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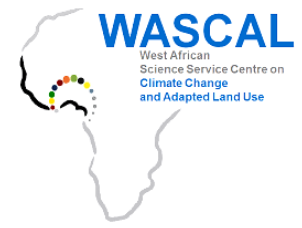
**West Africa Science Service Centre on
Climate Change and Adapted Land**

FACULTY OF ART AND HUMANITIES
DEPARTMENT OF GEOGRAPHY

MASTER RESEARCH PROGRAM CLIMATE CHANGE AND HUMAN SECURITY

ASSESSING THE EFFECTS OF CLIMATE VARIABILITY AND CHANGE ON HUMAN MOBILITY AND CONFLICTS IN THE DISTRICT OF LOGA, NIGER REPUBLIC

Thesis N°…………….
Thesis submitted in partial fulfilment of the requirements for the award of Masters Research Degree

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DEDICATION

To:

"Almighty God for his Love, Grace and Mercies bestowed upon me throughout my entire life".

My lovely mother, my brothers and sisters and finally my pastor, Toyin Olorunnisola for their support: financial spiritual, physical, may God almighty bless you all.

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ACRONYMS

AU: African Union

ECOWAS: Economic Community of West African States

FAO: Food and Agricultural Organization

GCCA: Global Climate Change Alliance

GIS: Global System Information

IOM: International Organization for Migration

IPCC: Inter-Governmental Panel on Climate Change

IISD: International Institute for Sustainable Development

NASA: National Aeronautics and Space Administration

NDVI: Normalized Difference Vegetation Index

NAPA National Action Plan for Adaptation

UNFCCC: United Nations Framework Convention on Climate Change

UNDP: United Nations Development Programme

UNEP: United Nations Environment Programme

UNISDR: United Nations International Strategy for Disaster Reduction

WASCAL: West African Science Service Centre on Climate Change and Adapted Land Use

WFP: World Food Programme

WMO: World Meteorological Organization

NCESD: National Council of Environment for a Sustainable Development

ABSTRACT

Climate change and migration are among the most pressing issues facing the international community and its impact could be different from one place to another. To assess the effects of climate change and land degradation on migration and conflicts, it is reasonable to consider a region that is subject both, to changing environmental conditions and human migration. This study aimed at examining the relationship between climate-induced migration and conflicts in Southwestern Niger. This study assessed the perception of population on climate-induced migrations and conflicts; analyzed gradual environmental changes on migration channel and conflicts; and identified coping strategies use to lessen the impact of environmental changes on migration and conflicts. The study used primary data (Focus group discussions, individual and expert interview to capture respectively information) and secondary data (temperature and rainfall from 1980 to 2016 and satellite images). They were subjected to statistical analysis using SPSS, Excel, ArcGIS and R. In addition, problem tree techniques and systematic analysis was used. The result reveals that climatic and environmental changes indeed have effects on human mobility however the correlation is not significant which is showing the interlinkages or the interaction between migration's drivers. The perception of the communities on climate-induced migration is positive. Based on the findings most of them know that climate has effects on migration, but the findings show that conflicts in this particular zone are not directly related to Climatic conditions but pastureland reduction may lead to eventual social tension in the future. Furthermore, adaptation and coping strategies is a greater challenge in the study area. Based on the main activity(agriculture) in the area, the study suggests a diversification of activities with the promotion of activities other than agriculture. Facilitate to women access to natural resources, knowledge and credit. The outcome of this study is to help decisions makers on the real issue which should be tackle in this specific area in order to protect Homan security and promote sustainable development.

Key Words: Niger, climate change, land degradation, migration, environmental change, conflicts, sustainable development, human security.

RESUME

Le changement climatique et la migration sont parmi les problèmes les plus urgents auxquels la communauté internationale est confrontée et son impact pourrait être différent d'un endroit à un autre. Pour évaluer les effets du changement climatique et de la dégradation des terres sur les migrations et les conflits, il est raisonnable de considérer une région soumise à la fois à des conditions environnementales changeantes et à des migrations humaines. Cette étude visait à examiner la relation entre la migration induite par le climat et les conflits dans le Sud-ouest du Niger. Cette étude a évalué la perception de la population sur les migrations et les conflits induits par le climat ; analysé les changements environnementaux graduels sur les flux migratoires et les conflits ; et stratégies d'adaptation identifiées utilisées pour atténuer l'impact des changements environnementaux sur les migrations et les conflits. L'étude a utilisé des données primaires (Focus group, entretiens individuels et experts pour capturer respectivement des informations) et des données secondaires (température et précipitations de 1980 à 2016 et images satellites). Ils ont été soumis à une analyse statistique en utilisant SPSS, Excel, Arc GIS et R. De plus, des techniques d'arbre à problèmes et une analyse systématique ont été utilisées. Le résultat révèle que les changements climatiques et environnementaux ont effectivement des effets sur la mobilité humaine, mais la corrélation n'est pas significative, ce qui montre les liens ou l'interaction entre les facteurs de la migration. La perception des communautés sur la migration induite par le climat est positive. Sur la base des résultats, la plupart d'entre eux savent que le climat a des effets sur la migration, mais les résultats montrent que les conflits dans cette zone particulière ne sont pas directement liés aux conditions climatiques mais que la réduction des pâturages peut entraîner des tensions sociales futures. De plus, les stratégies d'adaptation représentent un plus grand défi dans la zone d'étude. Sur la base de l'activité principale (agriculture) dans la zone, l'étude suggère une diversification des activités avec la promotion d'activités autres que l'agriculture. Faciliter l'accès des femmes aux ressources naturelles, au savoir et au crédit. Le résultat de cette étude est d'aider les décideurs sur le vrai problème qui devrait être abordé dans ce domaine spécifique afin de protéger la sécurité humaine et promouvoir le développement durable.

Mots-clés : Niger, changement climatique, dégradation de terres, Migration, Changement environnemental, développement durable, sécurité humaine.

CHAPTER ONE

INTRODUCTION

1.1.Problem Statement

A number of high-profile individuals and policy reports have spurred alarmist claims that environmental changes in general and climate change in particular will have enormous impacts on humanity. In 1990, the Intergovernmental Panel on Climate Change (IPCC) noted that the greatest single impact of climate change could be on human migration—with millions of people displaced by shoreline erosion, coastal flooding and agricultural disruption. Since then, various analysts have tried to put numbers on future flows of climate migrants sometimes called "climate refugees" (IOM publication on "Migration and Climate Change," 2008). Along the same lines, Thomas Homer-Dixon (www.nytimes.com) – perhaps the most widely-publicized scholar in the area of environmental conflict – argues that "climate change will help produce [...] insurgencies, genocide, guerrilla attacks, gang warfare, and global terrorism." The relationship between climate change, migration and conflict remains controversial because it is highly complex and heavily dependent on a country's socio-economic, institutional, and political characteristics. Many developing countries are relatively dependent on agriculture and their political institutions often have limited ability to cope with economic or climate-related shocks. As far as the direct link between climate change and migration is concerned, Barrios *et al*. (2006) find that rain shortages increase internal migration from rural to urban areas in Sub-Saharan countries.

Marchiori *et al*. (2011) report that temperature and rainfall anomalies affect both internal and international migrations in sub-Saharan countries. They also predict that weather anomalies will produce an annual displacement of 11.8 million people by the end of the 21st century. However, Beine and Parsons (2014) find no statistical significant effect of climate-related factors such as extreme weather events, deviations and anomalies from the long-run averages, on bilateral international migration. Climate variability and change create the risk of serious negative impacts on environmental and human systems, including extreme events such as drought, heat waves, floods, storms, and wildfires and slower onset impacts such as changing rainfall patterns, sea-level rise, increased salinization, decreased soil fertility, and others. These events could lead to population displacement as migrants relocate due to the damage or loss of land and property. However, there is disagreement surrounding the specific ways in which climate change will impact migration and how

significant climate change can be a determining factor in the decision to migrate. One last element that might have curbed the study of links between environment and migration is that several researchers have rejected the very concept of environmental refugees (Black, 2001). Rightly highlighting the shaky empirical character and sloppy nature of most works on the subject, they have brought to the fore problems arising from a unidirectional link between environmental changes and migrations in the face of well-established results from research on population flows. It is now established that the Sahel is experiencing climatic variability and unpredictability in semi-arid zones, particularly with monsoon climatic conditions, particularly in Niger, on a time scale ranging from season to decades as suggested by Miko (2008) and quoted by Gamatié (2011).

In Niger, the period 1960-2010 shows that the rainfall pattern is highly variable. After almost two decades of rainfall deficit, there is a recovery of surpluses in the 1990s. However, the highlight of this period is the alternating dry and wet wintering which increases the inter-annual variability of the pluviometry (Global Climate Change Alliance, 2015). The significant reduction in the rainfall regime in the 1960s was probably the most significant element of climate change in the Sahel. Indeed, the work carried out by Sivarkumar *et al*. (1993) and cited by Gamatié (2011) reported a significant decrease in rainfall of the order of 1 mm / km in the Sahel in the south-north direction in the period 1960-1990, compared to 1900-1960. But in addition to this reduction in the length of rains, the other sensitive characteristic of climate change is its poor spatio-temporal distribution.

These phenomena have an overall impact on the key sector: agriculture, livestock and water, i.e., the natural resources around which Sahelian populations have been able to establish pastoral and agro pastoral systems of exploitation; climate change is equally held responsible for the changes observed in this part of the world. As a Sahelian country in the three desert quarters, Niger is preoccupied, like other countries of the planet, with global concerns about the issue of climate change, which manifests itself through mainly rising temperatures, changes in water levels and variability of rainfall, etc. This phenomenon could have dramatic consequences for a country like Niger, due to the fragility of its ecosystem, the importance of population growth and people's poverty level, people who derive most of their livelihoods from their natural environment. Indeed, since the great droughts of the 1970s and 1980s, Niger has been confronted with an accelerated degradation of its environment. These recurrent droughts and strong demographic pressure on natural resources have considerably hampered its productive potential, making people more vulnerable to the precarious effects of food inadequacy (Gamatié, 2011).

Niger also faces a difficult security situation, including conflict over rangeland and water wells in the southeast and the north (especially near the Malian border). But the link between climate-induced migration and conflicts remains a big challenge in this country because it is difficult to make a real connection between them. Protecting human security requires addressing the challenges presented by the interaction between environmental degradation, migration and conflicts.

Therefore, this study is based on Household survey, climate data and time period land use land cover map in order to understand the existing linkages between Climatic conditions, migration and conflicts in the district of Loga and the possible way of lessening them.

1.2.Objectives

The main objective of this study is to examine the relationship between climate-induced migration and conflicts in Southwestern Niger.

The specific objectives are to:

i. assess the perception of the population of the commune of Loga on climatic conditions, migrations and conflicts;
ii. analyze gradual environmental changes effects on migration channel and conflicts;
iii. identify coping strategies use to lessen the impact of environmental changes, migration and conflicts.

1.3.   Research Questions

   The following research questions guide my investigation.

i. what is the perception of the population of commune of Loga on climate change as playing a major role in human mobility and conflicts?
ii. do the environmental gradual changes have an impact on migration and conflict?
iii. what are the coping strategies use to lessen human mobility and conflicts in this area?

1.4. Hypotheses

The following hypotheses drive this research work:

i. population has a positive perception on climate change as playing a major role in migration and conflicts;
ii. climate and environment changes are the key factors which increase migration flow and conflicts;

iii.   many Coping strategies are used in order to lessen migration and reduce conflicts.

1.5. Thesis Plan

This thesis is structured around five chapters.

Chapter 1 is focused on the problem, states objectives, research questions and hypotheses. Chapter 2 is focused on literature review, gives some definitions and clarifies some concepts. Chapter 3 deals with materials and methods, including the area of study, conceptual framework and methods. Chapter 4 presents the expected results and discussion, while chapter 5 concludes and offers some recommendations.

CHAPTER TWO

LITERATURE REVIEW

2.1. Definitions

2.1.1 Climate change

Climate change refers to a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate change may be caused by natural internal processes or external forces such as modulations of the solar cycles, volcanic eruptions, and persistent anthropogenic changes in the composition of the atmosphere or in land use. The UNFCCC defines climate change as a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is observed over comparable time periods. Moreover, the UNFCCC makes a distinction between climate change attributable to human activities altering the atmospheric composition, and climate variability attributable to natural causes (IPCC, WGII, AR5, 2014).

2.1.2 Conflict

Conflict is the result of two or more parties (individuals or groups) having incompatible goals and interests, and acting upon these differences. Conflicts arise from imbalances in human relationships, whether in social status, access to resources, or power, which can lead to discrimination, poverty, oppression and environmental degradation. Conflict is a natural phenomenon that is an expression of a changing society. It does not necessarily lead to negative outcomes, but may be a constructive process of change. A violent conflict, on the other hand, always has negative repercussions. It refers to the actions, attitudes or systems that cause physical, psychological, social, economic or environmental damage. Killing and intimidation are the most visible forms of violent conflicts (IISD, 2009).

2.1.3 Migrants

Migrants can also be categorized into those who move only out of necessity to avoid the immediate danger and those who travel long distances and settle in the safe, developed world. Furthermore, the underlying mechanisms of refugees – when there is no choice but to leave (in order to save one's life) – and conventional migration – when staying is a viable option – are qualitatively different. For

example, inhabitants of small island-states ultimately have to relocate if some of the most predictions about future sea-level rise come true, while people living in increasingly dry areas may have less extreme adaptation strategies at hand. Moreover, there may be numerous overlapping environmental, political, and economic push factors, as well as pull factors in the receiving area that influence the decision whether, where, and when to move.

Migrants choose destinations and duration based on existing networks, skill levels, credit constraints and travel costs. We can distinguish many forms of migration:

• depending on the destination: international and internal migration;

• depending on duration: seasonal migration, medium term, and permanent migration;

• depending on the reasons: climate migrants, economic migrants, political migrants, social migrants;

• depending on the underlying choice: Forced migration and voluntary migration; and

• depending on development outcome: Productive and unproductive migration.

2.1.4 Hazard

The potential occurrence of a natural or human-induced physical event or

trend or physical impact that may cause loss of life, injury, or other health impacts, as well as damage and loss to property, infrastructure, livelihoods, service provision, ecosystems, and environmental resources. The term hazard usually refers to climate related physical events or trends or their physical impacts (IPCC, WGII, AR5, 2014).

2.1.5 Exposure

The presence of people, livelihoods, species or ecosystems, environmental functions, services, and resources, infrastructure, or economic, social, or cultural assets in places and settings that could be adversely affected (IPCC, WGII, AR5, 2014).

2.1.6 Vulnerability

The characteristics and circumstances of a community, system or asset that make it

susceptible to the damaging effects of a hazard (Source: UNISDR Terminology on

Disaster Risk Reduction 2009).

2.1.7 Risk

The potential for consequences where something of value is at stake and where the outcome is uncertain, recognizing the diversity of values. Risk is often represented as probability of occurrence

of hazardous events or trends multiplied by the impacts if these events or trends occur. Risk results from the interaction of vulnerability, exposure, and hazard (IPCC, WGII, AR5, 2014).

2.1.8 Adaptation

The process of adjustment to actual or expected climate and its effects.

In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In some natural systems, human intervention may facilitate adjustment to expected climate and its effects (IPCC, WGII, AR5, 2014).

2.2. Presentation of Concepts

2.2.1 Environmental Refugees

Different terms are applied to those moving for environmental reasons, including environmental or climate refugees and environmental or climate migrants. Broadly speaking, environmental refugees leave their place of residency because of sudden environmental changes, whereas environmental migrants leave due to gradual, long-term climatic changes (Keane, 2004).

2.2.2 Climate-Induced Migration

Climate-induced migration is argued to lead to violent conflicts in receiving areas through at least four complementary processes (Reuveny, 2007). First, the arrival of newcomers can lead to competition over diminishing natural and economic resources, especially if property rights are underdeveloped. Second, a wave of migrants of different ethnic origins than the local population may give rise to ethnic tensions and solidification of identities. Third, large flows of migrants may cause mistrust between the sending and receiving states. Finally, climate-induced migration may create or exacerbate traditional fault lines; for instance, when migrant pastoralists and local sedentary farmers compete over the use of land.

While some evidence suggests a link between transnational refugee flows and outbreak of armed conflicts (Buhaug and Gleditsch, 2008; Salehyan, 2007), it is not obvious that environment-induced population flows will have the same security implications for the host population as migrants escaping armed violence.

2.2.3 Climate Change Perception

The perception of climate change designates the way an individual sees the process of climate evolution over time. It is the first factor that shapes the strategies of adaptation (Gbetibouo, 2009).

But most of these studies are focused on the national and regional levels, whereas climate change processes are global but its vulnerability and adaptation are more local (Salack, 2012).

2.2.4 Migration in West Africa

West Africa has a long history of population mobility, both regionally and internationally.

Linked with factors as diverse as long-distance trade, the search for pasture, urbanization and the growth of administrative centers, the demands of mining, industrial production and plantation agriculture, armed conflict, land degradation, drought and rural poverty; migration has played a major part in shaping settlement patterns in the region (DFID, 2004). Census based estimates by the United Nations Population Division suggest that West Africa has the largest absolute international immigrant stock (based on place of birth data) in Africa. It is also the only part of sub-Saharan Africa where migration stocks relative to the total population have been increasing over the past few decades (de Haas, 2007). Migration flows started to increase in West Africa in the 1970s and 1980s when severe droughts affected most countries, inflicting significant impacts on farmers' livelihood such as losses of crops and livestock. Widespread famine prompted a mass exodus from more affected areas to the central, southern and across countries to coastal countries (West *et al.,* 2008; Korah, 2008; Ouedraogo *et al.,* 2009). Moreover, from that period up to now, migrating to less drought affected areas has become an important livelihood diversification strategy.

West Africa has experienced a series of migrations caused by population pressure, poverty, poor economic performances and endemic conflicts. Historically, migrants regarded the sub-region as an economic unit within which trade in goods and services flowed, and people moved freely. In order to fully comprehend contemporary migration systems, and current migration policies, in the sub-region, it is pertinent to set the migration configuration in its proper historical context (Adepoju, 2005). The recent changes in West African migration patterns actually show that migrations that depend only on a local natural resource remain extremely fragile and dependent on the world market. West African migrations are becoming part of a dynamic and unstable world migration system and are strongly affected by economic and migration policies (expulsions and restrictive policies) both in developed and developing countries. The West African migration system is not an autonomous entity and closely relates to several migration systems in the South and in the North and interacts with them (Robin, 1996).

2.2.5 Environmental Changes Related to Climate Change

Environmental issues have been taken in the wide range context of human security since the end of the Cold War (Renaud *et al.,* 2007). Moreover, it has become clear from the literature reviews that satellite remote sensing data have been one of the best popular tool for monitoring environmental change (Marquette, 1997; Codjoe, 2004; Elhag *et al.,* 2009; Ouedraogo *et al.*, 2010; Traoré *et al.,* 2014). An empirical research conducted in Senegal using remote sensing and field assessment from 1990 to 2005 shows a dramatic increase in croplands from 17% to 21% between 1965 and 2000, while savannah areas decreased from 74% to 70% (Hummel *et al.,* 2012). Using the same method, other recent studies in Mali, Ghana and Burkina Faso found out a high rate conversion of forests into croplands and settlements (Codjoe, 2004; Ouedraogo *et al.,* 2010; Traoré *et al.,* 2014). Land use and land cover (LULC) constitute key indicators of environment information; these terms are sometimes used interchangeably but they are actually different (Duadze, 2004). Land cover is what covers the surface of the earth (water, snow, grassland, deciduous forest, and bare soil), while land use describes how the land is used (wildlife management area, agricultural land, urban, and recreation area) (Horning, 2004).

Land use comprises arrangements, activities, and inputs undertaken in a certain land cover type (a set of human actions). The term encompasses the social and economic purposes for which land is managed: e.g., grazing, timber extraction, conservation (IPCC, 2000). Changes in land cover (biophysical attributes of the earth's surface) and land use (human purpose or intent applied to these attributes) are among the most important global concerns (Lambin *et al.,* 2001). Large changes in vegetation distribution and composition will likely affect local climate which, in turn, will modify the amount and distribution of vegetation. Environmental change and climate change can impact the decision to migrate (Laczko *et al.,* 2009; Renaud *et al.,* 2007; Sow et *al.,* 2014). Furthermore, climate change may exacerbate the risk of conflict which may cause further migration. Subsequently, the effects of climate change lead to increased competition over scarce resources and the loss of livelihoods which may increase the risk of conflict and violence causing additional displacement.

2.2.6 Climate Change and Community Livelihood

To be vulnerable to climate changes does not make someone a potential 'climate migrant'. The evidence connecting climate change to migration is quite limited, both because data are generally unavailable and the decision to migrate is based on multiple factors. We contend that we can only

base our future predictions of migration on previous research on community responses to natural hazards. That research has emphasized how people incorporate physical and social vulnerabilities to hazards into their livelihoods as an initial resilience strategy. People in marginal regions have developed a great variety of mechanisms to strengthen their ability to cope with both slow climatic changes and extreme climatic events (Mula, 1999; Maxwell, 1996; Meze-Hausken, 2000; Findley, 1994).

Discussions of climate change coping mechanisms are typically located at the household level and a number of broad conclusions from case study literature are evident (Mcleman and Smit, 2006 and Henry 2006). How a household reacts to environmental hazards depends on the severity of the change, their particular vulnerabilities, and available assets and strategies (Mortimore, 1989 and Meke-Hausken, 2000). Resilience strategies are found to be tailored to the gravity of the particular situation (Watts, 1983); and as most climate changes will be gradual, households can determine how to slowly reshape their livelihoods (Henry, 2006). Multiple factors unrelated to environmental change influence resilience most directly. The availability of markets, access to infrastructure, and the promise and delivery of aid influence the ability of families to prepare for and withstand environmental hazards and changes (Eriksen *et al*., 2005).

Studies conducted in different parts of the world have shown a wide agreement among the scientific community that climate variability and change is taking place with impacts on the people's livelihoods and that various coping mechanisms have evolved and are still evolving in the various communities. Africa is one of the most vulnerable continents to climate change and variability, a situation which is aggravated by the interaction of multiple stresses, occurring at various levels. This is partly due to low adaptive capacity and higher reliance on natural resources, such as agricultural land, forests and water which are very sensitive to changes affecting the environment (Kangalawe and Lyimo, 2013). In addition, rainfall variability and increase in temperature and evapotranspiration have high socio-economic impact on rainfed agriculture (Sarr *et al.,* 2015). In general, the main channel leading to conflict is the way that climate change affects the livelihood of host populations by exerting pressure on local wages, by increasing competition for job opportunities, resulting in ethnic tension, mistrust, and friction and by affecting available resources, for instance, by reducing access to land or to natural capital in general through deforestation (Drabo and Mbaye, 2014).

Extreme events not only damage infrastructure, homes and the means for livelihoods, but can result, both directly and indirectly, in increased human migration and displacement. For example, severe floods in China in May 2010 and Pakistan in the summer of 2010 were each reported to have displaced over 10 million people (*Science for Environment Policy*, 2015).

2.2.7 Conceptual Framework

There are a number of existing estimates of the 'numbers of environmental/climate migrants', yet migration and global environmental change report argues that these estimates are methodologically unsound, as migration is a multi-causal phenomenon and it is problematic to assign a proportion of the actual or predicted number of migrants as moving as a direct result of environmental change. A deterministic approach that assumes that all or a proportion of people living in an 'at-risk' zone in a low-income country will migrate neglects the pivotal role that humans take in dealing with environmental change, and also ignores other constraining factors which influence migration outcomes.

This is not to say that the interaction of migration and global environmental change is not important: global environmental change does have real impacts on migration, but in more complex ways than previous cause–effect hypotheses have indicated. Environmental change will influence migration outcomes through affecting existing drivers of migration. This influence is most pronounced for economic, environmental and, to a lesser degree, political drivers. This conceptualization recognizes that the powerful existing drivers of migration, with economic drivers foremost, will continue to be the most powerful in most situations. However, environmental change will affect these drivers by having impact, for example, on rural wages, agricultural prices, exposure to hazard and provisioning ecosystems.
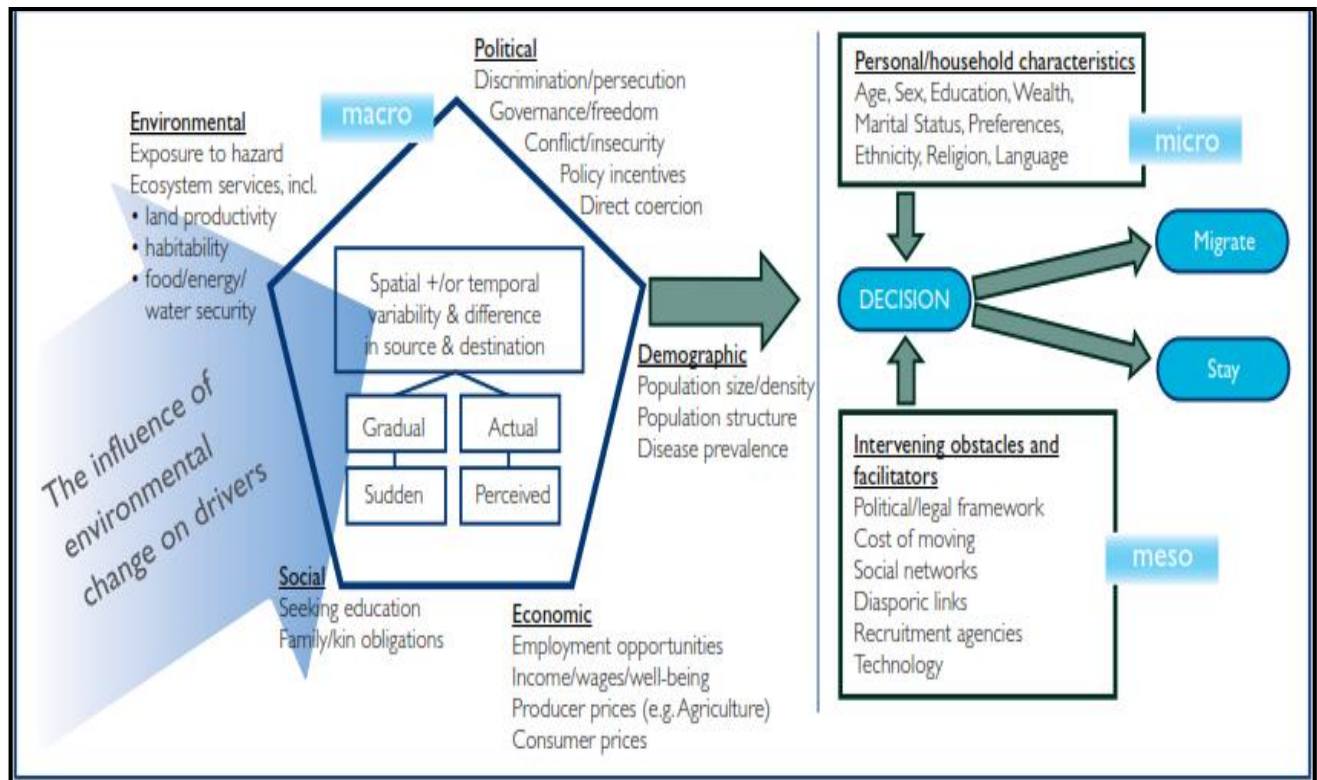
Figure 2.1: Framework for the Environmental Changes Impacts on Migration Drivers
Source: Foresight's report, 2011

2.2.8 Relationships between Climate Change/Environmental Changes, Migration and Conflicts

The relationship between the environment and conflict began in the 1970s by modern research as a theme in peace and conflict studies. The focus was on environmental degradation and scarcity of renewable resources as a cause of violent conflict. Even though a central finding of this line of research was that environmental factors are not by themselves causing violent conflict, researchers found considerable evidence that environmental degradation and resource scarcity can contribute to the likelihood of violent conflict when coinciding with other conflict drivers, such as ethnic polarization, weak political structures and low levels of economic development (Bächler *et al* 1996; Homer-Dixon 1999; Kahl 2006). However, later authors investigating the link between resource scarcity and violent conflict have largely expressed skepticism. This is particularly true for researchers using quantitative methods to comparatively analyze large numbers of cases (de Soysa 2002; Buhaug *et al*. 2010).

Migration was considered one of the pathways of linking environmental degradation and violent conflict in the literature on environmental security. Particular attention was paid to conflicts between pastoralists and farmers. Thus, it was posited already in the 1990s that conflicts in the Darfur region of Sudan were strongly influenced by lack of rainfall (Bächler *et al*. 1996). In general, migration was seen as potentially contributing to resource scarcity in receiving regions. Thus, violent conflicts could be expected in receiving regions with weak structures and institutions to prevent or mediate resource scarcity (Homer-Dixon, 1999; Reuveny2008).

While not ignoring the complexity of the consequences of migration, the environmental scarcity literature selectively emphasized environmental factors. Such an emphasis, however, runs counter to the mainstream of migration studies. Modern migration research has largely been dismissive of claims that migration leads to or facilitates conflict, except in special cases of 'militarized migration' such as cross-border movements of armed fighters (Muggah, 2006). Most of migration research has been particularly skeptical about the claim that conflicts over resources lead to violence in receiving regions. While it is not difficult to find such cases, they do not seem to be very frequent (Raleigh and Urdal, 2007).

Numerous works confirm that when environmental deteriorations cause displacements, they are often the by-product of economic, demographic or political factors (Hugo, 1996). Moreover, vicious circle phenomena are very frequent and it is not easy to isolate primary causes. Hence, population displacements will induce environmental problems that will have an effect on conflicts which, in turn, can exacerbate environmental deterioration (Hagmann, 2005). Despite the complexity of this terms, a working definition of climate-related migration is required. In this document we are going to follow the IOM definition of environmental migrants as: "persons or groups of persons who, for compelling reasons of sudden or progressive changes in the environment that adversely affect their lives or living conditions, are obliged to leave their habitual homes, or choose to do so, either temporarily or permanently, and who move either within their country or abroad." From this definition, migration-related to the impacts of climate change may be considered a sub-set of environmental migrants, with a revised definition reading that climate change migrants are: "persons or groups of persons who, for compelling reasons of sudden or progressive changes in the environment as a result of climate change that adversely affect their lives or living conditions, are

obliged to leave their habitual homes, or choose to do so, either temporarily or permanently, and who move either within their country or abroad."

Academic research into the links between climate change, migration and conflict has questioned such predictions. Their theoretical foundation and empirical support is thin. This does not mean that climate change will be irrelevant for future patterns of migration, including migration that may be linked to conflict. However, it has become clear that the links between climate change, migration and conflict are complex and defy simple and sensationalist conclusions. Unsurprisingly therefore, the climate change-migration-conflict nexus is not among the risks emphasized in the IPCC 5th assessment report published in 2014 (IPCC 2014, Summary for Policy Makers).

CHAPTER THREE

MATERIALS AND METHODS

This chapter presents the materials and methods used for this study. It discusses the steps followed in order to reach our goal, and tackles the Conceptual framework. The chapter equally explains the sampling method used.

3.1 The Study area

3.1.1. Geographical location

The commune of Loga is located in the northern part of the department of Loga, it is one of the three communes of the department with 1700 km². The population of this commune is estimated at 84.624 inhabitants with sixty-five (65) administrative villages in which are attached approximately 97 hamlets, grouping in this way Fulanis and Tuareg. It is administratively related to the department of Loga in the Dosso region. This population is predominantly composed of the Djerma's on to which are added Haussa, Fulani, and the Tuareg the minority. The languages spoken are especially the Djerma, follow-up of the Fulfulde and the Tamachek. It is characterized by the presence of dune trays, glacis, of Koris and hills. Devoided of permanent water courses,a few temporary pools exist which are used for the garden crops, watering of animals and depending on location human consumption. Two (2) types of soils are distinguished in the commune of Loga. It is composed of sandy soils which is predominance and sandy clay-favorable to the cultures of the millet, sorghum, peanuts, cowpea, to garden crops and other speculation. The vegetation is Sahelian type with the presence of wooded savannah and shrubs.
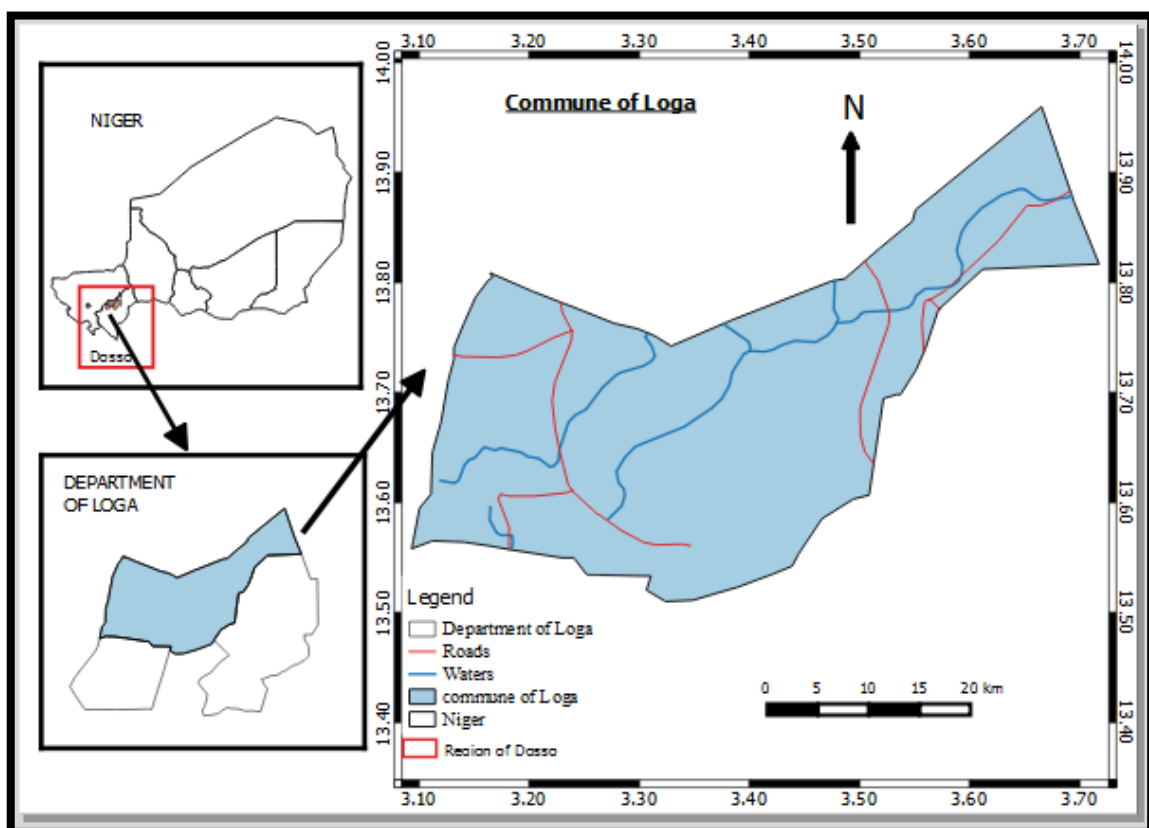
Figure 3.1: The Study Area

Data source: www.diva_gis.org/gdata

3.1.2. Climate

The commune of Loga is located in the Sahelian zone with an average rainfall between 300 to 600 mm. The average temperatures vary between 18°C and 41°C. With respect to the amplitudes, they are very high between March and May. The average monthly temperature varies from 16.8 ° C (January), to 28.4 ° C (May). We note a unimodal distribution of the average monthly rainfall with a maximum in August. For example, in 1996, when it fell 489 mm during the whole year, the month of August alone recorded nearly half of the precipitation (242.6 mm), (DMN 2011). Finally, as with other areas of the department, the climate is characterized by three (3) seasons to know:

➢ a rainy season;

➢ a dry and cold season;

➢ a hot and dry season.
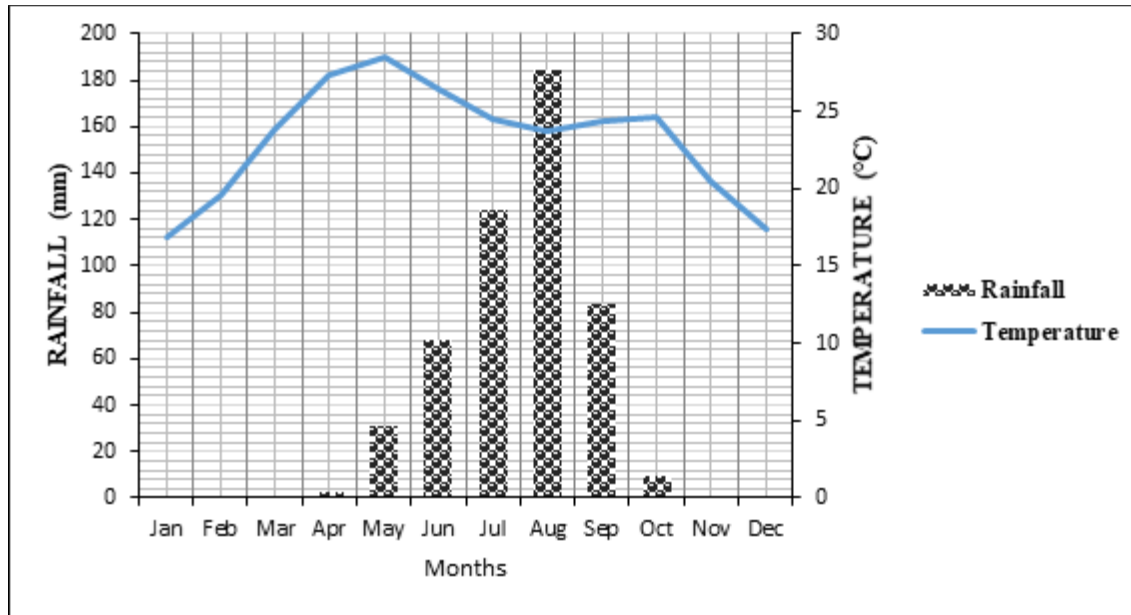
Figure 3.2: Distribution of Seasonal Rainfall and Temperature (1980-2010)

Data source: DMN 2011

3.1.3. Justification of the Study Area

Climate change is a global concern but it is important to note that its impact could be different from one place to another. In order to assess the effects of climate change and land degradation on migration it is reasonable to consider a region that is subject to changing environmental conditions and has a mobile population which depends on these conditions in everyday life Based on NAPA Niger (which aims is to contribute on reducing Climate change effects on the most vulnerable population) evaluation the commune of Loga has been identify as being part of the most affected zone by climate variability and change of Niger. The commune of Loga has been affected these recent years by accelerated Land degradation cause by climate change (NAPA). At the same time Human mobility is not negligible. The foregoing reasons ground our choice of this location.

3.2 Methods

3.2.1. Conceptual Framework

The study adopted the following concepts to describe how drivers of migration are interrelated and to see at which extend one driver can impact, be associated or affect another driver. This framework (Figure 4) shows how complex climate variability and change, environmental changes and migration

are. For instance, climate and environment gradual or sudden changes can be a direct cause of migration if the event was sudden and population does not have any choice to stay this case shows that climate is a direct cause of migration. However, it can have indirect effect which is the most likely. Climate change disrupts land productivity which is associated to famine which in turn will play a role on the people decision to stay or move.
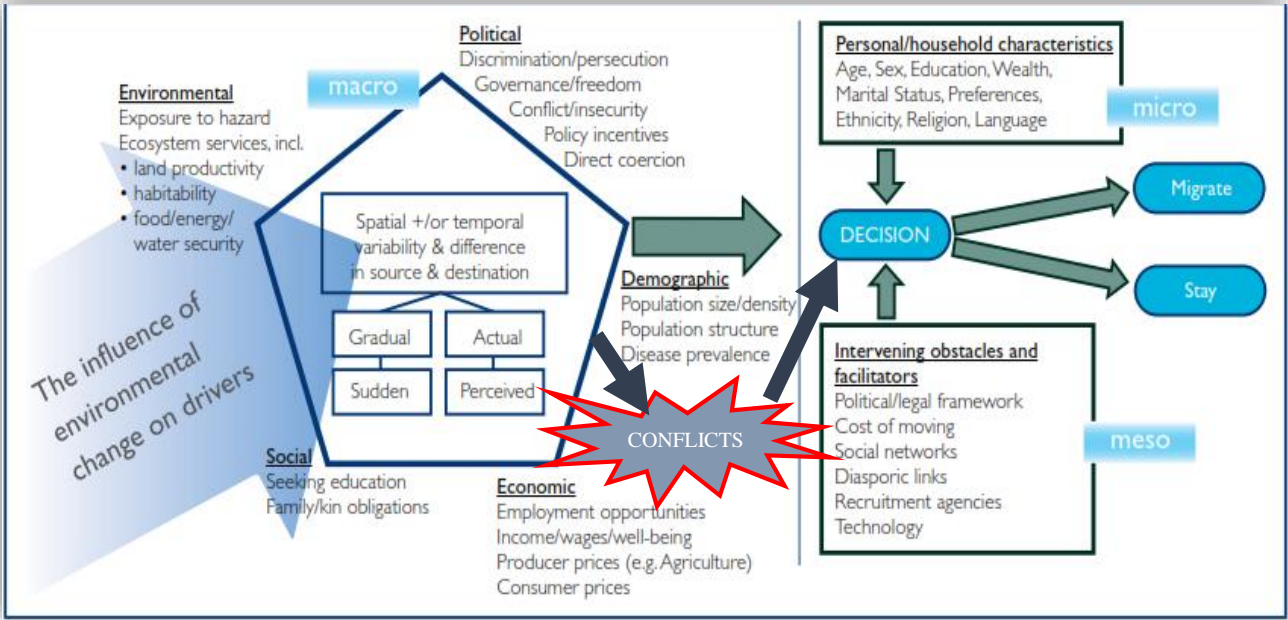
Figure 3.3: Conceptual Framework of the Study
Source: Adapted from Foresight's report, 2011

The methods used to attain each research objectives were basically based on Systematic analysis through household survey: Focus group and Individual interview using some guide line (questionnaire) (annexe) compared to historical data collected from books and various expert of different sectors, meteorological data (Temperature and Rainfall) and satellite data (Land Use Land Cover) using SPOT vegetation of 2000, 2013. For th years 1975 data collected by Agrhymet for the same purpose when Spot vegetation was not launch was used. Finally impact and adaptation matrix were used to achieve first and third objectives.

3.3. Data Collection
The study required the use of two types of data: primary data and secondary data through household survey, Focus Group Discussions to capture respectively information at the community and

individual (household) levels, interview with experts was conducted in order to have their own point of view. Also, we used climate data (rainfall, temperature), and satellite data.

3.3.1. Primary Data

Household survey was conducted to have the perception of Loga population about environmental change/climate change, migration and conflicts. In addition, GIS tools was used to perform land use/cover map. The questionnaire was divided into four key sections: A) localization; B) identification: sex, age, educational level, income source, etc.; C) environmental change/ climate change: the causes; D) impacts and adaptation strategies; E) migration: motivation, advantage and disadvantage of rural livelihood; and F) conflict: conflict causes (climatic and non-climatic causes), insecurity; conflict trend and management tools was examined.

An interview was done with some key informants who have some experiences about the issue (Rural development projects workers, NGOs, Head of the Department, etc...).

3.3.1.1. Focus Groups Discussions

It is a discussion with a target group in order to collect global information on the study area based on some specific point listed which was used as guide line to performed our discussion. In this study the focus groups were organized in the villages based on the people availability. Focus group with different specific group (men and women) was made. Because of the culture, women can be influenced by men during the focus group. In addition, women tend to shy from men when they have meetings.

In the same perspective and in the aim to triangulate the information, other focus-groups have been organized respectively with some agents of OIM, NCESD, National mayor.

3.3.1.2 Individual Interviews

Picture 1: FGD with men in Dar Salam   **Picture 2**: FGD with women   **Picture 3**: FGD with Sargadji men's

Face-to face interview was conducted to the respondents with the guide of questionnaire. This second phase of surveys, interviews with heads of households (men or women) of at least 40 years of age (this may be the perception before the last 30 years) in the 10 villages randomly chosen of the study area in order to collect the information corresponding to the questionnaire items. The number of households to be surveyed was determined from the Lahcen formula (2014):

$$n = \frac{N}{(1+N)e^2}$$, *where N = Total number of households; n = Sample size or Number of*

households to investigate; e = Level of precision.

The size of the sample and the distribution of the households surveyed in the respective villages are summarized in Table 1. The choice of households surveyed was made randomly. The level of precision was set at 7% because of difficult access to certain villages and time constraints.

Table 3.1: Statistics on Households of the Study Area with 7% Level of Precision.

Localites	Number of Households	Frequency of Number of Households %	Number of Households size to investigate
SOUMANA DEY	30	3,48	7
MADINA	15	1,74	4
GARBEY GOROU	58	6,73	14
DAR SALAM	106	12,31	25
TOMBO BANA	173	20,09	41
KOROMBE DEY	12	1,39	3
KOKORBE-KOUKOU	07	0,81	2
SARGADJI	410	47,61	97
FANDOGA	15	1,74	4
BADARADEY	35	4,06	8
Total	861	100	205

It was a little bit difficult to interview females due to some social and cultural norms constraints. Female respondents did not want to give different opinions from the one given by males. It has often been said during the focus group discussion that women are not allowed to talk about family issues. However, their point of view was capture during focus group allocated to them only and it was fruitful because they were free to express themselves and provide their point of view.

3.3.2. Secondary Data

Climatic data (Rainfall (monthly and annual) and temperature) from the nearest synoptic stations were collected and analyzed. The IPCC defines climate change as a change in the state of the climate that can be identified (e.g. using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer (at least 30 years). This definition mandates considering time series going from 1980-2016 and it has been noted that the important changes in the climate of Sahelian zones had occurred after 1970 (Hulme *et al.,* 2001; Brooks, 2006). The period after 1970 (1980-2016) was considered, because it includes the major climatic hazards (drought and flood) which are supposed to be the impacts of major changes in the climate (IPCC, 2001). The census data were collected. This database contains the total population of the department and the number of households in general and per village.

❖ **Satellite Data: Image Acquisition Procedure**

Remote sensing techniques were used to provide a land cover map for vegetation cover characteristics as input parameters for land cover type. Two (2) satellite images (Spot vegetation) these satellite images were provided by Agrhymet Regional Center. It was collected from 3 years: 1975, 2000 and 2013 to generate Land use land cover map. In order to provide land Use Land cover map some process was used as shown in the flow chart but this study has analyzed only the overall trend.

3.4. Analysis

3.4.1 Analysis of Climate Data

The change in precipitation was measured by rainfall data from synoptic station around the area. This study will compute the Standard Precipitation Index (SPI) as indicator of rainfall variability. The SPI base gives a better representation of abnormal wetness and dryness. It was designed to be a spatial invariant indicator of drought that recognizes the importance of time scales in the analysis of water availability and water use (Khan et al., 2008). The SPI is based on the probability of precipitation for

any time scale. The probability of observed precipitation is then transformed into an index. It is being used in research or operational mode in more than 70 countries. (WMO, 2012) Positive SPI values indicate greater than median precipitation and negative values indicate less than median precipitation. Drought periods are represented by relatively high negative deviations. The SPI will be computed as follows:

$$SPI = \frac{Xi - Xm}{\sigma},$$ *where Xi is seasonal precipitation at the synoptic station; Xm and σ are respectively the mean and the standard deviation of annual rainfall observed in the series.*

Therefore, the classification system shown in the SPI value Table 2 was used to define drought intensities resulting from the SPI. (WMO, 2012). The Mann Kendall Trend Test (sometimes called the M-K test) was used to analyze data collected over time (1980-2016) for consistently increasing or decreasing trends ("monotonic trends") in Y values. It is a non-parametric test, which means it works for all distributions. If the Tau is positive the trend is increasing if Tau is negative the trend is decreasing.

Table 3.2: SPI value and interpretation

SPI value	Interpretation
2.0+	Extremely wet
1.5 to 1.99	Very wet
1.0 to 1.49	Moderately wet
-.99 to .99	Near normal
-1.0 to -1.49	Moderately dry
-1.5 to- 1.99	Severely dry
-2 and less	Extremely dry

Source: WMO, 2012

3.4.2 Household Data

SPSS was used for household data entering and analysis. Descriptive and statistical analysis were used. The usefulness of SPSS software is that the quantitative and qualitative data can be used. Furthermore, excel (2016) software was used to plot figures.

3.4.3 Determination of the Impacts of Climate Variability and Change on Resources.

Determining the impact of climate variability and change on resources requires First of all identification of the resources in the study area, identification of the specific impacts of climate change on resources.

3.4.4 Identification of the Resources in the Study Area.

The identification of district of Loga subsistence resources exposed to climate variability and change has been made through focus-groups and individual interviews.

3.4.5 Identification of the Impacts of Climate Variability and Change on Resources in the Study Area.

To analyze people's perceptions of the impacts of climate change on subsistence resources a focus groups and individual interviews was done. This focus allowed to identify the impacts of major climate risks on the main resources of subsistence.

Table 3.3: Example of Specific Climate Change Impact Matrix

Resources Risks	1	2	3	4
R1				
R2				
R3				
R4				

3.4.6. Adaptation Strategies Analysis of the Community

Strategies were identified from survey results and focus groups. They are composed of adaptation strategies already implemented and those that stakeholders want implement to address climate change (Table 4). They are listed in the adaptation matrix that is identical to the impact matrix because at each impact is associated with an adaptation measure.

Table 3.4: Example of Specific Climate Change Adaptation Matrix

Resources Risks	1	2	3	4
R1				
R2				
R3				
R4				

3.4.7 The Rate of Land Use Land Cover Change Analysis

The proportion of each LULC type in a study area will be calculated as:

$$A_i \% \text{ of LULC type} i = (\text{area of the LULC type} i / \text{total study area}) * 100,$$

Where Ait1 and Ait2 represent the Total area of the LULC type I at t1 and date t2 respectively. The change analysis at overall scale will provide the overall gain and loss for the specific LULC type.
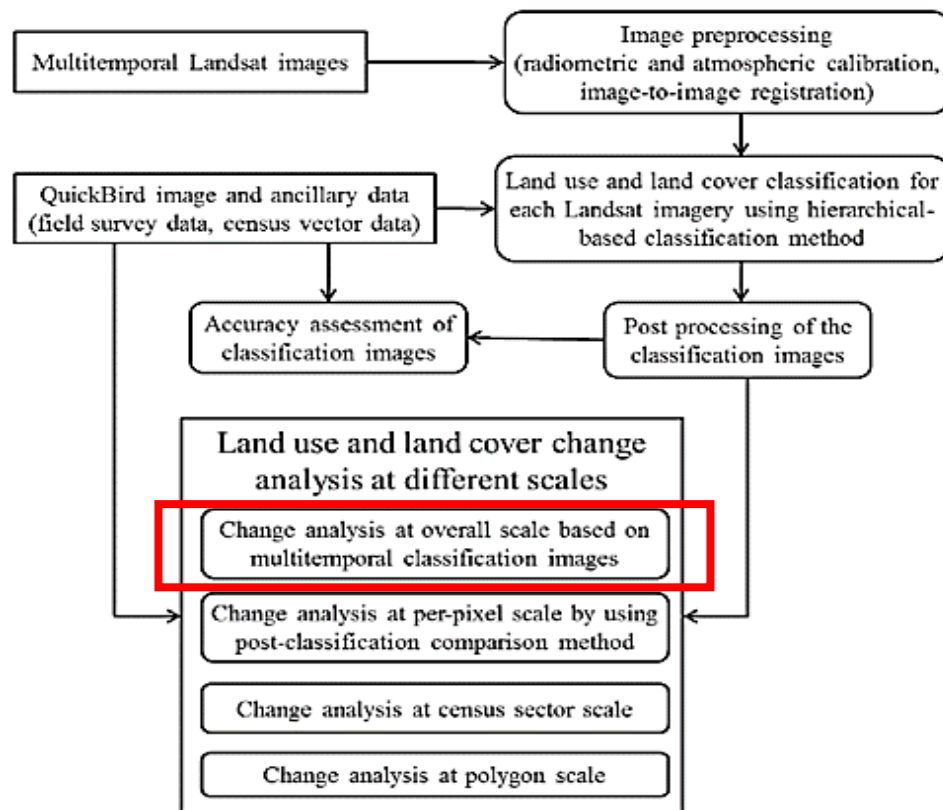
Figure 3.4: Flow Chart of Land Use Land Cover Changes Detection and Analysis
Source: adapted from Lu Dengsheng, 2013

3.4.8. The Rate of Land Use/Land Cover Changes and Human Mobility

The rate of Land use land cover change was analyzed through Observation on the field, expert acknowledge, Satellite images because land use and land cover change evaluation depend on several factor such as human pressure, migration/rural exodus, local convention, rainfall, effect of project on land protection.

Possible land use factors potentially contributing to increasing vegetation cover include: changed land management (grazing, cropping, manuring) new agricultural policies (removing subsidies on agricultural inputs, fuel-wood collection and demographic trends (L. Olsson et *al*.,2005).

Furthermore, Pearson's correlation is used to measure statistically the strength of a linear relationship with some selected variable using Household survey data with SPSS. Pearson's correlation coefficient is a statistical measure of the strength of a linear relationship between paired data. In a sample it is denoted by r and is by design constrained as follows Furthermore:

- Positive values denote positive linear correlation;
- Negative values denote negative linear correlation;
- A value of 0 denotes no linear correlation;
- The closer the value is to 1 or –1, the stronger the linear correlation.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1. Characteristics of Respondents

Figure 4.1 shows that out of 205 head of household interview only 21% was women while 79% was men. These women who respondent were mostly widows and some women who were not widows responded when their husbands were not around. However, their point of view was capture during focus group allocated to them and it was fruitful because they were free to express themselves and provide their point of view.
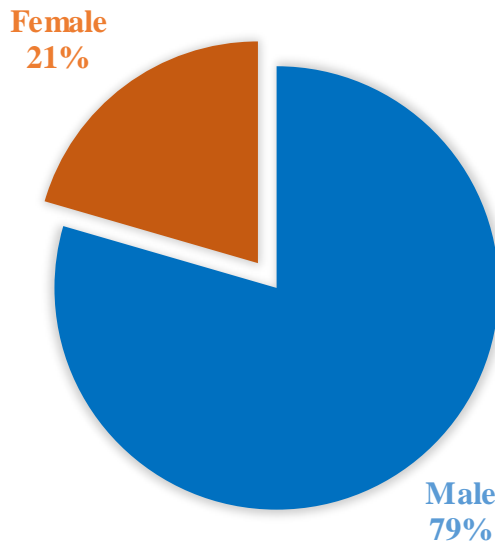
Figure 4.1: Sex Ratio in the Study Area

4.2.   Socio-economic Characteristics of Respondents

100% of the respondent's activity is agriculture (Figure 4.2). 69% of the respondents are in animal breeding as already stated in the first statement agriculture and animal breeding "agro pastoralism" is the characteristic of the area. That means that even though every household work in the farm some of them associate it with animal breeding. Only few respondents added with it trade (10%).
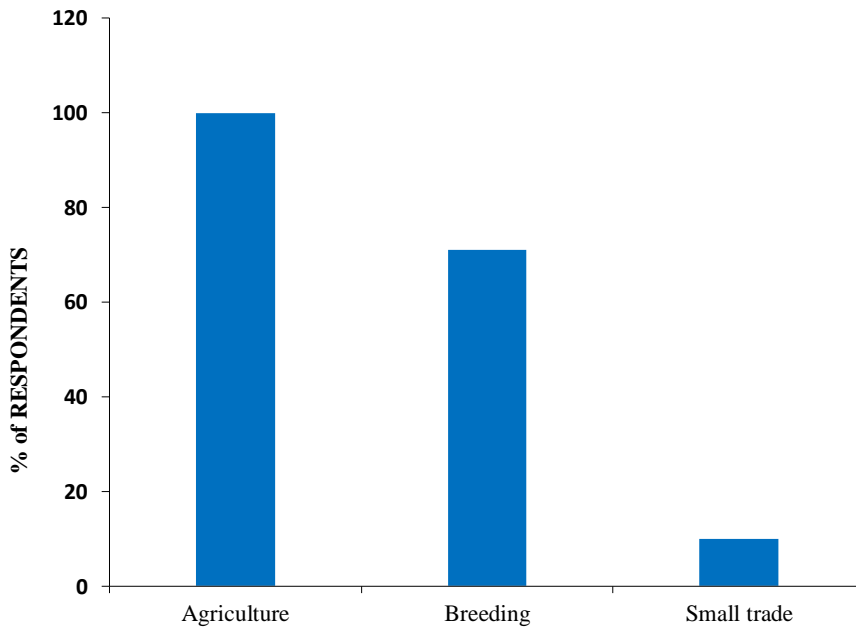
Figure 4.2: Socio- economic Activities in the Study Area

The environmental conditions are particularly important, since 100 % of the respondents' families as earlier illustrated on Figure 4.2 rely on agriculture as their main source of income and food supply. In this agro pastoralism area, most of the agricultural outcome is totally consumed (89%) and only few (11%) respondents mentioned that the consume and sell in order to get some income. However, this outcome is not sufficient to feed the entire household which means that variability and changes in climate patterns have an effect on the production.
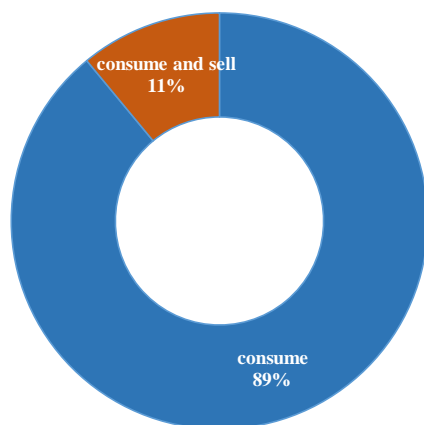
Figure 4.3: Production Utilization Tendency

4.3. Perception of Climate and Environmental Changes

For many respondents the droughts in the 1970s and 1980s are important events that shape their view on climatic and environmental changes. Since the occurrence of these extreme events, and in particular the drought in 1973, most respondents 69.8 % are of the opinion that the rainfall amounts decreased within the last 30 years. While 19% of respondents perceived Variation of rainfall amounts, hardly anyone (7.8%) saw an increase and (3.4%) stability. Although the mean annual rainfall amounts are still lower compared to the pre-1970 conditions, recent analyses show that they have been increasing since the 1990s (Brandt et al. 2014). These recent analyses support the climatic data analysis that shows an increase trend of rainfall which is not significant which come to confirmed the communities' perceptions on decreasing rainfall.

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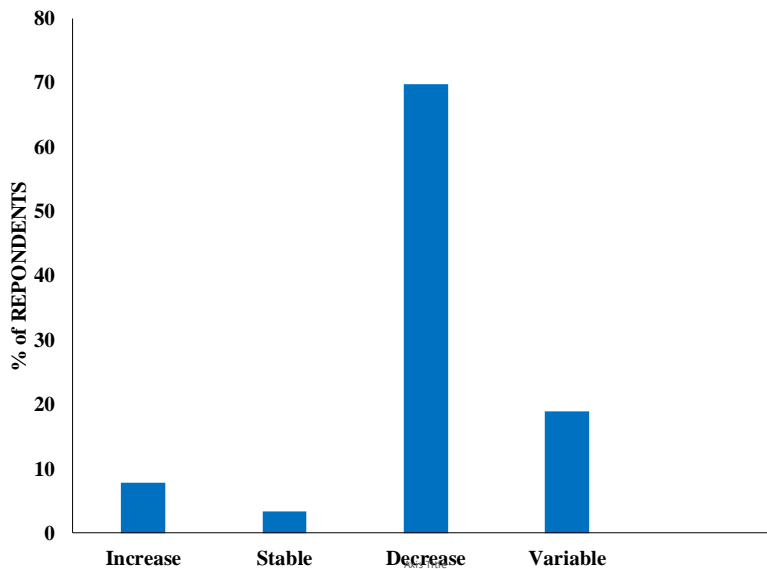
Figure 4.4: Perception of Respondent on Annual Rainfall

Communities' perception on rainfall patterns with regard to the last 30years with 70% respondents noted that rainfall decreases compared to last 30 years (Figure 4.5). Only 8% perceived a decrease in rainfall because they compared rainfall to their Yield. And 19% noted that it varies. 53% noticed that the length of rainy season decreased over the years. 100% respondents perceived that dry season have increased these years. 62% respondents talked about variation which occurs at any state either

wet or Dry season. they noticed that it is not exactly increasing or decreasing it can vary but it is different compared to the last 30 years.
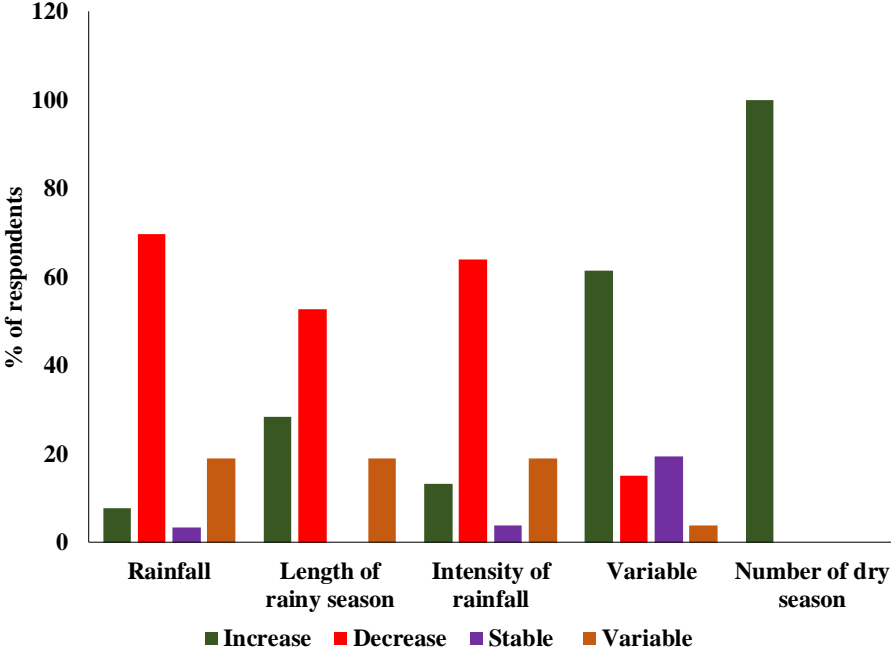
Figure 4.5: Perception of Communities on Rainfall Patterns Regard to Last 30years

The trend of extreme events in the study area compared to the last 30 years, 100% respondents stated that in these years' drought tendency has increased. 63% perceived that Flood tendency is stable in the area (Figure 4.6).
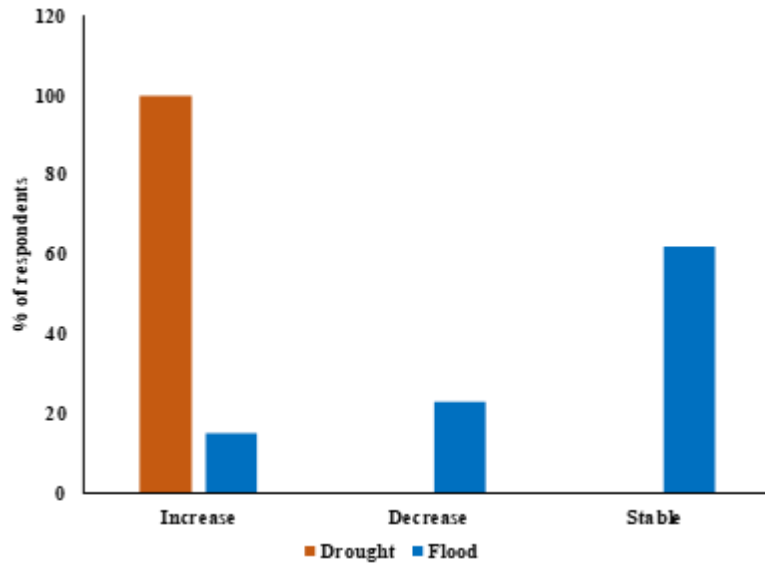
Figure 4.6: Communities perception on Extreme Events Tendency

The Figure 4.7 illustrates that the rainfall in the study area is increasing even though the trend is not significant (P>0,05). This test was done through Mann Kendall trend test analysis with tau=0.0780 and pvalue= 0.504. Vliet, *et al.;* (2013) suggests that environmental change related to rainfall will be a challenging issue in future development. The 1980's was characterized by drought as perceived by the communities. This meteorological data come to confirm the perception of the communities on rainfall decreasing. When the SPI is above 0 it defines the excess years and when it below it stands to deficit years.
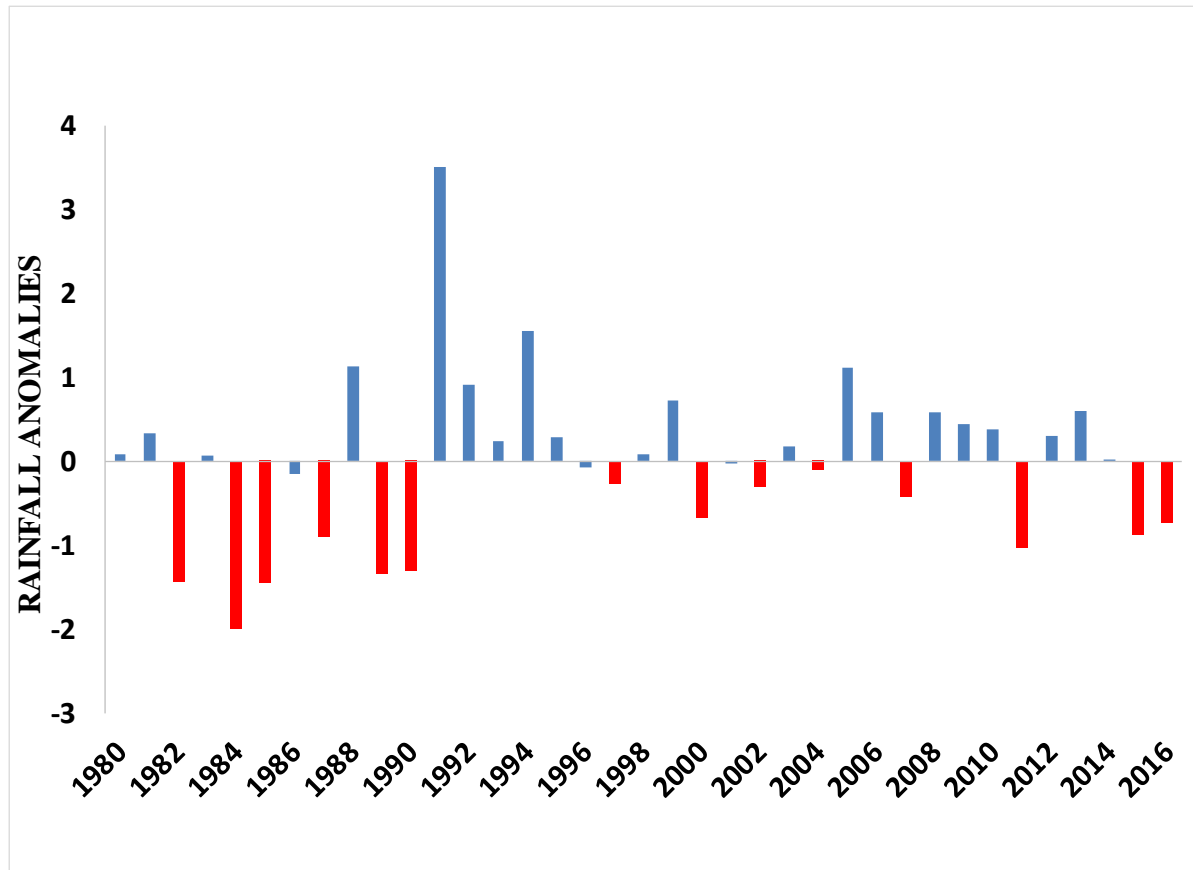
Figure 4.7: Rainfall anomalies in the District commune of Loga

Data source: DMN 2017

4.3.1. Perception of the Communities on the Impact of Climate Change on livelihood

The resources impacted by climate change in the study area According to the communities are basically: population, water resources, crop, animal production. In the same line the climatic hazards the most relevant are high temperature, flood, late onset and early cessation in the rainy season, finally, drought. The Table 4.1 illustrates the impact of climate change on resources based on the Focus group, and the figure based on the individual interview. One of the direct impacts of climate change and variability that the communities especially agro-pastoralists have noticed is the availability of pastoral resources which may be affected by climate variability. All the respondent 100% have observed a decrease in soil fertility, an increase in land degradation. 88% of respondent perceived yield, pastureland decrease and 79% decrease in animal productivity. They also said climate change is impacting livestock health (72%) and water availability (73%).

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Table 4.1: Specific Climate Change Impact Matrix

Climatic hazards	Resources			
	Population	Water resources	Crop	Animal Production
High temperature	• Increase diseases • Increase mortality • Food insecurity • Poverty	• High evaporation • Dry up stream, rivers	• New pests • Increase water stress • Reduce crop yield	• Diseases • Animal death • Animal productivity reduction
Flood	• Food insecurity • Poverty • Income reduction • Destruction of settlements	X	• reduce crop yield • Land degradation	• Fodder shortage • Animal productivity reduction
Late onset	• Food insecurity • Poverty	X	• Reduce crop yield • Loss of seed • Late sowing	• Fodder shortage
Early cessation of rainy season	• Food insecurity • Poverty	X	• Reduce crop yield • Loss of seed	• Fodder shortage
Drought	• Food insecurity • Poverty • Income reduction	• Dry up stream, rivers	• Increase water stress • Land degradation • reduce crop yield	• Fodder shortage

X: No Impact

The way climate change is impacting the life of communities was drawn in this Figure 4.8 beside that yield, pastureland, soil fertility, etc... are affected also social tension is decreasing.
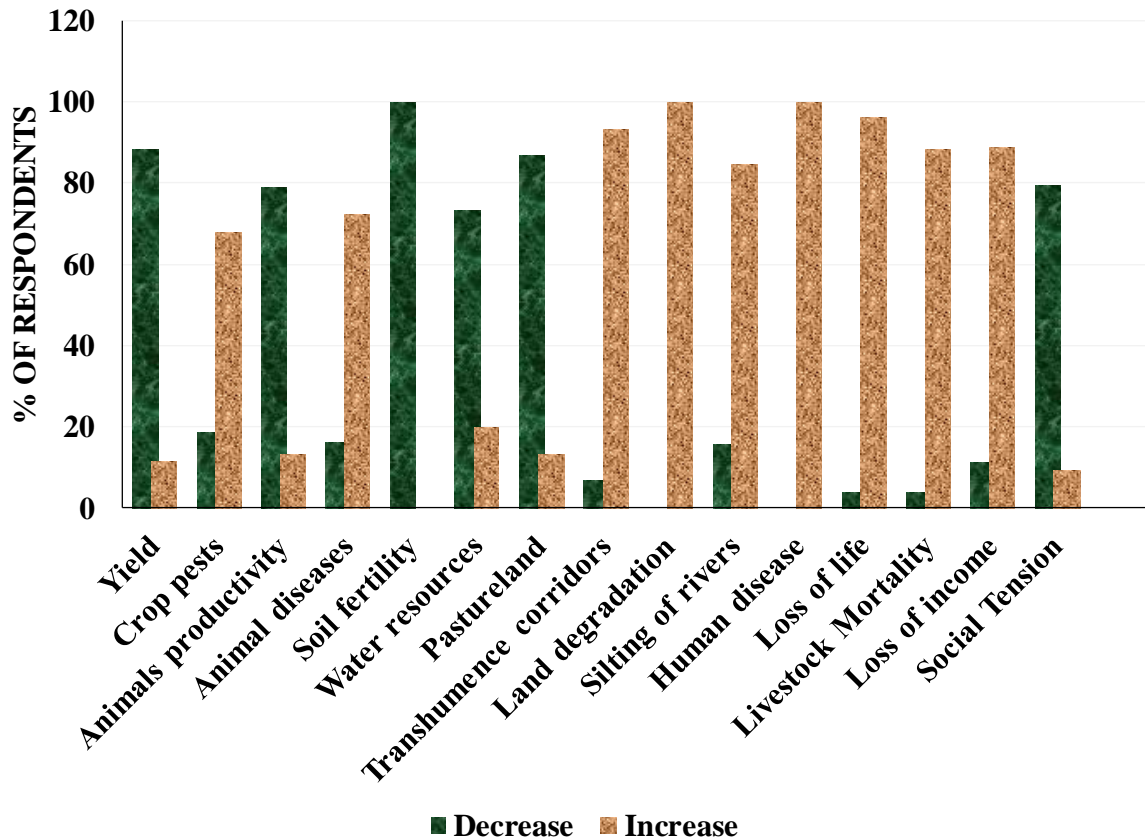
Figure 4.8: Perception on Climate Change Impacts on livelihood

4.3.2. Adaptation and Coping Strategies in the Study Area

During the focus group and individual interviews, it was noted that adaptation strategies remain a big challenge in the study area. When people's livelihoods are threatened by such environmental disruptions, a traditional response is to migrate. Most of the respondent noted that migration is not good for their home country and village but it contributes to solve family problem (elder, children and women who stay behind) such as Food, clothes, Marriage etc... It has been notice that seasonal migration has long been traditional strategy to cope with temporal and geographical variability in the study area. Adaptation strategies and coping strategies are a big challenge in the area. Table 4.2 shows the dominant adaptation strategies are migration followed by Foodstuff storage, crop diversification etc... 100% of the respondent said reforestation is not part of their adaption strategies Despite the fact that actions are tacking for reforestation in the area these actions are not at individual level. Government and NGOs are the actors. Communities are just respecting the laws put in place which discourages cutting tree without authorization.

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As we can see in the adaption matrix communities don't do much effort to adapt because most of them migrate in order to get money to send to the family to cope. They just come back when they tell them of the begging of the rainy season which accounted only for 4 or 5 month depending on the starting point of the rainy season.

Table 4.2: Perception on Adaptation to Climate Change

Coping Strategies	Percentage of respondents %	
	Yes	No
Crop diversification	53.2	46.8
Crop resistant to drought	23.4	76.6
Irrigation	14.6	85.4
Migration	96.1	3.9
Agro pastoralism	39	61
Dig wells	15.1	84.9
Water retention	7.3	92.7
Improved breeds of animals	0	100
Food storage	66.8	33.3
Reforestation	0	100
Sell of personal property	34.1	65.9
Diversification of income	22.4	77.6
Common property system	3.9	96.1
Micro insurance	0	100

Table 4.3 reveals coping strategies in line with climatic hazards, it is indicated that when people are facing high temperature the best way to cop is to migrate nothing is done for water resources crop, or animal production. In case of flood, coping strategies was not mentioned a part for crop that respondents said they tried to store food which can help them the moment and more. The only coping strategies for late onset are mostly migration and mixture in agriculture and breeding "agro pastoralism" they also sell their personal property to get

money. For early cessation of rainy season only migration with diversification of income was mentioned. To face drought situation, it was cited migration, crop diversification, food storage and agro pastoralism.

Table 4.3: Adaptation and Coping Strategies Specific Matrix

Climatic hazards	Resources			
	Population	Water resources	Crop	Breeding
High temperature	Migration	X	X	X
Flood	X	X	Food storage	X
Late onset	• Migration • Sell personal property	X	X	Agro pastoralism
Early cessation of rainy season	• Diversify income • Migration	X	X	X
Drought	• Migration • Diversify income	X	• Crop diversification • Food storage • Agro pastoralism • crop resistant to drought	Agro pastoralism

X=No adaptation

4.4. Migration View

This study defines migration as 'being absent from the place of origin for more than three months'. This definition fulfills with the definitions used in the Human Development Report (UNDP 2009) and the Foresight project (Foresight 2011). Based on this definition the majority (83.4 %) of those respondents in the study areas have migrated. However, in the study area the gender plays an

important role regarding the migration experience. Only 40 % of the women of the study area migrated while 94 % of the men left their home village for more than 3 months. As many respondents confirm, the main reason for this unequal distribution is the traditional way of life and associated restrictions that deny women the opportunity to migrate but gradually these restrictions are lifted. When men are out of the village, women have the entire responsibility of the house which can be heavy to them if the man does not come again. The duration migrants stay at their destination before returning to their place of origin or moving to another destination is in many cases less than a year. Two type of migration are found: seasonal and permanent migration, it can be internal or international. Many of respondents (40 %) leave after the harvests as seasonal migrants and return before the next harvest. If we consider the destinations of migration it is apparent that 50% of the migrants cross the national border to the Ivory Coast, Nigeria, Ghana, Benin and Togo.
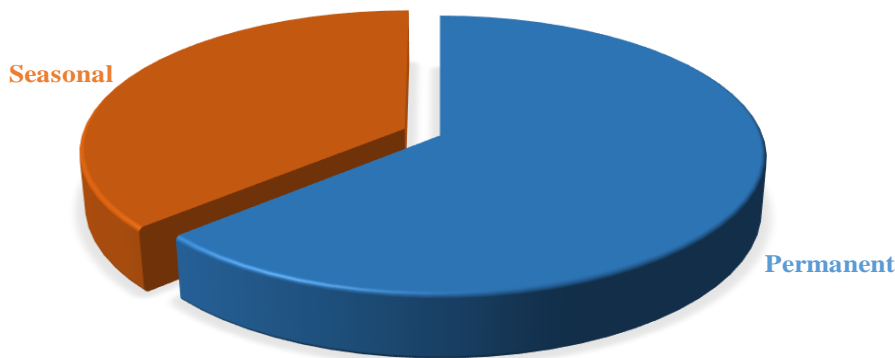
Figure 4.9: Type of Migration

4.4.1. Causes of Migration on the Study Area

Human migratory movements cannot be explained by single causes as shown on Figure 4.10, the vast majority of migrants (32%) named search for job, (14%) drought and famines, (9%) search for pasture, (18%) variation in rainfall and (27%) lack of basic means as the main causes of migration. Further differences exist between men and women. Although economic causes are dominant for both,

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they are less frequent for women who more often migrate for familial reasons or to visit someone. This view of causes of migration shows the importance migrations have for a household's livelihood. Besides other strategies like selling animals or mutual help between neighbors, migration is an important measure to diversify the household's income in years with poor harvests. In this sense migration serves as a coping strategy or an immediate reaction to bad conditions and as an adaptation strategy for income diversification in the long run. These causes show how the drivers of migration are interlinked and they all move together.
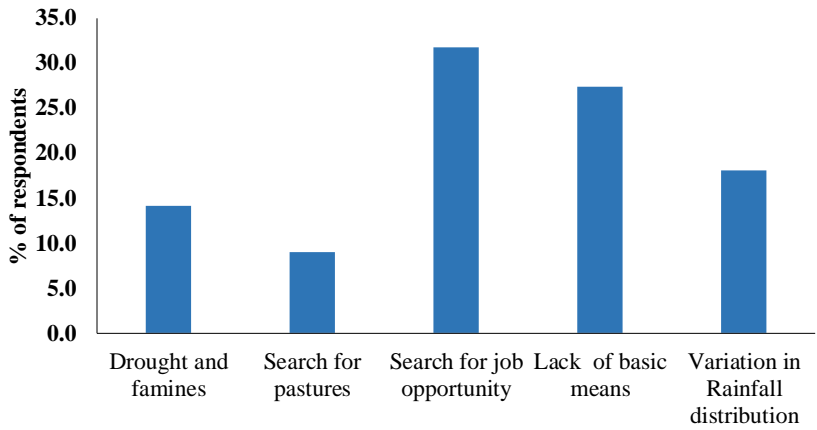
Figure 4.10: Perception of the Communities on the Causes of Migration

4.4.2. Migration Benefits

Migration has always played an important role in sustaining and expanding people's livelihoods in one way or another in the villages. Most villagers (97%) found migration as a good strategy for village development. Figure 4.11 shows the benefits coming from migration in the study area detailed by the migrants and the relatives: poverty reduction 37%, improvement of living standards (27%), family needs (30%), saving (3%), building of houses (3%), agricultural input (12%) and procurement of knowledge (2%), Marriage (3%). The income from migration for family needs comprise school fees for the kids, health care and other unexpected events. Additionally, migrants and their family members claim that the income from the migration guaranteed the food security in their households. The saving is mainly used on the small breeding (goats, Oxen). This activity plays an important role in their economic life.
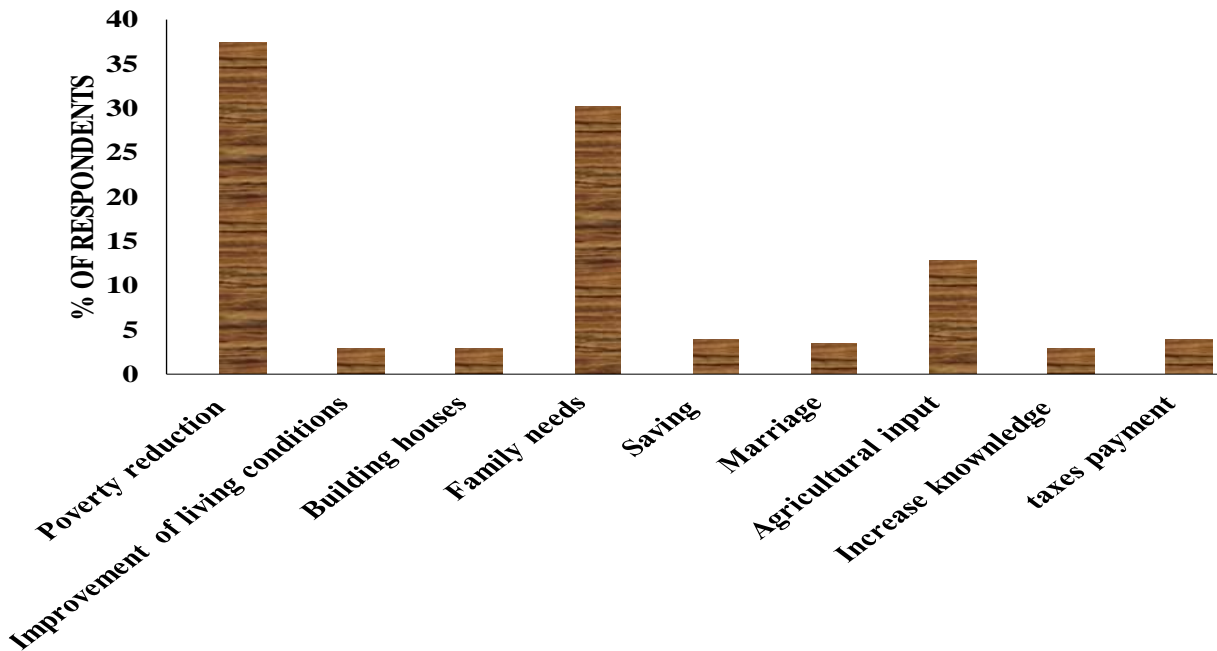
Figure 4.11: Benefits Coming from Migration

4.5. Land Use Land Cover Changes and Human Mobility

Figure 4.12 provide an overall picture of changes trends for the entire study area over time series then in 1975, the most dominant LULC class was steppe about 55119.42 ha (44 %). This was followed by the agriculture of 37360.13ha (30 %) and short grass savannah 29512.65 ha (23%). In 2000, the steppe 48103.95ha (38 %) decreases and gives the place to agriculture 49211.55 ha (39 %), short grass savannah about 24377.87 ha (19 %). However, in 2013 an important point to remember is that the cropland was substantially high and it has exceeded both Steppe and Short grass savanna. It can be well observed in the year 2013 an increasing of cropland for about (49%) while a decrease has been occurred in the areas of dense vegetation (29 %) and low vegetation about (18 %) compared to its coverage in 2000.
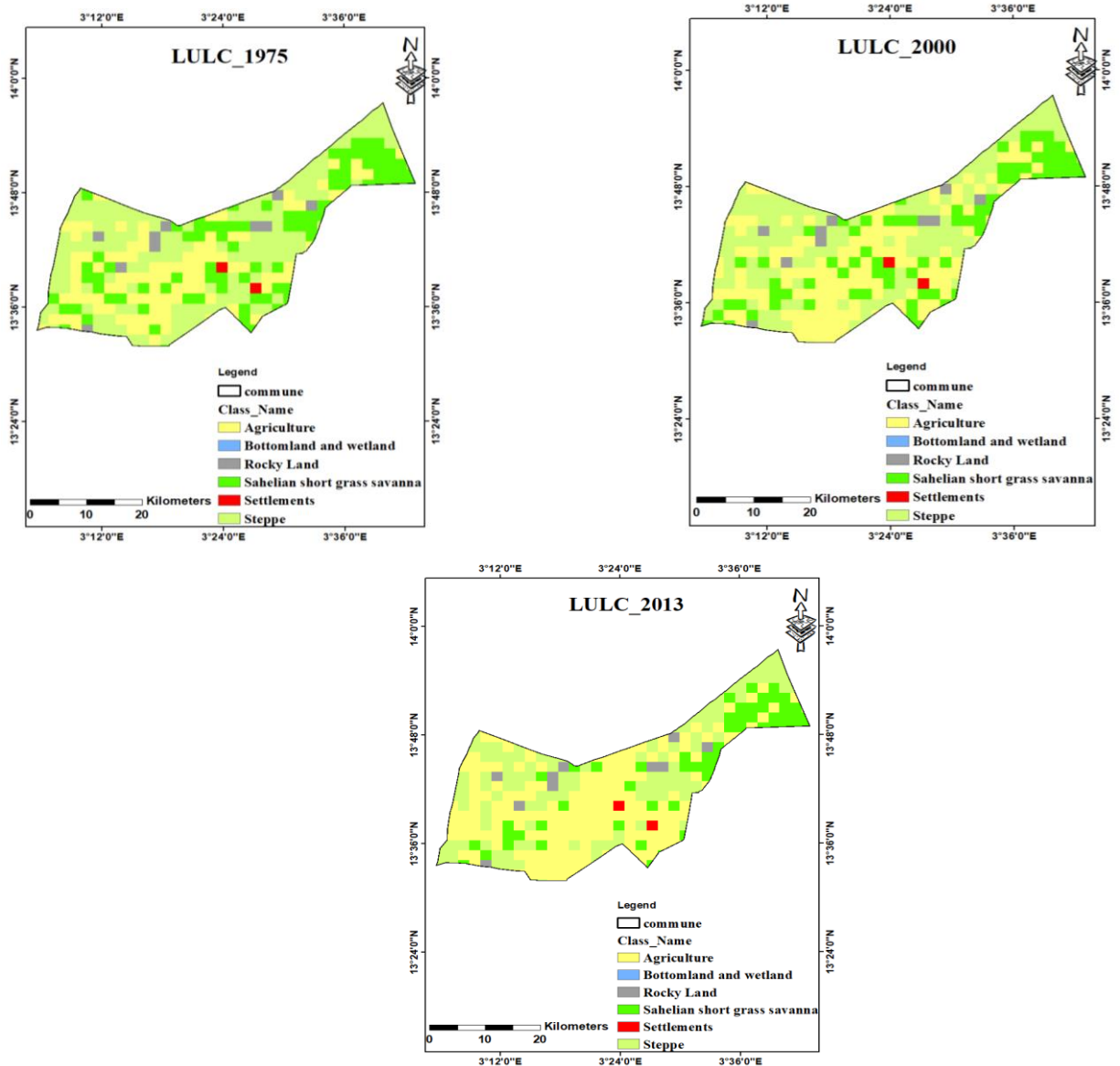
Figure 4.12: LULC Changes over the Years 1975, 2000 and 2013

Data source: Agrhymet Regional Center, 2017

Land use land cover map of 1975 compares with the 2013 one's shows the way agriculture area is spreading over the years which can be explained by the fact that one person has six or more agriculture land for his household. In addition, settlements are not spreading over the year, it is not means that the area is not experiencing population growth. This can be explained by the fact that people are not coming in but going out of the area.

Table 4.4: Change Detection of Land Use Land Cover of the Study Area (1975, 2000 and 2013)

LULC classes	1975		2000		2013	
	Area (ha)	%*	Area (ha)	%	Area (ha)	%
Agricultural Land	37360.13	29.57	49211.55	38.94	350091.29	49.35
Rocky Land	3538.74	2.80	3873.86	3.07	17654.90	2.49
Sahelian short grass savannah	29512.65	23.36	24377.87	19.29	127186.43	17.93
Settlements	800.00	0.63	800.00	0.63	3558.52	0.5
Steppe	55119.42	43.63	48103.95	38.07	208839.57	29.44
wetland						0.29

*calculated based on the total of the study area

The Figure 4.13 describes LULC changes over the years (1975, 2000 and 2013) clearly stated with percentage, for instance, in 1975 grass savanna has covered 23% of the total area of the study area while in 2000 and 2013 it respectively accounted for 19% and 18% of the total area. The overall result of LULC demonstrated a tendency of environmental degradation in the study area. This finding is highly supported by survey data, the majority (87%) of the respondents mentioned decrease of pastureland which is affecting their livelihood. In addition, the area has also experienced several rainfall anomalies which in turn have impacted negatively life cycle of ecosystems.
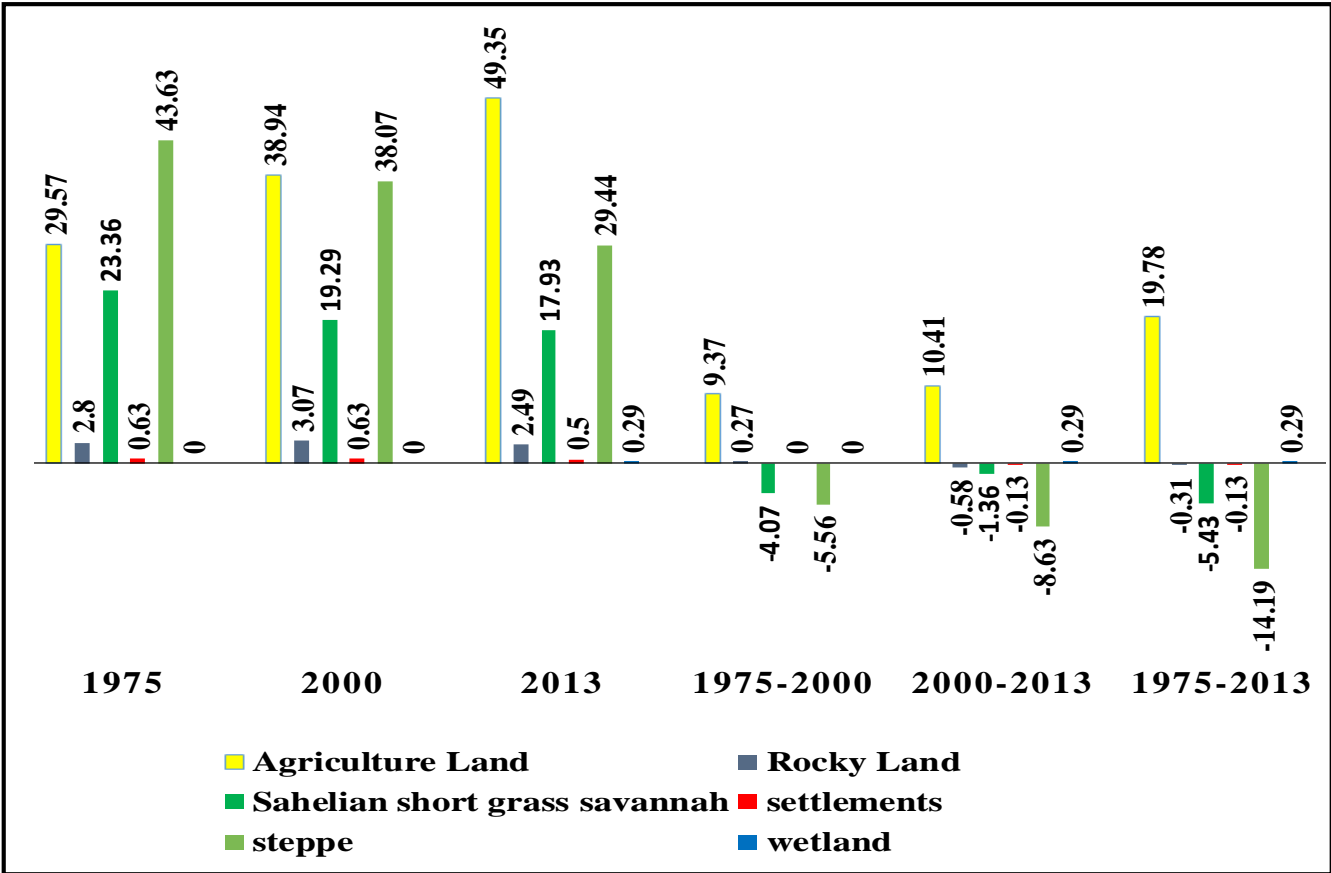
Figure 4.13: The Dominant LULC Changes Area.
Data source: Agrhymet Regional Center, 2017

Based on Figure 4.13 pastureland is decreasing which will probably lead to displacement or transhumance as early mentioned the communities have to feed their cattle. This statement come to support that environmental changes have effect on Human mobility in order word, it affect the decision to stay or migrate. It is well documented by several studies that migration has always been a local response or survival strategy of people confronted with environmental changes that endanger human welfare. (Renaud et al. 2007 ; Hugo, 2008 ; Paré *et al.*, 2008 ; Warner, 2011 ; Renaud, *et al.*, 2011 ; Ouédraogo *et al.*, 2012).

4.6. Perception of Insecurity in the Study Area

During focus group communities recognized that lines of causation between climate change and conflict cannot be drawn systematically. Every conflict is complex with many interconnected causes, and communities or people do not suddenly start fighting because temperature, drought or flood

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events are increasing. However, the main causes of conflicts mentioned by respondents are population growth which cause conflict around the farmland, marginalization, decreasing in transhumance corridors which can be explained by the fact that farmers sow beyond their boundary and reduce the corridor. They also mentioned that conflict is not frequent in their area and when it occurs the settle it before the chief of the village which means that the local institution need to be reinforce. One of the respondent said: "When you are hungry, anger is not your first option".

The Figure 4.14 shows the conflict tendency in the study area. It obvious that natural resources scarcity and competition (due to depletion, limited access and policies restriction) are factors that lead to land degradation which in return affect the community's livelihoods with some consequences food, economic, health insecurity and cause conflicts. Only 12.12% observed increase conflicts. I am tempted to say that it is difficult to make the link between climate change as a factor of conflicts because the communities think that conflicts occur where we have abundance of resources. This point of view is share by some authors (Tuner *et al*., 2011; Hellendorff, 2012; Cullen and Idean; 2012).
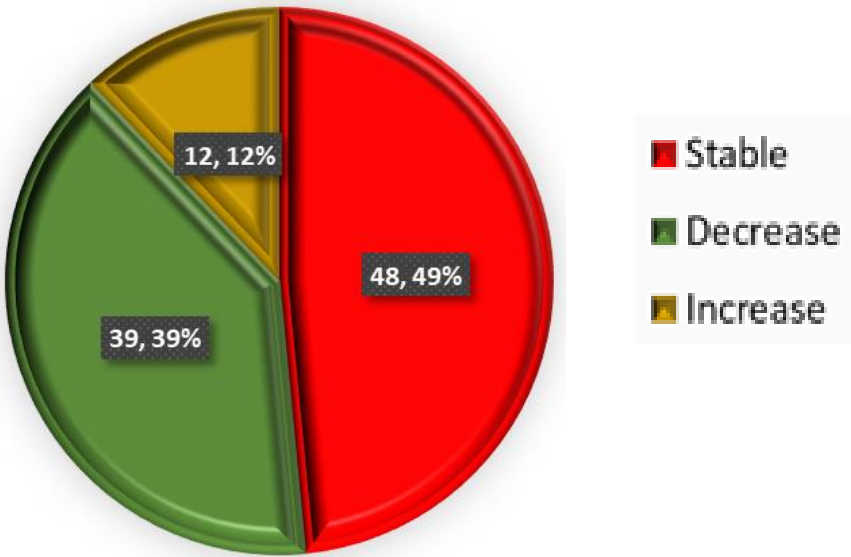
Figure 4.14: Perception of the Communities on Conflicts Trend

Statistically, based on the correlation analysis of selected variables (Table 4.5) the variable is correlated to migration and the correlation depends on the variable but the correlation is not significant which confirms the interlinkages and the interaction between the different variable in

other word there is not only one driver of migration, they are many and works together, interact and influence the decision to migrate or stay. In addition, Pastureland and social tensions are strongly correlated which means that future social tension may raise because of the reduction of pasture land if nothing is done.

Table 4.5: **Correlation Analysis of Selected Variables**

		Migration	Temperature	Annual rainfall	Social tension	Pastureland	Yield
Migration	Pearson Correlation	-					
	Sig. (2-tailed)						
	N	205					
Temperature	Pearson Correlation	-.055	-				
	Sig. (2-tailed)	.430					
	N	205	205				
Annual rainfall	Pearson Correlation	-.037	.304**	-			
	Sig. (2-tailed)	.598	.000				
	N	205	205	205			
Social tension	Pearson Correlation	-.096	-.131	.111	-		
	Sig. (2-tailed)	.170	.061	.113			
	N	205	205	205	205		
Pastureland	Pearson Correlation	-.078	-.107	.124	.596**	-	
	Sig. (2-tailed)	.263	.127	.078	.000		
	N	205	205	205	205	205	
Yield	Pearson Correlation	-.073	-.100	.138*	.740**	.576**	-
	Sig. (2-tailed)	.296	.153	.048	.000	.000	
	N	205	205	205	205	205	205

**. Correlation is significant at the 0.01 level (2-tailed). *. Correlation is significant at the 0.05 level (2-tailed).

CHAPTER FIVE

CONCLUSION AND POLICY RECOMMENDATION

Findings of the study confirm that climatic and environmental changes can indeed have effects on human mobility. The perception of the population on climate change, migration and conflicts is positive. However, the relationship between climate, environment, migration and conflicts is complex, and environmental stress is usually not the most important factor or in other word the key factor pushing people to migrate based on this statement the second hypothesis of this study is rejected. Human mobility is traditionally a part of the culture and everyday life in the study area, and thus the suppression of migration does not represent an adequate political option. Instead, policies should make use of the positive potential of migration as it has been seen as a traditional for sustainable regional development. Such policies could build upon already existing "co-development" approaches which support the investments of migrants in the areas of origin. In Our case study, Rural area investments in sustainable agriculture are necessary, which should go along with measures that generate income and employment opportunities, not just within agriculture, but also in other economic sectors even though the main activity in the area is agriculture. Therefore, integrated regional development strategies which focus on linkages between urban and rural areas are required. For example, they should consider infrastructure development and the promotion of integrated land and water resources management (because in some villages of the study area there is water pound but useless for the community) for the prevention of land degradation. Furthermore, chances in life, particularly for the young generation, need to be increased, including better education opportunities. For instance, in 2006 the government therefore started a programme, offering financial support to encourage young men to return to their region of origin, and to take part in the ecological restoration of the environment. The programme created many temporary jobs, including the fixing of sand dunes, controlling tree chopping, digging half-moons, and digging out sand from the river. This way, the project not only offered returning migrants a livelihood opportunity, but also contributed to the ecological restoration of their environment. This kind of programme will play an important role today again in the process of reducing migration where it's needed. Against this background, there is the need for cross-sectoral strategies which integrate issues of migration, socio-economic development and environment, and which consider the participation of relevant societal actors and stakeholders.

In summary, the positive effect of migration on the adaptive capacities of households could be further supported by governments and administration in order to build up infrastructure for transport, public health, etc. This could be a key to making communities less dependent on agriculture, which means that migration serves as a long-term strategy for securing wellbeing instead of a short-term response. However, they will also need to take measures to prepare for environment-induced migration and conflicts where it cannot be avoided. And where migration can act as a positive adaptation strategy, policies that facilitate such 'adaptive migration' will be needed.

The policy recommendations we can draw from this study could be the following:

1. Aware communities on the social tension which can derive from pastureland shortages
2. Put in place a local pastureland management.
3. diversify sources of income by introducing off-season culture and non-agricultural activities (craft, tourism etc…).
4. improve the organization of community network and help especially women to have access to natural resources, knowledge, and loan to develop their activities.

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Annexes

<u>FOCUS GROUP DISCUSSION</u>

<u>I-Generalities</u>

1 – Department:	2- Commune:	3-Village:
Date of survey: --- --- --- ---		
Number of women	Number of men	Population

II-Chronology of important events

1-What are the important events that mark the history of the village	Local names	Dates	Causes	Consequences	Management
1-					
2-					
3-					
4-					
5-					

III-Perception of the community on the variability and climate change

N°	Questions	Codes		Passer A
2	How can you appreciate the trend of rainfall over 30 years? 1.Increase 2.No change 3.Decrease 4.Do not know	A. Annual rainfall quantity B. Duration of rainfall season C. Intensity of rain D. Variation E. Duration of dry season	[___] [___] [___] [___] [___]	
3	What is the situation of the duration of the beginning of rains	1. late 2. Early 3. Identical	[___]	
4	What is the situation of the duration of the end of rains	1. late 2. Early 3. Identical	[___]	
5	What is the trend of the phenomenon of drought?	1.Increase 2.Decrease	[___]	

		3.No change 4.Do not know		
6	What is the trend of the phenomenon of flood?	1.Increase 2.Decrease 3.No change 4.Do not know	[___]	
7	What is the trend of the increase of temperature? 1.Increase 2.Decrease 3.No change 4.Do not know	A. Heat B. Hot days C. Hot nights	[___] [___] [___]	
Observations				

8-What are the most important climatic risks faced by the area? Rank them

1--

2---

3---

9-What are your income source activities? Rank them

1---

2---

3---

4---

10-What is the proportion of your available natural resources in term of superficial measure?

Land use	Area (km^2)
Vegetation	
Pasture	
Water	
Farms	
Habitats	

11-What are the impacts of climatic risks on the available resources?

Resources Risks	1	2	3	4

R1				
R2				
R3				
R4				

12-What are the adaptive strategies you develop to face those impacts?

Resources / Risks	1	2	3	4
R1				
R2				
R3				
R4				

13-Are there migrants in the village? People coming from other localities? Yes/No
-If yes, what activities are they doing?

_____

_____

14-How do migrants have access to land?
Renting/-----/   Lending/------/   Purchasing/--------/

15- A r e there in the village people that migrate?	**16- How many time in average?**
1-Rural migration Yes[___]No[___] 2-Transhumance Yes [___]No [___] 3-Neighbor country Yes [___]No[___] 4-International Yes [___]No[___]	1-Rural migration ………. 2-Transhumance …………. 3-Neighbor country ………. 4-International ………….

17-What are the main reasons that explain the migrations? Rank them

1---
2---
3---
4---
5---

18-Do migrants send you money? Yes / No
If yes, how do you invest the money?

19-What should you do in the following situations to preserve your resources
-Continuous degrading climatic conditions (temperature increasing and rainfall decrease)

Improving climatic conditions during next years (rainfall increasing, return to normal conditions)
20-Analysis of conflict touchiness

    1. **Vulnerability mapping/insecurity: exposure-vulnerabilty matrix**

Aleas Resources Exposees	Drought	Flood	Dry spell	Violent rainfall		
Pasture						
Water						
Livestock						
Transhumance corridor						
Crops and farming lands						
Roads						

2. Conflict tree
    ❖ What is the main problem of conflict between pastoralists and farmers?

    ❖ What are the causes of the problem?

    ❖ What are the effects and impacts of the problem?


```
                            Impact
                                      Impact
        Impact
                        Impact

                    Main cause

              Cause                        Cause
                      Cause        Cause
```
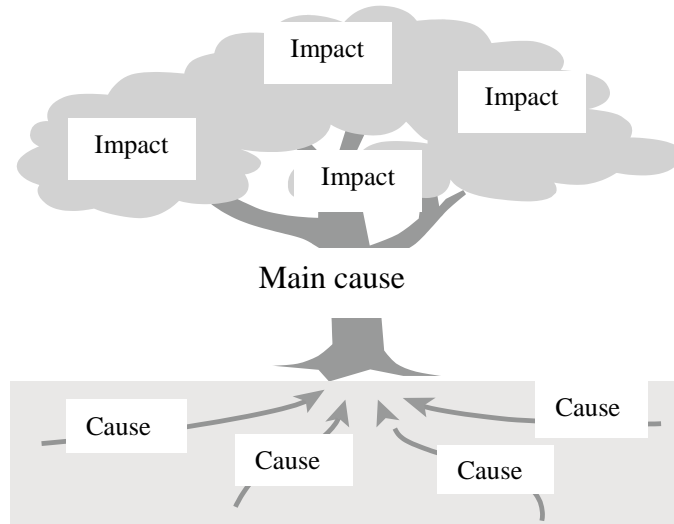
21. Do you have conflicts prevention system? Yes / No
If yes
1. What are their functioning for use?

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2. Are the useful for the conflicts management?

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22. In which domain do you receive the support of projects, NGO or government in the past 30 years?
1. Agriculture   4.Health
2. Breeding   5.Craft industry
3. Environment

QUESTIONNAIRE

Section A: LOCALIZATION

A0. Date	----------/-------------/2017		
A1. N°of the chart	A4.Village		
A2.Department	A5.Name of interviewer		
A3.Region	Coordinate	Longitude	
		Latitude	

Section B: IDENTIFICATION OF THE INTERVIEWEE

N°	QUESTIONS	CODES		PASSER A
B1	Name (Head of household)			
B2	Sex	1. Male 2. Female	[___]	
B3	What old are you ?			
B4	What is your ethnic group?			
B5	What is the number of the household members?		[___][___]	
B6	How many years do you spend in the village?		[___][___]	
B7	What are your sources of income?	1. Agriculture 2. Livestock 3. Forestry 4. Apiculture 5. Other (Specify)	[___] [___]	

			[___]	
B8	What was your occupation 30 years ago?	1. Agriculture 2. Livestock 3. Forestry 4. Apiculture 5. Other (Specify)	[___]	

B9. Assessment of households

B9. a. How many farms do you have?

Type of farms	Acquisition mode	Area (ha)	Utilization of the yield

[1] Cotton   [1] Heritage   [1] 100% consumed
[2] Honey   [2] Gift   [2] 50% consumed and 50% sold
[3] Sorghum   [3] Loan   [3] 75% consumed and 25% sold
[4] Bean   [4] Share-cropping   [4] 75% sold and 25% consumed
[5] Peanut   [5] 100% sold
[6] Maize

N°	Questions	Codes		Passer A
B9.b	What are your work tools? 1.Yes 2.No	A. Plough B. Tractor C. Hoe D. Pickaxe Other (Specify)	[___] [___] [___] [___]	
B9.c	What input do you use? 1. Yes 2. No	A. Fertilizer B. Weed-killer C. Insecticide D. Manure Other (specify)	[___] [___] [___] [___]	

B9.d	Do you use animals?	1. Yes 2. No	[___]	2 □ B14.9
B9.e	For what goal? 1.Yes 2.No	A. Plowing B. Sale C. Dairy production D. Transport Other (specify)	[___] [___] [___] [___]	
B9.f	Do you still have available lands for farming?	1. Yes 2. No	[___]	
B9.g	If No, why ?			

B9. h. Does your production sufficient to feed your family?
      If not, why? --

Section C: PERCEPTION ON CLIMATE CHANGE

N°	Questions	Codes		Passer A
C1	How do you appreciate the trend of the rainfall during the past 30 years? 1.Increase 2.No change 3.Decrease 4.Do not know	A. Annual rainfall quantity B. Duration of rainfall season C. Intensity of rainfall D. Variation E. Number of dry months	[___] [___] [___] [___] [___]	
C2	What is the situation of the period of the beginning of rainfall?	1. Late 2. Early 3. No change	[___]	
C3	What is the situation of the period of the end of rainfall?	1. Late 2. Early 3. No change	[___]	
C4	What is the trend of the phenomena of drought?	1.Increase 2.Decrease 3.No change 4.Do not know	[___]	

C5	What is the trend of the phenomena of flood?	1.Increase 2.Decrease 3.No change 4.Do not know	[___]	
C6	What is the trend of the increase of temperature? 1.Increase 2.Decrease 3.No change 4.Do not know	A. Heat B. Hot days C. Hot nights	[___] [___] [___]	
Observations				

Section D: IMPACTS OF CLIMATE CHANGE AND ADAPTATION STRATEGIES

N°	Questions	Codes	Passer A

D1	What are the impacts of climate change on your socio-economical activities? 1.Decrease 2.Increase	A. Agricultural yield B. Yield devastators C. Livestock productivity D. animal sickness E. Soil fertility F. Water resources G. Pasture H. Transhumance corridor I. Land degradation J. Sandbank K. Human sicknesses L. Human lives lost M. Livestock mortality N. Decrease of income O. Conflicts	[___] [___] [___] [___] [___] [___] [___] [___] [___] [___] [___] [___] [___] [___] [___]	

D2	What are the climate change adaptive strategies? 1.Yes 2. No	A. Crop diversification	[___]	
		B. Drought resistant crop	[___]	
		C. Irrigation	[___]	
		D. Transhumance/Migration	[___]	
		E. Agro-pastoralism	[___]	
		F. Well digging	[___]	
		G. Building of water retention	[___]	
		H. Utilisation of improved breed	[___]	
			[___]	
		I. Foodstuffs stocking	[___]	
		J. Reafforestation	[___]	
		K. Selling of personal goods	[___]	
		L. Income diversification	[___]	
		M. Cleanliness system	[___]	
		N. Micro-assurance	[___]	
		Other (specify)	[___]	
Observation				

Section E : MIGRATION
a. Autochtone

N°	Questions	Codes		Passer A
E1a	Have you migrated during the past 30 years?	1. Yes 2. No	[___]	
E2a	Does a family member migrate during the past 30 years ?	1. Yes 2. No	[___]	

E3a	What are the type of migrations?	1. Seasonal (3-9 mois) 2. Permanent (10 mois-année)	[___]	
E4a	What are the destinations? **<u>NB</u>: Name the place**.	1.Rural-rural 2.Rural-Urban 3.Transhumance 3.International	[___]	
E5a	What are the main causes of migration?			
E6a	Do you draw benefits from migration?	1. Yes 2. No	[___]	
E7a	Specify them			
E8a	Do you think migration is a good strategy for your needs supply?	1. Yes 2. No	[___]	
E9a	What are its advantages?			
E10a	What are its invonveniences?			

E11a	Do you think migration bring change in the village	1. Yes 2. No [___]	
E12a	If Yes, how ?		
E13a	If No, how?		

b. Immigrant

N°	Questions	Codes		Passer A
E1b	When did you arrive in the village ? ?	1. [0- 1 an] 2. [2- 3 ans] 3. [4- 5 ans]	[___]	
E2b	For which reasons are you in the village?			
E3b	Do you think going back to your village or country?	1. Yes 2. No	[___]	
E4b	If Yes, why?			
E5b	If No, why?			
E6b	Do you think migration is a good strategy for your needs supply?	1. Yes 2. No	[___]	
E7b	If Yes, why ?			

E8b	If No, why ?			
E9b	Do you think migration bring change in the village?	1. Yes 2. No	[___]	
E10b	If Yes, how ?			
E11b	If No, how?			
E12b	Do you think migration must be encouraged?	1. Yes 2. No	[___]	
E13b	If Yes, what are the avantages?			
E14b	If No, what are the inconveniences?			

Section F: CLIMATE CHANGE-INSECURITY-CONFLICTS

N°	Questions	Codes		Passer A
F.1	What are the main factors of insecurity according to you ?	A. Pasture scarcity B. Water shortage C. Reduction of corridor of transhumance/access way D. Recrudescence of livestock sicknessess E. Reduction of livestock productivity	[___] [___] [___] [___] [___]	
F.2	Does climate change be the main cause of insecutity factor?	1. Yes 2. No	[___]	

F.3	If No, what is the main cause?			
F.4	Does climate change be an exacerbation factor of insecurity factor?	1. Yes 2. No	[___]	
F.5	What is the current trend of the insecurity factors?	1. No change 2. Decrease 3. Increase	[___]	
F.6	What is the impact of these insecurity factors?	1. Conflicts causes 2. Exacerbation of conflits	[___]	
F.7	What is the trend of conflicts in the village?	1. No change 2. Decrease 3. Increase	[___]	

F.8	Causes of conflicts in the village 1. Yes 2. No	A. Socio-economical B. Demographic C. Political D. Land degradation E. Climatic (rainfall, drought, flooding with reduction of natural resources).	[___] [___] [___] [___] [___]	

F.9	How do you settle conflicts?
	   1. Yes
	   2. No
		1. Amicable
		2. Management committee
		3. Court
			[___]	

F.10	If amicable, what are the frames of conflicts management? 1. Yes 2. No	A. Chief of the village B. Mayor, prefect C. Technical services Other (specify)………….	[___] [___] [___]	
F.11	Aviez-vous des dispositifs de prévention de des conflits ?	1. Yes 2. No	[___]	