in the arid land of Kenya to the local and national interest.

2. Investigate the various threats that challenge the pastoral community in Turkana, which pose disaster risks.

3. Identify the perception of pastoral community to impacts of climate change on their livelihoods in comparison with other types of threats and hazards, and in comparison to actual climatic trends or changes.

4. Identify and assess the adaptive capacities used by the pastoral livelihood community, then suggest actions of support required to support these capacities.

1.3.3.2 Secondary objectives

In order to achieve the study objectives, it is necessary to:

1. Conduct a literature review in relation to disaster risk management and climate change adaptation.

2. Review relevant concepts and methodologies that have been used in both arenas of climate change and disaster risk management.

1.3.4 Research questions

The following questions will be addressed during the course of the study. These questions will be revisited in various sections due to their interconnectedness.

1. What is the added value of pastoralism in Kenya and whether it is a viable sector?

2. What are the major threats or hazards that the pastoralists' main livelihood face, which also threaten their food security?

3. What are the major climate and climate change related risks that they face and their impacts on the sustainability of traditional sources of livelihood?

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

1.4 Research methods and procedures

1.4.1 Method of study and data collection

The study focuses on the Turkana pastoral community in the northern part of the district, see annex (1) map of Kenya. This is because; (1) most meteorological data was available at the Lodwar meteorology station, which represents that part of the district,

and (2) the community in this part is purely pastoralist livelihood group dependent on livestock. The study was designed to analyze disaster risk related to impacts of climate change in the contexts of other disaster risks prevailing in the area. This requires understanding of the past, current and future challenges and opportunities that would shape traditional coping strategies, resilience, management practices of natural resources, and adaptive capacities of the Turkana community. Given that livestock constitute 90% of income and livelihood to this community (Oxfam, 2006), much focus and analysis in this study is given to this main livelihood.

The study followed the following steps:

1. Desk review of available literature relevant to the pastoral community in the Horn of Africa, Kenya and in particular the Turkana district. The aim was to understand regional challenges and opportunities that are facing the pastoral communities in the region that are affecting their socioeconomic conditions. The desk review also included reports on recent and recurrent disasters (disease outbreaks, drought and floods), socioeconomic, security, climatic and environmental studies and surveys.
2. Review outputs of climate change projections and impacts on the country and on Turkana district in particular.
3. Obtain historical weather data and analyse changes and trends in terms of temperature, rainfall and extreme events such as droughts and floods.
4. Conduct a field study to collect information from community at various levels. Partially, the field study was part of a wider survey called "Security in Mobility)[1] that was done jointly by OCHA, Organization for International Migration (IOM), CARE, Institute for Security Studies (ISS). Participatory rapid assessment (PRA) tools and methods were used to construct community-based risk assessment to inform climate change vulnerability and capacity analysis. Various (PRA) tools are used namely; focus group discussions, key informants interviews, and field observations, transect drives and walks. Open-ended questions were used in semi-structured interviews with key informants (officials, aid workers, elders and community individuals). Focus group discussions were organized to obtain information from men, women and young people. Mixed

[1] Security in Mobility is a joint initiative that is still going on that aims at supporting advocacy campaign to ensure safe mobility of pastoralists within a country and cross national borders.

and separate groups per gender were organized to capture their different perspectives. Using various PRA tools was useful for triangulating and validating information and arguments. By coincident, it was possible to talk with a group of young warriors equipped with rifles. The researcher prepared sets of questions that guided the discussion in each group. The researcher gave enough time to the participants in the group discussions to debate issues, which was useful to capture differences in their views. The researcher was assisted by other 2-3 colleagues to capture and record notes, participants' votes in order to prioritize, rank and eventually quantify as much as possible the given information by the participants. During the fieldwork, 13 focus groups were conducted (11-15 participants in each), 7 (3 men and 4 women) elders were interviewed individually, as it was not possible to bring them altogether to one place. Discussion and meetings were conducted with representatives of 3 aid agencies, local civil society organizations, and representatives of 3 administrative offices and security personnel. See table (2) for details.

Table (2): Summary profile of community participants in the filed study

Community Participants	**Number of groups**	**Total number of people in all groups**
Pure male group	6	78
Pure female group	5	65
Gender and age mix group	6	82
Individual elders		7
Total	17	225

5. Analysis of outputs of the field study which allowed for comparison between climate change projections, actual trends and community's perception and observations.

6. Community-based risk assessment was conducted during the filed visit. It input into a climate change vulnerability and adaptive capacity assessment by using CARE's Climate Vulnerability and Capacity Analysis (CVCA) and household livelihood security frameworks (CARE, 2009). More details on these frameworks are provided in Chapter 3.
7. Finally, conclusions were drawn to inform policy recommendations necessary at various levels to support the adaptation process to climate change impact in Turkana.

1.4.2 Significance of Study

The importance of the study is to clarify the illusion around the impact of climate-change-related hazards on the pastoral community. Impact of climate change on deepening poverty and reoccurrence of disastrous events such as droughts has become an excuse to the prevailing food insecurity, failing development and humanitarian interventions, and depleted community-based traditional coping strategies. It is an attempt to establish a better understanding of the importance of the significance of climate-change- related hazards on livelihoods, and separate it from impacts of other socioeconomic factors. Eventually, this study provided a set of priority recommendations that shall inform all stakeholders' decisions and actions necessary to mitigating the impact of climate change. The study recommended an approach that promotes socioeconomic development that integrated disaster risk management and incorporates climate change adaptation.

1.4.3 Limitations of the study

There are a few limitations to this study:

1. The study didn't intend to validate scientific reasons which are supposedly causing climate change. This is part of the global debate. Though, the study will analyse changes in patterns of rainy seasons and temperatures.

2. It was not 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 used several methods to triangulate the given information.

3. It will be difficult to isolate the impact of climate-change-related hazards from the impact of other socioeconomic events and natural threats. Therefore, the study shall take in consideration the interrelationship between climatic, socioeconomic and natural factors.

1.4.4 Practical and ethical considerations

The field visit was conducted during a period of severe food insecurity that is affecting Turkana, and the northeast and eastern parts of Kenya. The current situation resulted from multiple reasons; (1) failure of past three rainfalls and drought in 2009, (2) high food prices that have prevailed since global food prices crisis, and (3) due to consequences of the after elections violence in 2008. The current food crisis has exacerbated conflicts and insecurity conditions due to competition over pasture and water resources (IRIN, 2009). The above circumstances posed some difficulties in obtaining objective answers from people as they were driven by their urgent daily needs for food and water. As also they were concerned about deteriorating conflicts, safety and security conditions. The researcher has taken in consideration these factors while interpreting the obtained information.

1.5. Composition of the report

Following to this description of the study, the next chapters will provide information and analysis that would address and answer the objectives and questions defined for the study. Chapter two is a review of relevant concepts and frameworks that are deemed necessary to understand the raised issues around climate change in Turkana, and to carry a proper analysis in order to address the study objectives. It also reviewed the relationship between climate change impact, disaster risk and development. Chapter three described the target community and its traditional livelihoods, challenges and opportunities that they face. It also discussed the contribution of the pastoral community and its added economic and social value at various levels. It also described the interaction of and added value of pastoralist livelihood to the environment. In chapter four, an analysis of meteorological data, climate change projections, community risk was conducted in order to find out whether climate change is affecting the Turkana community. Moreover, the vulnerability of Turkana community was analysed as a step to assess the adaptive capacity of this community to climate change. Chapter 5, provided a summary of research findings and recommendations to address challenges associated with climate change, influencing vulnerability and adaptive capacity of Turkana people. It

also recommended a further study to establish a baseline of the Turkana adaptive capacity and an index to monitor progress towards reducing vulnerability to climate change impact.

Chapter 2: Literature review

Climate change adaptation and disaster risk management

2.1 Introduction

The following sections will provide an overview and discussion of concepts and analytical tools that are relevant and necessary for completing the study. The relationship between climate change, disasters, and achieving development goals is also discussed. Views of disaster risk and climate change communities were addressed to understand the commonalities and differences in their approaches. The usefulness of using community-based disaster risk assessments and tools are demonstrated in addressing climate change impact. The following sections will demonstrate how climate and non-climate hazards influence each other, and how would general vulnerabilities increase disaster risks when mediated with these hazards. It will become clear in the course of the discussion that today's vulnerability is tomorrow's poverty. Therefore, disaster risk provides an important venue to address risks associated with climate change impact.

2.2 Concepts and tools relevant to climate change and disaster risk management

2.2.1 Climate change and climate change impact

Climate means the overall long-term characteristics of the weather experiencd at one place. It is also the long term summary of the weather conditions taking in account the average and variablity of these weather conditions. Only over a sufficient period and within a large number of recorded extreme events scientist can claim if a specific climatic event is within a normal historical variation or is attributed to other factors such climate change (UNISDR, 2008).

The concerns over human activities that may affect the global climate system have led to the establishment of the Intergovernmental Panel on Climate Change (IPCC) in 1988. Consequently, the United Nations' Framework Convention on Climate Change (UNFCCC) was developed in 1992 and entered into force in 1994. It is an international treaty aims at reducing the greenhouse gas emissions that cause climate change to level that would prevent anthropogenic interference with climate system. States that are parties to the convention agreed to common but differentiated responsibilities in achieving this global objective. This is becuase the higher per capita states have contributed more to the carbon emissions and have more financial and technical resources (UNFCCC, 1994). Moreover, developing countries claim that limiting their carbon emissions may slow or prohibit their development process, deprive them from what industrialized countries have enjoyed along the process of their development. It will mean that they have to carry the burden of and pay for the damages made by industrial nations (Oxfam, 2009).

The general understanding is that climate change is caused by factors which human beings have been undertaking. They gradually have altered the world's climate through fossil fuel burning, clearing forests and other human activities that increase the concentration of green house gases (GHG) in the atmosphere. The GHG act as a blanket which absorbs and tarps incoming solar energey and keeps the earth's surface warmer than otherwise would be, so increase in green houses would lead to to dditional warming. The concenration of these gases has increased by 70% between 1970 and 2004 (IPCC 4th assessment report, 2007).

The UNFCCC defined climate change *as " the change that can be attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods" (*UNFCCC, 2004). While the IPCC refers to the climate change as the change that has been cuased by all activities whether arising from human or natural cuases, and also linked it to time and variability in climate characteristics. The IPCC defines climate change as*" a change in the state of the climate that can be identified by changes in the mean and or the variability of its properties, and persists for an extended period, typically decades or longer." (IPCC fourth report, 2007).*

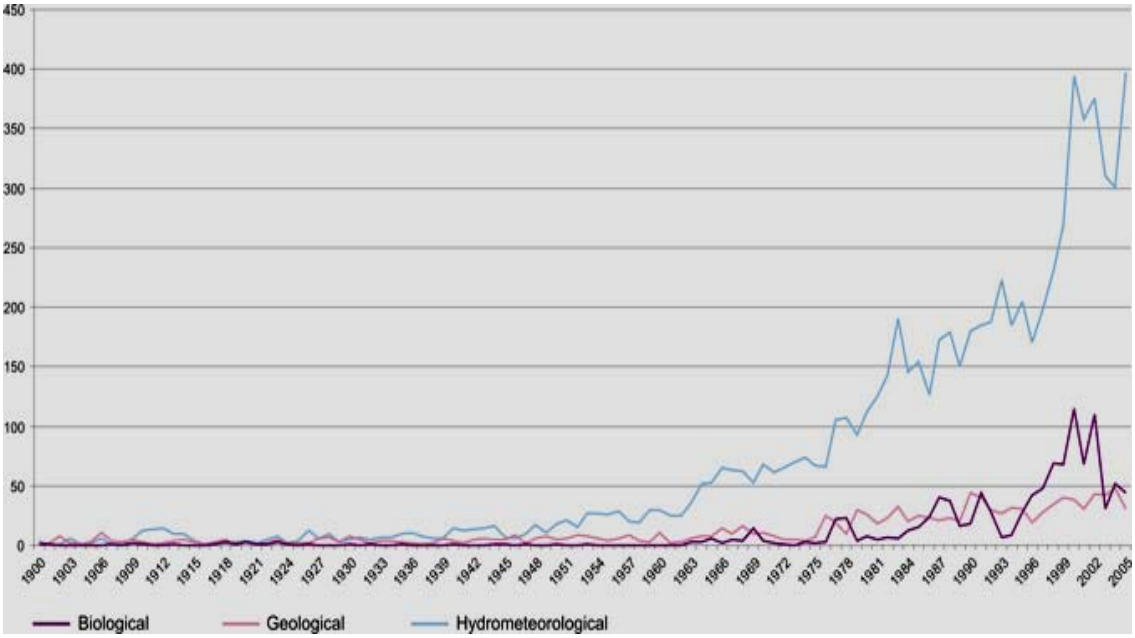
The researcher has no intention to approve or disapprove the happening of the climate change or determining its causes; whether they are man-made, natural-lead or part of a climatic cyclical change that is taking place in our time. There is a prevailing trend among scientists to accept the fact that climate change is taking place and is manifested in many ways (IPCC working group 2 of 3rd assessment report, 2001). For example, the global temperatures have been risen over the past few decades. The IPCC 3rd report revealed that Africa; like the rest of the world, became warmer during the past century, and temperatures are expected to continue rising in the future. Scientists refer mostly to the atmosphere's GHGs; which reached the highest concentration since 5000 years. GHGs trap incoming solar energy and keep the earth's surface warmer than it would be (IPCC 4th report, 2007). The IPCC has examined and published results from several computer-based climat-projection models. One could claim that the accuracy of these models has improved in recent years, and tested by using existing historical data to predict rectoactively some previous specific climatic events. Most of models converge to one conclusion that climate change is happening and will impact different places of the world in different ways. By 2100 according to *(IPCC fourth assessment report, 200)::*

1. The global surface air will increase by 1.1-6.4 CC.
2. Sea level will rise between 18-59 cm.
3. Ocean becomes more acidic.
4. More freaquent weather extremes will occure i.e. hot weaves and heavy precipitation.
5. Very likely to have heavy precipitation at higher altitudes and less in most subtropical land areas.
6. Tropical cyclones more often and more freaquent with more heavy rains and peak winds due to increase in temprature of sea surface.

Climate change impact is defined as "the Consequences of *climate change* on natural and *human systems (IUCN, 2007).* Depending on the consideration of *adaptation*, one can distinguish between potential impacts and residual impacts. Potential impacts: All impacts that may occur given a projected change in *climate*, without considering adaptation. Residual impacts: The impacts of climate change that would occur after adaptation".

The above mentioned climate projections are expected by the IPCC 4rth Assessment Report of Group II on "Impacts, Adaptation and Vulnarability" to affect the world; in different ways and at various levels. They will affcet social, econimic sectors, and environment. The effects will be more significant on sectors that are more dependant on meteorological characteristics including rainsfall and temperature. Humanitarian disasters, particularily related to metreological and hydrologycal hazards and climate extremes are on the rise compared with other natural disasters as predicted in figure (1). This is according to the Em-DAT of CRED[2] as cited in (UNISDR, 2009). Some researchers claim this increase to the improved recording of disasters, but this could be refuted by knowing that the CRED only reports disasters that qualify to a certain criteria which is used consistantly overtime.

Figure 1: Increase in hydrometreological reported disasters in 20th Cnetury



Africa is expected to be affected more than other continents with climate change impacts (Sperling, F., and F Szekely, 2005). This is due to the increase in frequency and intensity of metreological hazards; droughts, floods and rising sea water levels. According to World Bank & UNISDR (2008), the hydro-metreological events cause the majority of loss of life and economic losses specially in natural-resource livelihood zones

[2] EM-DAT: is the OFDA (US Office of Disaster Assistance)/CRED) available at www.emdat.be – University Catholique – Brussels, Belgium
A disaster is entered to CRED database if at least one of the following is fulfilled: >10 people reported killed, >100 reported affected, declared as a state of emergency and call for international assistance.

of Africa such as pastorlalism and agro-pastoralism. The World Bank & UNISDR (2008) estimated that drought and floods account for 80% of loss of life and 70% of economic losses linked to natural hazards in sub Sahara Africa. The same report indicated that Africa has the highest mortality-related vulnarability coefficients for droughts and very high coefficients for cyclones. This may indicate the significant increase in number of affected people by disasters. In the Horn of Africa alone, the number of people in need food aid has rise from 6.6 million people to more than 20 million people due to failiure of rainy seasons, recurrent droughts, and resource based conflict (OCHA, 2009). The Status report on disaster risk reduction on Sub-Sahara Africa (UNISDR, 2009) indicated that climatological and hydrological hazards dominate the disaster profile of the region, affecting around 12.5 million people per year. Moreover, the report mentioned that one disaster per week was registerred by EM-DAT in the region since 2000.

2.2.2 Disaster risk, climate change and sustainable development

Sustainable development is defined as the development that meets the needs of the present without compromising the ability of future generations to meet their own needs (Sustain)[3]. The definition contains two key concepts: the concept of 'needs', in particular the essential needs of the world's poor, to which overriding priority should be given; and the idea of limitations imposed by the state of technology and social organization on the environment's ability to meet present and future needs (UNDP, 2004).

There is a consensus among development, humanitarian practitioners and scientists that having a clear understanding of the nature of disaster risks is crucial for bridging the gap between humanitarian relief and development work. This also would ensure sustainable progress towards achieving global development goals (MDGs), and protecting these achievements (UNDP. 2004). Disaster risks are not merely due to the occurrence of natural hazards, but they are a result of the interface between hazards and vulnerabilities of elements at risk (people, property, livelihood sources and infrastructure etc.). Vulnerability is the concept that explains why people (given a level of physical exposure at time of hazard occurrence) are at risk and it brings together several human variables. These variables include social processes, structures, living conditions,

[3] Sustainable livelihoods glossary:
http://www.livelihoods.org/info/guidance_sheets_pdfs/sect8glo.pdf

poverty, source of livelihoods that partially determine the level of resilience, capacity to cope with effects of a disaster, and ability to recover and reduce future risks (Twigg, 2007). The dynamic aspects of vulnerability and changes in the characteristics of particularly climate-related hazards make the development process more challenging than ever.

The ultimate goal of development process in most developing countries is to eradicate poverty by improving access to public services, sustaining livelihood sources and enhance income. Since 1980s, a shift in the development theory has been taken place where more focus is put on addressing causes of vulnerability rather than increasing absolute economic growth rates and gross national production (GNP). This is because higher growth rates are not a guarantee for lifting people from poverty. It is due to unequal distribution of income, and concentration of resources beside other vulnerabilities that impede many people benefiting from national economic growth.

Development assistance amounts to around US$ 55-60 billion annually compared with US$ 3-6 billion pledged for 2002-2006 for climate and other global environment issues. But much of the humanitarian and development work doesn't incorporate climate and other natural hazard risks in their programs. It was revealed by a review of Poverty Reduction Strategy Plans (PRSPs) that these plans rarely take environment issues, climate change and natural hazards into account (Yamin, 2005). This means that common development practices treat climate and other natural risks as external factors to the development process and address them by a "quick fix approach" or short-term relief interventions when disasters as a hazard occurs. It is estimated that the disaster relief cost amounted around US$ 6 billion annually from donors' money, and yet rising (DFID, 2005). Though, it has been estimated that for each US$ 1 invested in preparing for a disaster and a disaster-related risk reduction measures, it would save US$ 4-10 in the cost of recovering from the disaster (Tearfund, 2005). This proves the urgent need to shifting development and relief approaches towards a more integrated one, which would increase efficiency of using resources, reducing disasters costs and ensure sustainable development.

Attempts by aid agencies such as Tearfund (2006) and UNDP (2004) attempted to establish a link between disasters impact and development. UNDP developed a disaster risk index (DRI), it shows that poor countries are more at risk and loose more when they

face a disaster than the developed nations. The relationship between the increase in number and density of disasters due to climate change impact; as discussed in previous section proves that climate change impact has consequences on sustainable development efforts. This proxy relationship predicted in table (3):

Table 3: Climate change impact- disaster-development relationship

Relationship	**Manifestation of climate change impact – development proxy relationship**
Climate change alters characteristics of hazards and vulnerabilities	Meteorological and Hydro hazards are more frequent, and intense New hydro and meteorological hazards are occurring; melting of glaciers and rising water sea level Occurrence of extreme metrological events Effects on ecosystems and may increase their vulnerability More frequent disasters (including smaller ones) exhausts peoples' capacities to cope with shock and adapt to long term changes
Disasters limit and destroy development achievements	Loss of life including skilled and productive labour force. Damage and disruption of infrastructure, social facilities and source of livelihoods. Migration and disablement of productive labour force. Diverts resources (financial, equipment and other inputs) to humanitarian response than long term development interventions.
Development caused disasters	Unsustainable development practices: Degrade natural resources, environment, and create unsafe living conditions Increase inequality, exploitation, and exclusion of specific social groups Lead to unplanned urbanization and establishment of informal unsafe settlements (slums).

Development reduces risk disasters	It improves social and public services such as water, education, health services, transport facilities which increases people's resilience Provides technology to be used in early warning systems and emergency response Provides source of income and improves living conditions which reduces people's vulnerability Provides more equal opportunities for gender balance and active participation in decision making (increase capacity and capability)
Disasters create development opportunities	Opportunity to introduce disaster risk measures in relief and reconstruction activities Opportunity to improve related development policies to address causes of vulnerability and integrate disaster risk management in development planning and implementation

2.2.3 Climate change impact and poverty In Africa

Kofi Annan in his openining address to the Global Humanitarian Forum 2007, said that "climate change is hapenning, and it is hapenning now. We can no longer consider it as a threat that is yet to hit us; all over the world we see its impact). Archoishop Desmond Tutu was more specific by saying" climate change impcts continue to fall dispropotinately on the world's poorest people and countries; many of which are in Africa" (Toulmin C., 2009).

The Africa continent stands out as the least contributer of GHGs to the atmosphere. In 2007, the per capita emmisions for the entire continent continent of CO2 stood at 1ton in comparison with world's average per capita 4.3 ton (ISDR, 2009b). Even in absolute terms, Africa contributed the least of Co2 emissions. The international negotiations since the Kyoto protocol of 1997 and the forthcoming Copenhagen Conference in December 2009, are calling upon nations to cut down on their GHGs emissions. Given the increasing need on energy production from fusel fule for development, expansion of agricultural areas and increasing exploitation of forests; Africa will need to increase its gas emessions to secure an adequate rate of development to eventually eradicate poverty (Toulmin C., 2009). Due to the dominance of industrialised countries on the

international negotiations on greenhouse emessions, Africa might find itself voiceless and marginalised. Therefore, Africa's poor nations will feel most consequences of climate change impact. This is unless rich nations commit to support new financial facilities, provide technologies and cost-effective means for producing energy, reducing deforestation, and supporting poor countries in adapting to the impact of climate change to reduce emergning hazards (Stern, 2006) as cited by (Toulmin, 2009).

Given the growing disparity between the rich and the poor in Africa, poor and vulnarable communities will be at a higer disasters risks. It is mainly due to the low capacity to adapt to impacts of climate change, high socioeconomic and ecosystems vulnarability, and limiting social and economic conditions or disabling factors:

1. High dependency of major livelihoods (subsistence agriculture, pastoralism, tourism) on natural resources that are highly reliant on climatic conditions especialy rainfal and temprature.
2. High rates of population growth.
3. Rapid urbanization; in 2008, 37% of Africans lived in urban environments, and about 50% of Africa's population will be in urban settings including informal settlements by 2050 (UNHABITAT, 2008). Most of the urban growth is driven by natural growth of poor and vulnarable population who imigrated from rural areas, and living in poor housing conditions. (UNHABITAT, 2008) reported that about 62% of Africa's urban people live in high population-density; slums with low income, food insecurity, poor environmental and health conditions.
4. High poverty rates. The World Bank (2008) estimated 400 million people in Sub Sahara live below the poverty line. This means that this number of people are food and livelihood insecure. This forces them to exploite the environment (i.e. charcoal and fuel wood trade), which ultimately will increase disaster risks and perpetuate their poverty.
5. Low household income and vulnarability to shocks.
6. Prevalance of diseases including malaria, HIV&AIDS and (TB) Tubercolosis.
7. Governance problems. In February 2009, a high level conference on the Horn of Africa organised by OCHA regional office in Nairobi concluded that "structural problems in the socioeconomic and political systems is an underlying cause of the recurrent and prolonged humanitarian crisis" (OCHA,2009). This requires a different approach of humanitarian response rather than provision of food aid and

other quick fix interventions. These structural problems are manifested in corruption, weak delivery of public and social services, marginalization and underrepresentation of ethnic groups and women, inequal distribution of wealth and public investments. This eventually increases vulnarability and exposure of large segments of the population to recurrent hazards and consequences of climate change impact. (UNSDR, 2009) indicated that despite of governance problems, there is a progress made by African states in implementing the Hoyogo Framework and National Adaptation Programs (NEPA), which in many ways; if implemented, will improve communities resilience and adaptation capacities. However, there is large gap remaining between the level of progress between rich and poor nations.

8. Conflicts and insecurity. East Africa region is pleaggued with several internal ethnic conflicts and political upheaval. Many of these conflicts are often trigorred by competition over controling and accessing natural resources especially water and land. Examples of such conflicts are in northern and northeastern districts of Kenya, Karamoja district in Uganda, several districts of Ethiopia, Somalia, and South Sudan. These conflicts might be intensified as climate change is expected to alter current ecosystems and affects natural resources (O'Brien K. et al, 2008). Therefore disaster risk reduction and climate change adaptation processes shall go hand-in hand to mitigate these conflicts. Both mitigation and climate change adaptation should be seen as human security imperatives in a broader sense (UNDP, 2008)
9. Low technology levels. Countries in Sub Sahara region have limitted access to modern technologies and they invest little in this sector. For example, they depend heavily on international agencies and programs for early warning information. Public budgets allocations to disaster risk mitigation and climate change adaptation are not based on results of risk assessments and remain below the need (UNISDR, 2009).

The previous points show that current poverty, disaster risk and climate change impact constitute a vicious circle that perpetuate and deepen poverty and vulnerability. Poverty; reflects lack of resources and leads to inadequate investments in disaster risk reduction measures, exacerbates vulnerabilities to changing hazards due to climate change

impacts, reduces people's capacity to adapt, increases disasters impact and pushes people to a deeper level of poverty (CARE UK, 2008). Table (3) below; amended and adopted from (O' Brien, 2008) summarizes the impacts of climate change on the achievement of the Millennium Development Goals (MDGs) and poverty conditions.

Table (4): Climate change impact on MDGs

Change in mean climate, variability, extreme events and sea level rise ⟶ ⟵	**Impact on poverty** ⟶ ⟵	**Impact on MDGs** ⟶ ⟵
Increase in temprature, change in precepitation will reduce agriculture production and natural resources	**Lowered industrial and labour productivity, trade imbalance, fiscal and macroeconomic pressures** lead to reduced economic growth, and hinders investment in poverty-reduction measures Reduced productivity and security of poor people's livelihood assets, and reduced access for the poor to their livelihood assets Less effective coping strategies among the poor and **increase**	***1: Eradicate extreme poverty, hunger and food insecurity;*** jeopardised by more disasters eroding livelihoods ***2: Achieve universal primary education***: more children will drop out of school and be employed to help their families cope with more disasters ***3: Promote gender equity and empower women.*** About two thirds of affected populations by disasters are women. ***4: reduce child mortality:*** climate change is expected to influence the outbreak of diseases such as Malaria which is a major killer of children in Africa ***5: Improve maternal health;*** pregnant women are more susceptible to malaria, and health facilities will be exposed to damage of more hazards ***6: Compact HIV&AIDS, malaria and other diseases.*** Increase poverty and vulnerability due to frequent disasters. Increase prevalence of mosquitoes due to more floods

	vulnerability	***7: Ensure environmental sustainability***: Climate change causes extreme, more frequent and intense hazards that would increase people's exploitation to environmental resources

Cannon (1994) pointed out that "*it may be true that most of the suffering in disasters is experienced by poor people, it may not be the case that all poor suffer. Nor is it only the poor who suffer, but the impact of hazards* …(and emerging of new hazards due to climate change)… *may well be a factor in creating newly impoverished people*."

2.3 Conceptual framework in context of disaster risk and climate change

2.3.1 Disaster risk and climate change relevant concepts

The following sections will discuss definitions of main relevant concepts to the study.

2.3.1.1 Disaster risk

The term risk refers to the "expected losses from a given hazard to a given element at risk" (UNDRO, 1997; cited by Coburn et al, 1994). This definition focuses on the hazard and its characteristics and the way it affects elements at risk. It implies also that a disaster is the output of the happening of a hazard and its severity, and the susceptibility of elements at risk to this hazard. This definition evolved as factors of susceptibility and vulnerability are not only driven by a hazard, but also by inherent characteristics of the elements at risk, and external enabling / disenabling factors in the contexts. Therefore, the disaster risk definition evolved to encompass three interrelated factors; hazard (H), vulnerability (V), and capacity (C). A disaster risk could be presented in the equation: **R = H + V** (Wisner *et al*. 2004; ISDR, 2002). This implies capacity as a part of the balance status of vulnerability. This could hide various types of vulnerability and drive more focus on hazards than associated vulnerabilities.

However, since elements at risk could have different capacities to face different hazards and their characteristics, the risk definition has evolved as presented as below (UNISDR, 2004).

$$\textbf{RISK} = \frac{\textbf{H X V}}{\textbf{C1 X C2 X… Cn}}$$

The equation above also means that the capacity to reduce the level of a hazard within a specific community or given environment is not necessarily the same capacity required to improve the vulnerability status of the given community or environment. Capacity here could also include inherent capacities of individuals, communities, environment systems. It also includes the community structures that are necessary to manage the disaster risk (manageability). This is in line with the (UNISDR, 2002) definition which stated that risk results from *"the combination of hazards, conditions of vulnerability and insufficient capacity or measures to reduce the potential negative consequences of risk".* Accordingly, the risk of a possible disaster could be determined by at least three main contributing factors:

i) The hazard and its characteristics.
ii) The level of vulnerability (all aspects of vulnerability as discussed below) of the particular elements at risk
iii) The capacity in dealing with the hazard as well as the various aspects vulnerability.

Therefore, a disaster risk is the interaction of a hazard with vulnerability that produces an outcome. Disaster risk could be measured in terms of physical (number of death and injured) or economic (financial terms and economic values), and damage to human related systems (Brooks and Adger, 2003) that occupy the space at time of exposure to the hazard.

IPCC defines risk as "*a function of probability and consequences of an event, with several ways of combining these two factors being possible. There may be more than one event, consequences can range from positive to negative and risk can be measured qualitatively or quantitatively*" (IPCC, 3rd assessment report ch. 2, 2001). This definition represents a hazard driven approach, where risk is defined as a function of the

probability of a hazard occurrence and its consequences on the element at risk. This also implies that outcome risk is a function of “event” and inherent “social vulnerability” of element at risk.

2.3.1.2 Disaster

A disaster is a serious disruption of the functioning of a community or a society causing widespread human, material, economic or environmental losses which exceed the ability of the affected community or society to cope using its own resources (UN/ISDR, 2004). Community’s ability in the definition refers to many societal aspects including financial resources, equipment, infrastructure, skills and awareness, leadership, systems and structures.

A disaster situation refers to a progressive or sudden, widespread or localized, natural or manmade occurrence which:

a) causes or threatens to cause; 1) death, injury or disease, 2) damage to property, infrastructure or the environment, 3) disruption of the life of a community
b) is of a magnitude that exceeds the ability of those affected by the disaster to cope with its effects using only their own resources (Government of South Africa-Disaster Management Act 57, 2002).

Consequently, a disaster as measured in terms of loss of lives, number of people affected, economic and environmental losses is therefore, the outcome of a specific hazard (or hazards) that is mediated with properties of human systems that are exposed to and affected by the hazard.

2.3.1.3 Hazard

“A potentially damaging event, phenomenon and or a human activity, which may cause loss of life, injuries, property damage and economic and social disruption and environment degradation” (UNISDR, 2004).

For the purpose of this study, the term hazard is used to refer to a physical manifestation of climatic variability, stressors or change, such as events of droughts, floods, storms, episodes of heavy rainfall, long-term changes in the mean values of climatic variables, and potential future shifts in climatic regimes. A climatic hazard in this sense could be determined in terms of absolute values or departures from the mean of climatic variables

such as rainfalls, temperature, which could also be combined with factors such as speed of onset, duration and spatial extent (Brooks N., 2003).

2.3.1.4 Vulnerability

Understanding vulnerability of a system is crucial for assessing a disaster risk, and to inform the decision makers regarding possible disaster risk reduction measures to be undertaken.

It is defined as "*a condition or process resulting from physical, social, economic and environmental factors, which determine the likelihood and scale of damage in a system from the impact of a given hazard*" (UNISDER, 2004).

The above definition provided the basis to the IPCC definition of vulnerability. The IPCC (IPCC, 2001, P. 995) defined vulnerability as "*the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity*".

The definition of vulnerability has evolved overtime in the fields of disaster risk management and social studies. Some definitions emphasized the degree of exposure to physical hazards and their impact as the driver of vulnerability rather than on the ability of the elements (i.e. human and ecosystems systems) at risk to cope, adjust and recover from a specific hazard. However, both definitions mentioned above conclude that vulnerability of a system is not only determined by the nature of a hazard to which it is exposed, severity, likelihood and frequency of the hazard occurrence. But it is also determined by the degree of exposure and sensitivity of the system itself to the hazard. In other words, a system is vulnerable if it is sensitive to a hazard and its characteristics, and if the system is present at place and the time of a hazard occurrence (O'Brien K., et al, 2004).

In human science vulnerability is explained in terms of three elements; system exposure to stresses and shocks, inadequate system capacities to cope with severe consequences, and slow (or poor) system recovery (Kasperson 2001). Vulnerability is not constant, and it is determined by factors such as; physical, social, economic, political, cultural, organizational, institutional, ecological, educational, location, and

environmental factors or processes. These factors increase the susceptibility of a community or elements to the impact of hazards. This affirms Wisner's statement that vulnerability refers to the following: *"Characteristics of a person or group and their situation that influence their capacity to anticipate, cope with, resist and recover from the impact of an extreme natural event or process*" (Wisner et al., 2004). Wisner; as it will be explained later, described the dynamic nature of vulnerability that progresses initially from root to dynamic causes then poor living conditions, which result in a disaster if mediates with a hazard. Consequently, vulnerability represents the current state of all aspects of a human system; physical, social, economic and environmental. These factors could be shaped by attitudinal, behavioural, cultural, socio-economic and political factors that constitute the environment of a system at risk (IIRR, 2006).

Social vulnerability has occupied a significant amount of research due to its complexity and significance in determining peoples' ability to withstand occurrence of a hazard and recover from its impacts. Often it is used to describe different factors that may adversely affect people's capacity to deal with a specific hazard. These factors include among others; gender, age, disability and health status, wealth and livelihoods that they are engaged in (Twigg J., 2004). Vulnerability is the reflection of the current state of the individual and collective physical, social, economic and environmental conditions at hand. The mentioned factors are shaped continually by attitudinal, behavioural, cultural, socio-economic and political influences on individuals, families, communities and countries. Governed by human nature and activity, vulnerability cannot be isolated from ongoing developmental efforts. Vulnerability therefore is a reflection of development level, and it plays a critical role in all aspects of sustainable development (ISDR 2004:41). Vulnerability in the human social science is often identified in terms of three main factors (Kasperson 2001); (1) system exposure to crises, stresses and shocks, (2) inadequate system capacities to cope, (3) severe consequences and a weak system recovery from a hazard. These elements cover both potential damage due to the risk and the inherent weaknesses of the exposed system.

It is important to differentiate between poverty and vulnerability. Poverty refers to status of "lacking", whilst vulnerability refers more to inability to and disempowerment of a system to use its potentials to address a risk or for long-term develop. Vulnerability is not poverty; vulnerability is *"shorthand for factors that drive people into poverty and lock their*

exit routes from poverty" (Action Aid, 2005). Yamin (2005) concluded that today's poverty is yesterday's unaddressed vulnerability.

In the case of Turkana people as this report will discuss later, climate change variability, changes and extreme events may play a significant role in increasing their poverty. It is because of their current social vulnerability and disproportionate dependence on vulnerable natural resources for their livelihoods. This vulnerability is also coupled with their vulnerability to other non-climate related stressors such as increase of population, political marginalization and conflicts.

The term vulnerability is viewed in two categories in the climate change related literature: (1) the amount of potential damage caused to a system by a particular climatic hazard; (2) a state that exists within a system before it encounters hazard event. The first category downplayed the role of the human systems and focuses on hazard outcomes. This type of vulnerability was referred to as "biophysical vulnerability", and the second one as "social vulnerability" which is inherent to the system determined by its internal characteristics and not driven by the hazard output (Brooks, 2003).

Through this study, vulnerability refers to the definition of (IPCC, 2001) mentioned earlier in this section which encompasses both biophysical and social vulnerabilities.

2.3.1.5 Disaster risk management

The systematic management of administrative decisions, organization, operational skills and abilities to implement policies, strategies and coping capacities of the society or individuals to lessen the impacts of natural and related environmental and technological hazards (UNISDR, 2004).

2.3.1.6 Disaster risk reduction

The systematic development and application of policies, strategies and practices to minimize vulnerabilities, hazards and the unfolding of disaster impacts throughout a society, in the broad context of sustainable development (UNISDR, 2004).

2.3.1.7 Coping capacity:

The manner in which people and organizations use existing resources to achieve various beneficial ends during unusual, abnormal and adverse conditions of a disaster phenomenon or process (UNISDR, 2004).

Coping strategies are usually short term meant to withstand adverse impacts of a disaster risk. Coping is also a function of risk perception and potential avenues of action based on the available level of information, resources, opportunities and constraints. Therefore, the strengthening of coping capacities usually builds resilience to withstand the effects of natural and other hazards (Thywissen, 2006). The recurrent of disasters such as the frequent droughts in Turkana may exhaust the coping mechanisms to the extent that forces people to undertake negative coping mechanisms. This includes, passive and irreversible measures such as selling their productive assets and migration to urban areas (drop out of the pastoral system), undertaking risky activities to gain income such as opting to cattle rustling and theft.

In pastoral areas, a set of coping strategies is used in a progressive and rational way depends on the progression of the severity and impact of the stressor. The ultimate objective of these coping mechanisms is risk evasion and ecological adaptation in order to preserve livelihood sources (livestock) for the future. Therefore, coping mechanisms (short term measures) are used alternatively and rationally over a period of time to respond to progressing hazards (Kebebew, 2001). However, when the hazards reoccur more frequently and intensely, short term coping measures become ineffective and exhausted. A need emerges for new methods to adapt to the new risk conditions.

2.3.1.8 Mitigation

Disaster risk reduction and climate change scientists use this term differently. On the one hand, the IPCC in its 3rd assessment report refers to mitigation as "*an anthropogenic intervention to reduce the sources or enhance the sinks of greenhouse gases*". In simple worlds, it is all actions and policies aim at reducing greenhouse gases emissions. On the second hand, "*mitigation is the lessening or limitation of the adverse impacts of hazards and related disasters"* (UNISDR, 2009c).

The adverse impacts of hazards often can't be prevented fully, but their scale or severity can be substantially reduced by various strategies and actions. Mitigation measures encompass structural techniques, improved relevant policies and public awareness. The contrast between both climate change and disaster risk communities in defining mitigation is that climate change focuses merely on reducing what is considered a source of "greenhouse gas emissions" or the hazard, which is causing climate change. In disaster risk, mitigation refers to all types of hazards (human-driven and natural

hazards) including the climate change and their impact. In this report, the researcher focuses on the UNISDR definition.

2.3.1.9 Climate change adaptation and adaptive capacity

Based on the United Nations Framework Convention on Climate Change (UNFCCC), UNISDR defines adaptation as *"adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities"* (UNISDR, 2009c).

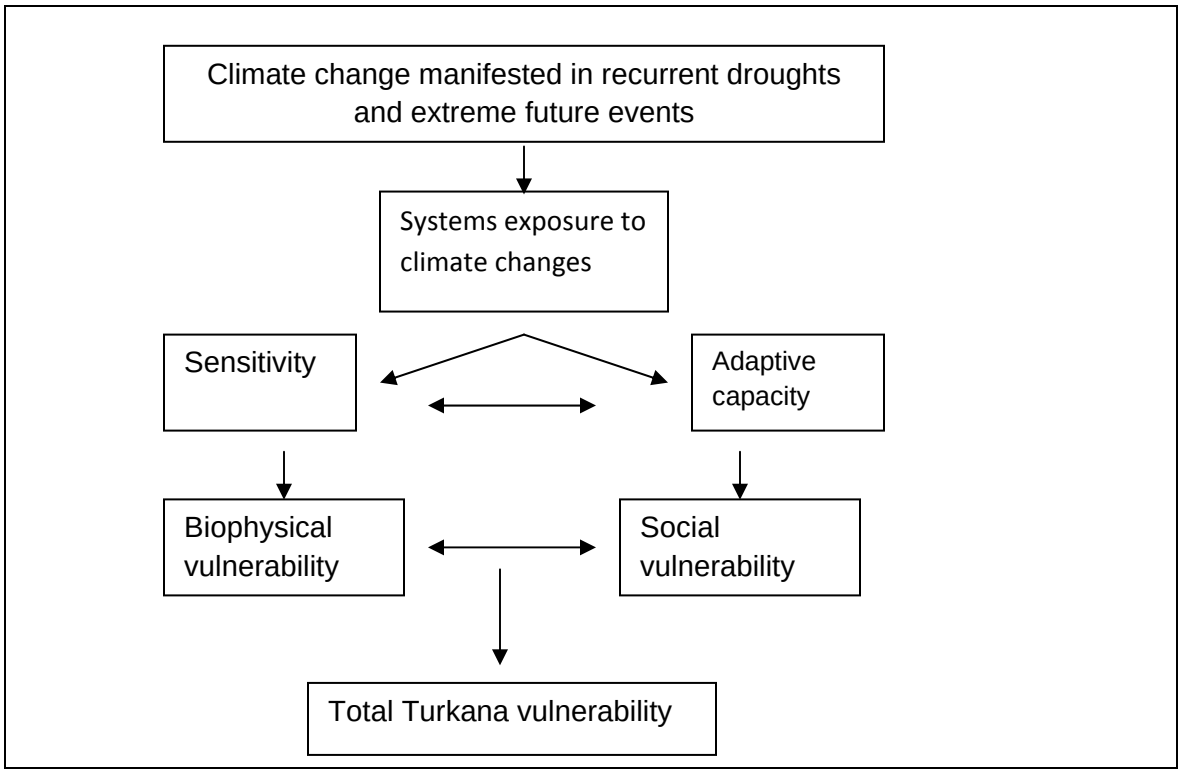
This definition focuses on climate change but it shall be applicable to other non-climatic hazards or factors such as land degradation. Adaptation is a long-term process that could be internal to the adapting system, or results from a planned process that encompasses development and implementation of policies and adaptation programs. Disaster risk reduction measures can directly contribute to the adaptation process in many ways. For example, undertaking disaster risk measures that enhances pastoral communities' capacities and coping mechanisms to address current droughts will provide a foundation for a successful adaptation process to potentially reduced precipitation due to climate change.

Adaptation will help human and natural systems to moderate harm or exploit beneficial opportunities of the change. There are various types of adaptation that can be distinguished, including anticipatory and reactive adaptation, private and public adaptation, and autonomous and planned adaptation (Fussel, 2007). Consequently, the adaptive capacity of a system is defined as *"the ability of a system to adjust to climate change (including climate, variability and extremes) to moderate potential damages, to take advantage of opportunities, or to cope with the consequences* (UNISDR, 2009)". In order to assess an adaptation process or identify adaptation options, evaluation criteria shall be used such as availability, cost-benefit analysis, effectiveness, efficiency and feasibility (UNISDR, 2009). The adaptive capacity of a system depends on several factors which could be generic or context specific. Therefore, adaptive capacity could be represented by level of social and economic development (wealth, level of income, education, availability basic services), availability and quality of (governance and civil society) institutions and infrastructure, information and knowledge, equity, potentials for alternative livelihoods (IPCC, 2001).

The relationship between climate change adaptation and vulnerability to climate change has been discussed in the literature by several writers (Fussel, 2007; IPCC Working group II, 2001). According to the vulnerability definition of IPCC in the 3rd assessment report, vulnerability consists of three elements namely: (1) adaptive capacity, (2) sensitivity, and (3) exposure. Sensitivity is the degree to which a system is affected; either adversely or beneficially, by climate change stimuli, whereas exposure is the nature and degree to which a system is exposed to climate variations (IPCC, 2001). For example, in Turkana where livestock is the main source of livelihood, the sensitivity of livestock to climate variations such as frequent droughts and high temperature is considered high as it may cause death, disease outbreak and reduce livestock productivity. Therefore, the change in income due to lower livestock productivity or increased death could be used as an indicator to measure the sensitivity of Turkana to climate change impact. Exposure in the Turkana case may represent the predicted or estimated changes in climate conditions based on climatic projections. Turkana is expected to face climatic uncertainty characterized by more frequent dry spells, longer wet periods and intensified rainy seasons (means reduced number of rainy days per season) when it rains (HPG, 2009). This implies that Turkana community and their livelihoods will be exposed to more harsh conditions (climatic hazards) in the future.

The above relationships between vulnerability, sensitivity and adaptive capacity of the Turkana could be predicted in figure (2) bellow, which an amended version from (Deressa T., et al, 2008).

Figure (2): Vulnerability elements of the Turkana to climate change impacts



Therefore, the Turkana's vulnerability to climate change impacts could be determined as the net effect of the three elements in the equation (Deressa T., et al, 2008) bellow:

Vulnerability = adaptive capacity – sensitivity – exposure

2.3.1.10 Disaster risk assessment

It is "a process to determine the nature and extent of a risk by analyzing potential hazards and evaluating existing conditions of vulnerability/capacity that could pose threat on people, property, livelihoods and environment on which they depend" (UNISDR, 2002).

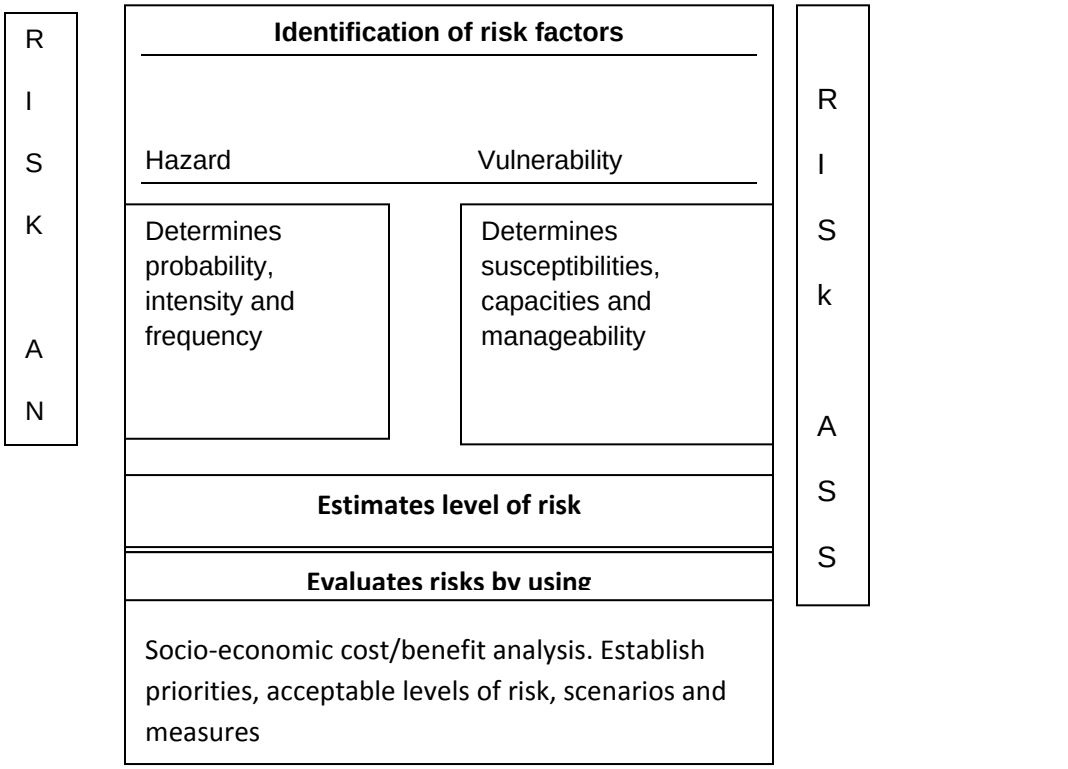
Conducting a disaster risk assessment, based on the above definition requires analysis and assessment of all risk factors (as explained in section 2.3.1.1) in relation to a particular hazard or hazards. Accordingly, a disaster risk assessment process encompasses the following steps, which is also predicted in (3) figure bellow (UNISDR, 2002. P 66):

1. Hazard assessment. To identify hazards, probability and other characteristics.
2. Vulnerability assessment. Determine elements which are at risk because of their exposure to the hazard. The vulnerability assessment shall undertake an

integrative approach that addresses both biophysical and social vulnerabilities, which also analyses the vulnerability progression.

3. Capacity and manageability assessment. To identify status of community's resources available to prevent, mitigate and response and assess people's level of access and control of these resources (ProVention website). Moreover, to assess relevant authorities' ability to address and manage risks and their impacts.
4. Disaster risk analysis. Determine acceptable levels of risk and draw conclusions such as prioritizing risks, plan actions to mitigate them, and mobilize resources based on processing findings from the previous steps. This step is important so the community can develop disaster management and response strategies to address impacts of priority threats and their risks.

Figure 3: Risk assessment process



Risks can be assessed in quantified, semi-quantified or qualitative forms. It is inherently very difficult to quantify (or actually put probability value to) risks in many cases of natural, biological and man made hazards. Moreover, it is because of the difficulties in determining levels and types of vulnerabilities. This is also due to the lack of historical

reliable records and gaps in current data due to reasons a) technical capacities, b) nature of hazards, c) lack of consistency in defining terms relevant to disasters, d) inconsistent and irrelevant reporting mechanisms, e) political pressures, and f) lack of capacity to collect data due to logistical difficulties (UNISDR, 2002. P 64-66). However, risks should be quantified as far as is possible and practical. Otherwise, qualitative risk assessments are recommended as long as rigorous methodologies and tools are used. Risks can be described as extreme, high, medium and low, or qualified by a simple scoring system, for example, 1-5 for both the level of risk and for the degree of potential consequences. This will help to establish a prior ranking for identified risks, which will provide a solid platform for contingency planning (IFRC, 2006; IIRR, 2007).

2.3.1.11 Resilience

The capacity of a system, community or society to resist or to change in order that it may obtain an acceptable level in functioning and structure. This is determined by the degree to which the social system is capable of organizing itself, and the ability to increase its capacity for learning and adaptation, including the capacity to recover from a disaster (UNISDR, 2009).

2.4 Analytical framework in context of disaster risk management and climate change adaptation

2.4.1 Linkages between climate change adaptation and risk management

“Out of the 40 worst catastrophes between 19970-2001, all but two occurred in developing countries, and almost half were climate-related”. Swiss Reinsurance, Sigma no.1/2002, as cited by (DFID, 2004). Earlier discussion in this chapter indicated that climate change will increase the poor’s vulnerability to the increasingly unpredictable and changing patterns of climate-related hazards. The poor’s coping strategies to deal with immediate impacts of current hazards could establish a base for long-term adjustments, and sustainable adaptive capacities to address climatic hazards including climatic variability and extreme events. In responding to the potential increase in climate-related disasters due to climate change, lessons shall be drawn from current disaster risk reduction practices, and current coping strategies with existing climatic hazards and variability (DFID, 2005b). Moreover, many lessons exist in the current practices of community-based disaster risk reduction, and in their well-long established resilience capacities, which they have developed to deal with current hazards.

As climate change may result in more frequent and severe climatic shocks; which communities may not have experienced to date, there is a need to integrate long-term climate change into disaster management policies and practices. This is becoming crucial, because it is more difficult to predict the patterns (probability, frequency, severity) of climatic hazards in the mid-long term due to the changes in global climate. Incorporating projections of climate change impacts for a country or a district would improve the quality of disaster risk assessments by better mapping of potential hazards and vulnerabilities. For example when disaster risk measures ignore long-term climate change projections, they may become a problem and cause more risk. Bangladesh invested in flood defences that were designed for a certain level of floods without considering future projects of floods in the area, these constructions became counter-productive as they started trapping floodwaters and prolonging the flood period (DFID, 2004). This proves the mutual benefit of integrating disaster risk management and adaptation to climate change impact. It was agreed by 168 countries at the World Conference on Disaster reduction in 2005, in Kobe, Japan. The same conference stated "substantial reduction in lives and social losses, economic and environment"……therefore there is… " a need to promote integration of risk reduction associated with existing climate variability and future climate change into strategies for reduction disaster risk and adaptation to climate change" (UNISDR, 2005).

Climate change adaptation and disaster risk interventions are in many ways inseparable or inherently interconnected. Measures aim at altering crop strains to increase their resistance or tolerance to drought and pets are measures of risk reduction to reduce food insecurity. Simultaneously, this practice will improve farmers' resilience and enhance their adaptation to long-term climatic changes (more frequent and intense droughts), which may require introduction of new varieties of crops and new agricultural practices. Enhanced environment management policies and practices in high-climate risks would provide basis for more resilient livelihoods and adaptive capacities (UNISDR, 2008).

The importance of integrating disaster risk reduction and climate change adaption is necessary for several reasons (Sperling & Szekely, 2005):

1. The climate change implications on disaster risk management, and its impacts on exposure of communities to changing patterns of climatic hazards.

2. Changing baseline of environmental conditions due to climate change will require a future-oriented disaster management approach.
3. Climate change is altering patterns of current hazards, it will also induce new hazards where there is no current experience to deal with such hazards.
4. Climate change increases the vulnerability of communities through impacts on water, food security, physical infrastructure and sources of livelihood.
5. Climate change generates climatic threats in new areas which are not facing such hazards now.
6. Risk reduction implies addressing multiple hazards and underlying social, economic and environmental vulnerabilities at all levels. This provides an avenue for climate change adaptation and strengthening community resilience in the face of changing climatic patterns.
7. Understanding current vulnerabilities and resilience factors is a building block in strengthening adaptive capacities.

While acknowledging similarities and interconectedness between climate change adaptation and disaster risk reduction, there are differences to be considered:

1. Climate change adaptation mainly considers extreme climatic hazards, changing patterns of current climatic hazards and the rising of new ones.
2. Climate change adaptation is informed by projections of future climatic conditions. Whilst disaster risk reduction depends heavily on historical and current data to inform future disaster risk plans and measures.
3. There are different policies, frameworks, funding channels available for each.
4. Disaster risk reduction deals also with non-climate hazards, whereas adaptation addresses longer-term impacts/changes in climate.

Pastoralists are among those at most risk of climate change due to their heavy dependency on natural resources. However, over thousands of years, they managed to live in harsh conditions of arid and semi-arid lands by developing resilient livelihoods, social processes and coping strategies that strengthen their long term adaptations (Mortimore, 2001). It is claimed that pastoralist are adaptive to challenging and changing environments (Nori M. et al, 2008). Nori also emphasised that adaptation is intrinsically pastoral characteristics if they have maintained their

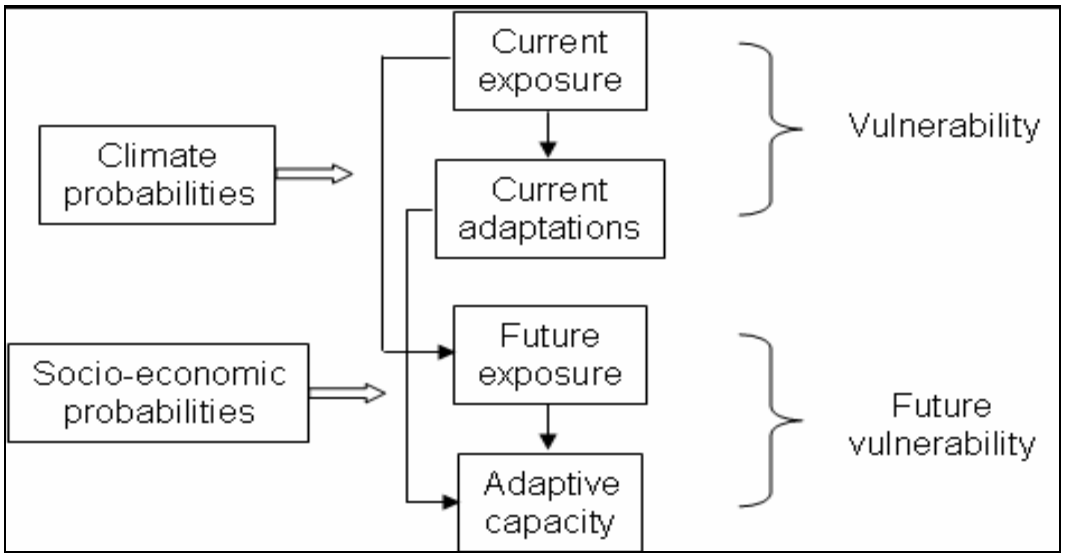
free choices and freed of restrictions that disenable their adaptation and coping capacities. In order to guide strategies to support pastoralists' adaptation to climate change impacts, Christensen (2007) reiterated the need to understand how this livelihood group coped and adapted to climate variability. The pastoral adaption to climate change and the role of disaster risk reduction will be discussed in Chapter 4.

2.4.2. Role of disaster risk reduction in climate change adaptation

Adaptation to climate change is gaining a momentum at several levels as its impact has been felt in several parts of the world. The approach to climate change adaptation started in a top-down perspective. It was driven first by the global objective to mitigate climate change by reducing GHG emissions; an issue that has been discussed at political top-level agendas and influenced by rich countries. However, the international negotiations on reducing gas emissions haven't been concluded, and are waiting for the upcoming Copenhagen Conference in December 2009. Meanwhile, impact of climate change is already happening and affecting human socioeconomic activities. Therefore, more emphasis is put on fostering the adaptation processes of communities and systems that are at risk. The top-down approach to adaptation started from taking the global climate model scenarios then moved down to sectoral and regional impact studies, and finally to assessment of adaptation options at various levels.

The role of disaster risk management in enhancing the adaptation policies and practices is increasingly acknowledged by IPCC, UNISDR, UNFCCC and others; as cited by (Van Aalst M.K., et al, 2007). The driver behind this move is the relationship between vulnerability and adaptive capacity to climate change impact; see section 2.3.1.9. Reducing vulnerability and building resilience is a cornerstone in the disaster risk reduction policies and practices. Therefore, disaster risk reduction provides an entry point and a venue to climate change adaptation by addressing all types of vulnerability and building adaptive capacity. Figure (4) below explains this relationship, (ILRI, 2006):

Figure (4): Relationship current and future vulnerability and climate change adaptation



Hence, understanding vulnerability from the climate change perspective is crucial due to its implications on the measures to be undertaken to reduce risks of climate change related hazards. There are two views of vulnerability as explained by Kelly and Adger (2000). On one hand, it is an end-point; this means that it is a residual of climate change impacts minus adaptation. This definition assists in defining the extent (net residual) of climate change impact (cost) on a community, and facilitates decisions regarding the costs of mitigation of GHG and adaptation measures. On the other hand, vulnerability is a starting point; which means that is the state or output of a system generated by several factors including environmental and socioeconomic societal processes, which also exacerbated by climate change (Kelly and Adger, 2000). The starting-point interpretation is useful in determining the origins and progression of social vulnerability to climate change (root, dynamic and living conditions), its characteristics and distribution, and how vulnerability contributes to climate change. This helps in determining who is vulnerable, why, and how to reduce their vulnerability. In summary, considering vulnerability as an end-point implies that adaptation and adaptive capacities determine level of vulnerability to climate change. Whilst if it is a starting-point, this implies that vulnerability determines the adaptive capacity of a community to climate change impact.

There is interdependency between human-ecological or environmental systems in pastoral areas, and human and livelihood vulnerability. In this study, the researcher will use both vulnerability perspectives in order to assess and determine the progression of vulnerability of Turkana to climate change impact, and the influence of climate change

on Turkana vulnerability. Ultimately, this will facilitate the risk assessment of climate change related-hazards in Turkana from the community perspective. This has not been emphasised enough in recent vulnerability studies to climate change impact in Turkana.

2.4.3 Climate change impact assessments

There were several attempts to develop indices or matrixes to measure and monitor vulnerability, sensitivity to climate change, and the adaptive capacity of specific regions and livelihood groups to climate change impact (Deressa T., 2008; UNITAR, 2007; Vincent K., 2004; Brooks N., 2004, Gbetibouo G. A., 2009). Others attempted developing a national index of climate change that would allow comparisons between countries, reviewed by Vincent K. (2004). This includes among others: small island developing state vulnerability index, economic vulnerability index for developing countries with special reference to the Caribbean, Commonwealth Vulnerability Index, the vulnerability- resilience Indicator prototype model (VRIP). These top-down attempts started in climate change scenarios derived from global climate models in a scaled-down form to a region, a country or a district. Then they are applied on a specific element (i.e. region, ecosystem, livelihood group) in order to model the climate change impact on this target. Consequently, indices were developed to capture the vulnerability, sensitivity and adaptation of these targets to the projected impacts (Van Aalst, 2007). These indices are based on identifying sets (categories) of variables which are measured by direct or proxy indicators, then the indicators are aggregated to form an index (Sharma A., 2007). However, most data used in applying these indices derived from national statistics or the humanitarian development report of the UNDP, without taking communities perspectives. Then, each category of indicators is given a weight by using various methods including experts' judgment.

In his paper to the UNFCCC workshop in Cairo, Sharma A. (2007) reviewed examples of sectoral and multi-sectoral tools and analytical frameworks. These tools are available for assessment and management of climate-related risks in different communities. This included for example, vulnerability mapping and impact assessment guidelines, statistical down scaling model (SDSM), climate analysis indicators tool, adaptation wizard, opportunities and risks of climate Change and disasters (ORCHID), environment sustainability index, and vulnerability assessments and sustainable livelihood (VASL) approaches.

The advantage of these indicator-based attempts is that a wider range of variables can be incorporated to present a complex reality in a comprehensive and concise manner. It allows for comparing conditions in different places. However, these indices may not be able to capture realities due to the complexity of the issues at hand such as vulnerability, adaptive capacity and risk as they have intangible and dynamic aspects. Moreover, vulnerability, risk perception and adaptation are all context specific, aggregating variables and indicators in an index may not represent these specificities and simplify the reality. Some indices use national economic and social inequality indicators such as GDP, income per capita, Gini coefficient. These indicators may hide differences and inequalities between districts, communities and members of households within a country. Moreover, availability and quality of available data may influence the type and number of indicators or variables to be considered in developing an index.

Following to the previous discussion, the need for community-based risk assessments (CRA) or mixed approaches rises to assess and strengthen community-based adaptation (CBA). CRA is a methodology that uses a range of participatory rapid appraisal methods and tools (PRA) for information collection. Several agencies including IFRC (2006); ActionAid (2006);and IIRR (2007) have adapted the CRA in assessing or determining and building local adaptation capacities and awareness (or in developing and implementing CBA). PRA tools which are widely used by aid practitioners include risk mapping transect walks, asset inventories, ranking, historical and seasonal timelines, focus groups discussions, informant interviews. Several guides were developed to support practitioners in using these tools (ADPC, 2004). These tools proved to be useful in assessing risks by determining hazards, trends, capacities and vulnerabilities while allowing active participation of community members. Moreover they provide an opportunity to communities to engage in identifying solutions. This shift towards more active community participation has its roots in the following:

1. Humanitarian relief and recovery interventions over the years proved that active participation of affected population is necessary for their success. Communities have accumulated knowledge and skills that should inform any intervention, which also shall be strengthened.
2. According to the Sphere Project, communities are the first respondents and aid agencies shall not consider them passive or helpless (Sphere, 2004).

Communities have accumulated knowledge and experience over the years about their environs which shall be built on to strengthen there adaptation capacities.

3. It improves downward humanitarian accountability by empowering communities to participate in the process at various stages.
4. Shift from needs based approaches to right based approach in development and disaster management.

However; based on the researcher's field experience and Adger et al (2008), using CRA in general, and in CBA in particular requires some caution for several reasons:

1. Participants (community) tend to focus on the daily challenges, survival and immediate needs (symptoms) in their lives without identifying factors behind these challenges.
2. It might raise or increase expectation for external funding and aid. Therefore, communities tend to agree with the facilitators on any idea. For example, mentioning climate change may capture people's attention so they prioritize it if they feel that it may lead to funding.
3. Communities are not homogeneous, within a community there are several differences based on gender, age groups, power relations and structures, wealth and other social norms.
4. It is relatively easy to identify coping mechanisms and livelihood strategies that are used by a community to face a short term hazard. Local capacities and vulnerabilities have roots and causes beyond their boundaries at national and global levels (Wisner, 2004). These shall be considered in analysis risks related to climate change and adaptation.
5. Communities could define and analyze known hazards, but they may lack scientific information and the knowledge to articulate new trends that may change these hazards or create new hazards and risks related to climate change.

Following the above discussion, the need arises to use a mixed approach of CBA that uses CRA and available downsized climatic projections to the possible lowest local level,

and analysis of trends in weather conditions based on historical data over a sufficient time period.

2.5 Tools and anaytical frameworks

In this study, the researcher will use a community-based climate change adaptation analytical framework that was developed by CARE International. CARE's climate vulnarability and capacity analysis (CVCA) handbook was developed as a result of a series of consultations with experts and communities (CARE, 2009). The CVCA is based on a framework of enabling factors at household, community and national levels for community based adaptation. It focusus on: (1) climate change and its impact on lives and livelihoods (resilience level of livelihoods) of target populations, (2) analysing conditions and hazards which bridges the gap between analysis that is focused on poverty conditions and those done for disaster risk reduction with empahsis on reducing vulnarability, (3) emphasises a multi stakeholder learning and dialogue, (4) focuses on community but also on enabling factors. It is in line with the understanding of the concept of vulnerability progression. The CVCA framework is summarized in Annex (2). The CVCA aims at:

1. Analyisng vulnarability to climate change and adaptive capacity at community level.
2. Combine community knowledge and scientific data to yeild greater understanding about local impacts of climate change.
3. Strengthening planning processes by engaging multi-stakeholders in collaborative larning and dialogue, and providing context-specific inofrmation impacts of climate change and local vulnerability.

The CVCA is designed to complement other existing frameworks such as gender anaylisis, household livelihood framewrok and rights-based approach for analysing vulnerability. In this study, the livelihood framework, and the "Pressure and Release (PAR) and Access models (Wisner et al, 2004) will be used to support the analysis.

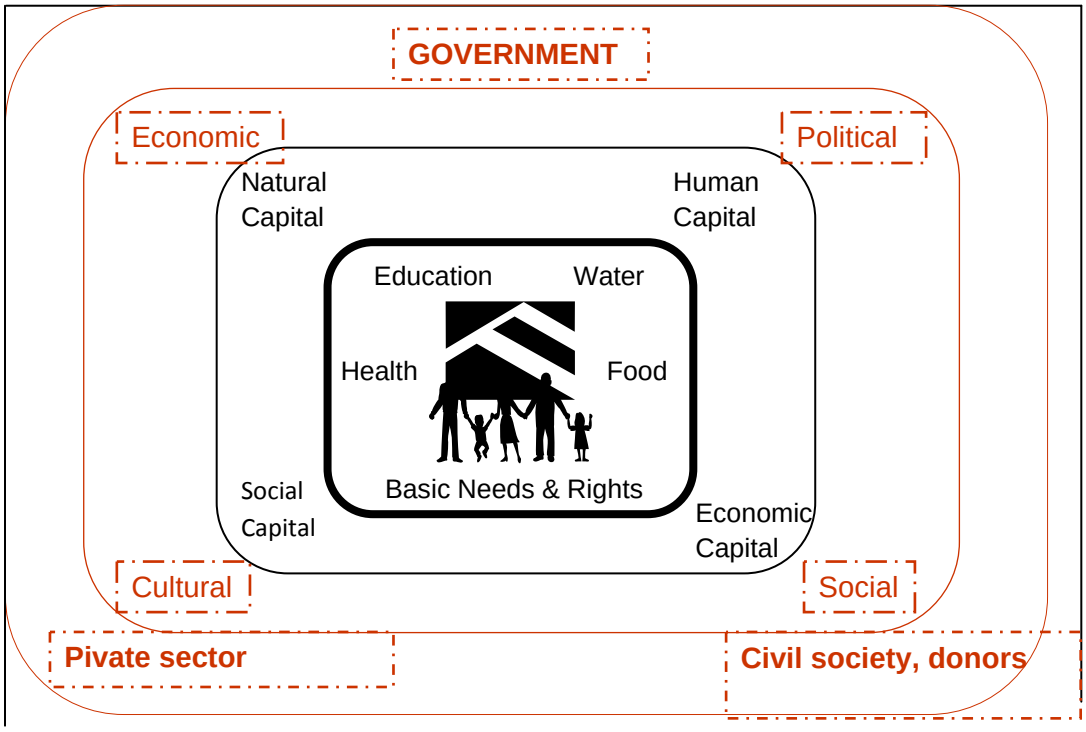
The livelihood framework was developed and used by NGOs such as CARE (1997-1998) and adopted by donors (DFID,1997). Sustainable household livelihood framework (HLS). A livelihood is defined as the set of assets, activities and capabilities required for a means of living (McCaston, 2002). Consequently, HLS

framework (see figure (4) below) is a systematic process of understanding how people use diverse assets or resources (both tangible and intangible) to undertake a range of activities, in order to achieve desirable outcomes. These assets or “capitals” include:

1. Human capital such as “education and skills”.
2. Social capital “networks and community structures”.
3. Financial capital “cash and credit”.
4. Physical capital such as equipment and livestock.
5. Environment “land and water”.

All these assets are viewed in the context of (external enabling factors) political and government structures, and global systems, which determine access and utilization of these capitals by people. Therefore, it will also influence their vulnerability. Livelihood assets are also not static; they are influenced by shocks such as droughts, floods and conflicts. The output of the livelihood system includes satisfaction of basic rights, and sustainable access to basic needs such as water, shelter, and food. It helps in understanding how people access and control various mixes of assets and activities, and how these differ within and among households in ways that affect their ability to achieve the desired outcomes in their lives. The livelihood analysis also helps in determining external factors and their influence on peoples’ livelihoods. These factors include gender, social norms, policy frameworks, economic trends, and the physical environment. The CVCA framework is designed to apply a climate “lens” to livelihoods analysis. It helps in determining the influence of the physical environment on livelihoods, the means of using available resources, and identifying aspects of livelihoods that are most vulnerable to climate change (CARE, 2009).

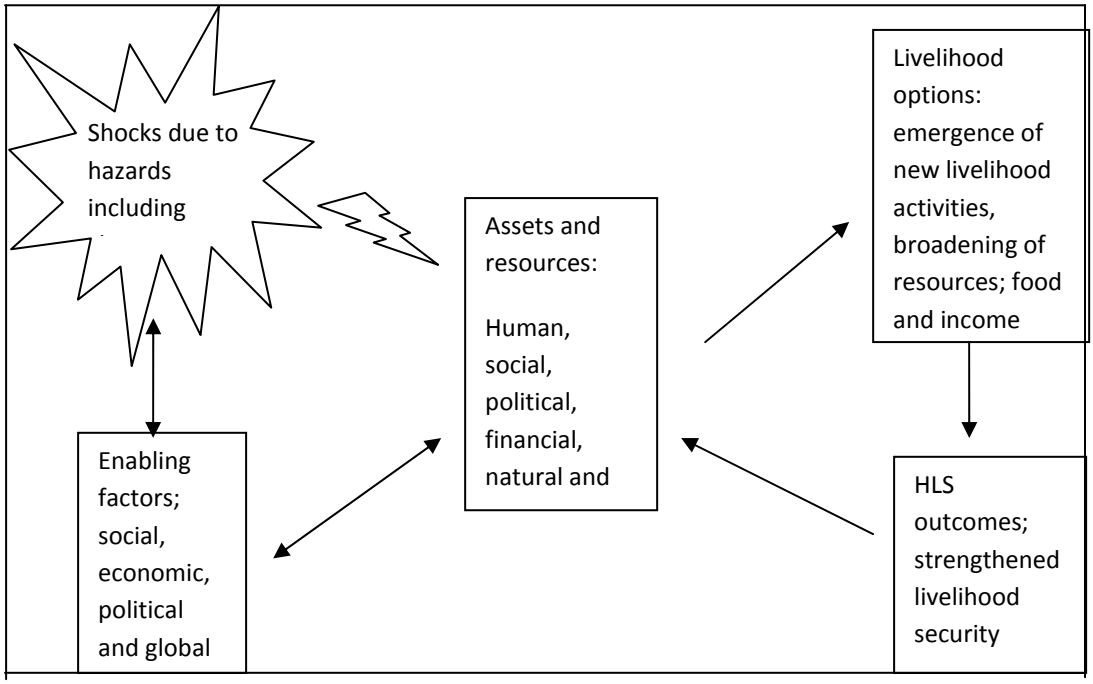
Figure (5): Livelihood analysis framework.



Source McCaston, 2002. CARE's Underlying cuases of poverty unifying framework

The following figure (6) predicts HLS framework incorporating risks driven by current and climate-change related hazards to the livelihood security system.

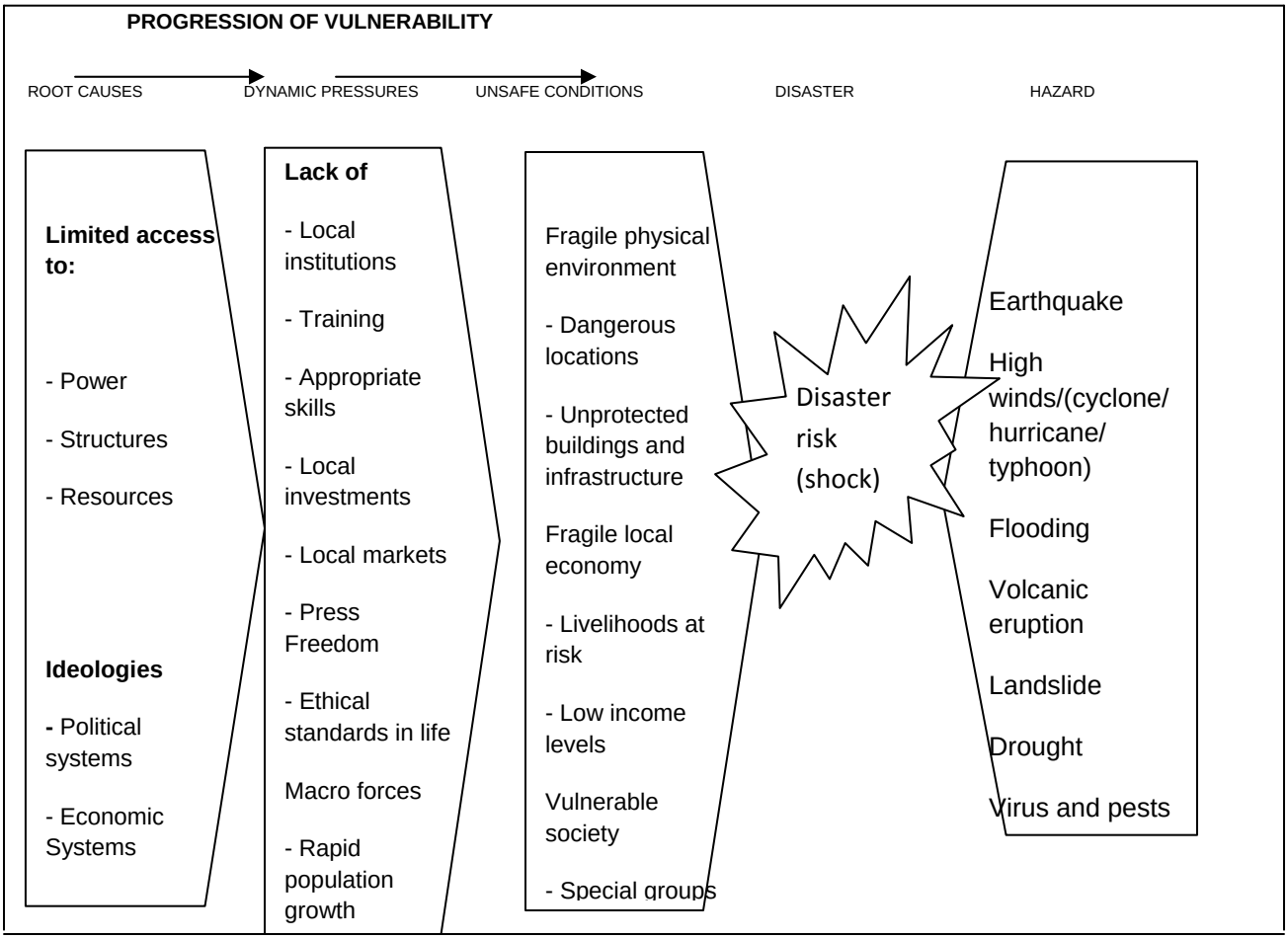
Figure (6): Interaction between livelihood systems and climate change related hazards



The second analytical framework that will be applied or reconstructed later to help understanding and interpreting the findings from the CVCA application is the pressure and Release (PAR) and Access models (Wisner, 2004). The PAR model is summarized in figure (7).

The pressure and release model (PAR) explains a disaster as the intersection of two opposing forces. Those processes that generate vulnerability are on one side, and hazards or events (natural or man-induced) that trigger a disaster when they interface with vulnerable conditions on the other side. The model identifies three layers of causes of vulnerability; root and dynamic causes and unsafe conditions. Each layer of these causes is located at a different level of control by people or elements at risk. Root causes appear to be far from affecting people directly since they mainly include higher and macro level factors including global elements. The dynamic causes include those processes and elements that transfer the impact or pressure from the root courses into unsafe conditions. At this level, people and their properties are exposed to risks of disasters when a natural or man-made event (trigger) occurs. The model is very useful in identifying and classifying the socioeconomic and political processes that lead to progressing the vulnerability. But it doesn't provide enough analysis on how the unsafe conditions get transferred into a disaster, how it impacts people and elements at risk, how do they cope and recover or get worse.

Figure (7): Pressure and Release (PAR) Model: the progression of vulnerability



Therefore, the Access model is developed to help understanding the complex social, economic and environmental events and long-term processes that may associate with a specific event. In other words, it explains at micro level the vulnerability elements and impact of a disaster as it unfolds at levels of households, and members of a household. The model helps understanding people's coping strategies and recovery, and the role of other actors who are involved in a disaster. To this end, the Access Model requires a good understanding of conditions, structures and processes prior to and after a disaster. It is useful in understanding causes of a disaster, its impacts and to guide developing response strategies and long term disaster risk reduction measures. Both models complete each other by providing different levels of information and analysis to the processes that have lead to vulnerability conditions and impact of disasters (Wisner 2004, 49-110).

2.6 Summary

This chapter was an attempt to demonstrate the linkages between current disasters, climate change impact and development processes. The earlier discussion shows that a combination of various tools and analytical frameworks is necessary to understand the consequences of climate change on the livelihoods of the pastoral community in Turkana. In order to assist the community to enhance their adaptive capacity and reduce their vulnerability to climate change, it is necessary to undertake a community based approach. This is because it encourages community to be aware of the emerging risks and take ownership of the necessary steps required to address them. Moreover, it empowers the community to reach out and request for their rights and support for their needs. Disaster risk management is necessary to address climate change impact particularly if climate change impact is incorporated in planning and implementing disaster risk measures. This chapter laid the necessary background to conduct further analysis that will assess the risks associated with climate change in Turkana, and how would those interact with non-climate hazards, and all aspects of vulnerability.

Chapter 3 – Pastoralism in the Face of Impact of Climate Change

3.1 Introduction

This chapter will provide a brief description of the Turkana way of life and livelihood system. The added value of the pastoral community to the national interest will be described. The chapter will also describe the traditional mechanisms that are in place and been used to minimise losses due to various hazards. This is deemed necessary in order to affirm the need to support the sustainability of this livelihood. This understanding is necessary to lay the ground to identify proper actions and policies that would build on existing capacities and knowledge.

3.2 Pastoral communities in Kenya

The Arid and Semi Arid Lands (ASAL) in Kenya constitute as in the entire Horn and East of Africa region more than two thirds of the land. These lands are home for about 10 million pastoralists and agro-pastoralists; almost 30% of the Kenyan population (Nori, 2008).

Pastoralists are people who primarily derive their living from the management of livestock (sheep, goat, camel and cattle) on rangelands. According to Ellis and Swift (1988) as cited by Kebebew (2001), pastoralists drive at least 50% of their household revenue from livestock or related activities. Three types of pastoralists are known in the region of East Africa. This study refers to the pure pastoralist community in Turkana district of Kenya who fall into the second and third types of pastoralists:

a. Sedentary pastoralists are those who are almost settled preeminently with their livestock within a defined area.
b. Semi-nomadic are those who move with their livestock over more or less regular routes settling for a part of the year in one known home area.
c. Nomadic those who move with their cattle and transportable homes or shelters over irregular routes seeking pasture and water.

Pastoralists could be also defined in cultural terms equally as in an economic or source of livelihood sense. This encompasses people who have maintained connections, and

live pastoralist lifestyle in which livestock has cultural and social than economic values (Nassef M., 2009). In many pastoral communities, cows are perceived as the main source of social status, and means of social transactions especially in marriage and settling feudal disputes. The above definitions show that pastoralists are not a complete homogeneous group.

The pastoral land is known for its harsh environment where communities strive to secure water and pasture on which their main livelihood source, livestock, depends. This makes them reliable on natural and climatic aspects especially rainfall, and vulnerable to weather variations such as heat and wind. Over thousands of years, pastoralists have managed their resources and livelihoods in the face of environmental challenges and difficult socio-economic conditions (Mortimore, 2001). They to large extent developed their own long term livelihood strategies and copying mechanisms in harmony with their environment. Recent decades show that pastoralists are challenged in maintaining these livelihoods and coping mechanisms due to a range of ecological, demographic, economic, social, political and climatic causes. Consequently, they become impoverished, marginalized, vulnerable, and increasingly face both chronic and acute crisis.

Since the droughts of the 1970's, the Turkana district has repeatedly been facing food insecurity conditions. It became dependent on humanitarian food aid which has been provided to bridge the reoccurring hunger gap (IRIN, 2009). The inhospitable environment in Turkana and the recurrent food crisis created a negative image about the Turkana's lifestyle as environmental waste, food aid dependent and as an incapable system to cope and adapt with the environment and climate emerging challenges. It also contributed to the impression that pastoralists in general are helpless against the challenges of nature, and that their way of life is incapable of meeting basic food security needs and keeps them vulnerable to hunger (Lind, 2004).

3.4 Added value of pastoralism and arid lands

"*Pastoralism is more than a mode of production. It is a highly imaginative and original system of intricate modes of social organization and patterns of culture. It is a mode of perception."* as defined by Markakis (2004:4,14, cited in Brocklesby Mary et al., 2009). This shows the sentimental and socioeconomic significance of the pastoral system and their land to the pastoralists themselves, and the entire society. Pastoralism is one of the

old known human productive activities, it relies heavily on natural resources and dependent on rainfall. Archaeological findings proved that pastoralism developed in East Africa about 6000 years ago in response to climate variability (Davis, 2008). They developed and sustained systems and adapted inherent capacities and strategies to cope with climatic and environmental changes over all these years. Given this fact, pastoralists found a fine relationship between their needs (including of their livestock) and local ecosystems that enable them to sustain their livelihoods and life style. Often lived in marginalized, harsh, and variable climatic and environmental conditions.

In the Horn and East of Africa region, there are more than 20 million pastoral people where livestock constitute a significant portion of their livelihood system (Hesse and McGregor, 2006). Pastoralism and the arid lands contribute significantly to household, local and national economies and food security. According to GoK (2007) pastoralism and arid lands:

a. Provides a source of income and wealth and employs significant number of people who engage in rearing animals, trading and manufacturing livestock products.
b. Provides 70% of fuel wood demand in Kenya.
c. Hosts wildlife-based tourism, which generates 13% of GDP in Kenya.
d. More than 70% of livestock in Kenya is found in pastoral areas. This means that livestock from pastoral areas provides a significant amount of meat, milk, skins and hides.
e. Livestock sector represents 20-25% of the Kenyan agriculture GDP.

Pastoralism and arid lands have other unforeseen contributions that are no less than the socioeconomic benefits to Kenya. This includes:

- Livestock in pastoral lands provides several benefits to the environment and the ecosystem as it opens up pastures, stimulates vegetation, and contributes to soil fertilization and pasture diversity.

- Carbon sequestration[4]: Grasslands store approximately 34 per cent of the global stock of CO2 presenting opportunities for carbon sequestration which sees monetary returns for communities. Carbon sequestration projects in Africa are already seeing financial returns, such as in the Nhambita Community Carbon Project in Mozambique, where each participating household is set to receive a cash payment of $242.60 per hectare over the next seven years for carbon sequestration by various land-use activities (Thornton et al. 2006).
- Given the vast dry lands in Kenya, the added value of pastoral areas in carbon sequestration is envisaged to be significant. According to the 3rd report of IPCC, soil organic carbon is one of the largest terrestrial carbon reservoirs, and much of this soil is in open grazing arid lands which covers about 45% of earth surface. Therefore, arid lands have the capacity to restore carbon below ground more than any other ecosystem, so they provide a great opportunity to mitigate climate change. These lands are largely managed by pastoralists who over long years maintained practices for sustainable rangeland and ecosystems. However, it is claimed that livestock contributes 9% of all CO2 derived from human activities, and pastoralist are part of the livestock sector. But this claim could be refuted based on the fact that intensive modernized livestock farming is more harmful than mobile pastoralism. Pastoralism with free mobility would enhance soil fertility and balance the ecosystem (HPG, 2009).

3.5 Pastoral livelihoods' resilience and adaptive capacity

3.5.1 General overview

In its glossary, the UNISDR defines disaster risk resilience as *"the capacity of a system, community or society potentially exposed to hazards to adapt, by resisting or changing in order to reach and maintain an acceptable level of functioning and structure. This is determined by the degree to which the social system is capable of organizing itself to increase its capacity for learning from past disasters for better future protection and to improve risk reduction measures".*

[4] Carbon sequestration: The process of increasing the carbon content of a carbon *reservoir* other than the *atmosphere*. Biological approaches to sequestration include direct removal of *carbon dioxide* from the atmosphere through *land-use change*, *afforestation*, *reforestation*, and practices that enhance soil carbon in agriculture (IPCC terminology, available on IPCC official website).

The above definition indicates that resilience is a societal value and quality, and entails a set of “intended or deliberate” actions that communities proactively undertake collectively and as individuals in order to reduce disaster risks, adapt to changes and bounce out better after disasters by learning from past experience. This won’t be possible without community cohesiveness, and developing ability of influencing governance systems, institutions and policies, and the course of social and economic change.

There are several attempts by researchers to define characteristics of a disaster resilient community. Twigg (2007) provides a detailed description of characteristics and parameters of resilience. His description is based on the priority thematic areas of the Hyogo Framework of Action. However, there is some consensus on basic characteristics of a resilient community. It comprises the ability to successfully identify threats, assess risks, mobilise resources, respond to emergencies, take actions in order to meet and overcome challenges, learn from the past to inform the future, and make use of new technologies and knowledge to manage disasters risk.

The Turkana pastoral community; as the rest of the pastoralists in Kenya, was able to develop livelihood and coping strategies to live with the variable climate and ecosystems prevailed in the arid lands. They did that as long as they had had their free choice and decision on their strategies without restrictions. Several conditions emerged during colonization period and after the independence of Kenya. These conditions came with constraints on the tried and successfully tested coping strategies and well established resilience factors. Pastoralists developed and used these strategies, which provided them with means to manage climatic and environmental challenges (Davis., and Nori, 2008). Their livelihood (mainly livestock) hinges upon strategies that continuously adapted to variable and unpredictable arid land resources which rely mostly on climate conditions.

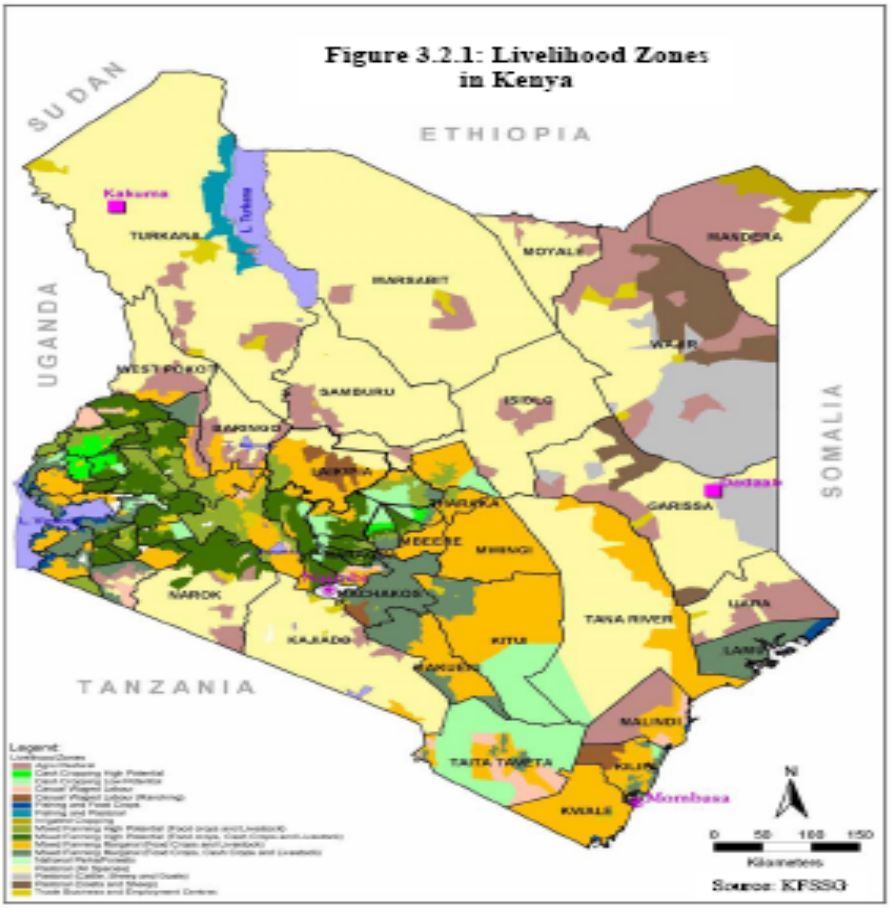
The IPCC fourth assessment report defined adaptation to climate change impact as*” the adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities*”. Pastoralist were the best to know the climate variability of their areas. They for example, chose specific types of animals and diversified them to reduce losses due to climatic hazards, they established routine migration routes that took them years to circle while seeking for pasture and water. Some external factors have limited these choices and

strategies in recent decades. Among other factors are establishing national borders, changing land use and ecosystems, and unpredictable changes in climate. These factors appear in the finding of this study, (see next chapter).

3.5.2 Sensitivity of pastoral livelihood to climate related hazards

As the main livelihood in the study area, this section will focus on the impact of climate conditions particularly drought on livestock. The map (2) below shows the prevalence of livestock as main livelihood in north areas of Turkana district, which is presented in light grey colour).

Map (2): Livelihood zones in Kenya. Source: (UNICEF& FAO, 2006)



Pastoralists are known to utilize different coping mechanisms or risk management methods in response to different levels of stress. The difference in the type and time of the employed coping strategy depends on pastoralists' perception of the stress or hazard dynamic. It means how much the condition is different from the norm. It also depends on the pastoralists' tolerance and the ability to mitigate the impact of stress. It

could be also influenced by the level of wealth (Ndikumana et al. 2000). Other factors such as access to pasture and water, veterinary services, public basic services, information, credit and markets were among factors mentioned by participants in this study.

Pastoralists' traditional responses to hazards including natural and manmade become increasingly ineffective as manifested in the increasing food insecurity in pastoral areas. Manmade hazards are often driven by competition over accessing and controlling water and pasture areas. Both are highly dependent and sensitive to climate characteristics.

Several studies such as Ndikumana et al. (2000) and Oxfam (2006) provided an overview of the various coping mechanisms used in north Kenya and Turkana. Their findings were used as a starting point by the researcher for discussion with the community. Ndikumana (2000) also examined the impact of weather conditions on livestock conditions, productivity and dynamics before, during and after extreme climate-driven hazards such as drought and El Nino. For example he indicated that:

1. Herd size is slightly reduced prior to drought due to sale in order to avoid major loss.
2. More losses during drought occur due to higher mortality as animals' resistant to parasites decreases.
3. Less productivity and breeding rates pre and during drought. Given that drought is a slow onset hazard, deterioration occurs gradually.
4. Significant death when rains start immediately after drought due to weak bodies of the animals so they could not sustain the change in weather.

The community indicated during the field study that recovery of those with small herds is becoming more difficult, if possible at all, due to the frequency and intensity of droughts. Their coping strategies and livelihoods resilience have been exhausted.

3.5.3 Minimizing risk and managing loss

Coping mechanisms are responses of an individual, group or society to challenging situations, or to a potentially known occurrence of a hazard (FAO, 2006). The coping mechanisms are inherent to a system and lie within the framework of the individual's and society's risk aversion or tolerance level. Some coping mechanisms may be developed newly or by experience in response to a repeated hazard. Others may represent an intensification of an already in-built or existing strategy. Coping mechanisms could be grouped into two categories: (1) managerial strategies, (2) community strategies. Managerial strategies include: movement and migration, various aspects of herd management, supplementation of grazing with other feeds, changes in herding labour with intensification of stress, management of diseases (both human and livestock), and changes in human diet. Community strategies include: sharing, loaning and giving of livestock as gifts and for milk (FAO, 2006).

3.6 Pastoralism, mobility, conflict and insecurity

The mobile pastoral production system is challenged by internal (district) and state borders which were historically divided without consideration of pastoralist needs and access. This limits pastoral movements in search of pasture and water for livestock, and increases insecurity during migration. Internally, the creation of new administrative units (districts and divisions) has resulted in a sense of 'ownership' of resources; and has provided a new pretext and an additional trigger for conflict.

Limited government presence defines the northern pastoralist regions of Kenya, accompanied by inadequate security provision and overall, a lack of basic services, infrastructure and development. Weak governance structures coupled with porous borders and ineffective security systems sustains an environment of lawlessness and impunity. In this context, to safeguard their lives and livestock from attacks by other armed groups, communities have resorted to acquiring arms, leading to the proliferation of illegal arms. This has increased national and regional instability and turned traditional conflicts and cattle rustling more deadly. Cattle rustling, once labelled as a 'cultural' practice used for restocking in times of scarcity has become more frequent, and has in many instances turned into a well-organized and profitable commercial activity.

Given the impact of climate change as manifested in several aspects as discussed in next chapter, security condition may get worse. This will add to the vulnerability of Turkana to cope with current climatic, non-climatic hazards and climate change impact.

3.7 Summary

This chapter demonstrated the added value of pastoralism to the social and economic sectors, and the environment. Pastoralist are perceived negatively by government due to their nomadic style of life. This perception has influenced policies and activities of the government negatively, which put Turkana at the prephery of the national development process. The livestock as the main source of livelihood to the pastoral Turkana community is proved to be sensitive to climate and environment conditions. Therefore, they will be sensitive and vulnerable to climate change impact.

The current coping strategies that Turkana community used may not be adequate to adapt to the climate change that may affect the district and rest of Kenya. The recurrent of various disasters in the region have depleted these strategies. In addition, external factors took place and have constrained the traditional coping strategies and livelihoods. Next chapter will discuss these factors from various angles in order to understand how climate change would affect the district and identify current vulnerabilities to climate change.

Chapter 4
Results and discussion of research findings

4.1 Introduction

This chapter will examin the perception of Turkana pastoral community to climate change impacts based on their daily life observations. The significance of disaster risks related to climate change impacts will be analysed in comparison to other risks facing the community. These risks are limiting and threatening their coping and adaptation strategies to environmental and climatic changes. The researcher will make a comparison between community's perception with actual trends in climate conditions based on the available meteorological data, and with the climatic projections as made in the IPCC assessment reports which were based on output of climatic models. Moreover, traditional past and current vulnerabilities, coping strategies and capacities will be identified and examined in order to determine the current and potential adaptation capacities to climate change. To the same end, limitations and opportunities in the current socioeconomic and environment conditions will be discussed in order to understand their impact on vulnerability and adaptive capacity of the Turkana. Chapter 1 provided details of the research methodology.

4.1.1 An Overview of the population and study area

Turkana district is located in the north western part of Kenya and shares international borders with Ethiopia and the Sudan to the north and Uganda to the west. Locally it is bordered by the districts of Marsabit to the east, Samburu on the southeast, Baringo and West Pokot to the south. The District is geographically isolated from the rest of Kenya by rough terrain, long distances, barren landscape surrounded by extinct volcanic mountain ranges and Lake Turkana. It has a land area of about 77,000 square kilometres, which includes 6,000 sq. km occupied by Lake Turkana. See (annex (1) map of Turkana district).

Rains are scarce and erratic with frequent failures. The soil is mainly rocky-sandy punctuated with clay and black cotton soils in certain areas. Many seasonal dry riverbeds cut through the district.

The district population is estimated at 500,000 who are spread in 6 sub-districts and 17 administrative divisions. Due to insecurity conditions; the fieldwork covered communities

in and around Lodwar, Lokiama, and Lokichoggio. Security escort from the Kenyan security forces was present during the field visit. These areas are among the least developed with high levels of vulnerability due to conflicts, poor roads and telecommunications, and inadequate services. Consequently, this geographical isolation that made the Turkana communities have little or no contact with other people or even the rest of Kenyan society.

Turkana is the main tribe in the area with main traditional institution called the Adakar (grazing social unit). The Adakar structures are based on security i.e. protection from organized raids, natural resources management and social-cultural links. It is headed by an elders' council, which represent all herdsmen. All Turkana speak one language and follow one basic set of customary laws, but they do not recognize one global traditional governance or leadership. Consequently, the Adakar units are quite independent and autonomous. The scarcity of water and pasture forces Turkana to migrate each year, which leads conflicts and raids between the Turkana and almost all their neighbouring communities across all international and local borders. Migration routes vary, according to the availability of pasture and water, but the general trend is north and westwards (Oxfam, 2006).

4.1.3 Climate of Kenya

This summary is based on the data and information from the Kenya Department of Meteorology, and the UNDP country climate profile. Kenya is located at latitudes of 6°S to 6°N. In general, its climate is tropical, but moderated by diverse topography in the west. Kenya's topography rises from the coastal plains to the eastern edge of the East African Plateau, and the Great Rift Valley. The central highland regions are substantially cooler than the coast. Temperatures vary little throughout the year, but drop by around 2 degrees in the coolest season. Seasonal rainfall in Kenya is driven mainly by the migration of the Inter-Tropical Convergence Zone (ITCZ), relatively narrow belt of very low pressure and heavy precipitation that forms near the earth's equator. The exact position of the ITCZ changes over the course of the year, migrating southwards through Kenya in October to December, and returning northwards in March, April and May. This causes that Kenya experiencea two distinct wet periods – the 'short' rains in October to December and the 'long' rains in March to May.

The amount of rainfall received varies per month and by region/district, exceeding 300mm per month in some localities. The onset, duration and intensity of these rainfalls also vary from year to year. The movements of the ITCZ are sensitive to variations in Indian Ocean sea-surface temperatures and vary from year to year. One of the most well documented ocean influences on rainfall in this region is the El Niño Southern Oscillation (ENSO), which usually cause greater than average rainfalls in the short rainfall season. Whilst cold phases (La Niña) bring a drier than average season.

4.2 Analysis of climatic trends in Kenya and Turkana district

4.2.1 Recent climate conditions in the country

Temperature

1. Mean or average annual temperature has increased by 1.0°C since 1960, an average rate of 0.21°C per decade.
2. Daily temperature observations show significantly increasing trends in the frequency of hot days, and much large increasing trends in the frequency of hot nights. A hot day or night is when temperature is 10% higher than average under current climate.
3. The average number of 'hot' days per year increased by 57 (an additional 15.6% of days) between 1960 and 2003, based on trend analysis of temperature measures of the period.
4. The average number of 'hot' nights per year increased by 113 (an additional 31% of nights) between 1960 and 2003.
5. The average number of 'cold 'days per year has decreased by 16 (4.4% of days) between 1960 and 2003.
6. The average number of 'cold' nights per year has decreased by 42 (11.5% of days).

Precipitation

1. Observations of rainfall over Kenya since 1960 do not show statistically significant trends.
2. Trends in the extreme indices based on daily rainfall data are mixed. There is an increase but not statistically a significant trend in the proportion of rainfall occurring in heavy events. A 'Heavy' event is defined as a daily total rainfall that

exceeds the threshold that is exceeded on 5% of rainy days in current climate of that region and season.

4.2.2 Climate future projections for the country

The following projections are taken from the UNDP Climate Change Profile at (http://country-profiles.geog.ox.ac.uk). This profile is based on (2007) IPCC Working Group I Report: 'The Physical Science Basis', Chapter 11 (Regional Climate projections): Section 11.2 (Africa).

Temperature

1. The mean annual temperature is projected to increase by 1.0 to 2.8°C by the 2060s, and 1.3 to 4.5°C by the 2090s.
2. All projections indicate increases in the frequency of days and nights that are considered 'hot' in current climate.
3. Projections indicate that 'hot' days will annually occur on 17-45% of days by the 2060s, and 23-75% of days by the 2090s.
4. All projections indicate decreases in the frequency of days and nights that are considered 'cold' in current climate. These events are expected to become exceedingly rare.

Precipitation

1. Projections of mean rainfall are consistent in indicating increases in annual rainfall in Kenya.
2. The models consistently project increases in the proportion of annual rainfall that falls in.
3. The increases in heavy events range from 1 to 13% in annual rainfall by the 2090s.
4. The models consistently project increases in 1- and 5-day rainfall annual maxima by the 2090s of up to 25mm in 1-day events, and 3 to 32mm in 5-day events.

4.2.3 Recent climate conditions in Turkana district

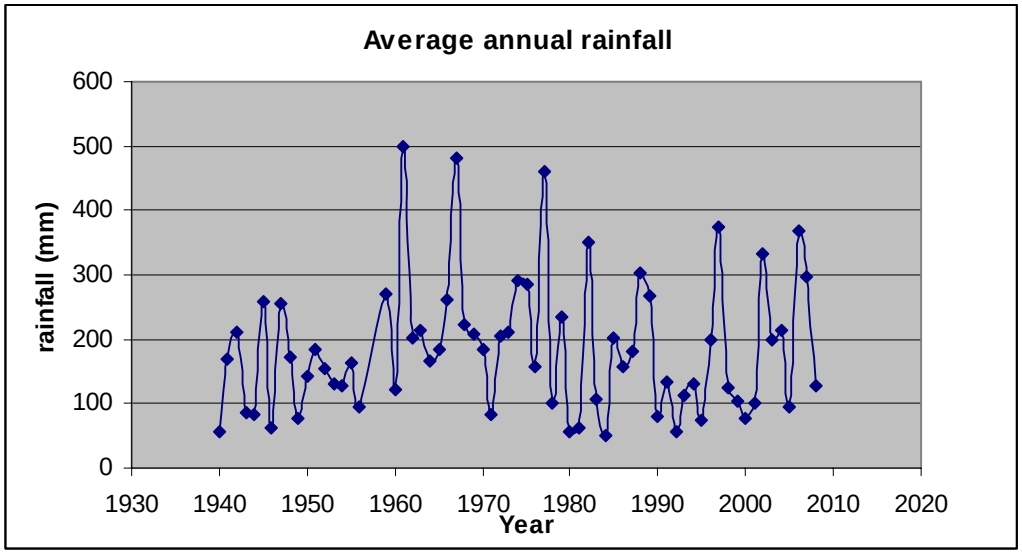
In general, the Turkana climate is arid and semi-arid with an annual rainfall in the range of 80 mm – 200mm. There are two rainy seasons (March-May & October-November to mid December). Rains are erratic most often and torrential. Temperatures are high with an average daily range varying between 24cc – 38cc, and an 18-22cc average night temperature.

Rainfall

The researcher obtained weather data from the Kenya Department of Meteorology which was collected by the Lodwar Meteorology station, one of the oldest stations in the country. A simple analysis of this data suggests the following:

1. The rainfall in the district is unreliable. In early 1940's the annual average was low in most years. The average rainfall during this decade fell shorter than 150mm, with five years of low rain (<100mm), and only in two years the average exceeded 200mm. The highest variation between highest and lowest rainfalls within the century was about 200mm (Figure 6).
2. In the 1940's, figure (7) shows that there was a pattern between the long rainfall and short rainfall. The average rainfall during the long rainy season was increasing while the annual average short rain was decreasing. This pattern has changed since early 1950's, where both have an increasing or decreasing trend at the same time. This new trend which is almost consistent; with a slight variation during1975-1985, may help in explaining the drought conditions. This could be summarised as "whenever the long rains are low or fail, and short rains follow same trend, then that year in general is exposed to drought conditions". This is because the failure of either rainy season is not compensated for by the other one, given also the fact the length of the dray period in between (June-October). For example, from late 1960's to early 1970's the average rainfall in both rainy season was declining (figure 7), which culminated in a very severe drought in 1971-1792.
3. The quantity of rainfall in the long rainy season (March-May) is significant and would determine the rain condition of a year.
4. There is a trend; which is not statistically proved strong by looking at its frequency. Whenever there was an early good rainfall in February there was a good long rainy season (March- May). This was more frequent in 1960s' and less frequent in other decades, though this relationship remained reasonably valid in other decades. However, the early start of rain doesn't show any effect on conditions of the short rainy season.
5. In the past decades since 1940, average annual rainfall exceeded 400 mm only three times, last was in mid 1980's after a severe drought. Any other peak fell shorter than those previous levels (see Fig 8).

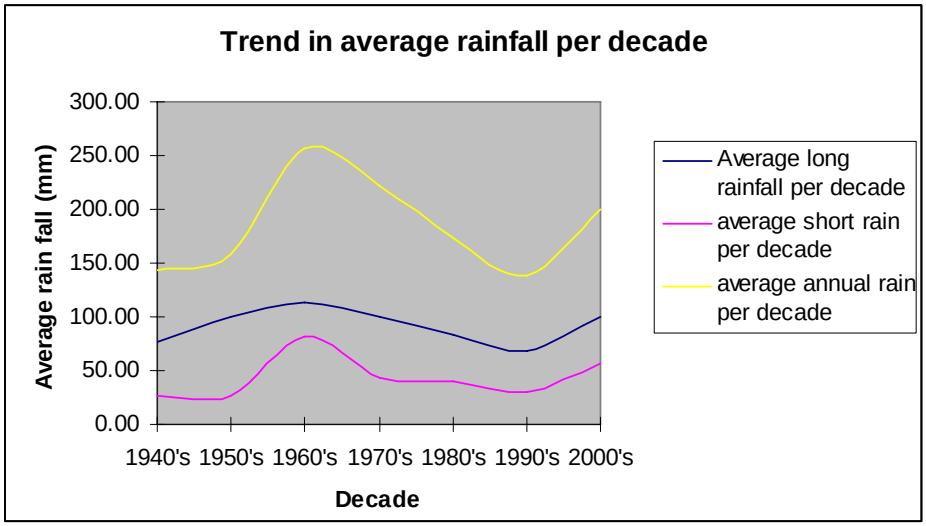
Figure (8): Average annual rainfall (1940- August 2009)



6. There was a general decline in annual average rainfall during 1960-1990. There is a gradual improvement since 1990 but not yet have reached the early 1960's level (figure 9). However, by talking to meteorologists, this slight and gradual increase in average annual rain is not a guarantee of better conditions. It is because the rainfall occurs on a fewer number of days and is spatially more erratic.

Unfortunately, it was not possible to obtain the number of rainy days per year which might not be available. The constant decline of rainfall levels in 1960-1990 could be considered as a main contributor to the degradation of the Turkana environment (degraded soil, reduced green coverage, loss of indigenous grass species and increase of unpalatable invasive species), and the rising of resource-based conflicts.

Figure (9): Trend in average rainfalls per decade (1940 to date)



Temperature

The temperature records which are available cover the period of 1960 to date. This provides a reasonable period to analyze trends that may have taken place in Turkana.

1. The figure (10) below shows that decadal average temperature level has steadily increased from 34.4 cc in the 1940's to 35.6 cc in 2009, a total increase of 1.2 cc. Temperatures in the 1980-1990's were about same level, a significant change occurred in 1960-1980, then started to increase since 2000, figures (8&9).

Figure (10): Increase in annual and seasonal temperature in the past 5 decades

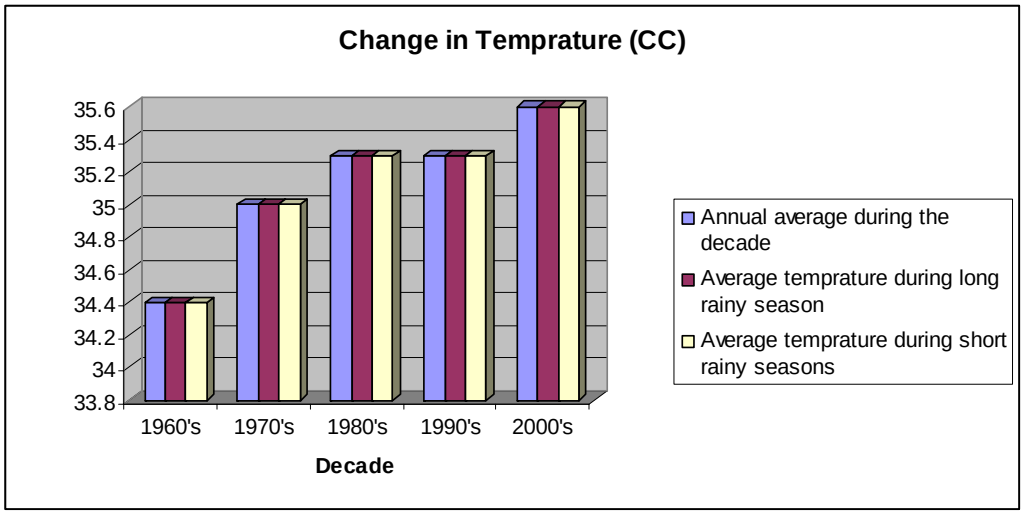
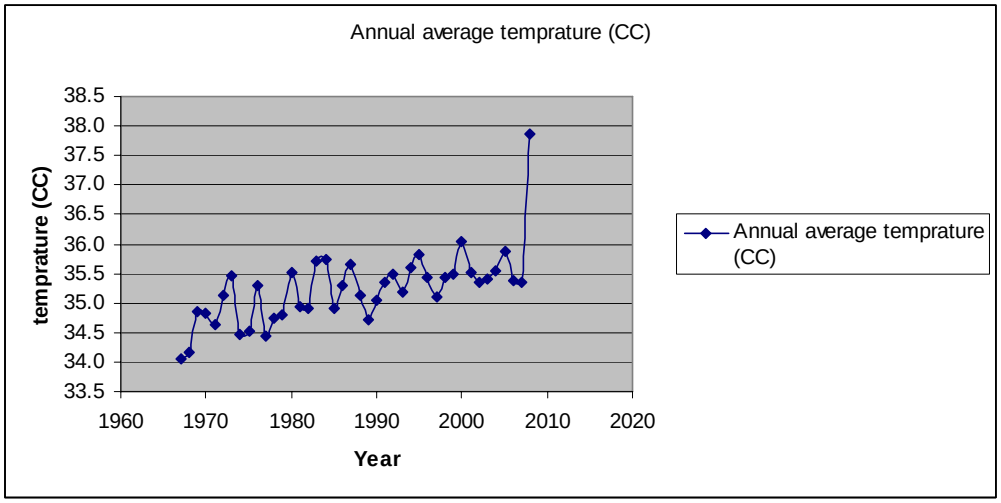


Figure (11): Annual average temperature 1960-2009



2. The temperature increased in day and night time since the 1960's, 1.2 cc and 1.5 cc respectively. See table (5) below. The biggest increase in day temperature was between 1960's-70's (about 0.6 cc), then increased by 0.3 cc between 1970's-80's where it remained at same levels till late 1990's before it started rising again. There is a trend of increasing night temperature but it doesn't follow the same rhythm as in day temperature.

Table (5): Change in day and night temperature

	1960's	**1970's**	**1980's**	**1990's**	**2000's**
Average day time	34.4	35.02	35.3	5.3	35.6
Average night time	22.6	24	23.8	24.5	24.1

4.2.4 Projections: Climate change impact for Turkana district

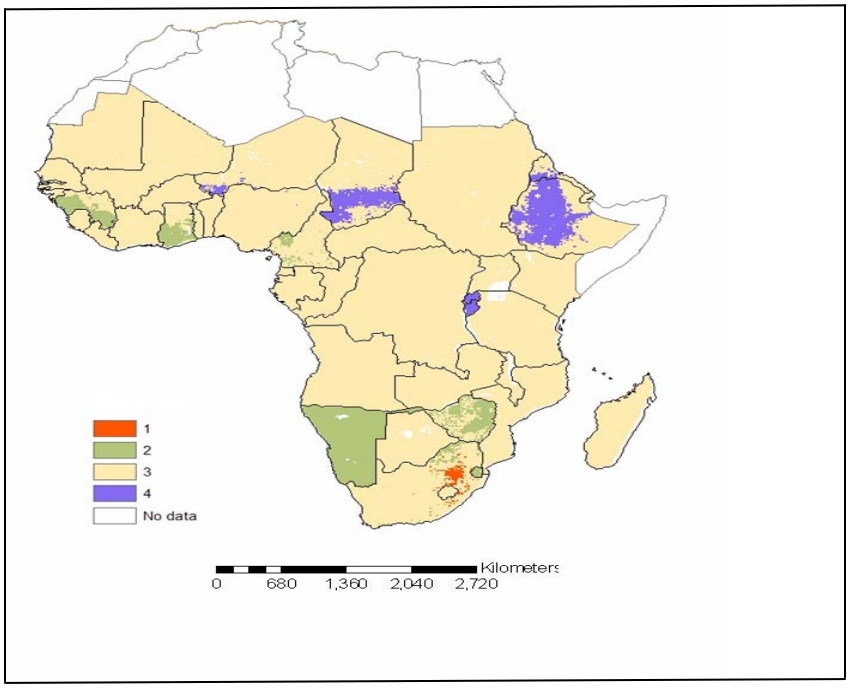
4.2.4.1 General Projections for East Africa

In general, the climate change projections for East Africa over the next 40 years indicate the following effects of climate change across the region (Thornton et al 2006).

1. Increased rainfall variability

2. Increased rainfall intensity- increased floods.
3. Successive poor rains- failure of rainy seasons and droughts.
4. Increased temperature.
5. Increased frequency and intensity of extreme events
6. Inconsistent effects of projected rainfall and temperature changes to 2050 on the length of growing period for crops and forage. In general, there will be an increased failure of crop seasons and less forage for livestock. The projected increase in temperature will offset the effect of increased rainfall and length of growing periods.
7. This would increase aridity, which is expected to preclude cropping. The map (3) below is a result of combining projections of climate change effects on crop and forage productivity with an index of socio-economic vulnerability. The quartiles represent relative significance of climate change and poverty interactions. The 4th quartile shows highest (worst) levels of interaction. Kenya including Turkana district falls into the 3rd quartile (which is the second highest level).

Map (3): Interaction between climate and vulnerability indicators



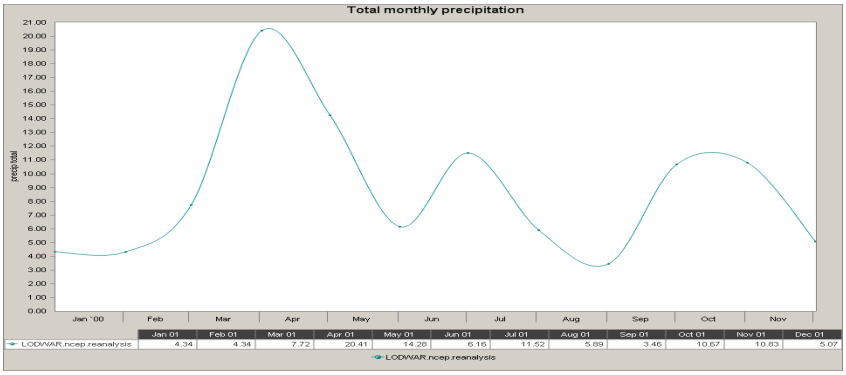
Source: Regional pastoral livelihood advocacy project (HPG, 2009)

4.2.4.2 Rainfall Projections for Turkana

By using rainfall data available from Lodwar Station (Turkana district), projections for precipitation for the period (2046-2065) indicate HPG (2009), see figure (12).

1. Possible extension of the first rainy season (March-May) and strengthening of the October-December rainy season see figure (10).
2. There will be an increase in the intensity of rain. There was no consensus on the start and end dates of rainy seasons between the models that were used for projecting the climate changes. But there was consensus on the projected increase of rain intensity except for the month of August.

Figure (12): Projected total monthly precipitation for Lodwar (Turkana)



Source: (HPG, 2009)

3. Increase in rainfall may not be large in absolute terms but when compared with the current low level of rain, it would be significant.

4.2.5 Community's perception of climate change impact

Communities and individuals can have different attitudes towards risks i.e. be passive or proactive in addressing disaster risks. It depends on their perceptions of a hazard and associated risks.

Risk perception is the subjective assessment of the probability of a specific incident to happen and how concerned we are with the consequences. Perception of risk goes beyond the individual, and it is a social and cultural construct reflecting values, symbols, history, and ideology. In general, people tend to resist being at risk from any particular hazard. Most people believe that they are in less danger than the average individual. Individuals who feel safe and those whose attitudes reflect some degree of knowledge

about the risk in question experience fewer obstacles to modify their environment than those who respond defensively (Cepis: internet based risk tutorial)[5].

Several factors influence people's risk perception. This includes the level of knowledge, believes and traditions including hazard and risk perception by the community and individuals. Traditions, norms, availability of choices and means (assets) for people to address a hazard, media, level of development and economic conditions they have. Another factor is the degree to which they think that their lives and livelihoods are threatened by a hazard based on recent and past experiences.

In order to avoid any influence on communities' response, the researcher avoided asking direct questions or using the term "climate change". Instead, whenever a participant described or hinted conditions that imply a change in weather or climate conditions, the researcher followed up with probing questions. Box (1) below summarizes the most frequent expressions made by the community, which imply their awareness and perception of climate change and its impacts. However, their expressions were not scientifically sophisticated enough to express the changes they have felt to date.

Box (1): Community's expressions about climate change impact

- "We used to know when to expect rain much better than now, some expert people before used to tell us because they knew when it might rain". (elder)
- "At specific times of the year we followed (migration) routes where we expected to have more grass due to rain in that direction". (elders)
- "I lost more than 35 goats due to (flash) flood when my son was grazing in the riverbed; we didn't water in the river to come this time because there shall not be rain this time of the year up there. It was not like this before; we knew when to avoid grazing in riverbeds". (elder)
- "It rains less and less, when it rains all falls in some days, then disappears for so many days; grass grows then dries and disappears before it rains again". (all)
- " It is becoming hot and there are no many trees as it was before" (women)
- " We always have to travel long distances now to fetch water for the house, it is risky these days and too hot to walk". (women)
- " Everything is impossible now, before we negotiated access to water and grazing area if our place was not good, we went far, sometimes it took more than 5 years to come to our place of origin. That made it possible to keep our cattle and grow it, now borders are everywhere, and too many people aim at the same source". (elder and younger men)
- "We are in June already, and the rain came once or twice only, last rain and the one before all the same. It is very little even the grass hasn't browsed…the long rainy season is not long anymore". (general response)

Continued:

- "There are new plants that are not here before, they are useless, animal don't eat them". (elders and others)
- "Everything (soil/sand) dries fast after rain, it is little rain and the sun is hot". (young men and women)
- Our men go so far and for long to graze the animals, we can't join them, it is unsafe, and we can't keep animals here to milk and feed our children, there is no grass around where we stay. This is why it is safer here, no one is interested in the place because there is no grass or water here…no one will attack us". (women)
- " There is no water in the riverbed to dig and water the animals, we go far, then we find other there with their animals, not easy we all need water, they don't like or accept us using their water. (young men)
- "Water pans and sand dams dry fast, may be it is too hot and takes long before next rain comes". (general response)
- We fear lightening, it kills and burns. It was not like this and I don't remember it happening this much" (elder)
- "The animals die of diseases, they spread and kill fast". (Young men)
- "Our cows don't produce milk as mush as before, they are hungry and thirsty, very weak most of the time". (young men and women)
- "Give us water and food, we don't have any, we cut and burn acacia trees to sell charcoal in order to survive. We are five women, takes us 4-5 day to fill this sack, walk to the town and sell in 2-3 days if lucky, it sells for 400-500 KSH (about 6 USD). One of us has to stay in town till the charcoal is soled, market is far from here. The money is not enough for food, and the animals are far with our men to milk from". (women).

Community's perception of climate change parameters, which they expressed as in Box (1) are summarized below. Table (6) summarises percentages of people who agreed whether there is an increase, decrease of no change in climatic variables. The ages of participants in the discussion range between 30 - 55 years. Feedback of elders was used to verify or confirm the groups' perceptions; the differences were minimal in most cases.

Table (6): Perception of climate change parameters by participants as they remember

Precipitation	***Characteristic***	***Increase (%)***	***Decrease (%)***	***No Change***

				(%)
	Total annual rainfall	15	75	10
	Rainfall in long rainy season	15	72	13
	Shift/uncertainty in start and end date	62	8	30
	Number of rainy days	15	60	25
	Rain intensified	55	15	30
	Rainfall in short rainy season	30	30	40
	Shift in start and end date	57	5	38
	Number of rainy days	15	55	30
	Rain intensified	43	17	40
	Length and intensity of dry season	63	7	30
Temperature	General during the year	61	7	32
	Long rainy season	63	7	30
	Short rainy season	65	5	30
	Day	55	5	40
	Night	55	10	35

4.3 Occurrence of drought

There is no official acceptable definition of drought in Kenya. Experts from the Meteorological Department describe drought as a serious failure of (or below normal)

two successive rainy seasons. Generally, the failure of the long rainy season contributes more to the drought conditions and affects all livelihood groups in different ways. Lay people from different groups of livelihoods characterize drought differently, obviously based on the water supply and demand in their environment (Ndichu, 2009). This perception is driven by the sensitivity level of their livelihood and coping strategies to aspects of rain or drought. Some emphasized the start and end dates of rains as equally important to quantity of rainfall in determining a drought condition. Duration of the rainy season and number of rainy days in a season seem to be significant to pastoralists. This is because of their dependency on natural resources for grazing and watering their animals. Traditionally, they use either hand dug or shallow wells in riverbeds, water pans, or seasonal rivers to secure water for themselves and livestock. Therefore, the longer the rain converge the better. Intense rains don't help much as community members mentioned *"water runs away quickly in the rivers and everything gets dry fast, it creates floods, takes soil away and not good for grass",* one participant said.

A recent chronology of the most famines in East Africa during the past 1700 years (Ndichu, 2007), indicated that drought and diseases as major causes. The severity of a famine was higher when both were combined at the same time. The same study observed that droughts in the region including the study area followed a pattern, they often occurred when El Niño event phased out. This pattern has been consistent for the past centuries. However, in past centuries El Nino occurred every 50-80 years, droughts then followed and lasted for as long as 5-20 years. As of the 19th century, El Nino occurred on average every 10-20 years and a drought followed for 2-3 years. For example per Ndichu; there was a severe El Nino in 1876/8 followed by a severe drought-led famine 1884/5, then both events occurred ten years later. Recently, El Niño occurs once almost every five years or less followed by a drought or a dry spell. In short, frequency of both events has increased as also was described by community elders.

Table (7) provides a chronological overview of El Nino and drought events that occurred in the past 60 years. It is constructed based on Ndichu (2009) and Oxfam (2006). Then it was used to probe further comments from the community. Comments from elders describing each event are provided against each one in the table below:

Table (7): Chronology of drought and El Nino events

Year	Type of event	Comments
1956/7	El Nino	It was a good year, there was grass and water, we didn't have to move far from our place
1959-60	Drought	There was a lot of rain but came and disappeared very quickly in a short period and the water was lost with the heat
1971/2	El Nino	It was very a good year
1973-1976	Drought	Very bad years, got hot, no water and no grass
1982	El Niño	A good year at the beginning
1983/4	Drought	Very bad years everywhere we tried to go, got hot, no water and no grass, no food
1990/1	Drought	It was bad but we could move to high areas where there was a more of rain and grass
1995/6	Drought	This was almost the same as 10 years ago very bad, no food
1997/8	El Niño	There was plenty of water and grass
1999-2000	Drought	Very bad year, it was so hard everywhere
2002/3	El Niño	It was very good
2004/6	Drought	It was so bad we lost many animals, there was no food and water
2006/7	El Niño	It hasn't improved much
2008/9	El Niño and Drought	This year El Niño is expected to have weak to moderate impact which may improve the rainfall in October-December. Based on the researcher observations, the effect is not significant in Turkana. Therefore, this will not offset the effect of the on-going drought since early 2008.

4.4 Comparison: Climate projections, recent trends and community's perception

Indications of climate change impacts are indicated by the actual steady increase in temperature levels over the decades since 1960's, the frequent dry spells, and change (uncertainty) in rain patterns. These changes are inline with the future projections of climate change impact on Kenya, and with the downsized clime change projections to Turkana. Communities; individuals of different age groups, have already felt the change and expressed it in their own words.

In general, there are four elements of climate change identified by the community, trends in meteorological data and future climate projects. This includes; (1) more frequent droughts, (2) more intense rain patterns, (3) higher temperatures, and (4) increased uncertainty in terms of the start, end dates and duration of rainy seasons. However, the occurrence of extreme climatic events except severe droughts and El Nino were not featured by the community, historical data and climate projections for the district.

These changes have added to the Turkana's uncertainties with regard to the future of their lives and livelihoods. Their traditional and well-long established coping mechanisms, which were used alternatively and rationally in order to face known climatic hazards are now questionable. Would they withstand the emerging changes!. Turkana's traditional coping strategies relied on "their mobility" and free choice to follow routes of grass and water sources. This seems to be jeopardized by several factors as will be explained later. The question is whether their existing coping mechanisms and other capacities constitute a sufficient adaptive capacity to climate change. Do they have an adaptive capacity to sustain their livelihoods and life style in the face of the climate change? The following sections will address this question.

4.5 Turkana: Community based risk assessment

4.5.1 Hazard assessment

The community participants were asked to list all factors that affect their source of their livelihoods (livestock). The difficulty was for them to differentiate between threats/hazards and their impacts. This is because of the current difficult conditions of food and water shortage. Therefore, whenever food and water shortage were

mentioned, there was a need to clarify the cause behind this condition. Similarly, there was a need to clarify the cause behind the loss or death of animals or reduced productivity, as these are symptoms of one or more causes. The discussion was lead by the participants themselves with interventions to ensure that no one dominated the others; nor was focused on immediate emergency needs. The following hazards occurred in all group discussions, with no order of significance.

1. Animal disease outbreaks
2. Shortage of water and drought
3. Outbreak of human diseases
4. Delay of rain and less rainy days
5. More hot weather
6. High temperatures
7. Increased incidents of flash flood
8. Cattle rustling and conflict
9. General insecurity and lack of safety
10. Restrictions on movement to other districts and cross international borders
11. Reduced grass and trees
12. Reduced fertility of soil
13. New invasive species

After the identification of main hazards, a debate was triggered among participants of each group in order to identify hazards that affect their livelihoods negatively. At the same time the participants discussed their significance and ranked them from the most to the least significant hazard. The researcher then categorized and grouped the identified hazards as in table (8).

Table (8): Hazard assessment

Hazard category	**Highly significant 5**	**Medium 3**	**Low 1**	**Rank 1-5**
Diseases				
Human diseases		x		4

Animal diseases	x			
Insecurity: Cattle rustling General insecurity (theft, banditry) Conflicts with other tribes & cross borders Restrictions on movement	 x x x	 x		4.5
Environmental risk Reduced soil fertility New invasive species Reduced grass and trees	 x	 x x		3.6
Climate change impact: Delay in rainy season More hot Less rainy days Less rain	 x x x	 x		4.5
Climate related hazards (within norm climate conditions) Shortage of water and Drought High temperature	 x 	 x		4

Key of vulnerability ranks: 1 = low, 3 =Medium, 5 = High

Each hazard was assigned a value based on participants' perception in each group. Each participant was given three coloured cards, red (most significant), yellow (medium) and green (low). Each participant was free to choose the colour relevant to the threat after they debated it. Each participant was allowed to raise one card per threat. The

number of cards of each colour was counted and recorded for each hazard. The hazard with most cards was the highest and given score (5), the second lowest number of cards was considered medium (3), and the threat with the least number of cards was assigned (1) low. All scores from all groups were summed up per hazard before assigning a score to a hazard based on same criteria explained earlier. The final ranking of each category is simply the result of summing scores of all hazards in each category divided by the number of hazards in same category. For example insecurity is ranked (4) and calculated as (3*5 +1*3)/4 = 18/4 = 4.5.

No significant differences were observed between men and women in the way they perceived the importance of each threat. However, men were more interested in highlighting access problems due to restrictions imposed on crossing borders and insecurity while moving within Turkana or to other districts, Uganda or South Sudan. Women perceived insecurity equally significant as men. Women's concern was about their own safety being left behind for a long time, when men moved for longer distances with the animals. They were also concerned about their safety while fetching drinking water from far places. Women also motioned that the environment guards or (rangers) who are assigned by government often harass them, especially if they get caught cutting and burning trees for charcoal.

Climate-related hazards and climate change-impact-related hazards (impact) scored high. Uncertainty about start of a rainy season and reduced number of rainy days is significant. Increased hot weather was perceived as important when it is associated with dry periods. In general, climate-change impact and insecurity appear to be equally significant, followed by diseases. By investigating this result further and based on information from key informants (elders and district official), the following reasons came out:

1. The impacts of climate change (uncertainty of start and end of rainy seasons, reduced number of rainy days, less rain) are already felt. But their importance in relation to their livelihoods become high when is combined with restrictions on their ability to adapt or use their traditional coping strategies. This is particularly due to the restriction on their movement or mobility, which is considered the core of their coping and resilience mechanisms. National borders and borders between divisions (sub-districts) increased tensions, and provided pretexts to

conflicts. It often triggered conflicts as it became harder to negotiate access to land and water in other divisions or in a neighbouring country.

2. Restrictions on movement and associated conflicts forced people to move out of their traditional migration routes in search for water and pasture. The new "safer" routes are often confined with district's boundaries, crowded and have less pasture and water. These conditions increased the potential of animal disease outbreaks and quick spread of diseases.
3. Women and young children are left behind in "safe places" which have no or little water or pasture so they don't attract others "invaders". Traditionally, small ruminants were left behind for milk. Currently, due to lack of water and pasture nothing is left, also to avoid attracting bandits. For their survival, women are forced to produce and sell charcoal or engage in some handcrafts for little income.

4.5.2 Vulnerability & capacity assessment

Vulnerability is the propensity of an element that is within the hazard boundaries to be affected or damaged due to the occurrence of a hazard. People's lives, livelihoods, and wellbeing are at risk either directly or indirectly from the destructive effects of a hazard. Their incomes and livelihoods are at risk because movement, access and utilization of their productive assets (livestock, land and water as in Turkana) are restricted. In addition, it is because of the loss of their livestock due to death and conflicts. Each type of hazard puts somehow a different set of elements at risk due to their vulnerability. Disaster reduction, including mitigation interventions are often focused on reducing vulnerability. To this end, development planners need to identify elements that are most at risk from the principal hazards, which have been identified (UNDP, 1991: p.40). In the Turkana case, elements at risk comprise people's life and wellbeing, livestock, local systems and social structures, traditional coping strategies, and environment or natural resources.

In a vulnerability assessment, various 'intangible' characteristics of a community will need to be assessed; such as social and power relationships. It is a process, which may end up more difficult compared to hazard assessment. It is because determining social vulnerability of a community is cumbersome to quantify. However, social processes that underpin and cause vulnerability (Van der Linde & Strydom 2008:7) could be measured indirectly or by using proxy variables and indicators.

The process of creating vulnerability profile for an area or a community shall address four main vulnerability aspects e.g. social, structural (physical), environmental and economic (Van der Linde & Strydom 2008:7). Box (2) below provides main elements of each aspect of vulnerability as perceived by the community participants. The same participatory steps; which were used in the hazard assessment, were used in assessing and ranking each vulnerability category. Then the output of focus group discussions was discussed with key informants including elders. The vulnerability assessment; in table (9) was conducted from disaster risk reduction point of view. The focus group discussions predicted that it would be more useful and practical to undertake the vulnerability and capacity assessment in one step. The ranking of the identified elements of vulnerability in table (9) represents the community's balance status of vulnerability. It was challenging to make participants delineate between capacity and vulnerability. Therefore, the ranking was based on their perception of how would they find their vulnerability to each hazard, given the capacities they have. This approach is based on the definition vulnerability, which is the status of inadequate capacity to deal with a hazard (Thywissen, 2006).

Table (9): Vulnerability assessment

Hazard category	**Vulnerability aspects**				**Rank**
	Social	***Economic***	***Physical (infrastructure)***	***Environmental***	
Diseases	***4*** - Weak veterinary services and outreach system - Low coverage of vaccines - Dependency on cattle - Crowdedness of livestock and migration on same routes increases chances of wider outbreak of diseases - Inconsistent and inaccurate social and demographic statistics	***5*** - Limited alternative livelihoods - Limited access to markets - Lack of cash and high level of barter trade which limits potential economic growth - Prices of pastoralists produce didn't increase to the same level of other basic commodities - Weak public and private investment in livestock support services i.e. slaughter houses	***1*** - Lack of roads (weak transport system) - Weak telecommunications	***2*** - limited grazing areas and water sources - Competition with wildlife for pasture and water Weak natural resource management	***3***

Insecurity	***5*** - Ineffective police and security protection - Weakening traditional structure and systems - Proliferation of small arms - Ineffective political representation limited at elite pastoralists - Traditional on-going tribal and ethnic conflicts - Cattle rustling to pay bride price and feudal settlement, restocking after loss of animal etc. - Organised theft of cattle for trade purposes - Low level of public investment in social services i.e. Health and education - Low level of the "belonging" towards national structures	***5*** - Poor households can't afford protecting themselves and assets - Poverty (47% considered poor)drives people to theft and cattle rustling - Establishing protected parks for tourism drove people to marginal lands and increased competition over natural resources - Ineffective policy of protecting reserves with armed guards	***1*** - Lack of roads (weak transport system) - Weak telecommunications - Insufficient and inadequate (underequipped) police posts	***4*** - Limited and reduced natural resources (water and pasture areas) - Weak natural resource management systems and policies - Unfair distribution of and access to natural resources - Weakened communal system of natural resource management	***4***
Environment degradation	***3*** - Insecurity forces people to	***3*** - Cutting trees for	***3*** - Lack of investment in	***5*** **-** Arid and sandy land	***3.5***

	over graze pasture area - Reduced traditional control on communal land - Inadequate land and environmental policies - Population growth rate and increase - Un planned settlement programs - Low level of awareness and high level of illiteracy - High rate of female headed households who depend of natural resources for livelihood (wood and charcoal) - High rate of dependency where 45% of population is less 14 years old	charcoal - Better off pasture areas are crowded - No alternative feeding for livestock and complete dependency on natural resources - Private ranches - Privatization of communal land increases concentration on reduced areas of communal land - Loss of livestock (livelihood sources) due to diseases, insecurity and drought force people to exploit natural resources	land development schemes to protect erosion and soil degradation - Lack of road networks - Weak policies and enforcement mechanisms to protect and develop aid areas - Lack of investment in range land management and water catchment areas (terracing, dams for rain water harvesting etc.) - Lack of integration of arid land development in national development plans	- Hot climate and torrential rains - Numerous seasonal unprotected rivers	
Climate related hazard (current climate norms)	***3*** - Increased number of population - High dependency rate - High level of poverty and	***5*** - Lack of integration of disaster risk management plans in development	***3*** - Lack or weak investment in disaster risk reduction structures related to	***3*** - Weak arid land and environment development plans	***4.25***

	dependency on natural resources - Lack of disaster management and disaster risk management plans and structures - Weak early warning system especially in communicating early warning messages to communities - Lack of integration of climate information in development plans and emergency response preparedness - Emergency response often late after early warning signs	processes - High dependency of livelihood and source of income on climatic conditions and parameters - Depleted productive asset base specially of the poor - Lack of insurance and protection of livelihoods	climate hazards - Weak infrastructure and roads - No integration of climate conditions in planning -	- Arid and sandy terrain - Unprotected rangeland and water resources - Weakened traditional land management mechanisms	
Climate \change-related hazards	***5*** - Climate change projections are not communicated at community level - Top-dawn approaches still the norm and marginalizing traditional knowledge and experience. - Increased population - Increased number of livestock and dependency on cattle which more susceptible to	***5*** - Lack of integration of disaster risk management plans in development processes - High dependency of livelihood and source of income on climatic conditions and parameters - Depleted productive	***3*** - Lack or weak investment in disaster risk reduction structures related to climate hazards - Weak infrastructure and roads - Weak communication systems - Lack of investment in range land and natural	***5*** - Weak arid land and environment development plans - Arid and sandy terrain - Unprotected rangeland and water resources - Weakened traditional land management	***4.5***

	climatic hazards - Weak adaptive capacity due to low education and awareness levels, weak public services (health, education, veterinary services) and infrastructure, weak assets base, and disenabling governance environment and policies. - Lack of long term development plans with integrated climate change projections	asset base specially of the poor - Lack of insurance and protection of livelihoods - Weak market linkages - No processing or manufacturing facilities of pastoral produce	resources management that integrates climate trends in planning	mechanisms	

4.5.3 Manageability assessment

Manageability of a disaster risk refers to the capabilities of the relevant authorities, structures and institutions at national, district and community levels to intervene manage disaster risks. These capabilities basically include:

1. Awareness of hazard and priority risks.
2. Laws and regulations (legal frameworks) for disaster risk management.
3. Early warning systems, prevention and mitigation measures.
4. Resources, human, financial and equipment.
5. Prediction and early warnings, communication systems.
6. Preparedness planning.
7. Response capability.
8. Public, government and NGO coordination and participation in preparedness and response.

Table (10): Manageability assessment

Manageability element	**Diseases outbreak**	**Insecurity and conflict**	**Environment degradation**	**Climate related hazards (current norm)**	**Climate change-related hazards**
Awareness of hazard and priority risks	3	5	3	3	3
Disaster risk law, regulations, framework	1	1	1	1	1
DRR measures	3	1	1	1	1
Resources	1	1	1	1	1
Early warning & communication to community	3	1	1	3	1
Preparedness planning	3	1	1	1	1

Response capacity	1	1	1	1	1
Coordination, participation b/t government and aid agencies	3	1	1	3	3
RANK	2.25	1.5	1.25	1.75	1.6

The above analysis of manageability is the result of focus group discussions. Participants were given time to identify the level of support they receive and they need to tackle in order to address hazard without significant loss of their livelihoods or stressing their coping mechanisms. Their feedback was in line with the categories identified above; the researcher's interventions in the discussion helped the participants to focus their debate and articulate areas of manageability. It was not possible to rely only on assessing each category by the participants in the focus groups. This because many of them were not aware of existing structures, policies and programs that are in place. Therefore, key informants (community leaders, local civil society groups, and experts in the area) were consulted in order to complete the process.

The following paragraphs explain the status of the existing capabilities (manageability elements) in order to justify the ranking that is shown in the table above.

The Kenya Government has drafted a disaster risk management law and framework; they have not been approved or finalized. Recent efforts with support from donors and nongovernment organizations are underway to revise these drafts. However, the existing structures that are dealing with disaster risk management include, the National Disaster Operations Centre (NDOC), operates as a committee within the Special Programs Unit of the President Office (MWH, 2006). It was established and structured based on military and security styles. Its role is limited to coordinating emergency relief operations; in case an emergency declared, while relying on relevant entities and ministries for implementation. Unless the president declares an emergency, each ministry or entity relevant to the affected sector takes the lead on the response. For example, in case of drought, the NDOC coordinates with the Ministry of Arid Lands, Kenyan Food Security Structure (KFSS) and other stakeholders. The lack of a disaster risk management

framework in the country limits the government's ability to deal with disasters at national, district and community levels. This shows the weakness in the government structures and policies to address any hazard. Therefore, government responses are organized on case-by-case basis, and rely on NGOs, Red Cross and civil society to implement and often finance response activities. Unfortunately, the national approach to date, is reactive instead of proactive, and focuses on disaster management instead of addressing disaster risks (DRR) and long-term vulnerabilities. The lack of disaster risk management framework manifests itself in several aspects:

1. The absence of integrated approach that mainstreams disaster risk management in development plans.
2. Focus on disaster response and relief instead of disaster risk measures including prevention, mitigation and addressing long-term causes of vulnerability.
3. Lack of resources (finance, human skilled resources, equipment etc.) to implement disaster risk programs.
4. Early warning systems shown significant progress thanks to donors support. However, early warning messages and information are not communicated adequately to local communities.
5. Disaster preparedness and response are often lead by aid agencies.
6. There is a general perception among government officials that pastoralism is a system that is not viable. This perception influences the allocation of public budgets for development and disaster risk reduction in arid pastoral lands. This explains the lack of infrastructure, social and economic services in Turkana.
7. Development of pastoral livelihoods and economies is not yet given the same priority as of other areas and sectors.
8. Top-down approach remains the norm, though there is a slow shift towards more community participation. Representation of pastoral communities; despite number of parliament members from pastoral background, remains ineffective.

Given the situation as described above, the challenges that come with climate change impact on pastoral communities will require more efforts to strengthen the current disaster risk management and development practices, policies and structures.

4.5.4 Disaster risk calculation

The values assigned to risks in table (11) are determined by using the risk formula described earlier. The only change is that one net (balance) value is assigned to vulnerability/capacity to represent the balance as previously explained. Therefore, risk values of all hazard categories were calculated by using the formula:

R = (H x V)/M; where M refers to manageability, H to hazard and V is the net capacity/vulnerability status.

Table (11): Calculation of disaster risks

Hazard	***Diseases outbreak***	***Insecurity and conflict***	***Environment degradation***	***Climate related hazards (current norm)***	***Climate change-related hazards***
Risk value	5.3	12	10	9.7	12.7

The risk values show that climate change impact (related hazards) is considered the highest, followed by insecurity and conflict (including restriction on mobility). The risk assessment of the various hazards indicates the following:

1. There is interconnectedness between the different hazards as they influence each other due to causes that underpin each of them. The current vulnerability, capacities and policies that are currently used to address droughts, security and environment risks may determine the degree of capacity adaptation to future risks associated with climate change. There is a cause-effect between the identified risks, which makes a comprehensive disaster management approach most appropriate to address these hazards and their risks.
2. The current and future risks are rooted in long-term underdevelopment issues, vulnerabilities and governance at various levels.
3. Addressing these risks is beyond the capacity of the affected communities and will require long term commitments.

Based on this understanding of the identified risks, the last section of this report will provide suggestions required to build up the adaptive capacity and reduce risks associated with climate change.

4.5.5 Vulnerability progression of Turkana

The Pressure and Release (PAR) (Wisner et al., 2004) is used in this section to describe the progression of Turkana vulnerability, which was assessed earlier in this chapter. It will describe the transformation of unsafe conditions of Turkana into disaster conditions given the progression of their vulnerabilities that interface with the identified hazards.

The model is based on the concept of intersection of two opposing forces. On the one side, there are processes that are generating and underpinning vulnerability. On the other side is the physical exposure to hazards. Both sides are described as if they create pressures from opposite directions on people over time. People face an increasing pressure (risk) due to their potential or current exposure to a hazard, which if mediated with progressing levels of vulnerability that stems from several levels; those people will face a disaster. In the case of induced pressures on either side of the PAR Mode, the risk of a potential disaster increases. The PAR model also incorporates the “release” or reverse of the pressure from both sides by undertaking disaster risk measures. These measures shall reduce or reverse vulnerability conditions, prevent the happening of a hazard and mitigating its impact (Wisner *et al*. 2004).

Wisner *et al*. (2004) defined three vulnerability levels; each is caused by a set of causes that start with indirect and uncontrolled factors by ordinary people. Then it transformed to unsafe conditions which mediate with directly the hazards. An intermediate level of causes (dynamic processes) transfers vulnerability created by root causes closer to people, and puts them into unsafe living conditions; which expose them to a disaster as a hazard occurs. The three layers of vulnerability as identified in the model are not static, and they are interlinked by a cause-effect relationship. The model describes the three progressive levels of vulnerability as below (Wisner *et al.,* 2004:51):

1. Root causes

2. Dynamic pressures

3. Unsafe conditions

The model helps in understanding the interaction be between vulnerability as progressed through the three levels with a set of various hazards. These hazards are deemed significant for a particular geographical area or community within a defined period. The following PAR model is constructed based on the outputs of the risk assessment (Figure 13). This model explains the progression of vulnerability in Turkana. It will help in analyzing the status of vulnerability that would hinder the adaptive capacity of this community to the already occurring climate change impact and increased level of risks.

Figure 13: Progression of Vulnerability in Turkana

Root causes	Dynamic causes	Unsafe conditions		Hazards
Limited access to:	***Lack of:***	**Physical environment:**		Diseases outbreak
Power – Ineffective presentation at various levels of government including parliament	Investments in education, health, diversification of livelihoods, markets and processing livestock produce.	People live in fragile, degraded and drought prone areas.		Insecurity and conflicts
Development – least developed region in the country in terms of infrastructure, public and social services	Access to information including early warning Lack of credit and insurance system tailored to pastoralists' needs	Poor transport and communications systems **Local economy:**	Food insecurity	Environment degradation
Climate change impact information at local level	Engagement of Turkana in high level national interests and focus Turkana identity	Dependency on livestock Low level income	Loss of livelihoods	Current climate hazards (floods, droughts)
Ideologies:	***Macro-forces:*** Population increase	High level of barter trade and low level of cash transactions Low level of livelihoods diversification		Climate change impact associated hazards (higher temperatures, uncertainty end/start
Government perception of pastoralism as backward and	Increased livestock numbers Dependency on cattle Insecurity, rustling, conflict with other	**Social relations:** Weak local governance,		

unsustainable livelihood system High level of corruption at high levels of government Low integration in national structures and policies Unsuccessful decentralization process, created new divisions and boundaries within North Kenya enforced conflicts over resources	ethnicities in Kenya and neighbouring countries Decline in vegetation cover and soil productivity due to recurrent droughts & environment degradation Poverty increases deforestation, charcoal burning, cutting trees for survival Weakened communal land system, increase private ranches Limited options and infrastructure for livestock exports Global fuel and food prices Change in climate patterns Unsecured national boundaries and proliferation of small arms.	administration and security institutions Weakened traditional social and communal land tenure system Women lack ownership of productive assets (livestock) **Public actions:** Weak of disaster risk management policies and framework Focus in relief interventions instead on long-term solutions		of rainy seasons, change in duration of rainy seasons, change in intensity of rain)

4.6 Access model: Implications of vulnerability progression on sustainable livelihoods in Turkana in light of climate change impacts

The PAR model is useful in identifying and classifying the socioeconomic and political processes that lead to vulnerability progressing. It doesn't provide enough analysis on how the unsafe conditions get transferred into a disaster, how it impacts people and elements at risk, and how do they cope and recover. Therefore, the Access Model is developed to help understanding the complex socioeconomic and environmental long-term processes that take place and may be associated with and influence a specific event (disaster) (Wisner, 2004: p 88). In other words, it explains at micro level the vulnerability elements and impact of a disaster as it unfolds on households and members of a household. The model helps to understand people's coping and recovery mechanisms, and the role of other actors who are involved in a disaster. To this end, the Access Model requires a good understanding of conditions, structures and processes prior to and after a disaster. This helps in understanding its causes, impacts and guiding development of response strategies and long-term disaster risk reduction measures.

The Access Model describes the socioeconomic and environmental processes from political economy point of view. It puts these processes in two categories. First category is "social relations" which comprise the flow of goods, money, and surplus of economic produce between different actors. For example, the flow of livestock product between pastoralists and meat traders and consumers in the rest of the country, how fair and equal this flow, and how it translates in improving access of pastoralists to basic services and cash. Other dimension of access is at household level, which shall explain access of various household members to revenues and services generated by selling livestock and livestock products. This clarifies discrepancies between levels of access to services, livelihoods and food requirements by men, women and children at community and household level. The second category is "structures of domination". This category includes relations between members of households, which shape and shaped by existing norms, traditions, obligations, expectations from each household member. These structures of dominations also may extend to the wider family, ethnic group and the state levels. For example, the government's perception of pastoralism system in Turkana as a food insecure and backward system influences development policies directed to this community. It may create a feeling of alienation at the community's part,

as whether they are part of the national structure. The model helps in explaining the marginalization of women within a Turkana household and their higher exposure, vulnerability and level of disaster risk including climate change impacts. For example, women increasingly face insecurity, food shortage and malnutrition as they have no access or control over livestock. Turkana women, children and the elderly who are often not able to migrate with the men and the cattle to better grazing areas due to insecurity and lack of safety, are likely to be most affected. For example, women do not own livestock but they can use livestock produce such as milk to feed themselves and their children. Better off grazing areas where men migrate with cattle are highly insecure due to competition over water and pasture resources. Therefore, women, children and elderly are left behind in a harsh environment, which lacks water and grass. Consequently, they are left without any animals to milk and feed themselves. They often staying behind in marginal environments surviving by producing and selling charcoal at low prices. The fact that they can't own livestock means that they have no access to cash, and basic services including health and education. This makes them more vulnerable and limits their adaptive capacity to climate change equally to any other hazards.

Figure (14) below is an attempt to construct an Access model to Turkana while taking climate change impact in account. In this basic Access Model for Turkana shown in figure (14), box (10) presents the normal life of Turkana people. Different households are subject to sets of social relations and structures of dominations. They either limit or increase their safety and protection as well as their right to access, and ability to utilize available resources such as water and grazing areas. Within each household (HH), there are also social relations and structures that affects access, safety, choices of each individual. Gender, age and physical wellbeing affect ability of a household member to access and use the HHs resources, or benefit from public social services if they exist.

Turkana people are known for their strong sense of pride and belonging to the Turkana community. They provide assistance and protection to their Turkana members. In Normal days, HHs own various numbers and mix of livestock, it determines their wealth and social status in the community. The larger the size of the herd and the more cattle the better. Land system is organized in a way that allows a level of access to community members to pasture and water. A community also could buy access from other community if the conditions of their pasture area are not good. Therefore, a community

and its members have an access profile, which influences their income opportunities, development of their livelihood sources, and food insecurity.

The ability of HHs to utilize their livelihoods to obtain income and access to social services is dependent on existing social dominations and relations. It includes relations with other ethnic groups in Kenya, neighbouring countries, and with local administrations, and central government. For example, high dependence on livestock and natural and climatic conditions, makes a Turkana pastoral HH always in a state of mobility to secure these resources. Given the depleted natural resources and unfavourable policies, households have to trade off and make difficult choices. These choices are about whether they remain in the pastoral system, drop out, or diversify their source of income and livelihood. Other choice is to engage in cattle rustling and conflicts to secure a livelihood. The outcome of these choices and decisions determines the amount of disposal income that is available to (spend, invest or save; and the livelihood processes). It also determines level of access to food, schools, shelter, and health care (livelihood outcomes). By repeating this cycle, a HH or an individual will come into a new access profile i.e. some purchase more livestock to increase their herd which might improve their social and economic status, others drop out and seek other livelihoods, and many become dependant on external assistance i.e. food aid.

As climate change impact continues to occur, it will be expected to affect people's access to livelihoods (box 5&6 in figure 11). Current decisions and choices made in previous "normal time", social relations, and dominating structures will play a role in how the Turkana cope and adapt to climate change impact. It will vary based on the conditions prevailed in normal times, and that also affects how people cope, adapt to the emerging climate change. This is shown in (box 7) where households make their choices and decisions based on their rights to use their properties i.e. sell part of their livestock prior to the peak of the drought, and while the prices are still reasonable, take loans from relatives, move to another area with the livestock, and look for other source of income (charcoal burning). If these decisions do not pay off then due to severity of climate change impact, weak adaptive capacity, HHs and individuals start to take harder measures that would reduce their well being, diminish their source of livelihood, degrade natural resources, increase dependency on external aid, abandon pastoralism and engage in conflicts. The direction of arrows in box 7 shows improvement, deterioration or unchanged status in HHs' access profile or qualification to access resources. For

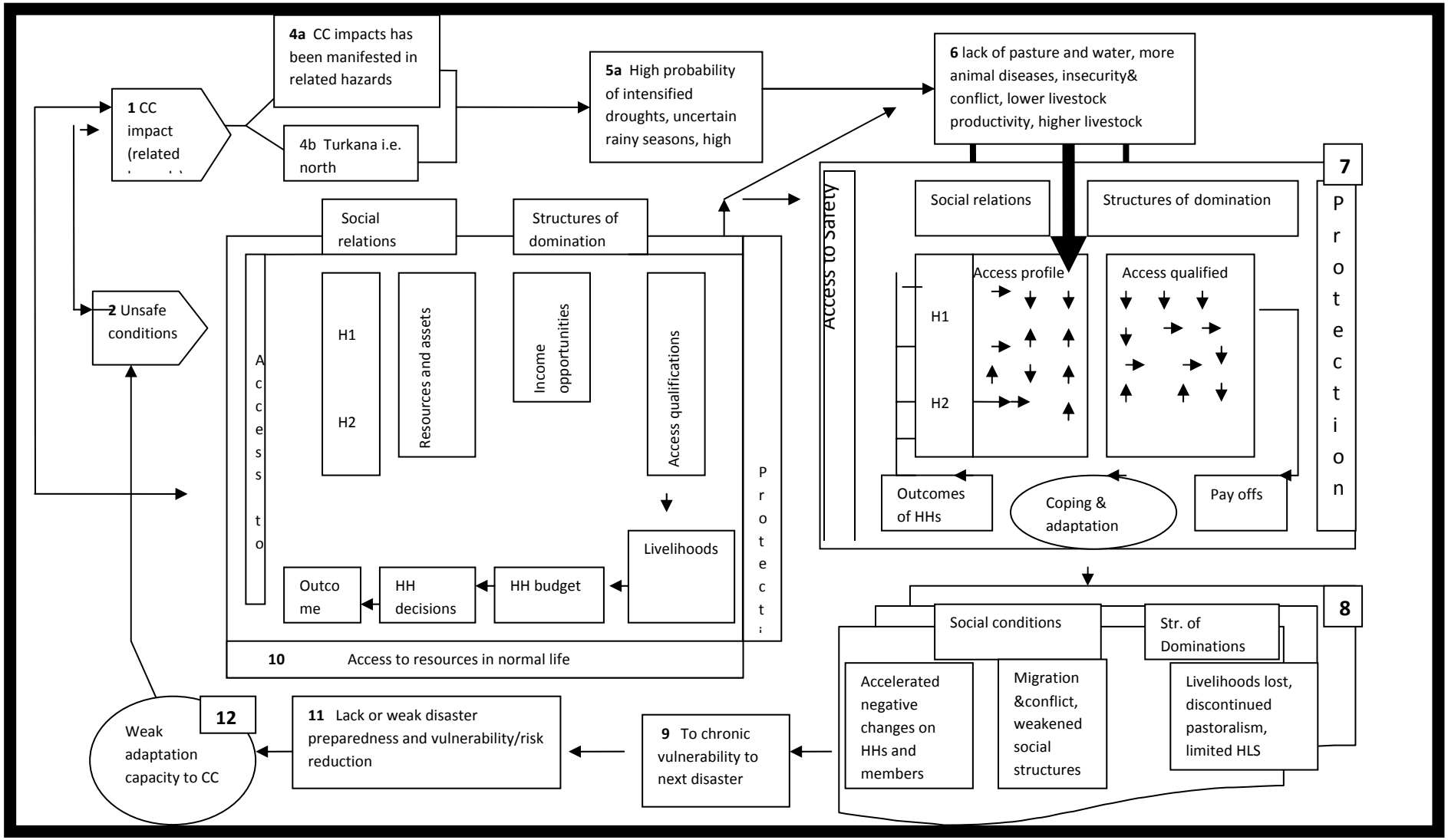
example, traders of grain and livestock may benefit during the stress period as barter trade favours grain in terms of livestock. HHs and individuals' access profiles and qualifications could also be affected by government policies that may restrain their movement within the region due to security problems, limit public investment in infrastructure, social services, and skew market opportunities.

Box (8) shows how conditions would become after a climate-change affected people and their livelihoods. The decisions that were taken by them during the disaster and the way they coped will result in:

1. Movement to a new place (migration).
2. Depletion of their assets, livelihoods and coping mechanisms. It may negatively change their access profile and qualification within the new settings. Consequently, social relations and dominating structures may alter as well.
3. Depletion of natural resources and environment degradation, which will increase conflict, marginalization and poverty.

This will result in worse vulnerability conditions as in box (9) and more exposure to new hazards as climate change intensifies. It will continue to deteriorate unless proper disaster risk reduction and disaster preparedness are undertaken in a systematic and comprehensive way to build people's resilience and adaptive capacities. This requires government commitment, support from aid agencies and active participation of communities. If these measures are undertaken, the conditions may get stabilized and adapted to the new realities. Otherwise, it will create more unsafe conditions, severe disasters, and deepened poverty.

Figure 14: Access Model in light of climate change impacts in Turkana



4.7 Turkana's adaptive capacity to climate change-induced hazards

A community's vulnerability to climate change is similarly influenced by a complex combination of social, economic, political, and environmental factors that are operating at various levels. The previous sections described this complexity by applying PAR and Access Models on Turkana contexts. It was explained that vulnerability is not evenly distributed across the Turkana community or at a household level. People are likely to be disproportionately affected by hazards including those driven by climate change. This highlights the need and importance of understanding the multiple levels of vulnerability that would limit the adaptive capacity of Turkana community as a whole, and the various vulnerable groups in the community.

The relationship between adaptive capacity, sensitivity, exposure and vulnerability was described earlier as ((Deressa, 2008) :

Vulnerability = Adaptive capacity – (sensitivity + exposure)

In this equation, it is possible to explain vulnerability to climate change as the net effect of sensitivity and exposure on adaptive capacity of the Turkana. Therefore, the higher the net value of adaptive capacity the less vulnerable the Turkana to climate change associated risks. In other words, the more sensitive the system and exposed to the climate change impact, the more vulnerable it is, unless its adaptive capacity is strengthened.

The matrix below (Figure 15) is constructed by using CARE's CVCA framework based on outputs of the PAR and Access models. Exposure and sensitivity of the Turkana's livelihood to impact of climate change were discussed in previous section. This framework encompasses a wide array of activities that are necessary to support adaptation process. Practically, this can't be carried out without prioritization, and building up on existing capacities and resources.

Figure 15: Turkana Adaptation Framework

	Climate-Resilient Livelihoods	Disaster Risk Reduction	Local Capacity Development	Addressing Underlying Causes of Vulnerability
National Level	- GoK supports livelihood protection and diversification measures in its response to recurrent and future climate related disasters. - Disseminate CC information related to livelihoods - Climate change projections are integrated into relevant sectoral policies especially natural resources management, people's movement and land tenure - CC impacts integrated into poverty reduction and development policies with focus on especial vulnerabilities and needs of pastoralists and their livelihoods.	- Develop and approve national framework for disaster risk management that considers CC impacts. - Invest in planning and implementing disaster risk management that considers CC projects for Turkana and their impact on livestock - Build government and community-based capacity to respond to disasters induced by CC - Establish national funding mechanisms and access global funding mechanisms dedicated to CC adaptation, and allocate to Turkana and pastoral communities	- Build capacities to monitor, analyze and disseminate to HHs information on current and future climate risks - Integrate climate change into district and community level policies and plans - Specific and targeted resources are allocated for implementation of adaptation-related policies and interventions. - Support local initiatives and integrate it in national budgets and plans. - Accelerate development process and improve provision and access to social and economic basic services and infrastructures	- Government recognizes the value of pastoralism in national economy, national social and political structures. - Recognize the sensitivity of Turkana to CC impacts starting from current vulnerabilities. - Address and reduce specific long-term vulnerability of marginalized groups to climate change - Develop and enforce effective security measures in Turkana - Negotiate safe access and cross border grazing with neighbouring governments - Draw/adopt lessons on adaptation from other countries in the world and the region
Local Government/ Community Level	- Access to climate information projected to local level - Communicate information in local languages in a simple way - Develop and undertake plans that support climate-resilient livelihoods such as diversification, access and mobility, security,	- Local institutions are part of the national disaster risk management framework. - Develop and integrate DRR measures in local development and relief interventions - Have regular access to information about risks.	- Recognize, analyze and disseminate information on current and future climate risks - Local institutions have capacity and access to resources required to implement adaptation activities - Have the ability to promote	- Engage active community participation in risk assessments and planning processes of DRR, adaptation and development activities - Promote rights of marginalized and vulnerable groups such as women and children to equal

	vocational skills, infrastructure, provision of social services, marketing. - Long term commitment to promote adaptation strategies to climate risks - Improve land tenure systems and natural resource management by building on traditional and local systems	- Develop capabilities to assess climate related risks within a larger risk management plan - Develop and implement early warning system that reaches communities - Strengthen local disaster response capacities	community-based adaptation processes	access to resources, livelihoods, protection, and basic social services - Strengthen traditional systems of conflict resolution, land tenure, natural resource management.
Household/ Individual Level	- Individual households and members of households are aware of CC impacts on their livelihoods and environment - People have access to climate information for planning their private economic activities and inform their decisions - Households are able to choose a mix of climate-resilient livelihood practices - Households have diversified livelihoods rather than livestock - Households are more engaged in cash economy	- Households have protection to their livestock at their place of origin and migration routs. - Key assets are protected and supported for recovery - People have access to early warnings for climate hazards - People have free choice of mobility without triggering conflict in the event of climate hazards	- Social and economic safety nets are available to households - Community based insurance system for livestock and key assets of households - People have knowledge and skills to employ deliberate adaptation strategies by building up on their resilience factors and coping mechanisms - People have access to seasonal forecasts and other climate information - Households have access to adequate education, health, drinking water, basic food/nutrition requirements, - Functional and safe roads and communication systems	- Support women's ownership and control of livestock and other assets. - Households have control over critical livelihoods resources - Women and other marginalized groups have equal access to information, vocational skills training and market services - Vulnerable household members are protected from conflict

4.7 Summary

It appears from the previous sections that climate change impact is a reality that would affect people's lives in many ways and to various degrees. The risks associated with climate change impact are expected to be significant on those who rely on natural resources for livelihood and survival. In the case of Kenya and Turkana district in particular, there is a consensus in the results of the analysis of historical meteorological data, climate projections and community's perception that climate change impact is taking place.

The climate change impact will have a serious impact on the development process of the Turkana community, sustainability of their traditional livelihoods, coping strategies and way of life. Climate change imapct is not a stand alone risk, it is combined with other non-climatic risks such as traditional conflicts, and policy- induced risks. The impact of all these risks will be higher when they were combined.

The analysis confrmed that vulnerability of the Turkana to these risks is caused by similar or the same causes. It is also predicted that the current vulnerabilities and poverty conditions will influence or hinder the Turkana adaptive capacity required to address impacts of climate change. The adaptive capacity and vulnerability to climate change have several aspect levels. It ranges from individuals to central government levels. Therefore, an integrated approach that addresses all these levels will be needed to support the adapataion process in Turkana. This shall include socioeconomic development that aims at reducing vulnerabilities and strengthening sustanability of livelihoods, and effective disaster risk reduction.

Turkana community has established a set of strategies that worked over the past centuries but they got stretched due to various internal and external factors. Supporting an adaptation policy shall consider the traditional strategies and build on them, while simultaneously addressing the external factors. The next chapter, will provide priority recomendations that aim at supporting the adaptive capacity of the Turkana and reducing their vulnerability to climate change impact.

Chapter 5

Summary of findings and recommendations

5.1 Introduction

This study was carried out in the mid of the food security crisis that has been affecting more than 20 million people (IRIN, Sept 2009) in East Africa. In October 2009 the Government of Kenya released a humanitarian appeal to assist about 9.6 million people with food aid, most of them are pastoralists. Turkana district and community is one of the districts in the country that is hit badly by the crisis. Food insecurity is the manifestation of various problems combined and underlying causes that have lead to this status. Climate change impact is claimed to have contributed to the progressing of the food insecurity and depletion of pastoral assets and livelihoods.

A desk review of several recent studies on pastoralism was carried out in order to appreciate the socioeconomic contribution of livestock to the national, local and household economy. It also depicted the vulnerability and sensitivity of livestock as a main livelihood to the Turkana to climate variables and changes.

In the previous chapters of this study, the researchers investigated, by using a community-based approach, the main factors that are affecting pastoralists' livelihood sources, traditional coping mechanisms, vulnerability and adaptation capacity. The researcher analyzed available meteorological data that covers the past 50 -60 years to identify trends in climatic variables. The analysis was compared with community's perception on climate change impacts as they feel it. Lastly, projections of climate change impacts on Turkana were compared with the previous findings. This has proved that there is an agreement that climate change is happening and impacting the Turkana community and their livelihoods. However, climate change impact is not the only factor that is threatening the Turkana's livelihoods. The study identified several elements at various levels that are determining the current vulnerability of the Turkana to climate stressors and variability under the current climate norms. The same factors when are combined will determine the adaptation capacity of the Turkana to climate change impact, which eventually affect their main livelihood (livestock) and life style. These elements fall into various categories; governance which influences the development

process and vulnerability of the Turkana, disaster risk management, and community's livelihood resilience.

The following sections aim at providing a set of priority interventions and policy recommendations at various levels that would strengthen the adaptive capacity of the Turkana community. It will also review the methodological process that was undertaken in carrying out this study, and suggest a further investigation or a process to monitor the status of the adaptive capacity of the Turkana.

5.2 Summary of findings

5.2.1 Trends in climate conditions

The review of recent meteorological data shows that there is an increase in annual temperature by 1.0°C since 1960 in Kenya, an average rate of 0.21°C per decade. There is also an increase in the frequency of hot days and hot nights. There is no statistical evidence that there is a significant trend in the amount of annual rainfall. However, change is observed in the start, end, number of rainy days, and duration of rainy season.

In Turkana district, the data analysis shows that there is a total increase in temperature by 1.2 CC since 1940's to date. The annual average of rainfall was decreased during the 1960- 1990 with some exceptions. Since the 1990's, there is an increase in the total rainfall but not yet to the levels of rainfall in 1960's. The decline in average annual precipitation for about three decades has probably contributed to the degradation of natural resources; on which pastoralist rely heavily for their livelihoods. However, this factor shall be considered in combination with other factors that proved to be important in determining the resilience of pastoral livelihoods.

It is also important to note that Turkana district receives low rainfall (max 400 mm/year), so any a slight increase is significant. The increase of temperature and the degradation of land would offset this improvement in rainfall. There was no statistical data to assess change in number of rainy days per year, but according to community observations; especially the elders, the number of rainy days declined and the rain patterns changed. This uncertainty around rain variables has disturbed the use of traditional coping mechanisms that constitute the core of pastoralist's resilience capacity.

5.2.2 Climate change projections

For the purpose of this study, climate change downscaled projections for Turkana were obtained and reviewed. The projections predict that the first rainy season might be extended and the short rainy season might be strengthened in the coming 40-60 years. However, there is no certainty about start, end dates and duration of rainy seasons. Rainfall is expected to intensify, which my make us conclude that the number of rainy days will be reduced. Such a condition would deteriorate further the pastoral livelihoods. This is because it will not help in improving pasture areas or recharging underground water. Given also that temperature is expected to continue rising, the little improvement in rainfall combined with uncertainty of rain time patterns will not be beneficial.

5.2.3 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.

The community identified climatic changes and trends that are inline with those identified by analyzing climatic data for the past 50-60 years in Turkana. This includes the uncertainty about the rainy timing and duration of rainy seasons, increasing temperatures, intensifying rains on a reduced number of days. There was a consensus between men, women, young and old generation about these changes. However, the community may not be able to figure the reasons behind such changes neither they could refer it to global warming and other processes.

Women, children and elderly are the most affected with the consequences of climatic hazards (in normal climate norms) and by climate change. The reduced entitlement to basic needs including food requirement is a manifestation of this impact. The impact of climate changes combined with other socioeconomic factors makes these segments of the population more vulnerable to climate change impacts and other types or disaster risks.

The community does not consider climate change impact as the most significant hazard, but they perceived it as of the highest risk. The community-based disaster assessment indicated that the community perceived disaster risks related to climate change impact higher than other risks compared to current risks (within current climate conditions), insecurity and land environmental degradation. The reason behind this perception may be explained as follows:

1. The community perception of current drought is significant because of the stress they have been facing in sustaining their livestock and food security. At the same time, they know that if they don't pass this current drought with minimum losses they will not be able to sustain a potential delay in rainfall or failure due to the increasing uncertainty in rain patterns. The community refers this uncertainty to changes in climate norms. This proves that current coping strategies and capacities are crucial for ensuring their adaptive capacities. The community finds that their current socioeconomic status including the conditions of their livestock, security (ability to move) and ability to make up their own choices freely are the pillars for their adaptation to climate change. The more vulnerable they are for current climatic hazards and insecurity, and the more they loose livestock, the more unlikely they will be able to adapt to climate change impacts.
2. Current vulnerabilities to climatic and non-climatic hazards are likely to deteriorate if they are not addressed now at all levels. This means they will be more vulnerable to climate change impacts. The community has little confidence that this will happen, which makes them suspicious or pessimistic about building their adaptive capacity to address climate change related hazards.
3. The community is aware of the interconnectedness between the various hazards and risks. As they are also aware of the current limitations that they have, this will disable their adaptation process to climate change impact.

5.3 Interaction of non-climate factors with climate change in Turkana

The study identified several non-climate factors that interact with climate change impacts. The combination of these factors with climate change impact would create significant common to pastoralist's livelihoods, socioeconomic development, and disaster risk management. Moreover, both types of factors influence each other and may increase disaster risks in Turkana. The non-climate factors also contribute to the

vulnerability conditions that increase risks of climate change and its impact, because they hinder community's adaptive capacity and adaptation process. These factors include among others:

1. Environment degradation caused by increased number of human and livestock populations. This creates more pressures on existing natural resources and depletes them at a higher pace, which would accelerates and worsen the impacts of climate change, and jeopardize the adaptation capacity.
2. Land tenure and use systems; privatization vs. communal land management system. Increasingly, land privatization is taking place for various reasons. This limits pastoral mobility and concentrates them in marginal areas, which will contribute to further environmental degradation and increased vulnerability to climate and non-climate risks. It also creates conflicts between pastoralist and new owners of the land.
3. Low level of cash transactions in local economy. Turkana use barter trade to obtain food and non-food items such as grain and sugar in exchange to their animals (mainly goats). This slows down or hinders the economic development in the districts and its engagement in economic transactions with the entire country. In addition, it limits options for income and livelihood diversification.
4. Insecurity, conflicts and cattle rustling. There are various traditional and no-traditional reasons for the prevailing insecurity conditions. Recurrent droughts, environment degradation, population growth, limited natural resources (water and pasture), development of new artificial boundaries between administrative divisions (sub-districts), ethnic traditional rivalry, hazy security procedures on international borders, ineffective disarmament policies and procedures, crime and proliferation of small arms. The insecurity conditions lead to confining pastoralists to change their migration routes, split families, concentrate in smaller marginal areas with less water and pasture resources. In short, it limits their mobility and access to natural resources, which limits their coping strategies to cope with climate hazards.
5. Poverty and poor access to social services. The poverty prevalence rate is high as indicated in a recently launched report by the University of Nairobi on the status of pastoralists in Kenya. This poverty is coupled with poor infrastructure and nearly absence of basic social services such as health and education.

6. Traditions and customs that influences vulnerability of specific groups such as women and children, and expose them to climate and no-climate hazards.

5.4 Determining factors of adaptation in Turkana

The discussion above and the community-based risk assessment in Turkana helped identifying a set of key elements that would shape the adaptation process to climate change impacts. The status of socioeconomic development, local and national vulnerabilities, type and resilience of livelihoods, governance and policies, ethnic divisions are significant among the determining factors. Each factor of those may need to be unpacked to several variables in order to understand the specific issues that underpin the adaptation process in Turkana. The following table (12) summarizes these factors and beaks them down into important variables.

Table 12: Determining factors of adaptation in Turkana

Main factors (categories)	**Specific variables or elements**
Socio economic development	- Access to social services (health care, education, vocational training) and fulfilment of basic needs - Gender equity in terms of access and property ownership and control - Wealth distribution - Community cohesion and structures - Integration in national development and poverty reduction plans - Availability of a functioning social safety net - Flexible credit, financing and insurance tailored to the pastoralists' needs - Access to markets and marketing facilities
Current vulnerabilities and disaster risk management	- Acknowledgment of current vulnerabilities and addressing them in socioeconomic plans and activities - Focus on the most vulnerable groups and the poor - The use of existing indigenous capacities, knowledge and skills - Long term commitment to address vulnerabilities - Mix of long-term and short-term interventions in addressing vulnerabilities and needs - Community participation in decision making and planning of adaptation activities
Livelihoods sources and resilience	- Level of dependency on livestock and level of diversification of sources of income - Availability of a functioning livelihood protection measures i.e. revaccination - Availability of livelihood choices and options - Sensitivity of livelihoods to specific hazards including climate

	change impacts - Willingness to change or adapt to new realities and economic options
Governance and policies	- Acknowledgement of the economic and social importance of pastoral system - Develop and implement disaster risk management framework that includes pastoral areas - Allocated funding and other resources to DRR measures - Engage communities in planning and implementation DRR measures and infrastructure - Integrated approach that incorporates DRR and climate change in development and relief activities - Allocation of adequate public budgets for marginal areas and those at climate change risks. - Shift from humanitarian (short- term) to long term solutions - Engagement in global climate change initiatives and benefit from arising funding and technological opportunities - Arrangement for legal cross border movement of pastoralists and livestock
Ethnic divisions/conflicts	- Effectiveness and efficiency of government security policies ad procedures - Land tenure problems - Effectiveness of conflict resolution policies and practices - Control of small arms - Security over international borders - Disarmament processes in Kenya, Uganda and South Sudan - Access arrangements in relation to districts borders - Community based solutions

5.5 Way forward – Recommendations and concluding remarks

The analysis of the various related aspects and determining factors of the Turkana community adaptation to climate change impacts shall inform relevant policies and practices. The following are priority recommendations that stakeholders including households, community, government, aid agencies and donors shall consider to strengthen the adaptive capacity and adaptation process in Turkana. These recommendations rotate around four major issues namely: (1) governance, (2) socioeconomic development, (3) development of local economic initiatives, (4) disaster risk management. Several priority actions are detailed below:

1. **Governance**
   1.1. Acknowledge local and communal land tenure and natural resource systems. New policies shall take in consideration the advantages of the presence and acceptance of such systems.
   1.2. Policies shall promote equity between various ethnic groups, marginalized and vulnerable segments of the population. This includes those groups who lost access to natural resources due to conflicts, women, children and elderly people.
   1.3. Effective and accountable representation of local community at local and central levels of the governance system.
   1.4. Allocation of public revenues and budgets equitable to the economic contributions of pastoralists to the national economy.
   1.5. Policies that would strengthen the integration of Turkana community in the national entity.
   1.6. Promote regional cooperation and initiatives to address pastoralists' issues relevant to adaptation strategies.

2. **Socioeconomic development and provision of social services**
   2.1. Develop and improve access of local communities to basic social services with focus on education (all levels including vocational training), and basic health care.
   2.2. Focus on development of infrastructure especially roads.
   2.3. Establish functioning social and economic safety net programs to assist pastoralist who choose or forced to drop out of the pastoral system
   2.4. Incorporate development plans of Turkana district equally in national plans.
   2.5. Socioeconomic development plans and activities incorporate deliberately disaster risk management interventions that would address climate and non-climate risks and mainstream climate change adaptation.
   2.6. Vulnerability at all levels shall be addressed in long-term development programs.

3. **Local economic initiatives**
   3.1. Conduct a comprehensive assessment of economic opportunities in the district.

3.2. Establish credit, financing and insurance schemes to support local (individual and community) economic initiatives that would enhance diversifying livelihood and income sources. Focus shall be given to women and youth.
3.3. Develop and support projects to exploit available economic resources such as the Gum Arabic and Aloe Vera.
3.4. Develop processing or manufacturing livestock products in order to create job opportunities and access to local and external markets.
3.5. Support local markets and linkages to national and external markets.

4. Disaster risk management

4.1. Finalize and approve the development of the disaster risk management framework and relevant policies and laws.
4.2. Incorporate and mainstream climate change impacts in regular multi-hazard and risk assessments.
4.3. Draw lessons from adaptation initiatives that were implemented in the region and pilot new initiative.
4.4. Make use of available knowledge, technology and support that is available at global and regional levels.
4.5. Access to global funding made available from different sources for climate change adaptation.
4.6. Pilot carbon sequestration at community level in order to generate income that would support adaptation processes.
4.7. Address frequent small and localised emergencies as they deplete livelihood and community coping strategies and livelihood assets.
4.8. Engage with community in disaster risk management and implementation of activities that mainstream adaptation to climate change.
4.9. Improve monitoring, information management and early warning systems which benefit all stakeholders including communities.

5.6 Recommendations for follow up research

This study provides and investigated the general climate change impacts in the Turkana community. To this end, the researcher analyzed historical meteorological data, collected information from community members to identify their perception of climate change and conducted a disaster risk assessment. This has led to identifying priority

policies and actions that are necessary to support community-based adaptation process to climate change impact. The current analysis would provide the basics to establish a baseline of various variables that are deemed necessary for an adaptation process in Turkana. In order to monitor changes in the status (vulnerability and adaptive capacity) and progress towards a successful adaptation process, there is a need to develop and apply an adaptation index. Such an index shall be contextualized, based on input from the community, as they have to identify indicators and variables that are most relevant to their adaptation process and contexts. The suggested index shall be applied periodically in participation with local communities, relevant policy makers and specialists. This will allow monitoring changes, undertaking timely corrective actions and informing relevant policies.

The index shall be based on the basic formula that describes the relationship between vulnerability to climate change, adaptation capacity, livelihood sensitivity, and exposure. The index shall also focus on adaptation that aims at fostering the sustainability of pastoral livelihoods.

BIBLIOGRAPHY

ActionAid. International emergency team. 2007. Participatory vulnarability analysis:a step by step guide for field staff. London

Adams W. M. 2001. Farmer adaptation, change and 'crisis' in the Sahel.

Adger N., Katharine V. 2004. Uncertainty in adaptive capacity
Tyndall Centre for Climate Change Research, School of Environmental Sciences, University of East Anglia, Norwich, UK

Asian development bank (ADPC). 2004. Community-based disaster risk management: filed practioners' handbook. Thailand (available at www.adpc.net)

Brocklesby Mary et al. 2009. Raising voice saving a livelihood. Institute of development studies. UK

Brooks, Nick. 2003. Vulnarability, risk and adaptation: aconceptual framework. Tyndall Center for Climate Change Research, University of of East Anglia. Norway. Retrieved from a CD-Rom distributed by UNISDR in 2006: "On better terms: A glance at key climate change and disaster risk reduction concepts".

Cannon, T. (2000). Vulnerability Analysis in Disasters. In D. Parker, (ed.) Floods. pp. 43-55. London: Routledge.

Cannon, T., Rowell, J. & Twigg, J. s.a. Social Vulnerability, Sustainable Livelihoods and Disasters. Report to Conflict and Humanitarian Assistance Department. Cape Town: University of Cape Town.

CARE International. 2004. Livelihood approach and unifying framework. CD Rom: personal copy

CARE International. 2009. CVCA handbook. At http://www.careclimatechange.org/cvca/care_cvcahandbook.pdf (retrieved on 20 June 2009)

Christensen, J.H. et al. 2007. Regional Climate Projections, the Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge: Cambridge University Press

Coburn, A. W., et al. 1994. Vulnerability and risk assessment ; 2nd edition. Cambridge UK. Cambridge Architectural research limitted

Daystar University. Communications unit. 2007. Unreached People of Kenya Project, Turkana Report. Nairobi, Kenya.

Deressa Teesgen, Rashid Hassan, and Ringler Claudia. 2008. Measuring Ethiopian Farmers' vulnarability to climate change across regional states. IFPRI discussion paper no. 00806. Addis. IFPRI Addiss Ababa Office. The peper was obtained by email ifpri-addisababa@cgiar.org

DFID. Global and local environment team, policy division. 2004. Adaptation to climate change:makung development disaster proof. London

DFID. Conflicts and humanitarian Affairs Department. 2005a. Disaster risk reduction: a development concern. London

DFID. Global and local environment team, policy division. 2005b. Disaster managemnt and climate variability. London

DFID. 1997. White paper on international development: eleminating poverty: a challenge for the 21st century. DFID. London, UK. Available at http://www.dfid.gov.uk/pubs/files/whitepaper1997.pdf (accessed on 10 September 2009)

DFID. Overview of DFID's sustainable livelihoods (SL) approach: http://www.livelihoods.org/info/guidance_sheets_pdfs/section1.pdf (visited on 15 Nov. 2009)

FAO. 2006. Real time evaluation report- Kenya drought. Nairobi. FAO Regional office.

Gbetibouo G. A.. 2009. Understanding Farmers' Perceptions and Adaptations to Climate Change and Variability: The Case of the Limpopo Basin, South Africa. IFPRI Discussion Paper 00849. Washington DC. IFPRI

Government of Kenya. Ministry of Arid Land and natural Resources. 2007. National policy for the development of arid and semi arid lands of Kenya. Nairobi

Hesse, C. and J. MacGregor. 2006. Pastoralism: dry-lands' invisible asset. Issue paper No. 142.IIED

IIRR & Cordaid. 2007. Building resilient communities: a training manual on disaster risk reduction. (Available at IIRR website www.IIRR.org and on a CD ROM)

IFRC. 2009 Climate Change Adaptation Strategies for Local Impact: Key Messages for UNFCCC Negotiators. Available at http://www.proventionconsortium.org/ (Visited on 11 Oct. 2009)

IRIN NEWS. 2009. Security in Mobility: Climate change imapct- Turkana pastoralist. Available at http://www.irinnews.org/Report.aspx?ReportId=85252 (visited on 15 July 2009)

IRIN NEWS. 2009. Kenya: Plea to donors over El Nino. Available at http://ww.irinnews.org/Report.aspx?ReportId=86187 (visited on 20 Sept 2009)

IPCC Fourth Assessment Report, working group II, Glossary of terms: at http://195.70.10.65/pdf/glossary/ar4-wg2.pdf (retrieved on 25 July 2009)

Intergovernmental Panel on Climate Change. 2001. Glossary of terms used by Working Group II: Impacts, Adaptation, and Vulnerability in the Third Assessment Report in 2001 Available on ISDR distributed CD ROM 2006: On better Terms- a glance at key climate change and disaster risk reduction concepts

IUCN. 2003. Livelihoods and climate change. At http://iucn.org (visited on 15 Sept. 2009)

J. Ndikumana. 2000. Effects of the 1995–97 drought and the 1997–98 El Niño rains and the responses of pastoralists and livestock. ILRI (International Livestock Research Institute. Kenya

Kasperson, R. 2001. Research and Assessment Systems for Sustainability. The George Perkins Marsh Institute, Clark University

Katharina Thywissen. 2006. Components of risk; a comparative glossary. UNU-EHS. Available at http://www.unisdr.org/eng/library/Literature/9985.pdf (visited on 10 Nov. 2009)

Kebebew, Fassil et al. 2001. Traditional coping strategies of the Afar and Borana pastoralists in response to drought. Report # 17. Nairobi. Dry Lands Coordination Group

Lind Jeremy. 2004. Changing customary land use in Turkana. Available at http://www.worldlakes.org/uploads/turkana.htm (retrieved on 15 June 2009)

Parry Martin et al. 1998. Climate impact and adaptation assessment. London. EarthScan publications

McCaston, 2002. CARE's Underlying cuases of poverty unifying framework. Available on CD Rom at CARE's office

Mortimore, M. J. et al, 2001. Farmer adaptation, change and crisis in the Sahel. Global environment change-human and policy dimensions 11: 49-57

Mortimore, M.J., and W.M. Adams. 2001. Farmer adaptation, change and 'crisis' in the Sahel.

MWH. Linking climate change adaptation and disaster risk management for sustainable poverty reduction. 2006. MWH report available at http://www.preventionweb.net/files/8724_envccvargadaptationen1.pdf (10 November 2009)

Nessef M., et al. 2009. Pastoralism and climate change: Enabling adaptive capacity. London. HPG/ODI

Nori M. & Davis J. 2008. Managing and mitigation climate change through pastoralism. Retrieved from http://iucn.org/about/union/commissions/ceesp_publications/pm/index.cfm (25 August 2009)

O'Brien Karen et al. 2004. What is in a word? Conflicting interpretations of vulnerability in climte change research. Center for international climate and environmental research.

OCHA Regional office for ECA. Emergency preparedness unit. 2009. Report on the high level meeting on the Horn of Africa. Available at http://ochaonline.un.org/rocea. (20 September 2009)

Orandi V., et al.2007. Pastoral livelihood adaptation to drought and institutional interventions in Kenya. Human development report 2007/8. UNDP. Nairobi

Oslo. retrieved from http://www.cicero.uio.no (24 August 2009)

Oxfam. 2008. Survival of the fitest: pastoralism and climate change in East Africa. Oxfam Publications. Oxford

OXFAM. 2006. Household Economy Assessment of North East Turkana. Oxfam regional office for EA Africa. Nairobi

ProVention Consortium. Tools for mainstreaming DRR: Guidance Note # 9: http://www.proventionconsortium.org/themes/default/pdfs/tools_for_mainstreaming_GN9.pdf

Sharma A., 2007. Assessing, predicting and managing current and future climate variability and extreme events, and implications for sustainable development: Background paper UNFCCC workshop (Cairo) on climate related risks and extreme events under the Nairobi work program on impacts, vulnerability and adaptation.

Sphere Project. 2004. At sphereproject.org (visisted on 11 Noember 2009)

Spering F. et all. 2005. Disater risk management in a changing climate. Informal discussion paper prepared for World International Conference on disaster reduction. Vulnerability and adaptation resource group of World Bank. Washington, D.C.

Stockholm Environmental institute. 2007. Identifying climate change vulnerability exposure, preliminary guidance from ACCCA teams. NAPA projects of UNITAR. Available at http://www.unitar.org/ccp/napa (visisted on 15 Sept. 2009)

Sustainable livelihoods glossary: http://www.livelihoods.org/info/guidance_sheets_pdfs/sect8glo.pdf (visited on 15 Nov. 2009)

Tearrfund. Global disaster response team. 2005. Mainstreaming disaster risk reduction within institutions donors: performance targets and indicators. London

The International Livestock Research Institute (ILRI). 2006. Mapping climate vulnerability and poverty in Africa: a paper for DFID. ILRI. Nairobi

Toulmin, Camillia. 2009. Climate change in Africa. UK. Zed Books ltd

Twigg, John. 2007. Characteristics of a Disaster-resilient Community - A Guidance Note: Disaster Risk Reduction Interagency Coordination Group of DFID. Retrieved from

http://www.benfieldhrc.org/disaster_studies/projects/communitydrrindicators/community_drr_indicators_index.htm (visited on 20 August 2009)

Van Aalst Maarten K., et al. 2008. Community level adaptation to climate change: the potential role of participatory community risk assessment. The Hague, Netherlands. Red

Cross/Red Crescent climate centre. The document was obtained directly from the author (mvanaalst@redcross.nl)

Van der Linde, T. & Strydom, M. 2008. Conducting Risk Identification and Assessment to Recognize Potential Hazards and Vulnerable Conditions. (Proceedings of the 2008 Conference of Disaster Risk Management in the Public Sector held at the Wanderers Club, in February 2008).

Vincent Katherine. 2004. Creating an index of social vulnerability to climate change for Africa: working paper no 56. UK. Tyndall center for climate change research, University of East Anglia Tyndall Centre for Climate Change Research and School of Environmental Sciences University of East Anglia. (The study was obtained via email: katharine.vincent@uea.ac.uk)

UNDP. Reducing disaster risk: adevelopment challenge. 2004. Visited website available at http://www/undp.org/bcpr/desired/rdr.htm (15 October 2009)

UNDP. Fighting climate change: human solidarity in divided world. 2008. Human development report 2007/2008. New York. UNDP

UNHABITAT. 2008. State of the World's cities. UNHABITAT Office. Nairobi

UNITED Nations Framework Convention on Climate Change, UNFCCC website visited on 20 June 2009 at http://unfccc.int/resources/docs/convkp/conveng.pdf

UNISDR. 2002. Living with risk- a global review of disaster risk initiatives. Annex 1: terminology: Basic terms of disaster risk reduction. UN. Geneva.

UNISDR. 2005. Hyigo Framework for Action 2005-2015: Building resilience of nations and communities to disasters. Part B, paragraph 4(i). Retrieved from http://www.UNISDR.org.eng/hfa/hfa.htm (visited on 22 June 2009)

UNISDR. 2008. Briefing note 01: Climate change and disaster risk reduction. Geneva

UNISDR regional office for Africa. 2009 (a). Status report on disaster risk reduction in Sub-Saharan Africa. UNISDR. Nairobi, Kenya

UNISDR. 2009b. Global assessment report on Disaster risk reduction: Risk and poverty in a changing climate. UNISDR, Geneva

UNISDR. 2009c. Terminoligy on disaster risk reduction. Retrieved from http://www.unisdr.org/eng/terminology/terminology-2009-eng.html (visistd on 19 Sept. 2009)

UNFCCC Article 1, definitions: visited at: http://unfccc.int/essential_background/convention/background/items/1349.php (visisted on 15 July 2009)

World Bank and UNISDR. 2008. Report on status of disaster risk reduction in Sub-Sahara Africa Region. UNISDR Africa Regional Office. Nairobi

Yamin F. et all. 2005. Vulnerability, adaptation and climate disasters:a conceptual overview. IDS Bullettin Vo 36 no 4: 1-14. UK. IDS, University of Sussex

Annex 1: Map of Kenya- Turkana District

Note:The field visits did not include Kapenunia and Kitale

Annex (2): Generic community-based Adaptation Framework

	Climate-Resilient Livelihoods	Disaster Risk Reduction	Local Capacity Development	Addressing Underlying Causes of Vulnerability
National Level	- Government is monitoring, analyzing and disseminating current and future climate information related to livelihoods - Climate change is integrated into relevant sectoral policies - Climate change is integrated into poverty reduction strategy and/or other development policies	- Government is monitoring, analyzing and disseminating disaster risk information - Government is engaged in planning and implementing disaster risk management (including prevention, preparedness, response and recovery) - Government has capacity to respond to disasters	- Government has capacity to monitor, analyze and disseminate information on current and future climate risks - Government has mandate to integrate climate change into policies - National policies are rolled out at regional and local levels - Resources are allocated for implementation of adaptation-related policies	- Government recognizes specific vulnerability of women and other marginalized groups to climate change - Policy and implementation is focused on reducing these vulnerabilities - Civil society is involved in planning and implementation of adaptation activities
Local Government/ Community Level	- Local institutions (gov't and non-gov't) have access to climate information - Local plans or policies support climate-resilient livelihoods - Local government and NGO extension workers understand climate risks and are promoting adaptation strategies	- Local institutions have access to disaster risk information - Local disaster risk management plans being implemented - Functional early warning systems in place - Local government has capacity to respond to disasters	- Local institutions have capacity to monitor, analyze and disseminate information on current and future climate risks - Local institutions have capacity and resources to plan and implement adaptation activities	- Local planning processes are participatory - Women and other marginalized groups have a voice in local planning processes - Local policies provide access to and control over critical livelihoods resources for all
Household/ Individual Level	- People are generating and using climate information for planning - Households are employing climate-resilient agricultural practices - Households have diversified livelihoods, including non-	- Households have protected reserves of food and agricultural inputs - Households have secure shelter - Key assets are protected - People have access to early warnings for climate hazards	- Social and economic safety nets are available to households - Financial services are available to households - People have knowledge and skills to employ adaptation strategies - People have access to seasonal	- Men and women are working together to address challenges - Households have control over critical livelihoods resources - Women and other marginalized groups have equal access to information, skills and services

	agricultural strategies - People are managing risk by planning for and investing in the future	- People have mobility to escape danger in the event of climate hazards	forecasts and other climate information	- Women and other marginalized groups have equal rights and access to critical livelihoods resources

Annex 3: Questionnaires

Focus Group Discussion (10-15 men and women from the community <40 years old)

Instructions:

In order to capture men's and women's perspectives some groups will be organised separately by gender. But it is necessary to induce a debate within both sexes in order to find out the line of agreement between them on same issues, therefore, mixed groups will be organised as well.

In order not to influence the answers and the discussion, climate change and weather variability shall not be mentioned and find out if it comes out and where they rank it. If climate change impact is mentioned, the questions below will be tailored to address it accordingly.

1. What are the main challenges to your livelihood(s) that you have faced during the past 0-10 years
   (rank them)

2. What are the main challenges to your livelihood (S) that you have faced during the past 10-20 years
   (rank them)

3. What has changed in the characteristics of the main challenges (- & +)
4. Why does the change happen and how
5. Which information is available to you about the change and the challenge (source, frequency and dissemination)
6. How does the change/s affected aspects of your life and livelihoods
7. Who has been affected more by the challenges among the community; i.e. Men, women, elderly, children, poor, rich.
8. What have you/they have been doing to face the changing-challenges (what resources-social, economic, infrastructure, knowledge, skills and external aid etc) in the past 0-10 years and 10-20 years
9. What have you changed in your live/livelihoods/source of income/practices/habits in order to face the challenges
10. Do you like and are you able to maintain these change you undertook
11. What are the constraints that are limiting your ability to face the emerging and changing challenges (ranks them) in the short and long run

Individual informant interviews (Men and women members of community > 40 years old –preferable 60+ years old)

Instructions: *As above. The objective of this exercise is to draw a time line as a result of the discussion and in comparison with outputs from interviewing the younger group. It will help in identifying major changes in climate and its impact over a longer time period as perceived by the elderly group.*

1. What are the main challenges to your livelihood (S) that you have faced during the past 0-10 years (rank them).
2. What were the main challenges to your livelihood(S) that you and community faced when you were about age of 20 years (rank them)
3. What is the main challenges to your ;livelihood(S) that occurred since then (in time order)
4. What has changed in the characteristics of the main challenges (- & +)
5. Why do you think the change happen and how
6. Which information is available to you about the change and the challenge (source, frequency and dissemination)
7. How does the change/s affected aspects of your/community life and livelihoods
8. Who has been affected more by the challenges and changes among the community
9. What have you/they have been doing now to face the changing-challenges (what resources-social, economic, external aid etc)
10. What would you have done differently if this occurred when you were young, and why
11. What have you changed in your live/livelihoods/source of income/practices/habits in order to face the challenges…when has the change started
12. Do you like and able to maintain these change you undertook
13. What are the constraints have limited your ability to face the challenges and changes (ranks them) in the short and long run

Individual informant interviews (Community leaders and community activists-men and women regardless of age)

1. What are the main sources of income and types of livelihoods in the community? Are they different livelihoods for men, women, youth and old people.
2. How do you classify people in terms of wealth (poor-rich); is this different between men and women
3. What are the threats that face people in the area?
4. Which hazards are more significant in terms of impacting people life and livelihoods
5. Which of the climate related hazards are most significant and why?

6. Who is affected most among the community by the impact of the climate-related hazards, why and how?
7. Is there any change in the characteristics of these climate related hazards; explain with examples?
8. What information is made available to community (when, how and how frequent)?
9. How does the change in these hazards impact people?
10. What do the individuals; households and community in general have (economic, social, infrastructure, knowledge and skills) to address these changes in the hazard characteristics and impact (short term (coping) and long term (adaptation).
11. Are changes that people undertake sufficient and effective to sustain their adaptation to the change in weather patterns and in climate-related hazards and their impact?
12. What is affecting people's ability to undertake and sustain the change they opted to (adaptation)?
13. Is there any risk reduction or disaster management plan for the region/community?
14. If yes, do community members know about it and engage in implementing it…give examples.
15. What is the government doing to assist people to strengthen and facilitate community adaptation process
16. What are the most three important interventions to be done by government (national and local levels), community, households and aid agencies