

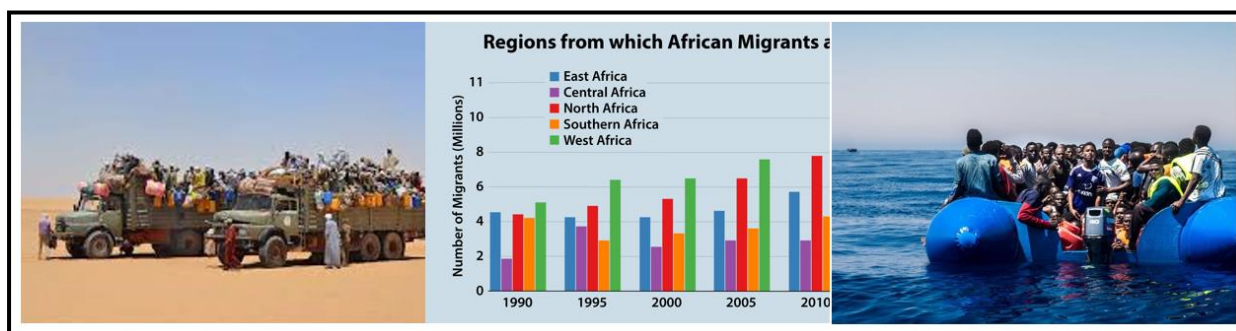
FACULTY OF HUMANITIES AND SOCIAL SCIENCES
DEPARTMENT OF GEOGRAPHY

DOCTORAL SCHOOL OF ARTS AND HUMANITIES

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

DOCTORAL PROGRAMME: Climate Change and Disaster Risk Management

MIGRATION DYNAMICS IN THE SAVANNAH REGION, TOGO: THE ROLE OF SOCIOECONOMIC AND ENVIRONMENTAL FACTORS



A thesis submitted in partial fulfilment of the requirements for Unique Doctor of Philosophy (Ph.D.) Degree in Climate Change and Disaster Risk Management at University of Lomé

Submitted by

Komlagan Mawuli Apélété YAO

Under the supervision of

Professor Edinam KOLA, University of Lomé

And co-supervision of

Professor Oluwole MORENIKEJI, Federal University of Technology Minna, Nigeria.

Professor Walter Leal, Hamburg University of Applied Science

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July 4, 2024

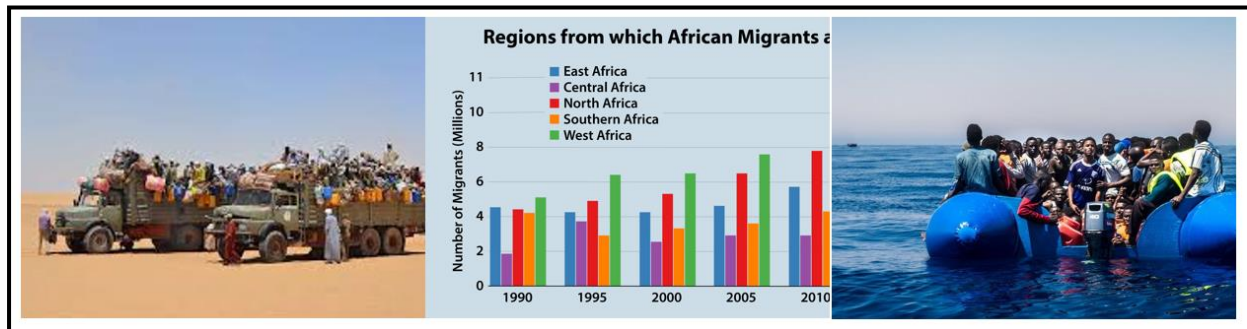
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The rapporteurs do not intend to give any approval or disapproval to the opinions expressed in this thesis. They should be considered as the author's own.

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DEDICATION

To

GOD ALMIGHTY, the Owner of my life, and source of knowledge

To my father Kouyê Comlan YAO,

To my mother Essi Edoh GBEMU-GOGLAN,

To my wife Afi Mawunyo,

To my children Daniella and Ezekiel,

I dedicate this Ph.D. thesis.

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The Almighty God, the Alpha & Omega, will reward you and bless you measurelessly

ACRONYMS AND ABBREVIATIONMS

ADB	: African Development Bank
AFUB	: Association Frères Unis de Bouanze
AGRHYMET	: Agriculture, Hydrology, Meteorology
AUDA	: African Union Development Agency
CDQ	: Comité de Développement de Quartier
CVD	: Comité Villageois de Développement
CILSS	: Comite Inter-Etat de Lutte contre la Sècheresse au Sahel
CIPRES	: Conférence Interafricaine de la Prévoyance Sociale
DFID	: Department For International Development
DGMN	: Direction Générale de la Météorologie Nationale
ECOWAS	: Economic Community of West African States
EDF	: Energie De France
EMN	: European Migration Network
FES	: Fondation des Emigrés Sénégalais
FDI	: Direct Foreign Investment
FSP	: Financial Stability Plan
GCM	: Global Compact on Migration
IBRD	: International Bank for Reconstruction and Development
ICMPD	: International Centre for Migration Policy Development
ILO	: International Labor Organization
INSD	: Institut National de la Statistique et de la Démographie
INSEED	: Institut National de la Statistique et des Etudes Économiques et Démographiques
IOM	: International Organization of Migration
IPCC	: Intergovernmental Panel on Climate Change
ISDR	: International Strategy for Disaster Reduction

ITRA	: Institut Togolais de Recherche Agronomique
MAECIA	: Ministère des Affaires Etrangères, de la Coopération et de l'Intégration Africaine
MATDCL	: Ministère de l'Administration Territoriale, de la Décentralisation et des Collectivités Locales
MCIPSPT	: Ministère du Commerce, de l'Industrie, de la Promotion du Secteur Privé et du Tourisme
MESR	: Ministère de l'Enseignement Supérieur et de la Recherche
MSPC	: Ministère de la Sécurité et de la Protection Civile
NEPAD	: New Partnership for Africa Development
OECD	: Organization for Economic Co-operate and Development
RGPH4	: Quatrième Recensement General de la Population et de l'Habitat
SAFER	: Société Autonome de Financement de l'Entretien Routier
SCAPE	: Stratégie de Croissance Accélérée et de Promotion de l'Emploi
SPS	: Santa Perpetua Solidaria
UN	: United Nations
UNCTA	: United Nations Conference on Trade and Development
UN DESA-EEA	: United Nations Department of Economic and Social Affairs-European Environment Agency
UNDP	: United Nations Development Programme
UNDRO	: Office of the United Nations Disaster Relief Co-Ordinator
UNEP	: United Nations Environment Program
UNESCO	: United Nations Educational, Scientific and Cultural Organization
UNFCCC	: United Nations Framework Convention on Climate Change
UNFP	: United Nations Population Fund
UNHCR	: United Nations High Commissioner for Refugees
UNISDR	: United Nations Office for Disaster Risk Reduction
UNODC	: United Nations Office on Drugs and Crime

UNU-CRIS	:United Nations University-Institute on Comparative Regional Integration Studies
URD	: Unit� de Recherche D�mographique
USAID	: United States Agency for International Development
WAEMU	: West African Economic and Monetary Union
WFP	: World Food Program
WGII	: Work Group II
UNODC	: United Nations Office on Drugs and Crime

ABSTRACT

Migration has become a phenomenon experienced by most young people in the Savannah Region, the northern region of Togo, bordering Burkina Faso, Benin and Ghana. The region has been subject to the adverse effects of climate variability and climate change in recent years, including irregular rainfall, drought and advancing desert. To overcome these problems, a large segment of the population of the region, especially young people, are crossing national borders in search of better living conditions. The objective of this study is to analyze the migration dynamics of populations and the impacts of socioeconomic and environmental factors on migration, to evaluate migration as a method of adaptation and to propose some approaches to solutions for a sustainable management of the migration phenomenon. To achieve this objective, a data collection methodology based on quantitative and qualitative methods was adopted; it was found that the region experiences irregular rainfall coupled with pockets of drought, evidence of climate variability and change. The emigration of populations is a response to these environmental changes that the region is experiencing and which are causing an economic crisis for the population. More young, married, poorly educated men are migrating to the countries of the sub region. Migration is not always a measure of adaptation to environmental changes; even if the migrants participate in improving the living conditions of their families in the departure zone, it causes imbalance in the areas of departure and the conditions to which migrants are exposed in the host environments are often not favorable to them. This leads us to set up sustainable management policies for the migration phenomenon.

Key words: Savannah Region, Togo, environmental and socioeconomic causes, migration, adaptation strategy, Savannah region.

RESUME

La migration est devenue un phénomène vécu par la plupart des jeunes dans la région des Savanes, la région septentrionale du Togo, frontalière du Burkina Faso, du Bénin et du Ghana. Ces dernières années, la région a subi les effets néfastes de la variabilité et du changement climatiques, notamment l'irrégularité des précipitations, la sécheresse et l'avancée du désert. Pour surmonter ces problèmes, une grande partie de la population de la région, en particulier les jeunes, traverse les frontières nationales à la recherche de meilleures conditions de vie. L'objectif de cette étude est d'analyser la dynamique migratoire des populations et les impacts des facteurs socio-économiques et environnementaux sur la migration, d'évaluer la migration comme méthode d'adaptation et de proposer quelques approches de solutions pour une gestion durable du phénomène migratoire. Pour atteindre cet objectif, une méthodologie de collecte de données basée sur des méthodes quantitatives et qualitatives a été adoptée ; il a été constaté que la région connaît une pluviométrie irrégulière entraînant des périodes de sécheresse, preuve de la variabilité et du changement climatique. L'émigration des populations est une réponse à ces changements environnementaux que connaît la région et qui provoquent une crise économique pour la population. De plus en plus d'hommes jeunes, mariés et peu éduqués migrent vers les pays de la sous-région. La migration n'est pas toujours une mesure d'adaptation aux changements environnementaux ; même si les migrants participent à l'amélioration des conditions de vie de leurs familles dans la zone de départ, elle provoque un déséquilibre dans les zones de départ et les conditions auxquelles les migrants sont exposés dans les milieux d'accueil ne leur sont souvent pas favorables. Ceci nous amène à mettre en place des politiques de gestion durable du phénomène migratoire.

Mots clés : Région des Savanes, Togo, causes environnementales et socioéconomiques, migration, stratégies d'adaptation, Région des Savanes.

GENERAL INTRODUCTION

Migration is the movement of people from one place to another, to settle in a new location. The history of mankind has been built on migration, which has been part of our evolution since prehistoric times, with the invention of agriculture and the first commercial exchanges, and the formation of the first ancient and medieval states (Demoule, 2008).

Over the last two million years, the homo genus has been constantly on the move, moving back and forth from one end of the globe to the other. Our ancestors, Homo sapiens, are at the origin of the first great migratory wave in human history, which began in Africa between 200,000 and 50,000 years ago, reaching Europe around 40,000 years ago and America between 20,000 and 15,000 years ago (Demoule, 2008). It was during the Neolithic period, 10,000 years ago, that migrations took off, as they were directly linked to the demographic boom produced by the invention of agriculture, animal domestication and, of course, the sedentarization of humans.

People often think of migration as a recent phenomenon. However, migration has been a feature of human existence for centuries. Humans have always migrated in groups and as individuals to seek freedom from war and conflict, to escape hunger and poverty, to find new economic opportunities and employment, to flee from religious intolerance or political repression, or even to trade and to travel to new places. The historian Robin Cohen (1995) has identified some distinct migration periods or events that have taken place over the last four centuries.

Migration can be voluntary or involuntary. According to European Parliament (2024), variety of different reasons, including economic, environmental and social issues can trigger the displacement of population:

- **Social and political factors**

Persecution because of one's ethnicity, religion, race, politics or culture can push people to leave their country. A major factor is war, conflict, government persecution or there being a significant risk of them. Those fleeing armed conflict, human rights violations or persecution are more likely to be humanitarian refugees. This will affect where they settle as some countries have more liberal approaches to humanitarian migrants than others. In the first instance, these people are likely to move to the nearest safe country that accepts asylum seekers.

- **Demographic and economic causes**

Demographic change determines how people move and migrate. A growing or shrinking, aging or youthful population has an impact on economic growth and employment opportunities in the

countries of origin or migration policies in the destination countries. Demographic and economic migration is related to poor labor standards, high unemployment and the overall health of a country's economy. Pull factors include higher wages, better employment opportunities, a higher standard of living and educational opportunities. If economic conditions are not favorable and appear to be at risk of declining further, a greater number of people will probably migrate to countries with a better outlook.

- **Environmental and climate migration**

The environment has always been a driver of migration, as people flee natural disasters, such as floods, hurricanes and earthquakes. However, climate change is expected to exacerbate extreme weather events, meaning more people could be on the move. It is hard to estimate how many environmental migrants there are globally due to factors such as population growth, poverty, governance, human security and conflict, which have an impact. Estimates vary from 25 million to one billion by the year 2050.

Every year, more than 20 million people are forced to relocate to other parts of their country due to extreme weather conditions like heavy rainfall, droughts, desertification, environmental degradation, sea-level rise, and cyclones (UNHCR, 2020). Each year, natural disasters force an average of 21.5 million individuals from their homes around the world. Scientists expect that migration will increase as the planet gets warmer. Rising seas, drought, blistering heat and other climate catastrophe are expected to relocate 143 million people over the next 30 years (IPCC, 2022).

Naturally, every human being has an urge to achieve a higher standard in life. Migration is an attempt on the part of human being to settle themselves to the physical and social set-up in such a way that it leads to the optimum satisfaction of the migrants (Goldscheider, 1971).

Over time the most frequently heard explanation for migration has been so called "Push-Pull Theory", which says that some people move because they are pushed out of their former location, whereas others move because they have been pulled or attracted to someplace else. This idea was first put forward by Ravenstein (1889), who analyzed migration in England. He concluded that pull factors were more important than push factors. Jakson defined the poor living conditions as "push" factors and attractive and better living conditions as "pull" factor. He says, "the declining socioeconomic conditions at the place of origin are push factor and better opportunities at the place of destination are pull factor" (Jakson, 1969).

In 1990, the Intergovernmental Panel on Climate Change (IPCC) issued a warning about the potential for significant human displacement due to climate change conditions (IOM, 2008). This phenomenon can be ascribed to the multiple effects of climate change that has the capacity to initiate displacement and aggravate the quality of living conditions, thereby obstructing the repatriation of individuals who have already been displaced.

The International Organization of Migration (IOM, 2015) asserts that climate change poses a significant issue for the international community, with migration and displacement being increasingly scrutinized by policymakers and scholars. Universally, it is now acknowledged and recognized that environmental and climatic factors significantly influence both coerced and voluntary migration. Furthermore, it is essential to recognize that migration itself has environmental consequences, as evidenced in various International Organization of Migration publications, such as *The Atlas of Environmental Migration* (Ionesco et al, 2017).

Milan (2016), offers a recent literature review on the subject of migration and environmental change, presenting four significant findings. Firstly, it is anticipated that the future will witness a stronger impact of environmental change on migration due to climate change. Secondly, the majority of environmentally induced migration will occur within state borders and over short distances, with the exception of border regions and small states, specifically small island developing States. Thirdly, while migration is often viewed as a lack of adaptation to environmental change, a growing body of research, as suggested by McLachlan et al (2007); Oakes et al. (2020), has emphasized that migration can also be an effective strategy for successful household livelihood diversification and risk reduction.

In the African continent, the matter of migration has become a pressing concern, because Africans are one of the most dynamic populations on the planet. Of the 31 million emigrants from Africa, about 2.3 million are recognized as being refugees displaced mainly by war, drought or other forms of natural disasters (Abebe, 2010). While some individuals opt for migration, others are compelled to do so due to undesirable circumstances such as war, political instability, poverty, or persecution (NEPAD-AUDA, 2022). Migration is a prominent phenomenon in Africa, characterized by significant numbers of migrants relocating both within and beyond the region. In the year 2020, a remarkable escalation was witnessed in the number of Africans residing in a foreign African nations, resulting in an estimated total of 21 million inhabitants. This figure represents a considerable escalation from the estimated 18 million individuals recorded in 2015 within the region. Correspondingly, the population of Africans

inhabiting distinct areas also exhibited growth during the same temporal span, increasing from roughly 17 million in 2015 to exceeding 19.5 million in 2020 (IOM, 2020).

The phenomenon of migration in Africa is distinguished by the predominance of emigration, primarily to other countries within the continent, as well as to some degree, to destinations beyond. The principal impetuses for migration from respective countries within the continent are political instability in Somalia and conflict in Sudan, South Sudan, the Democratic Republic of Congo, and the Central African Republic. Moreover, climate change and escalating rivalry over limited natural resources have become influential factors in migration in the Sahel region, where distress-push conditions are leading to movements from Mali and Niger. Labor demand in critical economic sectors has also played a significant role in driving migration to hubs such as South Africa (domestic service, mining, and construction) and Cote d'Ivoire (agriculture). Similarly, labor demand in Gabon's timber and mining sectors, Equatorial Guinea's oil sector, and diversified economies like Kenya has influenced migration to these economies primarily from neighboring countries (UNCTAD, 2018).

Nevertheless, demographic, security, and livelihood challenges are also contributing to migration flows. In the past few years, the rise of jihadist extremist threats in Nigeria, Niger, Burkina Faso, and Mali has led to an increase in population displacement. However, a growing body of evidence indicates that the alterations in the climate are aggravating these trends. The vast majority of migration in West Africa (84%) remains intra-regional (PRIO-UNFP, 2020). Within the Sahel region, which encompasses Mali, Burkina Faso, Niger, and Chad, a considerable number of individuals are relocating to countries offering better opportunities in industries such as agriculture, mining, and coastal activities. Their decision to migrate is primarily motivated by the unsuitable and deteriorating nature of the region's landscape (ICMPD & IOM, 2015).

The correlation between changes in the environment and migration has generated significant interest among demographers and economic planners, as well as those who aim to comprehend the human aspects of global transformations and develop strategies to alleviate the resultant human impacts. Given the widespread belief that developing countries will bear the shock of global environmental changes in the near future, the understanding of such connections is essential to development, as noted by Carr (2005). Conversely, the phenomenon of migration has been shown to give rise to a decline in the quality of natural resources within the host region, thereby presenting a possibility for an adverse impact on the environment and, in turn, exerting

an indirect influence on the initial status of the host areas (Ouedraogo et al, 2009; Djiga, 2015) cited in (Sanfo et al, 2017).

It has been observed that the semi-arid regions of West Africa are typified by pronounced climate variability, as evidenced by the findings of Salack et al (2016). In this context, it is worth noting that any escalation in rainfall variability could potentially lead to an appreciable decline in crop yields, which would ultimately translate into reduced household incomes. Moreover, such a scenario could conceivably serve as a catalyst for inducing families to migrate, as pointed out by Barbier et al (2008). Furthermore, swift deterioration of the environment, particularly in terms of the degradation of land, may serve as a catalyst for individuals to undertake migration, as posited by Henry et al (2003).

In the West African region, the majority of individuals who relocate do not venture outside the area. This phenomenon of south-south migration is notably more substantial than the movement of people from West African nations to other parts of the world, including Europe, by a factor of seven. Countries such as Côte d'Ivoire, Ghana, and Nigeria have become significant destinations for migrants, with a large percentage of them migrating for work purposes. Côte d'Ivoire, for instance, has the greatest number of immigrants, totaling 2.4 million, of whom only 50,000 originated from beyond the region. In addition, it has been observed that within seven West African nations, the monetary amount transmitted by migrants to their relatives residing in the same geographic region surpasses the monetary amount sent from other foreign nations. This emphasizes the significance of regional migration in enhancing poverty reduction and development (ICMPD & IOM, 2015). According to Henry et al (2003), various demographic and socioeconomic variables, such as local marriage rates, age and gender distribution, population structure, education level, income, fertility, and mortality rates, are linked to migration in West Africa, as documented by Cordell (1996); Ardjouma (1998); Sivamurthy (1982); Zachariah (1982).

Internal migration in Togo is driven by significant rural exodus movements to the country's main urban centers, particularly Lomé, but also by inter-regional movements. It is estimated that 25% of Togolese live in a region other than their native region. The explanatory factors for internal migration flows include: job search, climate change and its effects on the productivity of agriculture, education and training, and ethnic conflicts (IOM, 2015).

While the Directorate for Togolese Abroad (DTE) estimates the diaspora Togolese to have a labor force of 1.5 to 2 million people around the world, with more than 80% in Africa, the

RGPH4 data suggests that the Number of emigrants increased from 62,994 in 1960 to 372,600 in 2011, an increase of nearly 17%. In 2011, this population was divided into 187,045 males and 185,555 females. The main destinations of Togolese emigrants are Ghana (415,049), Nigeria (100,428), Ivory Coast (55,680), Benin (45,498) and Burkina Faso (23,768). According to the OECD (2011), the number of Togolese residents in the different European countries seems to be low. The main OECD countries with a significant Togolese community are Germany (10,219 registered Togolese in 2011), France (9,371 in 2009), Italy (4,422 in 2010) and Belgium (2,708 in 2010). Several factors explain Togolese migratory flows abroad: educational migrations, dominated by the transient movements of civil servants and students encouraged to strengthen the state's capabilities; the economic boom in Ghana, a border country that has attracted many Togolese in search of wealth; the economic downturn of the 1980s combined with the political instability of the 1990s and 2005; Changes in climate change and poverty in rural areas (IOM, 2015).

On the environmental front, rising sea levels are affecting or threatening to displace many coastal populations. The same applies to flooding, which is causing increasing numbers of disaster victims, homeless people and internally displaced persons in Togo.

The scientific discourse in recent years has focused on the influence of environmental change on migration patterns on account of the climate change debate (Black et al, 2011c; Brown, 2008; De Longueville et al, 2019; De Longueville et al, 2020; Gautier et al, 2016; McLeman, 2013; Rigaud et al, 2021). However, environmental factors must be integrated into a complex network of factors and processes and cannot be seen as a stand-alone determinant of migration (Bilsborrow & Henry, 2012, Cattaneo & Massetti, 2019; Adger et al, 2021). In particular, recent literature highlights the combination and interplay of several factors that influence the decision to migrate (Abu et al, 2014; Ackah & Medvedev, 2010; Black et al, 2011a; Bukari et al, 2020; Neumann et al, 2015; Sanfo et al, 2017; Van Hear et al, 2018). Economic and social factors play an important role when it comes to deciding whether to migrate or not (Carr, 2005; Bassett & Turner, 2006; Doeverspeck, 2011; Sow et al, 2014). However, beyond a combination of factors that would be conducive to migration, the process also requires financial means. In other words, households that do not have the necessary resources may send only one household member or none to migrate, and thus remain trapped in their situation (Black et al, 2013; Cattaneo & Massetti, 2019; Foresight, 2011).

It is complex to determine the specific factors that trigger the mobility of an individual or a people. Several reasons according to the literature, cause the emigration of a people; these are

socioeconomic, political and environmental causes, with explanations relating to the realities of the study area. Migration can cause significant social unrest and can be likened to a natural disaster. The study of migration dynamics requires a thorough examination of the various factors that contribute to this phenomenon. It is important to note that human displacement is not exclusively a reaction to poverty and societal inequities but rather a coping mechanism in light of the challenges posed by climate change (Scheffran et al., 2012). In fact, migration is a strategy that people use to sustain their livelihoods when faced with economic and environmental disruptions. As such, it is crucial for countries to have proper migration management policies in place to promote their development. To fully understand the complexities of human mobility in the Savannah Region of Togo, it is essential to analyze the causes of migration, particularly in relation to climate change and variability.

The proof of climate change or climate variability will be shown at the first stage. The socioeconomic and environmental causes of human mobility will be highlighted secondly. Thirdly, the assessment of migration as an adaptation mechanism gives an overview on migration as an opportunity to cope with the effects of climate change. Lastly, strategy to inform the climate-induced management will be recommended.

A nomenclature of six chapters grouped in two main parts, each part subdivided into three chapters, is adopted in this thesis, structured as follow:

The **first part** presents the conceptual, spatial and methodological framework of the research. It is made up of three chapters: **Chapter I** presents the general introduction including the problem statement, the objectives, and the related research questions. It highlights the scope and the justification of the study as well. **Chapter II** covers the literature review, the conceptual basis for the research on the concepts related to migration, adaptation strategy as well as the conceptual framework adopted for the study. **Chapter III** gives the characteristics of the study area, the location, population, economic, climate, and vegetation. The methods used in data collection and analysis are also included in this chapter. The **second part** entitled “Results and Discussion” is composed as well of three chapters; each chapter addresses the research objectives of the study. **Chapter IV** addresses the first specific objective of the study which focuses on the trend analysis of climate parameters using Mann-Kendall test. It exposed land use and land cover change in the selected region. **Chapter V** deals with the second specific objective. It focused on identifying the socioeconomic factors influencing the population emigration. **Chapter VI** covers the third specific objective, which focuses on describing the

role of environmental factors in migration dynamics considered as adaptation/ coping strategy to socioeconomic and environmental causes of emigration in the Savannah Region of Togo.

PART I:
**CONCEPTUAL, SPATIAL AND
METHODOLOGICAL FRAMEWORK**

INTRODUCTION TO THE PART I

According to Kerlinger (1964), the scientific research is a systematic, controlled, empirical, and critical investigation of hypothetical propositions about the presumed relations among natural phenomena. Consequently, scientific research relies on the examination of hypotheses in order to understand or analyze a given phenomenon within society, as opposed to common experience, which presents itself directly.

In this regard, this first part of the thesis covered the presentation of the conceptual, spatial and methodological framework. It first lays the background of the study, describes the statement of problem and justification of the study, research questions, general and specific objectives for the study, the research hypotheses, and a theoretical framework that is based on the clarification of concepts and a literature review.

Chapter I deals with the background of this research by documenting on human migration, and the factors that influence the population decision to migrate. Starting from understanding the reasons behind people displacement, the problematic was clearly defined. Well developed and oriented, the background enables the formulation of the research topic, the framing of relevant research questions, the statement of objectives and hypotheses.

Chapter II focuses on the definition and clarification of relevant concepts related to human migration, its drivers, and its role as an adaptation strategy to climate change. To understand the research topic and to be aware of the studies that were already conducted in the field of human migration, and what has been done by previous authors, and what were their results, a detailed literature review was developed. The use of scholarly articles, books, thesis, and other sources relevant to the subject of migration, was essential and important for the understanding of the topic.

Chapter III tackles the methodological approaches of the study. A proper methodological approach is a foundation of any scientific research; therefore its choice relies on the objectives pursued in the relation with the context and specific aspects of the research field. This methodological approach describes the research documentary process, the data and information collected, methods of data collection (primary and secondary data), data processing analysis methods. A conclusion, which sum up the main points addressed in the three chapters end this first part.

CHAPTER I:
BACKGROUND AND STATEMENT OF
PROBLEM

Introduction

Any scientific research is always linked to a clear context. To understand this context (theories, laws, concepts, activities...) a conceptual and theoretical framework must be defined. It is in this perspective that this first chapter of the thesis is devoted to the conceptual theoretical frameworks of the study. This chapter discusses the justification of the topic, the problem, the hypotheses, the objectives and the clarification of the key concepts. The problem is articulated around the statement of the observations, the formulation of the problem and the development of the research questions. Hypotheses, one main and four secondary, are formulated to provisionally respond to the questions. The study has one general objective and four specific objectives. Some key concepts were explained for a better understanding of the thesis.

1.1. Background

Migration is an important dynamic topic in national and international debates, as environmental migration in particular has become an everyday issue with increasing impacts. Migrants themselves face serious threats in their origin and destination. Such migrants have been identified by Brown (2011) as environmental refugees since the 1970s. According to the initial evaluation submitted by the Intergovernmental Panel on Climate Change, also known as IPCC, in 1990, it is probable that the most significant consequence of climate change will be observed in the realm of human migration. Then the problem of environmental displacement has attracted global attention and the influence of human on the environment is revealing a new frightening reality for the globe (Myers, 1997). As the number of people forced to relocate due to climate change increases, this matter has become increasingly pressing (Williams, 2008).

Thus, environmental migration or displacement appears to be a rapidly developing disaster for the international community (Westing, 1992); this potential disaster is expected to exceed any known refugee crisis in regards to the number of people affected.

In recent years, a substantial surge in the number of Africans who have been compelled to leave their residences has been observed, as indicated by the latest recorded figure of 25 million people, which represents a 500 percent escalation from the year 2005 (Williams, 2019). While the influx of economic migrants striving to enter Europe is of significant interest, it is noteworthy to mention that a staggering 95 percent of displaced individuals remain within the confines of the continent (Williams, 2019). Migration patterns in Africa are witnessing a rise, with the impetus for African migration being propelled by push-pull forces that are intensifying, thereby resulting in an upswing in both internal and external migration from the African region.

The documented number of migrants from and within the African region has undergone an almost twofold increase since 2010, persisting on a two-decade growth trajectory¹ (Figure 1).

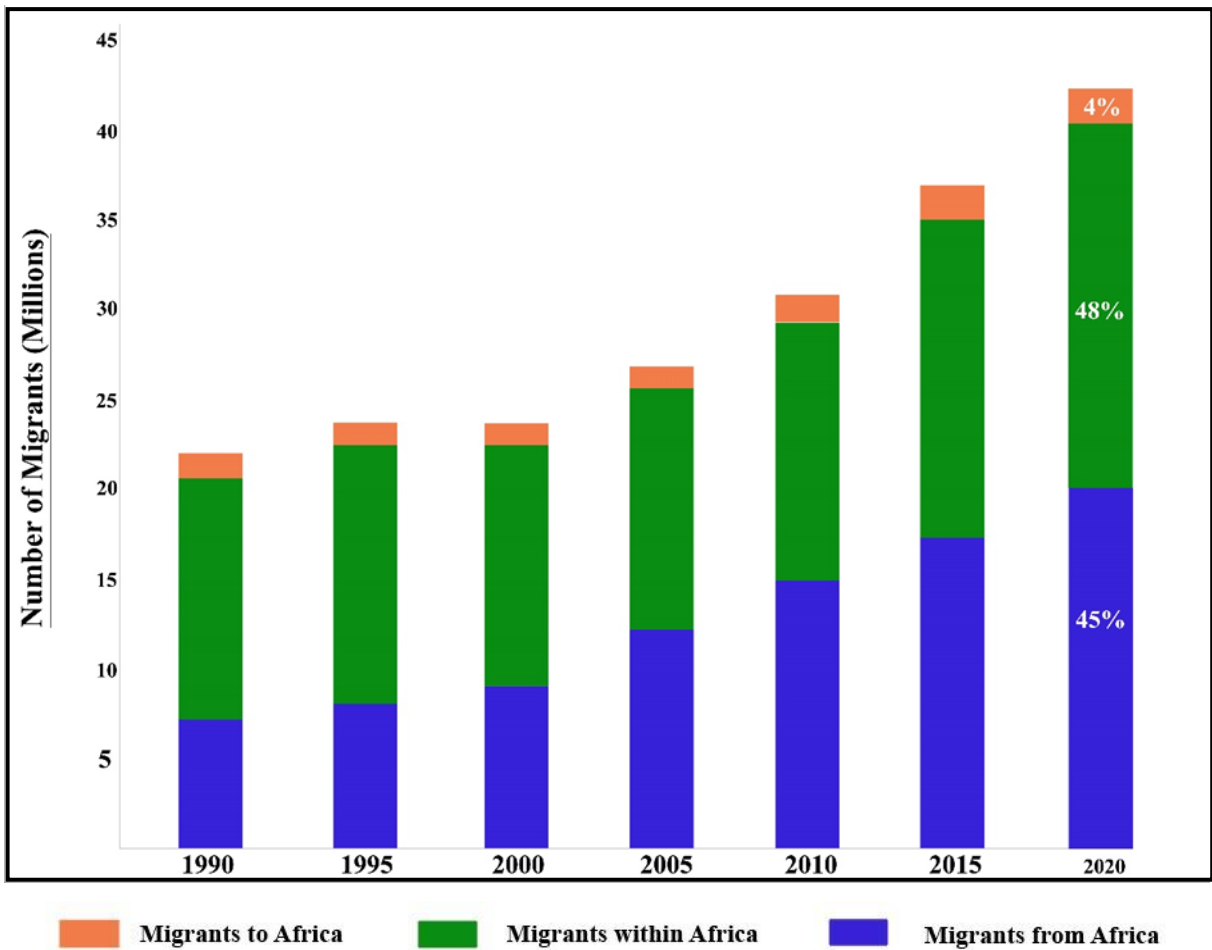


Figure 1: The number of migrants within and from Africa

Source: UN DESA, 2021

The prevalent trend of African migration primarily occurs within the continent, persisting throughout history. It is estimated that roughly 21 million verified african nationals reside in alternate african nations, although this figure may be understated due to insufficient migration tracking measures in various african countries (Williams, 2019).

Africa has been well characterized as a continent in the process of dynamic motion. Currently, Africa undergoes a plethora of migration patterns, both within and outside the continent; but the most prominent are labor migration, refugee flows and internal displacement (UN, 2016). From the number of migrants moving in Africa, most of them are young people.

¹ www.iom.int/west-and-central-africa retrieved on March 9

Migration is part of West Africa's history, everyday life and culture. Eighty-four percent of migration flows today take place in the region (IOM, 2020). About 8.4 million migrants, representing 2.8 percent of the total population, move around West Africa (UN DESA-EEA, 2009). This is Africa's greatest overall migrant stock moving internally, intra-regionally, continentally and internationally. West Africa has also the highest number of intraregional migrants (Figure 2). As regional economic integration and cooperation progressed, more and more West Africans departed from their home countries in pursuit of better opportunities. It is estimated that South-South migration contributes for more than fifty percent to all migratory movements within the region (UNDP, 2009).

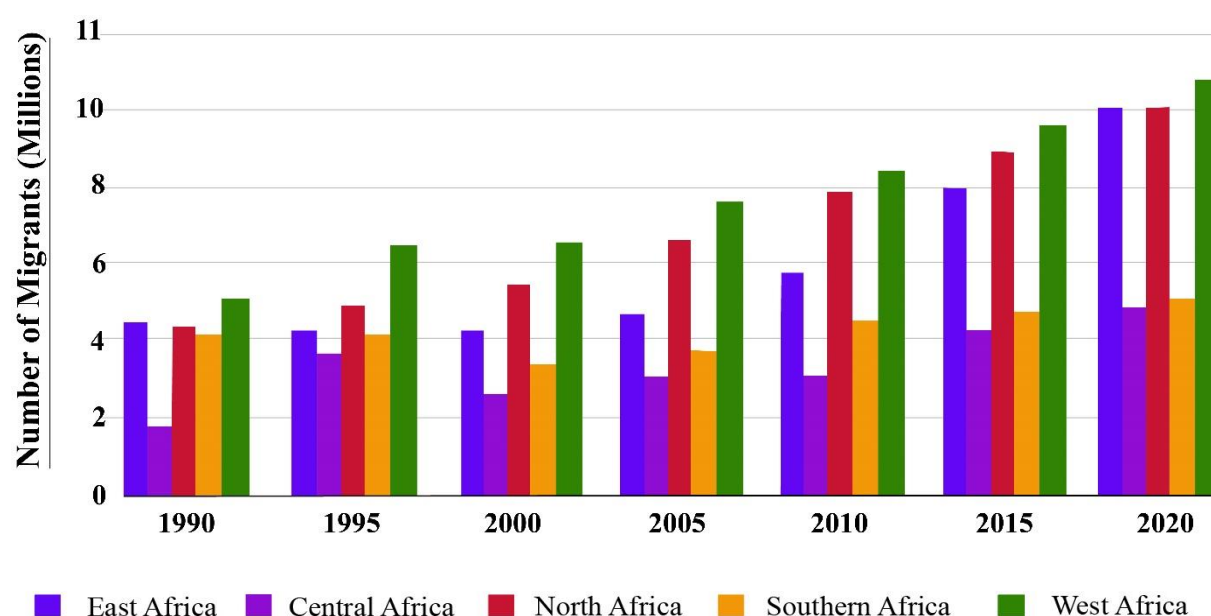


Figure 2: The number of migrants from African regions

Source: UN DESA, 2021

Migration in Togo is as old as its settlement. According to oral history, the nation was inhabited by waves of migration peoples from the north, east and west. Togo has kept track of both internal population migrations and migrant exchanges with foreign nations since the colonial period. Indeed, prior to 1960, year of independence in Africa, a considerable majority of Togolese lived in other West African countries, particularly in Ghana and Benin because of better employment opportunities. During this period, one-sixth of Togolese resided in Ghana and worked in the cocoa fields (Zachariah, 1982).

1.2. Problem statement and justification

Togo, a low-income country, is classified as fragile state due to the risky nature of its development. The country's economic woes, along with numerous sociopolitical crises since 1990 have contributed to making Togo essentially a country of emigration. Thus, Togo records both significant movements of its population and maintains exchanges of non-migrants, not only with its neighbors, but also with Western countries (Europe, United States, etc.) (INSEED, 2016). In Togo, internal migration is still an important part of citizen mobility. The rural exodus mainly affects girls (between the ages of 6 and 17) who are brought to the capital of Togo as servants or shop assistants (IOM, 2015). This internal movement also affects adults, peasants who have gone bankrupt due to food importation from Europe, victims of floods, droughts, or other climatic disasters, and women in vulnerable situations in the communities. As a result, many people are obliged to quit their communities in looking for well-being.

Emigration is often caused by a range of variables, the most prominent of which is economic. Thus, even if the economic growth indicators have been positive since the decade 2000 and port infrastructures represent a valuable economic asset, Togo is not a country with significant economic prosperity, big plantation crops (coffee, cocoa, etc.) or substantial oil or mining areas. The country's socioeconomic and even sociopolitical difficulties compared to the relative economic prosperity of certain neighboring countries such as Ghana, Ivory Coast or Nigeria tend to make Togo a country of emigration. Also, togolese emigration to other countries is more important than immigration to togolese territory (ILO, 2020).

As for the migratory movements between 2005 and 2010, the Lomé agglomerations, the Plateaux region and the Kara region show a positive migratory balance, while the Maritime, Centrale and Savannah regions show negative balances. The arid plains and soil factors of the Savannah and Kara regions offer fewer advantages for human settlements (Souradji & Honoré, 2016). With 4.3% of the proportion of natives leaving the region in 2010 and only 2% of lifelong migrants, the Savannah Region is among Togo's displaced regions. In addition, the region has a migration balance of -1.794 in 2010 (RGPH4, 2010).

Given the population exchanges that occurred in the five years preceding the fourth general census of population and habitat in 2010, the regions of Togo can be classified into two categories: those of immigration (Grand Lomé, Plateaux and Kara) and those of emigration (Maritime, Central, and Savannah).

This research makes it possible to identify two categories of regions: the immigration regions (Lomé and the Central region) with positive migratory balances and emigration regions (the Plateaux, Kara, and Savannas regions) with negative net migration.

The Table (1) results shows that the Greater Lomé region wins in all of its exchanges with other regions, whereas the Savannas Region loses in all of its internal exchanges

Table 1: Balance of interregional migration in 2010

Region of birth	Region of residence					
	Grand Lomé	Maritime	Plateaux	Centrale	Kara	Savanes
Grand Lomé	0	-202,208	-140,248	-49,487	-59,659	-19,785
Maritime	202,208	0	-967	-4,199	-15,210	-5,741
Plateaux	140,248	967	0	8,507	-51,945	-13,436
Centrale	49,487	4,199	-8,507	0	-50,537	-1,510
Kara	59,659	15,210	51,945	50,537	0	-124
Savanes	19,785	5,741	13,436	1,510	124	0
Solde migratoire	471,387	-176,091	-84,341	6,868	-177,227	-40,596

Source: RGPH4, 2010

Climate change leading to drought and land degradation is also leading to interregional migrations of agricultural populations in search of fertile farmland (Brüning & Piguet, 2018). Consequently, population of the Savannah Region in Togo are migrating to the southern regions in search of fertile cultivable lands.

The Harmonized Survey of Household Living Conditions released by the National Institute of Statistics and Economic and Demographic Studies on October 29, 2020 showed that the Savannah Region has the highest poverty index in Togo (65%), with 90% of people living on less than €1/day. According to the RGPH4, the native resident population of the Savannah region is 23735. Of this population, 4.3% leave the region, representing a proportion of around 1,021 inhabitants. The aridity of the region makes it very difficult to develop agricultural activities, despite them being the main activity practiced.

In the Savanna Region of Togo, young people particularly, are leaving the region because of its precarious conditions (poverty and lack of financial opportunities). Despite the various government effort to develop the region, the departure of the able-bodies arm is still evident. The contribution of the socioeconomic and environmental drivers as triggers of migration has not been yet addressed. Similarly, migration as an adaptation/ coping strategy to degraded environment of the area is not clear. These are the gaps this current research aims to address.

This study aims at determining the role played by socioeconomic factors under the degraded environment caused by the effects of climate change or climate variability in the Savannah Region.

This research is a further attempts to demonstrate the climate change or climate variability that the Savannah Region is experiencing; it evaluates the contribution of socioeconomic and environmental drivers in migration phenomenon, as well as the perception of the population on migration as an adaptation strategy; it suggests possible implementable policies to manage the phenomenon of migration. Therefore, the following research questions are resolved through this study.

1.3. Research questions

Considering the problem, the main question asked is: what role do socioeconomic and environmental factors play in migration dynamics in Togo's Savannah Region? Below are the secondary questions that arose from this fundamental question:

- What are the changes occurred in climate parameters trends, as well as the changes in land use and land cover during the period of 1981 to 2020 in the Savannah Region?
- What are the socioeconomic factors behind migration dynamics in the Savannah Region of Togo?
- What is the role of environmental factors in migration dynamics considered as an adaptation/ coping strategy to socioeconomic and environmental drivers in the Savannah Region of Togo?

Answering these questions enables to identify the factors that push the Savannah population out of their region, to weight the migration as an adaptation strategy and to find ways to manage the population emigration.

1.4. Overall aim and objectives

The overall aim of this study is to analyze socioeconomic and environmental variables role on migratory patterns in Togo's Savannah Region. Three specific objectives are derived from the main objective, they are as follow:

- Determine the trends in climate, land use and land change patterns in the Savannah Region in Togo;

- Identify the socioeconomic factors of migration dynamics in the Savannah Region of Togo;
- Describe the role of environmental factors in migration dynamics considered as an adaptation/ coping strategy to socioeconomic and environmental drivers of emigration in the Savannah Region of Togo.

To answer these questions, hypothesis are elaborated:

1.5. Research hypothesis

Understanding the drivers of population emigration contributes to the knowledge on the migration dynamics in Togo, particularly in Savannah region. This study lays foundation on the main hypothesis stipulating that socioeconomic and environmental factors are influencing the decision of migration in the Savannah Region of Togo. The resulting secondary hypotheses are based on the following assertions:

- The changes in climate parameters, land use and land cover patterns shape the environment of the Savannah Region.
- The socioeconomic factors are influencing the population migration in the Savannah Region of Togo;
- The environmental drivers play a role in migration dynamics that is considered as an adaptation/coping strategy in the Savannah Region of Togo;

1.6. Relevance of the study

Scientifically, the topic enables to deepen knowledge on the issue of migration and its causes in the Savannah Region of Togo. This study also makes it possible to provide researchers with a database for future research that will contribute to establish a policy for sustainable management of population migration. The adopted methodology in assessing the causes of migration and its role as an adaptation strategy is clear enough and can be replicated in another area for knowledge expanding. Practically, it is also a tool for stakeholders to have an overview on the adaptation strategies to the effects of climate change. This research enables the understanding of the causes of migration; it is also a tool for stakeholders to have an overview on the adaptation strategies of climate change and the results from this study could be also use in analyzing the constraints that hinder the local development.

1.7. Scope of the study

This research addresses population migration, the impacts of socioeconomic and environmental causes and the adaptation role of migration. This study was limited in geographical scope to population living in area that has been identified as favorable zone for migration due to its socioeconomic and environmental characteristics.

1.8. Limitations of the study

All research is born of the need to find solutions to a problem or to fill the gaps that undermine the development of a given society. In the course of this research, we were confronted with a number of difficulties.

The first difficulty is that of recognizing the households that have registered emigrants. This was a major obstacle. However, with the help of the presidents of the CDQs, CVDs and resource persons in the target localities, these households were identified. The reluctance and mistrust of the respondents were not negligible during the investigations because they were concerned about the scope of the information provided and were reluctant to answer the questions. In this regard, the field assistants were of a great help; most of them are from the region, and they work often with Red Cross; in this sense, they were able to convince the interviewee. In addition, some local stakeholders assist us during the questionnaire administration, giving more assurance to the population.

I was confronted with difficulties related to documentation, especially concerning the evolution of migratory flows in the study region. The non-existence of data base related to migration flow in the study area, especially, the number of people that are leaving the Savannah Region because of the effects and impacts of climate change or climate variability. To overcome this issue, we gathered information collected from the questionnaire administration.

Regarding the population census data, I was obliged to use the 2010 Togo population census data, since the reports of the one did recently was not available.

The main limitation of Logistic Regression is the assumption of linearity between the dependent variable and the independent variables. In the real world, the data is rarely linearly separable. Most of the time data would be a jumbled mess.

One of the drawbacks of the Mann-Kendall test is that it cannot distinguish between meaningful and non-meaningful differences in subsequent observations. Another disadvantage is that the

power of the Mann-Kendall test can be affected by missing data and the aggregation of data. Extrapolation was used to counteract the problem of missing data.

Conclusion

This chapter presents the problem statement based on a background, research questions, objectives and hypothesis. This part is crucial in thesis writing because it gives an overview of the gap that the study intends to fill; it enables the understanding of the whole thesis through the research questions, objectives and hypotheses that are clearly defined.

CHAPTER II:
CLARIFICATION OF CONCEPTS,
THEORETICAL FRAMEWORK,
AND LITERATURE REVIEW

Introduction

The definition of concepts is a fundamental step in research because it enables a better understanding of the themes used in the study. In this context, the definition of a set of words relating to emigration seems necessary for a perfect mastery of the subject of study. The conceptual and theoretical frameworks aim to clarify the concepts, theories, etc. Thus, this conceptual framework was elaborated around the identified problem. To better conduct this research and to reach the targeted objectives, a theoretical framework that leans on the clarification of the concepts and the literature review have been formulated.

2.1. Conceptual clarification

The definition of concepts is a fundamental step in the research insofar as it allows a better understanding of the study. In this context, the definition of a set of words related to the migration of populations seems necessary for a perfect mastery of the study subject. These are the concepts of emigration, immigration, migrant, adaptive strategy, environmental refugees...

➤ Migration

From the Latin "*migratio*", derived from the verb "*migrare*" which means "to migrate", migration is defined as any movement of people from one place to another (either from one region to another or from one country to another). Migration is also a voluntary movement of individuals or populations from one country to another or from one region to another, for economic, political or cultural reasons (Larousse, 2010). Migration is the movement of people from one territory or community to another with the intention of staying there for a given period of time to accomplish a mission (Kokou, 2018). Migration is also the crossing of political and administrative boundaries for a minimum of time (Migrations et Sociétés Inclusives, UNESCO, 2020). It includes refugee movements, displaced persons and economic migrants. The concept of migration involves both spatial and temporal dimensions. The spatial dimension refers to the notion of the geographical space in which migration takes place. The temporal dimension refers to the time elapsed since the change of residence (according to the IOM, this time is one year, and according to the RGPH4 in Togo, an emigrant is an individual who leaves his or her household or family for more than six months).

Migration is a movement to another place, often of a large group of people or animals (www.yourdictionary.com, retrieved on 20 Dec 2020). Human migration involves the movement of people from one place to another with intentions of settling, permanently or

temporarily, at a new location (geographic region). The movement often occurs over long distances and from one country to another, but internal migration (within a single country) is also possible (https://en.wikipedia.org/wiki/Human_migration accessed on 20 Dec 2020).

For the purpose of this research the definition the International Organization of Migration is adopted. Migration is defined as the movement of a person or a group of persons, either across an international border, or within a State. It is a population movement, encompassing any kind of movement of people, whatever its length, composition and causes; it includes migration of refugees, displaced persons, economic migrants, and persons moving for other purposes, including family reunification (IOM, 2019).

Four most common types of migration has been categorized, and it is important to note, that when examining an individual's migration story, the specific cause of migration could fall under multiple wide-ranging IOM categories; for example, both the "forced migration/displacement" category and "environmental migration" category can include migration due to a natural disaster.

- **Labor migration**

There is no internationally accepted statistical definition of labor migration. However, the main actors in labor migration are **migrant workers**, which the International Labor Organization (ILO) defines as: "... all international migrants who are currently employed or unemployed and seeking employment in their present country of residence." (ILO, 2015).

The United Nations Statistics Division (UN SD) also provides a statistical definition of a **foreign migrant worker**: "Foreigners admitted by the receiving State for the specific purpose of exercising an economic activity remunerated from within the receiving country. Their length of stay is usually restricted as is the type of employment they can hold. Their dependents, if admitted, are also included in this category." (UN SD, 2017).

The International Organization for Migration (IOM) differentiates economic migrants from labor migrants (Usher, 2004). It defines several subgroups of migrant worker, including business travelers, contract migrant workers, established migrant workers, highly skilled migrant workers, immigrating investors, project-tied workers, seasonal migrant workers, and temporary migrant workers.

"Labor migrants" are defined as those who move for the purpose of employment.

“Economic migrants” form a potentially broader group that includes people entering a state to perform economic activities, such as investors or business travelers, but can be understood also in a narrower sense similar to the category of “labor migrants”.

A “migrant worker” is defined in the instruments of the International Labor Organization (ILO) as a person who migrates from one country to another (or has migrated from one country to another) for purposes of employment other than on their own account and includes: any person who is regularly accepted as a migrant for employment (ILO, 2015).

The United Nations Convention on the Protection of the Rights of all Migrant Workers and Members of their Families defines a migrant worker as a person who is to be engaged, is engaged or has been engaged in a remunerated activity in a state of which he or she is not a citizen (Amirkhanian et al, 2010).

In this study, migrant workers are considered to be those who are looking for work or are employed in the host country, or those who were previously looking for work or were employed but are unable to continue working and remain in the host country, regardless of their documentation. When estimating how many migrants are migrant workers, some use legal status, others motivation, and others general employment (Amirkhanian et al, 2010).

- **Forced migration or displacement**

A migratory movement in which an element of coercion exists, including threats to life and livelihood, whether arising from natural or man-made causes (e.g. movements of **refugees** and **internally displaced persons** as well as people displaced by natural or environmental disasters, chemical or nuclear disasters, famine or development projects), (EMN, 2022).

The definition that is adapted from Deng (1998) fit with the objective of the research: Forced migration or displacement is defined as, “the movement of persons who have been forced or obliged to flee or to leave their homes or places of habitual residence, in particular as a result of or in order to avoid the effects of armed conflict, situations of generalized violence, violations of human rights or natural or human-made disasters”.

- **Human trafficking**

Human trafficking is a “form of modern-day slavery in which traffickers use force, fraud, or coercion to control victims for the purpose of engaging in commercial sex acts or labor services

against his/her will.” **Sex trafficking** has been found in a wide variety of venues within the sex industry, including residential brothels, escort services, fake massage businesses, strip clubs, and street prostitution. **Labor trafficking** has been found in diverse labor settings including, domestic work, small businesses, large farms, and factories (<https://humantraffickinghotline.org/en/type-trafficking/human-trafficking>, retrieved on Aug 8, 2023)

According to United Nations Office on Drugs and Crime (UNODC), Human Trafficking is the recruitment, transportation, transfer, harboring or receipt of people through force, fraud or deception, with the aim of exploiting them for profit.

- **Environmental migration**

Migration of populations as a result of failing ecosystems, vulnerability to natural hazards and gradual climate-driven environmental changes causing poverty and hunger (UNEP, 2022).

The definition of International Organization for Migration is considered in this study. Environmental migration is “understood to mean people or groups of people who are forced to leave their usual place of residence, temporarily or temporarily, or to live permanently, mainly because of sudden or progressive changes in the environment that adversely affect their life or living conditions their country or abroad” (IOM, 2007).

- **Migration management**

A term used to encompass numerous governmental functions within a national system for the orderly and humane management for cross-border migration, particularly managing the entry and presence of foreigners within the borders of the State and the protection of refugees and others in need of protection. It refers to a planned approach to the development of policy, legislative and administrative responses to key migration issues (Ushakov, 2020).

- **Migrants**

-The term "migrant" means any person who has been in a foreign country for more than one year, regardless of the voluntary or involuntary reasons for migration and regardless of the means used for migration (regular or irregular) (UN, 2008). For UNESCO, (2020), the term 'migrant' is defined as any person residing temporarily or permanently in a country where they were not born and who has established significant social ties with that country.

-A migrant is defined as any person who leaves his or her usual place of residence, crosses or has crossed an international border, or moves or has moved within a state, regardless of: the legal status of the person, the voluntary or involuntary nature of the movement, the causes of the movement, or the duration of the stay (IOM, 2007).

The term ‘migrant’ is not defined under international law and is sometimes used differently by different stakeholders. Traditionally, the word ‘migrant’ has been used to designate people who move by choice rather than to escape conflict or persecution, usually across an international border (‘international migrants’), for instance to join family members already abroad, to search for a livelihood, or for a range of other purposes. The term is increasingly used as an umbrella term to refer to any person who moves away from their usual place of residence, whether internally or across a border, and regardless of whether the movement is ‘forced’ or voluntary (<https://emergency.unhcr.org/entry/44937/migrant-definition>, accessed on 20 Dec 2020).

A migrant is an umbrella term, not defined under international law, reflecting the common lay understanding of a person who moves away from his or her place of usual residence, whether within a country or across an international border, temporarily or permanently, and for a variety of reasons. The term includes a number of well-defined legal categories of people, such as migrant workers; persons whose particular types of movements are legally-defined, such as smuggled migrants; as well as those whose status or means of movement are not specifically defined under international law, such as international students (<https://www.iom.int/key-migration-terms>, accessed on 20 Dec 2020).

At the international level, there is no universally accepted definition of the term “migrant”. Migrants may remain in the home country or host country (“settlers”), move on to another country (“transit migrants”), or move back and forth between countries (“circular migrants” such as seasonal workers) (<https://www.who.int/migrants/about/definitions/en/> retrieved on 20 Dec 2020).

According to (UNHCR Viewpoint, 2015), there are important differences between the terms ‘migrant’ and ‘refugee’, which cannot be used interchangeably. Refugees are outside their own country because of a threat to their lives or freedom. They are defined and protected by a specific international legal framework.

-Refugee (mandate) – A person who qualifies for the protection of the United Nations provided by the High Commissioner for Refugees (UNHCR), in accordance with UNHCR’s Statute and,

notably, subsequent General Assembly's resolutions clarifying the scope of UNHCR's competency, regardless of whether or not he or she is in a country that is a party to the 1951 Convention or the 1967 Protocol – or a relevant regional refugee instrument – or whether or not he or she has been recognized by his or her host country as a refugee under either of these instruments (<https://www.who.int/migrants/about/definitions/en/> retrieved on 20 Dec 2020).

-Refugee (1951 Convention) – A person who, owing to a well-founded fear of persecution for reasons of race, religion, nationality, membership of a particular social group or political opinion, is outside the country of his nationality and is unable or, owing to such fear, is unwilling to avail himself of the protection of that country; or who, not having a nationality and being outside the country of his former habitual residence as a result of such events, is unable or, owing to such fear, is unwilling to return to it (www.who.int/migrants/about/definitions/en/ retrieved on 20 Dec 2020).

➤ **Emigration**

-Emigration is the act of leaving one's country of residence to settle in a foreign country (IOM, 2007).

-The act of departing or exiting from one State with a view to settling in another (IOM, 2011).

For the purposes of this study, emigration is used to refer to any movement of people from the Savannah Region of Togo to a foreign country and spent at least six (6) months in the host country.

➤ **Immigration**

-A process by which non-nationals move into a country for the purpose of settlement.

-Immigration, on the other hand, is the action of going to a country of which one is not a national with the intention of settling (IOM, 2007). The immigrant is the one who carries out the immigration. In this work, immigration is not considered because this status is acquired rather in the country of destination.

➤ **Climate change-Climate variability**

-Climate change in IPCC usage refers to 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. It refers to any

change in climate over time, whether due to natural variability or as a result of human activities (IPCC, 2007).

-Climate change is defined by the UNFCCC as any change in climate that is directly or indirectly attributable to human activity, changes the composition of the global atmosphere and is observed over comparable time periods. In addition, the UNFCCC distinguishes between climate change, which is due to human activities that change the composition of the atmosphere, and climate variability, which is due to natural causes (AR5 Climate Change 2014: Impacts, Adaptation, and Vulnerability — IPCC, 2014).

-Climate variability refers to variations in the mean state and other statistics (such as standard deviations, the occurrence of extremes, etc.) of the *climate* on all spatial and temporal scales beyond that of individual weather events. Variability may be due to natural internal processes within the *climate system* (internal variability), or to variations in natural or *anthropogenic external forcing* (external variability) (IPCC, 2018).

-Climate variability refers to variation in the mean state and other climate statistics (standard deviations, the occurrence of extremes, etc.) on all temporal and spatial scales beyond those of individual weather events. Variability may result from natural internal processes within the climate system (internal variability) or from variations in natural or anthropogenic external forces (external variability) (www.fao.org accessed on 20 Dec 2020).

➤ **Rainfall variability**

Rainfall variability is defined as random fluctuations in rainfall intensity and their spatial and temporal shifts that disrupt the seasonal division of the year and complicate the course of the rainfall cycle. It is also reflected in the irregularity or fluctuation of rainfall with a succession of deficit and surplus periods.

-Gao et al (2020) considers precipitation variability as an irregular spatial and temporal dispersion of precipitation, or as random seasonal and interannual variations of large amplitude over different time periods.

-For Le Borgne (1990) he believes that precipitation variability is the tyrannical element of climate change. This creates a situation of water stress and a predisposition or risk of susceptibility to anthropic activities. In this work, this combination of appreciation of the concept of rainfall variability will be used.

2.2. Literature Review

The literature review is first devoted to an analysis of the socioeconomic and environmental causes of migration in Togo, then to an analysis of emigration as a survival strategy for the population and, finally, to the implementation of a management strategy for the adverse consequences of migration.

2.2.1. Migration dynamics in Africa

Migration is not a new phenomenon in the history of Africa. According to the literature (O'Connor, 1983; Hance, 1970), it has occurred on a substantial scale in many instances in the history of the peoples that inhabit the continent. Several reasons have been given for these periodic population movements ranging from wars of conquest, responses to ecological and other disasters, to the peaceful and gradual occupation of vacant lands by some groups. The displacement of peoples and of individuals is by no means a peculiarly modern phenomenon, nor one that pertains to Africa alone (O'Connor, 1996). Migration has received extensive attention in the literature particularly because of its effects and implications for urbanization (Hance, 1970; O'Connor, 1983; Adepoju, 1976; Amin, 1974). The emphasis in this regard has been on rural–urban migrations and the problems created for the urban areas through these. Internal migration is therefore seen to consist of rural–urban mobility, rural–rural mobility, urban–rural mobility, and urban–urban mobility. All of these contain intricate and complex processes such as step-wise urban migration, circular-migration and return-migration (Mortimore, 1982; Adepoju, 1976; Peil & Sada, 1984).

In order to understand fully the current migration-development interrelations in Africa, migration in its historical perspective has been examined followed by a review of the contemporary situation. Some observers have amply described Africa as a “continent perpetually on the move” (Ricca, 1989). More appropriately, the people of Africa are perpetually on the move perhaps more so than other regions in the world. Significantly, the movements are both intra—and inter—continental migrations.

Africa is undoubtedly a continent of considerable migration. Various forms of population movement in response to political, economic, religious, and security situations, and demographic factors, have been recorded from early times (Hance, 1970). Spatial mobility has been a fundamental social and historical aspect of African life. However, the different patterns, directions, and motivations of migration have been severely affected by the colonial experience

which, in turn, influenced economic, sociocultural, political, and demographic development (ECA, 1981; Prothero, 1968).

The problem of data on migration, in terms both of quality and availability is a perennial one in Africa. The sources of data for the study of migration which are quite varied have improved overtime. Originally, data on migration in Africa were found in localized studies conducted by anthropologists. Their interest usually focused on the determinants of migration among relatively small communities. Close on the heels of the anthropologists were sociologists who looked at migration from the perspective of the social structure. As urbanization spread on the continent and aspects of modernism, alien to African societies, started penetrating all corners of the continent, sociologists saw migration as a response to the disintegration of the social structure. Their focus was therefore more on the migrants themselves rather than on the communities (Adepoju, 1995).

The vulnerability of some African countries especially the land-locked countries of the Sahel region to environmental degradation, drought, flood or other disasters, also results in a wave of migration of displaced persons who literally cross national borders and settle in the neighboring countries, usually the coastal countries, to continue their familiar occupation near the borders (Adepoju 1983a). In fact undocumented migration and seasonal labor migration have taken place routinely in all regions of Africa, particularly West Africa (UNDP; 1992). Migrants, in desperation, often move from one poor country to another to escape unfavorable climatic conditions, ethnic conflicts and the like.

2.2.2. The socioeconomic drivers of migration

Taylor (1999) delineates migration as a viable mechanism for the transfer of capital, which could assist traditional communities in their adaptation to contemporary knowledge and education. Klerkx et al (2009), through the use of an exemplar, underscore the significance of agricultural expansion as a critical driver for the advancement of knowledge innovation and development in underdeveloped countries. Adger et al (2023) posit that the transfer of resources, such as knowledge, remittances, and the return of migrants, to the home region can significantly contribute to the appreciation of the importance of technical and institutional sources of climate information and advisory services. The incontrovertible effect of income generated from remittances on the resource foundation, economic prosperity, and ability to withstand adversity of the community of origin is apparent. The identification of social

networks in the host region as a migration factor is of paramount importance, as it facilitates the provision of support with respect to housing and employment opportunities (Jha et al, 2018).

As per the neoclassical economic theory, one's pursuit to enhance income by relocating from an underprivileged to a prosperous economy is deemed as the principal impetus behind migration, within the framework of this rationale (Ndione, 2006). The very difficult living conditions or personal and collective ambitions often force the African population to leave their country of origin in other directions (Assogba, 2002). These international migration trends are part of fragile socio-economic and environmental contexts that push individuals to respond, often through mobility, to try to improve their families' living conditions (Broekhuis, 2006; Ndione, 2006). Emigration therefore means the hope of improving one's own material standard of living in the present or in the future through savings opportunities (OECD, 2005).

According to Thioye (2009), international migration, an ever-growing demographic phenomenon in sub-Saharan Africa with multiple aspects, is driven by several factors. In the constant search for well-being, better living conditions and social balance, people are at the center of the changes. Guided by socioeconomic factors, at times constrained by environmental or political factors, it seeks to derive maximum benefit from its immediate or distant surroundings (Ba Cheikh, 1996; Karine, 2004; Thioye, 2009).

In Togo, some authors are interested in the topic of migration. International migration in Togo has several causes. Overcrowding and overexploitation of agricultural land are important factors to consider when explaining international migration (Marguerat, 1983). Deterioration of the natural environment remains one of the main causes of population migration in the Litime plain (Kola, 2011). For his part, Yabouri (2004) claimed that the main reasons for the exodus of the Moba Gourma population were soil impoverishment and lack of arable land. Aklamanu (1987), quoted by Kokou (2018), attributes the depopulation in Vo prefecture to the factors of demographic pressure and the deterioration of the rural and economic environment. The deterioration of the economic environment as a resultant of the fall in world market prices for cash crops has led to human bleeding in plantation areas that were formerly melting pot zones (Essiomle, 1993; Gu-konu, 1983; Kola, 2008; Nyassogbo et al, 1995).

This deterioration of the economic environment leads to increasing impoverishment of the peasant mass who, migrate into an area that is economically self-sufficient for its survival.

2.2.3. Role of environmental factors in migration

2.2.3.1. Climate change and migration

Since the end of the Cold War, environmental issues have been considered in the broader context of human security (Renaud et al, 2007). Furthermore, literature reviews show that remote sensing data have been one of the most widely tool for monitoring environmental change (Codjoe, 2004; Elhag et al, 2009; Marquette, 1997; Ouedraogo et al, 2010; Traoré et al, 2014). An empirical study done in Senegal from 1990 to 2005 using remote sensing and field assessment showed that croplands increased from 17% to 21% between 1965 and 2000, whereas savannah areas decreased from 74% to 70% (Hummel et al, 2012). Other recent studies in Mali, Ghana and Burkina Faso using the same technique, discovered 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) serve as significant environmental indicators, and although they are often utilized interchangeably, they hold distinct meanings (Duadze, 2004). Land cover refers to the various elements that envelop the earth's surface, including but not limited to snow, grassland, water, deciduous forest, and bare soil. On contrary, land use delineates the manner in which the land is utilized, such as agricultural land, wildlife management area, urban, and recreation area (Horning, 2004). Land use encompasses the various conversions, actions, and inputs executed in a particular land cover category, constituting a collection of human endeavors. This terminology pertains to the societal and economic objectives for which land is administered, such as grazing, timber harvesting, and preservation, as delineated by the IPCC in 2000. The modification of land cover and land use continues to persist as one of the most pressing global concerns, given that they entail changes to the Earth's surface biophysical characteristics and the human-designed objectives or aims that are applied to these characteristics, respectively (Lambin et al, 2001). The alteration in vegetation's distribution and composition may significantly impact the regional climate, ultimately leading to changes in the quantity and distribution of vegetation. The determination to migrate can be influenced by environmental and climate variations, as stated by Renaud et al (2007) and Sow et al (2014). Furthermore, climate change may exacerbate the risk of conflict leading to additional migration. As a consequence, the effects of climate change engender heightened competition for limited resources and the loss of livelihoods which may increase the likelihood of conflict and violence resulting in greater displacement.

2.2.3.2. Climate change and community livelihood

The susceptibility to the impacts of climate change does not necessarily indicate the likelihood of becoming a climate refugee. The correlation between climate change and migration is limited due to insufficient data and the fact that migration decisions are influenced by various factors. Our assertion is that when predicting future migration patterns, it is necessary to rely on prior research on how communities respond to natural hazards. Researches have highlighted the importance of individuals integrating physical and social vulnerabilities as their primary resilience strategy for their livelihoods. Communities have developed multiple mechanisms to improve their ability to cope with both gradual and extreme climate change events (Maxwell, 1999; Meze-Hausken, 2000; Mula, 1999). The topic of strategies for mitigating climate change is frequently explored in the context of individual households, with several overarching implications extrapolated from case studies conducted by Mcleman and Smit (2006) and Henry (2006). Household responses to environmental threats are influenced by several factors. These include the degree of severity of the change, specific vulnerabilities, as well as the availability of assets and strategies. Mortimore (1989) & Meze-Hausken (2000) have both explored this topic, highlighting its importance in understanding how households are affected by environmental challenges. Resilience tactics have been proven to be customized to the gravity of the specific circumstance as evidenced by Watts & Bohle (1993). Furthermore, given the gradual nature of the majority of climate changes, households have the opportunity to gradually transform their means of subsistence, as highlighted by Henry (2006). The direct impact on resilience is primarily caused by numerous factors that are not linked with environmental change. The availability of the market, access to infrastructure, and the assurance and provision of aid can significantly affect the capacity of households to anticipate and endure environmental risks and transformations as posited by Eriksen et al (2005). Climate variability and climate change are occurring, with consequences on people's livelihood, according to studies undertaken in many regions of the world, and diverse coping strategies have emerged and are constantly emerging in various communities. Africa is a continent that is particularly vulnerable to climate change and variability, which is compounded by the influence of numerous stressors that operate at different levels. This can be attributed in part to the continent's limited adaptive capacity and its heavy reliance on natural resources including agricultural land, forests, and water. These resources are exceedingly vulnerable to any alterations in the environment that may arise (Kangalawe and Lyimo, 2013).

Moreover, the agricultural sector that depends on rainfall is significantly affected by changes in precipitation patterns, temperature rise, and evapotranspiration, resulting in substantial socioeconomic consequences Sarr et al (2015). In broad terms, the primary basis for discord is linked to the effect of climate change on the subsistence of native inhabitants, which in turn intensifies local wage rates, provokes heightened competition for employment prospects, triggers ethnic hostilities and dissensions, and further exacerbates the scarcity of resources such as land or natural resources, as exemplified by deforestation (Drabo and Mbaye, 2014). Extreme events have the potential to cause significant harm not only to infrastructure, homes, and livelihoods but also to lead to increased human movement and displacement, both directly and indirectly. A concrete example of this is the displacement of over 10 million people caused by severe flooding in China and Pakistan in May and summer of 2010, respectively (Science for Environment Policy, 2015).

2.2.3.3. Impacts of climate change

Environmental factors, such as alterations in climate and climatic variability, have been noted by Hugo (1996) and Hunter (2005) as influential in regards to human migration. Additionally, Lutz et al (2002) have found that environmental conditions, involving climate shifts, can impact human population dynamics, encompassing migration.

The research conducted by Lamb (1982), Linden (2006), and Fagan (2008) proposes that the movement, establishment, and displacement of human populations during prehistoric and classical eras were frequently impacted by alterations and fluctuations in both global and local climates. McLeman & Smit (2006) assert that while the correlation between climate and migration is indisputable, it is crucial to precise that individuals and households do not exclusively consider climatic and environmental conditions when making migration-related decisions. There are other potential factors that can influence the decision-making process at any given moment in time. As such, the disentanglement and explication of the distinct impact of climatic variables on migratory patterns becomes a complex and challenging endeavor. This assertion was posited in a publication by Foresight in 2011, which highlights the difficulties in accurately isolating and interpreting the influence of climatic factors from other existing and concurrent factors.

2.2.4. Modelling migration

2.2.4.1. Modelling climate change-related migration

The study of migration in relation to climate change remains an emerging field of research. However, Marchiori & Schumacher (2011) have observed that any slight changes in climatic conditions can have a significant impact on migration patterns, as demonstrated in generalized macroeconomic models. As such, this area of study requires the attention of experts in economic, demographic, and other modeling fields. It is evident that current models have proven inadequate in light of recent findings on the correlation between climate and migration.

On one hand, the lack of dependable population data presents an ongoing challenge for aspiring modelers. On the other hand, global population movement data tends to be rudimentary, and datasets that relate population shifts to environmental stimuli are notably crude (Brown & IOM, 2008). The modeling of spatial vulnerability, which was an area of early development in the field, persists in its utilization and employs techniques that have been influenced by the natural hazard vulnerability research of Clark et al (1998), Cutter et al (2000), and Wilhelmi & Wilhite (2002).

2.2.4.2. Migration flow modelling related socioeconomic factors

Economic, social, and cultural aspects are crucial factors that exert a substantial effect on the decision-making process of migration. These determinants are systematized in migration models, which not only picture the consequences of migration on its origin and destination but also the interconnectedness between these effects. (Source: <https://www.encyclopedia.com/social-sciences/encyclopedias-almanacs-transcripts-and-maps/migration-models> accessed on 20 Dec 2020).

Most migration models that are of a formal nature prioritize the examination of economic factors that influence the decision to migrate. These factors include the income opportunities and limitations that exist in the migrant's place of origin, such as restricted capital and technology, job shortages, and suboptimal market conditions. Additionally, these models consider the income prospects that await migrants in their destination, particularly in urban centers where there is a high demand for their labor. Finally, migration costs such as travel expenses, potential migrant destination networks, and border politics are also taken into account.

Sociological research consistently indicates that migration is the outcome of rational decision-making by individual actors. However, these studies frequently incorporate non-economic factors into the catalog of determinants and view migration as a social process. On the other hand, anthropological research places less emphasis on formal or quantitative modeling and instead highlights ethnographic research, examining migration within a cultural, historical, and political-economic context.

The primary aim of migration models is to establish a systematic framework that can facilitate the identification of direct and indirect factors that influence migration, map out migration patterns, and predict the impact of external disturbances such as policy changes on migration. The development of both models and data collection is shaped by the advancement of migration theory. The earliest migration models were formulated based on the principles outlined by Ravenstein (1834-1913), a geographer who proposed 11 migration laws derived from his observations of migration trends in the United Kingdom and subsequently in the United States.

2.2.4.3. Gravity Models

Ravenstein, along with Newton, has had a significant impact on the development of gravity models. These models suggest that migration between two places, i and j , denoted as M_{ij} , is dependent on the repulsive forces at i , R_i , and the attractive forces at j , A_j , and is inversely proportional to the distance or "friction" between i and j , D_{ij} . Specifically, M_{ij} can be expressed as a positive function of R_i and A_j , denoted as $f(R_i, A_j)$, divided by the frictional distance between i and j , $g(D)$.

The prevailing perspective among gravity model formulations is that the migration that transpires from location i to location j can be characterized as having a direct correlation with the product of the populations of the two regions, while simultaneously exhibiting an inverse relationship with the distance separating them ($M_{ij} = P_{ij}/D$).

Stouffer (1940) expanded the scope of gravity models by incorporating the notion of intervening opportunities, which posits that the level of migration across a specific distance is positively linked to the number of opportunities present at the said distance, and inversely associated with the number of plausible alternative migration destinations between the starting and ending points. By adopting this approach, the characteristics of specific locales may carry greater weight than distance itself in determining the pattern of migration.

Gravity models, alongside other aggregate models, possessed the advantage of being effortlessly estimated. However, they were unable to furnish insights on the identity of migrants, the factors influencing migration such as alterations in policies, markets, and trade, as well as the social progression of migration. It is not feasible to rationalize migration behavior solely on the basis of distance and population.

Lee (1966) posited that the characteristics of both the destination and the origin exert an attractive or repulsive force on migrants, and that these characteristics are subject to variation in the perceptions of individual migrants. As researchers have sought to address these and other issues, the perplexity of migration models has correspondingly increased.

2.2.4.4. Models of Lewis and Schultz

In the realm of migration research, economic models have exerted considerable influence during the 1950s and particularly in the 1960s. Lewis's (1954) dual economy model of economic development, which assumes infinite labor supplies, acknowledges migration as the mechanism by which surplus labor in the agricultural sector is redirected to satisfy the increasing labor demands of the urban sector. While not explicitly intended to model migration, Lewis's model recognizes its significance. This migration is stimulated by demand and employment rather than wages, which are assumed to remain constant. The Lewis model presupposes the existence of a labor surplus, thus implying that the agricultural sector's productivity and wages are unaffected by the loss of labor to migration.

The aforementioned premise, which aligns with the principles of traditional economics, has encountered opposition from a group of economists, particularly Schultz in 1964.

The eradication of rural labor surpluses brought about by migration necessitates an increase in urban wages to entice more individuals from the rural sector to move; the modification of wages ensures a lack of congestion in both the rural and urban labor markets. Neoclassical migration models are founded on this principle, wherein the equation $M_{ij} = f(W_i, W_j, C_{ij})$ is employed, with W_i denoting wages at location i , W_j representing wages at location j , and C_{ij} indicating the costs associated with migration.

Empirical models have demonstrated that migrant movements tend to be from areas with low remuneration to those with high earnings and are hindered by the expenses incurred during migration. Conversely, models based on wage-driven migration are inadequate in elucidating the movement of migrants in the frame of high urban joblessness rates and can only be considered for a minor proportion of the diversity noticed in migration patterns.

2.2.4.5. Alternative Models

In 1969, Todaro proposed an alternative formulation of neoclassical migration models, which centers on the maximization of prospective migrants' expected income. In the migration equation, W_i and j are replaced with expected incomes at locations i and j , respectively. Empirical examination of the Todaro expected-income hypothesis generally rely on aggregate data on migration flows and wages, assuming a random job-allocation mechanism. In this way, expected revenue is equivalent to the remuneration multiplied by the rate of employment (or 1 minus the unemployment rate). The wage-driven neoclassical model is a subset of the Todaro model, where employment odds at both migrant destination and origin are equal to 1.

The Todaro model is recognized for its capacity to elucidate the enduring nature of migration in the frame of unemployment in migrant destinations. A higher urban sector wage relative to that in the countryside does not suffice as a motivation for migration, as the likelihood of securing an employment at the prevailing wage holds significance. Similar to their neoclassical forerunners, anticipated models of income suggest that an equilibrium will ultimately be achieved, resulting in reduced migratory pressures. In the Todaro equilibrium, expected incomes (rather than wages) are equalized across sectors, while also accounting for migration costs.

The aggregate models employed were found to be incongruent with the underlying theoretical models of migratory behavior. As a result, several critical queries remained unanswered such as the reasons for the migration of certain individuals while others do not migrate and the factors that distinguish the labor that migrates versus the labor that remains in rural areas.

2.2.4.6. Micro Behavioral Models

In the 1980s, there was a shift in research focus from aggregate to "micro" behavioral models that placed emphasis on the migration decisions made by individuals. Generally, models that analyze migration behavior presuppose that a person situated in location i will migrate to location j only if the net benefits derived from such an action outweigh the associated costs of migration.

2.2.4.7. Impact of Remittances

The current models of migratory behavior of individuals lack a clear explanation for the persistent ties migrants maintain with their source households, which are often sustained through the remittance of revenue or the return of migrants to their homeland. Furthermore, it

should be noted that such models do not provide a robust foundation for scrutinizing the impact of migration and remittances on the regions where the migrants originate. During the 1970s and early 1980s, various scholars endeavored to predict the impacts of remittances on migrant source areas by conducting surveys on the usage of remittances for productive investments by the households. Nonetheless, the aforementioned studies failed to investigate the consequential impacts of remittances on the determination of migration within the regions of origin of the migrants.

2.2.4.8. New Economics of Labor Migration (NELM)

NELM models propose that when it comes to migration, it is not just individuals who make decisions, but rather larger groups of individuals, namely households or families. These decisions are not solely driven by the aim of maximizing income, but also by the desire to minimize risks and overcome the various limitations posed by deficient markets in the areas of origin which may lack adequate capital and insurance markets. Furthermore, migration choices can be influenced by the actions of other members within the social circle of the potential migrant.

2.2.4.9. Structuralist Theory

Structuralists theory concentrates on the social structures affecting migration. Haas wrote, historical-structuralists postulate that economic and political power is unequally distributed among developed and underdeveloped countries, that people have unequal access to resources, and that capitalist expansion has the tendency to reinforce these inequalities. Instead of modernizing and gradually progressing towards economic development, underdeveloped countries are trapped by their disadvantaged position within the global geopolitical structure" (de Haas, 2007).

The theories of migration that are based on structuralism emphasize reorganization of labor as a result of the migratory act, which arises from uneven development (Chant & Radcliffe, 1992). In other words, it is not the individuals who are making free rational choices, but it is the structural process that manipulates, enforces, and predetermines the individuals rational choices (Kim et al, 2023)

2.2.4.10. Push-Pull Theory

The push-pull model is based on the following hypothesis: migration is the result of a combination of a number of push factors in the country of origin that push people to move away, with a number of positive or pull factors that attract migrants to a host country. In reality there are several push factors including such things as economic, social and political hardship in poorer countries, political, religious, racial or ethnic discrimination, poor weather conditions, natural disasters, poor housing, transport, education, training, etc. pull factors include the comparative advantages of wealthier countries (Khalid & Urbański, 2021; Van Hear et al, 2018). ‘Push and pull’ factors are accounted as the motivations behind the migratory move. The classical version of ‘push-pull’ theory infers these motives from the comparisons and contrasts of the characteristics of the area of origin and destination and imputes them to the migrants.

Besides, individuals’ decisions and actions are taken “as the outcomes of a rational economic calculation of the costs and benefits of migration” (Aslany et al, 2021; Morawska, 1990). This is where ‘push-pull’ theory is affiliated with neo-classical theories of labour market, and equilibrium theory (Portes 2010; Richmond, 1988). Furthermore, neo-classical equilibrium theory assumes that individual’s main goal is to maximise utility. That is why, individuals search and compare, calculate and make rational choices among the alternative places of residence. (Massey et al, 1993; Porumbescu, 2018)

Basic models of migration flows are commonly founded on the theory of gravity, as established by Ravenstein in 1889 and Zipf in 1946. These models utilize three variables which include the source and target populations along with the distance between each pair of locations to explicate migration. Subsequently, additional explanatory variables can be incorporated to represent diverse factors such as origin and destination, level of education, employment opportunities, degree of urbanization, population density, wage level, and others, as noted by Barber and Milne in 1988, Brown & Goetz in 1987, Flowerdew in 1991, and Gordon & Molho in 1998, amongst others.

Early examples of migration modelling in Africa consist of the adjustment model formulated by Lewis (1954). This model utilized economic disparities between the origin and destination to elucidate migration movement. The predominant focus of scholarly works regarding migration in Africa has centered upon analyzing the traits and attributes of those individuals who undertake such migration (Dallaire, 1978; INSD, 1991; Lututala, 1995). While notable

strides have been achieved in devising models aimed at explaining disparities in regional migration, their application in developing world contexts is yet to be realized.

2.2.5. Migration as a survival strategy for populations

The phenomenon of migration within Africa is characterized by a diversity of forms, shaped by a spectrum of factors, encompassing economic and ecological challenges, disparities in economic prosperity within regions, political instability, and migration policies that impose limitations. The patterns of African international migration encompass a range of voluntary and forced movements across national borders within the continent, as well as both regular and irregular migration to destinations beyond Africa. Notably, internal migration within Africa far outweighs migratory movements to other continents.

International migration, with its complex collection of causes, has moved to the top of national and international agendas (De Haas, 2007). The literature on international migration is becoming increasingly rich, but restricted in its angles of analysis. At first glance, the evolution of the reasons that motivate migrants to move is a topic widely studied by researchers (Karine, 2004). The expansion of the global population and the development of its movements have always had a direct impact on international relations on a global scale. On a smaller scale, international migration on African territory also has multisectoral impacts.

2.2.6. Migration in West-Africa

Recent statistics show that there are ten times more migratory movements within West Africa than towards European countries (Charrière & Frésia, 2008). According to studies by Kirwin and Anderson (2018), respondents in six West African countries have identified economic factors as a significant reason for migration in Africa. Conversely, those who express a desire to remain in their current location cite familial bonds and an affinity for their homeland as the primary motivating factors. Today, internal migration is as well developed in Mali as international migration. The phenomenon affects both women and men. Young people (10 to 35 years old) are more affected by migration due to unemployment. Due to poverty, weakness of human capital and the virtual absence of non-agricultural employment opportunities, the rural environment represents the main supplier of migration in Mali (Marouani & Raffinot, 2004). In Mali, extreme poverty, family reunification (especially for women), the tardy execution of the peace agreement of 2015, apprehension regarding security, as well as issues pertaining to malnourishment and healthcare warnings in the north are the stressors for external migrations (Gluliana, 2016).

Henry et al (2002) undertook a research study in Burkina Faso and ascertained that migration patterns were linked to demographic and socioeconomic factors, as well as environmental factors, as expected. However, the impact of environmental factors on migration was less significant than that of socio-demographic variables. The findings of the study demonstrate that inter-provincial migrations in Burkina Faso were influenced by several factors, including high levels of literacy and economic activity at both the origin and destination, as well as a significant predominance of males at the origin and a comparatively lower proportion of males at the destination. Additionally, adverse conditions regarding fluctuations in rainfall, the deterioration of land quality, and the limited availability of land at the origin and advantageous conditions for these variables at the destination were contributing factors.

Climate-induced risks to livelihoods are a major catalyst for farmer migration, with farmers' perceptions of climate change and socioeconomic circumstances influencing this phenomenon. The utilization of climate and agriculture extension services, which are instruction, knowledge, and technology-based, differs markedly between farm households that migrate and those that do not. The migrating households' ability to adapt is strengthened by the advantages of remittances, knowledge, and social networks obtained from the host region, according to Chandan et al (2018).

West Africa has a rich historical background of both local and global population mobility. The phenomenon has been influenced by various factors, such as lengthy trade, exploration for pastures, urbanization, growth in administrative centers, mining, industrial production, and plantation agriculture, armed conflict, land degradation, drought, and rural poverty. As an integral aspect of shaping settlement patterns in the region, migration has played a significant role (DFID, 2004).

According to estimates derived from census data by the Population Division of the United Nations, West Africa boasts the most significant international immigrant population in Africa, based on birthplace information. Additionally, this region is the sole sub-Saharan African area where the proportion of migratory stocks in relation to the overall populace has risen in recent years (De Haas, 2007). Migration flows began to increase in West Africa in the 1970s and 1980s when most countries were hit by severe droughts that had significant impacts on farmers' livelihoods, such as: crop and livestock losses. Widespread famine led to a mass exodus from more affected areas to the central, southern and coastal countries (Korah, 2008; Ouedraogo et al, 2009; West et al, 2008). Moreover, the process of relocating to regions that are less prone to droughts has emerged as a significant tactic for diversifying sources of income since that period.

West Africa has undergone a considerable influx of migrations, stemming from population pressure, destitution, inadequate economic performance, and recurrent conflicts. In the past, migrants perceived the sub-region as an economic entity in which the exchange of goods, services, and human movement flowed freely. To gain a comprehensive understanding of contemporary migration systems and policies in the sub-region, it is essential to contextualize the migration configuration appropriately in its historical backdrop (Adepoju, 2005). Recent changes in West African migration patterns indicate that relying solely on a single local natural resource for migration is highly vulnerable and subject to the fluctuations of the global market. The phenomenon of migration in Western Africa has become an integral component of a highly dynamic and unstable global system of movement. This system is subject to significant influence and impact from a range of economic and migration policies, including expulsions and restrictive measures, implemented in both economically advanced and developing nations. The West African migration system is intricately connected to numerous migration networks in both the South and North regions and thus cannot be regarded as an autonomous entity, as stated by Cohen (1996).

2.2.7. Extent and land use change: Definition

Land use refers to the manner in which individuals utilize land cover for specific purposes; this includes the soil and biomass layers, as well as natural vegetation, crops, and human-made structures that overlay the land surface. Land-cover alteration refers to the total replacement of one cover type with another, whereas land-use dynamics involves the transformation of land-cover type, such as the intensification of agricultural use, without altering the general categorization. This definition is in accordance with Agarwal et al (2002), while Turner et al (1993) further elaborate on the concept. Land use is commonly defined as the means by which individuals utilize the land and its resources, encompassing practices such as agricultural cultivation, urban expansion, grazing, logging, and mining, among others. Conversely, land cover pertains to the physical characteristics of the land surface, which may encompass various categories ranging from farmland, forests, and wetlands to pastures, roads, and settlements. Initially, the phrase "land cover" was limited to the type and condition of vegetation, such as forest or grass coverage, but over time, it came to incorporate other elements of the natural environment, such as soil composition, biodiversity, and surface and ground water, as well as man-made structures like buildings and walkways (Brandon, 1998). The utilization of land is shaped by the interconnectedness of biophysical elements like topography, climate, and soils, and human factors such as population, technology, and economic conditions (Veldkamp,

1996). Land use has a direct impact on land cover, and the alteration of land cover, in turn, influences land use. The global community faces the challenge of land use and land cover changes, although the extent of modification varies depending on location.

2.2.8. Extend of land use and cover change in West Africa

In modern times, there has been a significant rise in the transformation of grasslands, forests, and other natural habitats into croplands and pastures, as reported by (Mayaux et al, 2005). The escalating global demand for food, feed, and fuel has resulted in a significant amount of apprehension concerning the condition of deteriorated land, as indicated by Gibbs and Salmon (2015). Moreover, this trend is occurring at an unprecedented rate, while the amount of arable land suitable for agricultural production is decreasing in many regions worldwide.

2.2.9. Drivers of Land Use Change

The alteration of land use is characterized by a significant spatial and temporal variability that is influenced by biophysical factors, socioeconomic activities, and cultural contexts, as noted by Geist and Lambin (2002). To identify the causes of this change, it is necessary to understand the decision-making methodologies associated with land use and the manner in which various elements, at the local, regional, and global dimensions, interact to influence these determinations in particular contexts. As a result, the underlying cause and immediate cause are the two main categories of drivers of land-use change, as identified by (Leemans et al, 2003). The fundamental factors are intricate interconnections among societal, political, economic, demographic, technological, cultural, and biophysical factors that serve as the originating circumstances for human-environmental interplay. They stem from the regional (district, municipal, or state level) or even global level, with complicated interplays among various organizational tiers. The fundamental factors are frequently exogenous to, and thus beyond the jurisdiction of, the local communities that cultivate the soil, with scarce local factors endogenous to decision-makers.

➤ Demographic drivers of Land Use Change

The contentious issue of the precise role of population growth as the primary catalyst for environmental change has been a topic of intense debate among scholars (Veldkamp, 1996). The neo-Malthusian and Boserupian theories have emerged as the dominant perspectives in this discourse (Perz et al, 2006). The escalating population growth in the Sahel Region has exerted mounting pressure on the availability of arable land. The population density has experienced a linear increase from 18 to 34 inhabitants per km² between 1967 and 2003, indicative of an

annual average growth rate of 1.9% during this period (Ruelland et al, 2010). The Binah River watershed (North of Togo and Benin), a semiarid subcatchment of the Volta basin (West Africa), has undergone notable changes in vegetation cover over the past few decades. These changes are considered a consequence of an increasing population and the subsequent increasing needs for food products and energy, which itself is reflected in high demand for land utilized for agricultural and wood production (Badjana et al, 2015). In instances where the development of these cereal crops is impaired by land degradation, crop productivity may suffer, thereby impacting the constituents of food security, namely availability, accessibility, stability, and utilization, which may pose a danger to individuals inhabiting that region. Land degradation does not only impact food production but energy as well, since woody vegetation and crop residue, which are employed as a source of household energy, are also affected. The dearth of these resources has detrimental consequences on human security.

Kotir et al (2017) study on the Volta River Basin in Ghana revealed that population growth underpins significant modifications in the basin, such as environmental degradation, alterations in water volume and seasonal flows, and augmented competition and demand for land and water resources. The rate of land degradation, however, can be swiftly influenced by deforestation and other anthropogenic activities that expose the country to multiple hazards.

➤ **Institutional and Social Drivers of Land Use Change**

In addition to the growth of the population, factors such as sociocultural, political, and institutional aspects are serving as driving forces behind the alteration of land usage, as stated by Chabay et al (2016a). When attempting to comprehend the impact of culture as a stimulant for alterations in ecosystems, it proves useful to conceive of culture as a set of values, beliefs, and norms that are shared among a group of individuals, as suggested by Cotton (1997). In this regard, culture has a substantial influence on the way individuals perceive the world around them, which, in turn, influences what they consider to be important and recommends suitable or unsuitable courses of action. Nevertheless, differences in culture have significant consequences on direct stimuli, as noted by Nelson et al (2006a). Cultural factors have the potential to exert a significant influence on consumer behavior, thereby serving as a crucial catalyst for environmental change. Institutions, on the other hand, encompass a range of elements such as property rights, environmental policies, decision-making systems, and information systems pertaining to environmental indicators. These institutions also incorporate social networks that represent specific interests related to resource management, conflict resolution systems, and institutions that control the allocation of resources while concurrently

regulating economic differentiation (Lambin et al, 2003). In developing countries, misguiding or contradictory policies and institutions concerning land tenure and management systems have been recognized as key elements responsible for land and forest degradation. In addition, institutional factors, including land tenure and regulation, may contribute to alterations in land use/cover in tropical countries, as noted by Reid et al (2000).

➤ **Economic Drivers of Land Use Change**

The outcomes of economic activity are dependent by natural resources, which are the product of human endeavors aimed at enhancing the quality of life (Nelson et al, 2006b). While land use techniques are diverse worldwide, the end goal usually remains constant: acquiring natural resources to satisfy pressing human demands, often at the detriment of environmental conditions. As a community's population grows, the demand for food increases over time. Consequently, individuals are compelled to produce sufficient food to meet this demand. In regions where arable land is scarce and the necessary services cannot be afforded, individuals are obliged to employ unsustainable land use practices such as improper farming techniques, deforestation, and exploitation of water resources. Geist and Lambin's (2002) study, which examined 152 cases in tropical ecosystems across Asia, Africa, and South America, found a significant association between deforestation and agricultural expansion in 96% of cases. This relationship was, in turn, linked to a complex interplay of economic, institutional, technological, socio-political, and demographic factors, as noted by Zak et al (2008). As posited by Nelson et al (2006), it is evident that human welfare is significantly impacted by the upswing and allocation of economic growth. The extent and character of the institutional and social incentives for consumption are determined by the revenue acquired by individuals and households. Saguye (2017) observed that land degradation resulting from human activities directly encompasses deforestation and deforestation, overgrazing, agricultural practices, and continuous cultivation. Despite whether such practices alter forest cover, various land-use practices, including gathering fuelwood, grazing livestock, and constructing roads, can impair forest ecosystems in terms of productivity, biomass, stand structure, and species composition (Foley et al, 2005). Ravi et al (2010) postulate that human activities exert a significant influence on hydrological-aeolian processes that are instrumental in land degradation and the escalation of erosion processes that arise from anthropogenic disturbances. This is due to the considerable increase in management practices witnessed in the past century. The present inquiry, however, evaluates the socioeconomic triggers of land degradation and the ensuing strategies that have been adopted based on the perceptions of farmers.

Hansen and Brown (2009) explicated that land utilization is capable of modifying ecological processes through various means, including but not limited to natural disruption, vegetation progression, carbon sequestration, and atmospheric pollution. The practices of land use such as logging, grazing, and agriculture influence both the structure and function of ecosystems, as well as the regional climate (Zak et al, 2008). The assimilation of knowledge from indigenous farmers could potentially lead to a reduction in the expenses incurred in the implementation of recuperative strategies.

➤ **Biophysical Drivers of Land Use Change**

According to Brown (2009), it has been observed that the impacts of land use change at a local level are predominantly influenced by alterations in land cover, which pertain to the biophysical condition of the land. Similarly, Frost et al (2006) postulated that landscapes exhibit a broad range of diversity and that land use patterns and management decisions are shaped by a combination of biophysical, social, and cultural factors. For example, Golla (2009) found that in arid regions the restricted biophysical environment due to irregular rainfall is a major constraint on agricultural production. Moreover, the issue is further compounded by the exacerbating effects of climate change. Given this context, it is imperative that biophysics takes precedence in the analysis of sustainability strategies. It is worth noting that the biophysical causes of land degradation vary depending on the geographic location. This is because each region has unique ecological and geographic conditions, making the causes of land degradation site-specific and dependent on both natural processes and human activities. For instance, soil degradation can be attributed to natural processes such as land geographical location, wind and water erosion, and the gradient and structure of the land, which can expose the land to external hazards such as heavy rains and increasing siltation.

2.2.10. Effect of land use/ land cover change on livelihood

"A livelihood can be conceptualized as the amalgamation of various competencies, endowments (including both tangible and social resources), and activities that are essential for sustaining a particular way of life."

The issue of land degradation, particularly soil degradation, poses a significant environmental concern that endangers sustainable livelihoods in semi-arid regions. It is increasingly becoming a hindrance to future growth and rural livelihood development in many developing countries (Chabay et al, 2016b). Environmental degradation, as a result of unsustainable management

practices and policies, further exacerbates human vulnerability by undermining productivity (Simonson, 2005).

2.2.11. Land Use Change and Climate

In the current era, there has been a notable escalation of worldwide environmental transformations that have become a top priority for the international scientific and political communities. The preeminent challenges associated with global change entail alterations in land coverage and the climate, whereby human-induced modifications and transformations of land are the foremost causative agents. The impact of land use and cover on biogeophysical, biogeochemical, and energy exchange processes has been documented by Houghton et al (2001). These processes have a significant effect on climate patterns at the local, regional, and worldwide. The crucial processes that shape these patterns include the absorption and emission of greenhouse gases by the terrestrial biosphere through photosynthesis, respiration, and evapotranspiration. Furthermore, the liberation of aerosols and particles resulting from surface land cover disturbances and fluctuations in the exchange of sensible heat between the surface and the atmosphere due to land cover changes also play significant roles. Changes in land cover lead to variations in the absorptance and reflectance of radiation, thereby impacting surface reflectance and the influence of surface roughness on atmospheric momentum, both of which are contingent upon land cover. While human activities undoubtedly alter many of these processes and properties, it is worth noting that weather and climate, geological phenomena, and other natural processes also play a significant role.

2.2.12. Institutional and legal framework of emigration in Togo

According to Radji (2012), the topic of mobility, specifically emigration, is a primary concern of public interest. In Togo, institutions and texts in the field of migration management are defined by national guidelines, legal frameworks and institutional agreements; for almost four decades, migration flows in Togo took place outside of any regulated framework (Visions Solidaires, 2013). Migrants were effectively left to their own devices, as few countries in West Africa have genuine migration policies in place and fewer still strictly enforce existing international migration laws and regulations (IOM, 2006). Only in the 2000s did the issue of migration flows experience a positive development. Initiatives to coordinate efforts and try to better manage international migration, particularly emigration, have multiplied (IOM, 2006). According to Visions Solidaires (2013), the political desire for a systematic and effective

consideration of emigrants, especially Togolese abroad and returning emigrants, is particularly reflected in:

- the establishment of institutional mechanisms and structures for managing emigration issues;
- the existence of a legal framework.

All these makes it possible not only to better manage the coherence of migration with economic and social growth, but also to assure the protection of Togolese rights abroad.

2.2.12.1. The framework for action of the migration governance in Togo

In terms of migration management, Togo does not have a migration policy that clearly defines the main directions of the country (IOM, 2015). In such a context, not all the benefits of the diaspora are realized. But more and more initiatives are being taken to arrive at a long-term migration policy. In this way, the Strategy Document for Accelerated Growth and Employment Promotion (SCAPE) addresses the thorny issue of mobilizing the diaspora, which remains an important source of financial flows for the country's socioeconomic development (République Togolaise, 2012). SCAPE stresses the need to maximize the diaspora's contribution to Togo's economic and social development through the implementation of the Diaspora Mobilization Strategic Development Plan to achieve this, the Togolese authorities intend to:

- establish representative structures of Togolese Abroad, particularly the High Council of Togolese Abroad and the National Agency of Togolese Abroad;
- better channel and optimize remittances and encourage the Togolese diaspora to make productive investments, particularly through the establishment of an investment fund for Togolese abroad;
- support the recruitment and utilization of skills from the Togolese diaspora to strengthen public administration ability;
- encourage local development methods and levers that involve the diaspora, particularly in the context of decentralized cooperative initiatives.

Since 2013, we also note that there is a strategic plan for mobilizing the Togolese diaspora, which aims to mobilize and optimize all initiatives of this diaspora in favor of the country's development (Radji, 2013). Thus, the challenges, the challenges to be overcome, the strategic directions and the goals pursued are clearly defined. The strategic plan also proposes the establishment of a consultation framework in order to achieve a unified way of working

between the different bodies working in the field of migration. Interministerial Decree N006/14 MAEC/MPADT of 22 May 2014 establishing the Committee for the Coordination and Monitoring of Migration and Development Activities represents a major step forward in mainstreaming migration into sectoral policies (IOM, 2015).

2.2.12.2. State structures for managing emigration in Togo

In Togo, because emigration is a cross-cutting problem, it is managed by several ministries (IOM, 2015):

- the Ministry of Foreign Affairs, Cooperation and African Integration (MAECIA) is in charge all problems concerning Togolese abroad. He watches their safety, protect their interests overseas, and makes every effort to promote their development in their new home. The MAECIA houses, the Directorate of Togolese Abroad (DTE) whose mission is to design and implement the policy of the Togolese government, relating to Togolese abroad;
- the Ministry of Security and Civil Protection (MSPC), intervenes in the management of international borders at sea, air and land level;
- the Ministry of Territorial Administration, Decentralization and Local Authorities (MATDCL) deals, like the Ministry of Security, with the issue of border management. Its mission differs from that of the Ministry of Security by its extension to the field of action of local authorities, in particular through the management of decentralized cooperation. Decentralized cooperation as well as numerous projects of a diasporic nature;
- the Ministry of Higher Education and Research (MESR) and the Ministry of Health (MS) deal with the management of circular migration, in particular the return of skills to fill the gaps in qualified teachers and doctors in the universities and health centers in Togo; the Ministry of Trade, Industry, Promotion of the Private Sector and Tourism (MCIPSPT) intervenes in the establishment of favorable conditions for the investment of the diaspora. Efforts in this area relate to facilities in terms of tax exemption in order to encourage them to initiatives capable of contributing to boosting the country's economic growth. It is in this context that there is the Business Formalization Center which allows businesses to be created in 48 hours and reduces hassle for those initiating initiatives.

These various institutions of the ministries synergize their efforts to coordinate and manage the Togolese Abroad so that these constitute one of the levers of the economic growth of the country.

2.2.12.3. Research institutions in the management of Togolese emigration

There are research structures in this category whose activities inform decision-makers' political and programmatic choices. The National Institute of Statistics and Economic and Demographic Studies (INSEED) is in charge of producing national statistics (IOM, 2015). One of its tasks is to conduct a population census in order to collect statistics on the population, particularly the migrant population. There is also the Demographic Research Unit (URD), which gathers and analyzes statistics on population movements including emigration. The departments of Geography and Sociology of the public universities of Togo, which through the memories and theses of the students, research the migratory flows, particularly the emigration of the populations towards the outside of Togo.

2.2.12.4. Diplomatic representations guaranteeing the interest of Togolese Abroad

The diplomatic representations of Togo abroad protect the interests of Togolese living abroad. Similarly, there are diaspora organizations, whose objective is to promote and defend the interests of Togolese who live or have lived outside Togo. These organizations frequently create a plethora of development or humanitarian aid initiatives for the interests of their own nations or native communities (IOM, 2015).

2.2.12.5. Civil society organizations

In relation to the phenomenon of emigration and its socioeconomic ramifications, various Non-Governmental Organizations (NGOs) and civil society associations, such as Mouvement d'Action pour le Renouveau Social (MARS) and Vision Solidaire (VS), are actively engaged in the Togolese associative arena (IOM, 2015). This promotion is carried out by advocacy efforts towards the authorities in order to improve the inclusion of emigration and development in development plans, policies and programs, then through some direct interventions in the field.

The action of all these institutions is upstream and downstream of the management and promotion of Togolese emigration to other countries. The goal of these institutions is to make Togolese abroad actors in solidarity with the socioeconomic growth of the country. Outside the institutional framework, Togolese emigration is managed by legal texts in order to encourage an investment climate for emigrants carrying out new projects for their country.

2.3. Theoretical review

Many theories exist to explore the reasons and effects of migration in terms of the research's theoretical framework. One example is Harris Todaro's Rural-Urban Migration Model, which

emphasized economic advantages as the primary cause for migration. The core theory of Harris and Todaro's model is that economic incentives, disparities in wages, and the probability of securing employment at the intended destination, all have an impact on migration decisions (Harris & Todaro, 1970). This study, however, was guided by two conceptual framework models (Lee's & Len's). Our investigation of the impacts of climate severe events on population migration in the Savannah Region of Togo was influenced by Lee's theory of migration (Lee 1966) and the Lens model of decision-making research (Brunswik, 1956). Despite their age, these two models remain relevant and are leading many modern migration research. This is attributable to the reality that, primarily, Lee's theory of migration is predicated upon a push-pull paradigm of migration in which the determination of an individual to migrate is impacted by the advantages and disadvantages of their present domicile (i.e. origin) in comparison to their projected destination, the likelihood of impediments to migration (such as arduous travel or stringent immigration laws), and individual factors - such as employment and expertise - (Lee 1966). The model also supports the concept that intervening barriers might restrict migration to certain locations, but push and pull factors can drive movement from one region to another. Other conceptual models of climate change migration have explicitly embraced the idea of push and pull variables (Black et al, 2011). Secondly, the Lens decision-making model serves as a paradigm for drawing comparisons between an individual's usage of choice cues and their environmental validity, as posited by Brunswik (1956). Accordingly, while a choice signal may carry significant psychological weight in an individual's decision-making process, its utility may be limited when evaluated by policymakers or scientists from an ostensibly 'objective' quantitative scientific standpoint, as observed by Whitley et al (2018).

As a result, a potential migrant may be extremely drawn to work opportunities in a destination country, yet a politician may dismiss it as unimportant because job availability may not equate to economic feasibility. We may conclude that Lee's theory of intervening impediments accounts for many aspects of migration, including migration volume, migration streams, and migrant characteristics. Lee accommodates and strives to explain virtually every aspect of the moving procedure. While Lee's hypothesis is an impressive intellectual endeavor, it lacks objectivity. As a result, applying this theory to policy formulation takes time. The concepts of region and population variety, for example, are vague and imprecise. The 'decide' model has been designed to serve as a valuable tool for healthcare managers in their efforts to apply the crucial elements of decision-making. By utilizing this model, managers can augment their decision-making capabilities and, as a result, make more efficacious decisions (Guo, 2008).

Though this model is vital to the work, it is not a perfect fit for the study since migrants cannot be tracked and thoroughly examined in the same way that patients in a health facility may be regularly watched by health managers. The illegal migrants' covert character cannot be adequately analyzed to understand the choice cue accountable for the decision. Recognizing the limitations inherent in the aforementioned models, the present study employed the "Mental models' technique" in order to assess the impact of climatic extremes on juvenile illegal migration in the Gambia. Mental models, as conceptualized by Gentner (1983), represent a graphical depiction of human cognition, decision-making, and action in diverse contexts. Unlike mere 'imageries,' however, mental models are 'manipulatable' in nature, thereby enabling users to anticipate system states via the mental manipulation of model parameters (Cannon-Bowers et al, 1993).

2.3.1. Network theory

The network theory, developed by Boyd (1989), states that networks are linkages connecting the points of departure and arrival of migrants. These operate as intermediate factors, or mediators, between structural variables and actors. As a result, through survival methods, the family, defined as a domestic unit, plays a major role. Thus, networks comprised of a collection of social institutions employed for the reception, residential, and socio-professional integration of migrants enhance the likelihood of an individual migrating overseas (Sall, 2008). These networks are not tied to the migrant's community of origin. Permanent and institutionalized networks rely on family solidarity and utilize the resources of the community of origin (Ba Cheikh, 1992). The significance of these networks in the migration process stems from the fact that migrants may rely on them to decrease the financial and psychological expenses connected with migrating. As a result, they represent social capital on which the migrant might rely in order to get entrance to the foreign labor market.

There are two sorts of networks for this purpose: permanent and institutionalized networks and fluid networks. Fluid networks are informal networks generated by encounters based on the opportunities found by migrants. This is how the migrant community is transforming to seem more and more like the community of origin Gaselli et al (2003), allowing new migratory flows to continue.

2.3.2. Theory of Cumulative Causes

According to the cumulative causes theory proposed by Harris and Todaro (1970), migration is a process of change of economic and social conditions both at the point of origin and at the point of destination. Migration causes economic and social changes in the country of origin. Migration decisions made in this environment raise the likelihood of subsequent migrations by increasing the potential pool of migration candidates (Lall et al, 2006). The cumulative causes hypothesis is used to describe how migration improves the living standards of migrants and recipient families.

2.3.3. New economics theory of labor migration

According to the new economics of labor migration proposed by Stark (1980), the choice to move is a process that involves the entire family in order to reduce economic risks. Sending one or more family members on migration is one approach for households to alleviate their troubles in the lack of insurance given by the rural market. In this situation, volatility in agricultural product prices or a lack of economic possibilities in rural areas are factors driving population emigration. The arrangement is created between the migrant and his family circle so that the migrant seeking employment is supported in his travels by his family. The interest of these theories is that they make it possible to understand why migratory movements in general and emigration in particular persist despite the difficulty of economic integration of migrants and difficult entry conditions in the host countries. In exchange, the migrant's remittances allow his family to pursue agricultural endeavors. In exchange, the migrant's remittances enable his family to invest in agricultural operations and support his requirements (Lall et al, 2006; Kola, 2011). This idea has thrown fresh light on the socioeconomic consequences of population emigration. This is how the subject of migration's persistence emerges, despite often harsh conditions in host nations. These concepts are appealing because they assist to explain why migratory movements in general, and emigration in particular, persist despite the challenges of migrants' economic integration and stringent entry standards in host countries. These ideas help us comprehend that emigration makes an essential socioeconomic contribution to the populations that benefit from it.

In terms of the contents of the three theories examined, it is crucial to note that they contribute towards enhancing comprehension of the issue of population emigration and its socioeconomic ramifications in the Plateaux Region's West. A methodical approach to data gathering is used to get the research's outcomes.

2.4. Theoretical framework

This study is grounded in the theoretical foundation of mental models. Theoretical underpinnings for mental models are derived from the cognitive sciences and investigations into how humans comprehend their environment (Craik, 1968).

As accurately expounded by Whitley et al. (2018), there is a growing employment of models to enhance comprehension of intricate systems involving multiple stakeholders, particularly systems encompassing interactions among individuals and potentially hazardous phenomena, such as droughts, floods, and wildfires. The focus of this investigation involves the primary climatic extremes of droughts and floods. Illustrations of such cognitive model research are mostly prevalent in the realm of nature (Zaksek & Arvai, 2004). A mental model is conventionally defined as the collective behavior and experiences of a group of individuals in relation to a particular danger or circumstance. The primary data source for mental models is in-depth, open-ended interviews with individuals who have encountered or may potentially encounter the specific event under consideration (Whitley et al., 2018). Therefore, it is highly probable that this approach will be adopted since the sample for this study comprises of individual migrants and their parents or household heads who have encountered illegal movement. Furthermore, in-depth interviews are utilized to extract essential data.

Conclusion

This chapter enabled to put this research in its conceptual context. The clarification of concepts and the theories made it possible to lay a starting point of this study. Based on literature review, it appeared that migration is serious challenge and sensitive issue, nevertheless, much attention has not be paid to it. Researches are lacking on the identification of factors that compel population to live their place of residence, and how to solve the issue.

CHAPTER III: RESEARCH METHODOLOGY

Introduction

This work is conducted in a given and very specific geographical area that is the Savannah region, whose relevant characteristics deserve to be specified. With regard to the methodology, it is accepted that no initiative or activity can objectively produce the expected results without the author observing a rigorous and previously traced path. This chapter turns around three point: the description of the study area (study location, physical and socioeconomic characteristics); method adopted (sampling procedure, source of data and the required data); data collection and analysis (data collection procedure and data processing).

3.1. Study area description

The characteristics of the geographic space of the Savannah Region deserve elaboration as they allow for a good understanding of the study. Note that the choice of setting and its elements must depend on the problem of the study, the goals sought and the hypotheses to be tested (Fonkeng et al, 2014 cited in Dzoka, 2018).

3.1.1. Location

The Savannah Region, situated in the far north of Togo, is located at a distance greater than 600 km from the coast. It spans a geographical area of 8,533 km², equivalent to 15% of the national territory, and stretches between 10° and 11° North latitude as well as 0° and 1° east longitude (Figure 3). The region is flanked by Burkina Faso to the north, Benin to the east, Ghana to the west, and the Kara Region to the south (<https://togopolitique.org/presentation-de-la-region-savanes/>). The following figure paints the study area with the prefectures and their town city.

This is a synthetic map of the Savannah Region of Togo. It has been produced at a scale of 1/10000, and is intended primarily for the scientific world and anyone who wants to use it for any useful purpose. To better understand the area represented on the map, the following paragraphs will describe its characteristics.

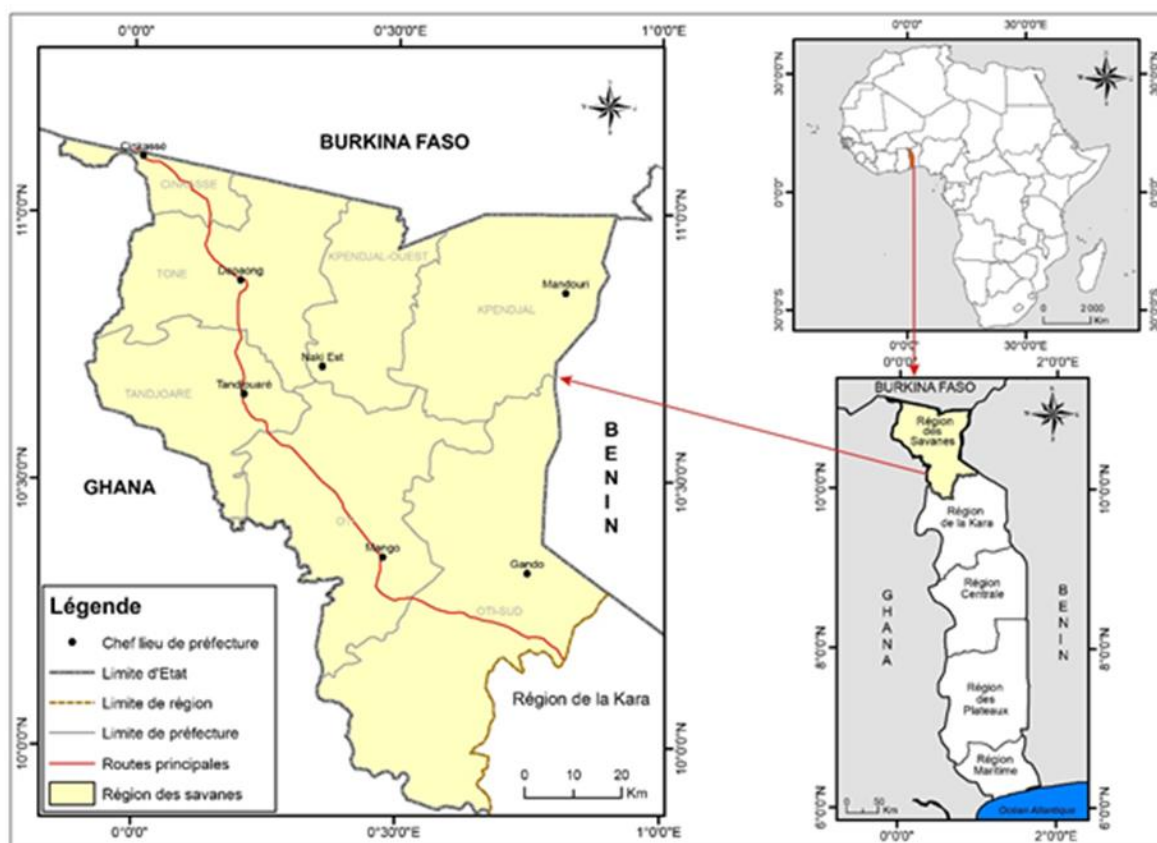


Figure 3: Study area map showing the selected prefectures

Source: Author, 2021

3.1.2. Physical characteristics of Savannah Region

➤ Geology

The soils of Togo are part of a geological group starting from Ghana and extending to Benin. The geological formations encountered there include ancient and recent types. The very old formations are made up of Precambrian terrain and primary series. For very ancient geological formations, we note the Precambrian base and the basin Primary Voltaian. The Precambrian base is made up of the Lower Precambrian or the Dahomeyan which is located in the eastern part of the mountains of Togo and in the extreme north of the country, from the middle Precambrian or Atakorian forming the Atakora chain and the terminal Precambrian or Buem series which obliquely crosses northern Togo from Bassar to Kanté and extends west to Ghana and the East in Benin. The Precambrian basement is composed of very old and resistant crystalline rocks such as: gneisses, mica schists, quartzites, granites. The basin is made up of thick layers of shale and sandstone. It covers the entire region of Savannas and is subdivided

into two series: the more schistose lower Voltaian in the Oti valley and south of Dapaong, the more sandstone upper Voltaian (SAFER, 2022). The geology is crucial in causing migration in the sense that, it determines the type of soil that is the substratum of the agricultural activities.

➤ **Geomorphology**

The study region extends over two geomorphological zones. The cuesta where the village of Tossiégou is located is composed of alternating sandstone of shale. On the other hand, the villages of Kantindi Center and Baniame Kantindi are located on the lower Dapaong Plateau, composed of granite. The landscape is slightly undulated and watered with backwaters mainly from the cuesta and containing water only at the end of the rainy season or after a downpour. The plateau is located between 230 and 250 meters above sea level. The parts the highest slope down gently towards the shallows, along the backwaters. The cuesta culminates at 325 meters above sea level. It is also cut up on all sides by backwaters. As a result of alternating sandstone and shale, the cuesta is dotted with rocky outcrops degrees (Poss, 1996). Geomorphology relates to human migration because it shapes the landforms. In the Savannah Region, agriculture being the main activity, the landform could be beneficial or not.

➤ **Soils**

Most of the soils in the Savannah Region are shallow leached tropical ferruginous soils that comprise the group of indurated tropical ferruginous soils and concretion tropical ferruginous soils. The agronomic value of these soils depends on the importance of concretion, hydromorphy, and induration as well as the depth at which the phenomena are manifested (SAFER, 2022). Soil degradation is widely considered as a key factor undermining agricultural livelihood in the developing countries. Therefore the characteristics of the soil is important in this study regarding the population main activity. Poor soil will not be conducive to farming, resulting in poor harvests, which will inevitably affect the incomes of farmers, who make up the bulk of the Savannah population. As a result, the able-bodied will leave in search of better earnings in other areas.

➤ **Hydrography**

In terms of hydrography, the Savannah Region is an integral part of the Volta blanche basin and is drained by numerous rivers whose flow varies according to the season. West of Dapaong is drained by the Biankouri river, which rises south-east of Timbou, crosses the border with Ghana to join with the Koulougouna, which flows through the north-western part of the region. The Oti, which rises in Benin on the eastern slopes of the Atakora chain under the name of Kpendjari, crosses the region in a north-east-south-west direction. It is the most important

watercourse draining the Mandouri-Mango plain, but with a low flow. On its right bank flow its tributaries, Ouké Oualé near Mandouri, Sansargou, the Namiélé, and the Koukombou, which forms the border with Ghana. From the confluence of the Kokoumbo, the Oti flows north-south, forming a 176 km-long border with Ghana. On its left bank, the Oti is fed by the Koumongou and Kara rivers, which flow from the mountain ranges. Apart from the Oti and Koumongou, which have permanent the rest of the rivers dry up in the dry season (SAFER, 2022). A dense, perennial and sustainable hydrography could be a solution in the case of water stresses such as drought, dry spells, changing rainfall variability and extremes that cause smallholder and subsistence agricultural production declining, therefore accelerating or amplify migration patterns.

➤ **Climat**

The Savannah Region is characterized by a tropical Sudanian climate with a unimodal regime made up of a dry season from November to April with strong thermal amplitudes and a rainy season ranging from May to October with an average annual rainfall varying between 850 to 1400 mm and relatively low monthly average thermal amplitudes.

Between November and March the North-East trade wind commonly known as Harmattan blows there and from May to October the South-West monsoon, a hot and humid wind inducing the North in general equatorial climatic conditions favorable to rain. The average of temperatures is 28° C with heat peaks recorded from March to April where averages monthly temperatures are around 30°C. Average low humidity ranges from 53 at 67%. Over the last 45 years, the area has experienced a decrease in rainfall and the number of rainy days with an increase in temperature reflecting a climate drying phenomenon (SAFER, 2022). Hotter temperatures can threaten agricultural livelihoods, sea-level rise can make floods more severe, and desertification can foster conflict over water access, all of which can lead to migration.

3.1.3. Human characteristic of the study area

➤ **Demographic structure**

The demographic structure of the Savanna Region is characterized by intense reproductive dynamics and population imbalance. In fact, the population of this region has grown rapidly, increasing from 240,723 inhabitants in 1970 (at a density of 28 h/km²) to 329,144 inhabitants in 1981 (at a density of 38 h/km²), a growth rate of 2.8 % corresponds (National Planning Department, 2005)

The population was estimated at 427,955 in 1990, rising to 565,906 in 2005. In 2010 it had 828,224 inhabitants (National Directorate of Statistics and Accounting, final results of RGPH4, 2011), it is unevenly distributed across the region. While Tone Prefecture, home to the regional metropolis of Dapaong, has a population of 286,479, Cinkasse has a population of just 78,592. In the north-western part there is a concentration of population, while other areas of the region are underpopulated. This unequal distribution of the population can be explained by several factors, most notably the unsanitary conditions in areas where onchocerciasis occurs; difficult natural conditions with rough terrain and lack of water; constraining socio-ethnic structures, etc. In addition, the creation of game reserves, covering 49.10% of Oti prefecture and 12.2% of Tone prefecture, has led to a significant population immigration flow to favorable areas, particularly Oti and Tone prefectures, which alone accounts for half of the region's inhabitants (477,022) (National Directorate of Statistics and Accounting, 2012). Demographic factors such as age, education, marital status, and language impact a person's willingness to migrate.

The demographic of the Savannah area is predominantly comprised of females, with an estimated count of 430,228 individuals, as compared to 397,996 males. This population is essentially rural. Indeed, the savannah region has the lowest urbanization rate in Togo (14.08%). There are only 116,637 urban people there against 711,587 people living in rural areas. In some prefectures such as Tandjoaré, the urbanization rate is almost insignificant (1.42%) with an urban population of only 1,671 people against 115,848 rural people.

The prefecture of Tône, which houses the regional capital, alone accounts for half of the region's urban population (58,071). The strengthening of the urban capacities of the capital, Dapaong, through the concentration of most of the equipment and infrastructure, partly explains this strong urbanization of the metropolis on a regional scale.

3.1.4. Administrative organization

The Savannah Region is subdivided into 07 Prefectures; 69 cantons; 16 towns (Table 2).

Table 2: Prefecture and cantons in the Savannah Region, Togo

Prefectures	Chief Town	Cantons	Township
Oti	Sansanne-Mango	8	2
Oti-Sud	Gando	8	2
Tandjouiare	Tandjouare	16	2
Kpendjal	Mandouri	4	2
Kpendjal-Ouest	Naki-Ouest	4	2
Tone	Dapaong	18	4
Cinkasse	Cinkasse	8	2

Source: Togo government, 2017

The Savannah Region is one of the first four administrative entities set up after the country's independence. Its capital is the city of Dapaong, which replaced Mango, the former regional capital. As for the other territories, the northernmost region of Togo has undergone many changes. The current administrative configuration is established by Decree No. 2017-144 / PR of 15/11/17, fixing the territorial jurisdiction and capital of the municipalities of the maritime regions and savannas.

3.1.5. Socioeconomic characteristics of Savannah Region

- **Socioeconomic situation**

With a poverty incidence of 90.5%, against a poverty rate of 61.7% nationally, and 24% in Lomé (Revised Interim Poverty Reduction Strategy Paper in Togo, 2008), the Savannah Region is the least developed part of Togo. Economic life in this part of the country is mainly dominated by subsistence agriculture and small livestock.

Subsistence farming is the basic activity of savannah residents (96% of households). The main crops are food (sorghum, millet, rice, beans, maize, voandzou and yam, etc.) and occupy almost 92% of the acreage (National Census of Agriculture, 2012). To these food crops are added some commercial products (cotton, tobacco and peanuts, etc.). Cultivation techniques are essentially traditional and are characterized by the fragmentation of agricultural land into family farms and a production system geared towards extensive land use.

The Savannah Region also excels in the pastoral field. The second economic activity of this region, breeding is very widespread there and remains an important source of income and food for the populations. Cattle, pigs, sheep, goats, poultry, etc. are raised there. While the region is favorable to breeding, serious problems linked to pastoral practice (lack of pasture and permanent water points, land issues) favor the emergence of regular conflicts between farmers and herders.

From a commercial point of view, the geographical location is an advantage for this region, which is the main gateway for the transhumant livestock of nomadic Fulani from the Sahel into the national territory. Indeed, located near the borders of Ghana, Burkina Faso, and Benin, trade is omnipresent and border contacts are permanent in this area of the country. Plant and animal products represent the largest volume of merchandise traded.

Fishing and handicrafts are secondary economic activities in the region. Activities such as basketry, leather goods, and weaving predominate in the area's crafts. They manufacture useful

objects worked for marketing in the markets of Dapaong and Cinkassé which come to life weekly (straw hats, bird cages, palm fan of palm trees, handbags, and leather bracelets).

The presence of the Oti River and various ponds scattered across the entire Oti plain, promote fishing, which remains an artisanal subsistence activity in this region.

While the region has long been considered the most disadvantaged area of the country, it is nonetheless a territory with economic potential, particularly pastoral, agricultural, and commercial. This explains the special attention paid to this land in recent years, both by the Togolese state and by various development support organizations that have made this part of the country their privileged area of intervention. A major reason why people migrate is income differences between origin and destination countries. Push factors could also be political instability, civil conflict, a lack of job opportunities, famine, (Ferne & Pitkethly 1985).

On the account of the socio-cultural level, the region is characterized by a multi-ethnic mix. The most represented population is that of Moba-Gourma followed by Tchokossi, NgamGam, Mossis, and Peuls. Cultural events (Tingban Pab, Koudapaani, etc.) are held regularly in the area and attract a large number of tourists. In addition to wildlife and wildlife reserves, the region is also full of important tourist sites. The lion's den, the sacred grave of Doung, the rock paintings of Namoudjoga and Sogou, and the sacred grave of Tanlona, are all places that attract tourists to the area.

3.2. Methods

3.2.1. Sampling procedure

In undertaking this study, the concern was to arrive, at the end of the analysis, at results that could be generalized to the entire population of the study area based on the samples selected. According to the objectives set, a target group consisting of heads of households² who had registered at least one emigrant, all categories combined, for more than six months was selected. Thus, the choice of survey locations and households imposes the sampling technique by degree. This type of sampling consisted in selecting the localities and households to be surveyed by degree, i.e. by successive levels.

² The heads of households were chosen to administer the questionnaire because it is difficult to find emigrants to survey

At the first level, based on the file of localities in the Savannah Region, 20 localities³ were chosen. The localities were chosen in a reasoned manner, according to the extent of the departures. These localities are: Naki-ouest centre, Tintouagbang, Tidonti, Walouague, Timbou-centre, Kpalmontongue, Tongua, Nano-centre, Dore, Sissiak-centre, Kampoat, Tchanaga, Fare, Nali, Koumongou, Pansieri, Kanmou, Namoudjoga-centre, Nalouate, Ogaro centre.

The second step was to determine the sample and its distribution in the different localities selected. The latest demographic data on the Togolese population dates back to the fourth population census conducted in 2010. Thus, to update the data, statistical calculations were made based on the growth rates (<https://perspective.usherbrooke.ca/bilan/servlet/BMTendanceStatPays?langue=fr&codePays=TGO&codeStat=SP.POP.TOTL&codeTheme=1>, accessed on March 15, 2021) of the populations of Togo. Since the average household size in the Savannah region is known, we were able to obtain the updated number of households in the Savannah region.

The survey sample is obtained from the application of the Slovin statistical method. Slovin's formula calculates the number of samples required when the population is too large to sample each member directly.

$$n = \frac{N}{1 + N(e)^2}$$

Where:

N is the population size; **n** is the sample size and **e** is the acceptable sampling error (0.05)

In this study, **N** represents the number of household per locality, **n** is the sample per locality and **e** equals to 0.05. Taking an exemple of Naki-ouest centre the calculation give

$$\begin{aligned} n &= \frac{195}{1 + 195(0.05)^2} \\ &= 131 \end{aligned}$$

$$\text{number of household to survey} = n \times \frac{25}{100}$$

³ These localities were chosen according to their migration dynamics.

$$=131 \times \frac{25}{100}$$

$$=33$$

For each locality, the same calculation was done to get the sample per locality. Because of the largeness of the sample, and because the field work delayed (due to COVID 19), it was suggested to apply 25% sampling rate to reduce the initial figure.

Table 3: Sample size surveyed by location

Prefectures	Cantons	Localities	Number of households per locality	Sample per locality	Total survey (25%)	Number of households to survey	Total of households per prefecture
Tône	Naki-ouest	Naki-ouest centre	195	131	25	33	121
		Tintouagbang	127	96	25	24	
	Sanfatoute	Tidonti	224	143	25	36	
		Walouague	154	111	25	28	
Cinkassé	Timbou	Timbou-centre	208	137	25	34	117
		Kpalmontongue	337	183	25	46	
	Biankouri	Tonga	231	146	25	37	
Tandjoaré	Nano	Nano-centre	117	90	25	23	103
		Doré	291	168	25	42	
	Sissiak	Sissiak-centre	243	151	25	38	
Oti Nord	Barkoissi	Kampoat	197	132	25	33	101
	Tchanaga	Tchanaga	204	135	25	34	
	Fare	Fare	210	138	25	34	
Oti Sud	Nali	Nali	238	149	25	37	104
	Koumongou	Koumongou	825	269	25	67	
Kpendal	Tambigou	Pansieri	230	146	25	36	72
		Kanmou	222	143	25	36	
Kpendjal-ouest	Namoudjoga	Namoudjoga-centre	228	145	25	36	124
		Nalouate	587	238	25	59	
	Ogaro	Ogaro-centre	161	115	25	29	
Total	14	20		2966			776

Source: Author analysis, June 2021

Based on the total sample of 2.966 households, a sampling rate of 25% ⁴ was applied at the level of each locality to find the number of households to be surveyed (Table 3). Having the sampling size of the studied population enable the data collection.

⁴ Since the population has the same characteristics, the sample size was reduced to 25% to respect statistical logic. Because, if the population has the same characteristics, a large population size will not necessarily give more precision than a small sample size.

3.2.2. Data collection

3.2.2.1. Documentary research

Documentary research is a very important step in the process of a research project. It allowed to better understand the theme, to get the strong ideas underlying the research. This documentary research focused on general and specific books, theses, dissertations, journals and scientific articles. Many research centers were visited, including the central library of the University of Lomé, the libraries of the Faculty of Human Sciences and Society (FSHS), and the Research Laboratory on the Dynamics of Environments and Societies (LARDYMES). The libraries and websites of national and international institutions were consulted. These include the General Directorate of National Meteorology (DGMN), the National Civil Protection Agency, the International Organization for Migration, Togo section (IOM), the United Nations Development Program (UNDP) and NGOs.

All these documents consulted provided useful information for this research. This information contributed to the elaboration of the questionnaire, to the writing of the literature review in relation to our objectives.

3.2.2.2. Primary data collection

In order to collect the information inherent to this research, primary data were obtained via a field survey conducted using a questionnaire. This collection tool was developed on the basis of variables.

➤ Variables selected

According to Edou (2021), the variable is defined as the translation of the concepts used in a study into operational elements suitable for classification. More explicitly, the variable is any factor that can take one or more different properties or values (Lamboni, 2017). In this work, two types of variables are considered, namely the independent variables or explanatory variables and the dependent variables or variables to be explained.

Table 4: Variables and indicators for the study

Hypothesis	Variables	Indicators
PH: The socioeconomic and environmental factors are influencing the decision of migration in the Savannah Region of Togo	IV: The socioeconomic and environmental conditions	Percentage of land degraded, percentage of farmers practicing rain fed agriculture
	DV: Emigration	Frequency of departure
SHP1: The changes in climate parameters, land use and land cover patterns shape the environment of the Savannah Region of Togo	IV: The climatic conditions, the land use and land change patterns	Rainfall quantity, temperature data, data on land cover and land use.
	DV: Environmental conditions	Land productivity
SHP2: The socioeconomic factors are influencing the population migration in the Savannah Region of Togo	IV: The decline in the quality of life of the population	Employment, low income, price of agricultural products
	DV: Emigration	Frequency of departure
SPH3: The environmental drivers play a role in migration dynamics that is considered as an adaptation/coping strategy in the Savannah Region of Togo	IV: The degradation of the environment, remittances and the realization of emigrants	Land degradation, low rainfall, volume of remittances, localized achievements of migrants
	DV: Emigration	Frequency of departure

Source: Author analysis, 2021

PH= Principal hypothesis; **SPH**= Specific hypothesis; **IV**= Independent variables;

DV= Dependent variables

Table (4) shows that emigration is the main dependent variable, while socioeconomic and environmental causes are the main independent variables. To collect data in the field, the principle of triangulation of methods⁵ was adopted. This triangulation of methods consisted of a synthesis of quantitative and qualitative methods.

All of the above variables were used to test the hypotheses and achieve the objectives of this research. The variables were translated into measurable and/or evaluative indicators that guided the development of the field survey questionnaire and the collection of primary quantitative data. The latter were collected through a field survey conducted after the pre-survey stage and based on a sample of the target population.

➤ Pre-field survey

⁵ The principle of triangulation of methods is the principle that combines documentary research, interviews and questionnaire administration to validate the hypotheses of a study.

The pre-survey is a preliminary work to the actual survey. It allowed us to target households where at least one member has emigrated based on random sampling. This pre-survey consisted of field visits to seven randomly selected villages in the seven prefectures. It also allowed for interviews with groups of heads of households, chairpersons of village development committees, village chiefs, and representatives and directors of NGOs working in the field of migration. This phase made it possible to become familiar with the realities of the phenomenon of emigration in rural areas and the conditions that encourage it, in order to be able to reorient the survey questionnaire, to target the resource persons concerned by the survey and to readjust the hypotheses. This pre-survey made it possible to constitute the survey sample.

➤ **Field survey**

This survey made it possible to collect quantitative and qualitative data. Indeed, the survey questionnaire was developed based on the selected variables, the hypotheses and the objectives of the research. The questionnaire is subdivided into several sections. These sections are: demographic characteristics, reasons for emigration, destination of emigrants, relationship between emigration and socioeconomic and environmental factors, emigration as a strategy for adapting to the effects of environmental degradation, etc.

To analyze the perceptions of the various actors on the issue of population emigration and its implications, qualitative data were collected. Since emigration is experienced differently by different households, interviews were conducted in the localities targeted for the survey. The interviews were conducted with heads of households, presidents of Village Development Committees (VDCs), returnees to their households, officials of non-governmental organizations (NGOs) and other actors involved in migration management in Togo.

Photo 1: Interview in the community of Sisiak in Dapaong (a) and in the community of Koumongou (b) in Mango



Source: Houmou, April 2021

The qualitative data made it possible to gather information that could not be collected from the questionnaire. The analysis of the content of the qualitative information made it possible to expose the different perceptions of the actors. This triangulation of techniques made it possible to cross-reference the information collected in order to better exploit the data collected.

➤ **Focus Group Discussion**

The utilization of focus groups yields a multitude of perspectives and emotional responses within a communal setting. In a comparably brief timeframe, the researcher is able to obtain a significant amount of data (Morgan & Krueger, 1993). Prompted and persuaded by the potency and appealing attributes of focus groups, this study employed focus group discussions as a means of procuring valuable and in-depth information, which would have been arduous to gather solely through the administration of questionnaires.

Photo 2: Members of Focus Group Discussion in the community of Kpalmatong (a) in Dapaong and in the community of Tchanaga (b) in Mango



Source: Houmou, April 2021

In one of the localities of each prefecture, a group of 10 people (5 heads of household and 5 women heads of household) was formed for discussions. The terms of discussion revolved around the apprehension of climate change, the causes of emigration, the advantages and disadvantages of emigration, and their appreciation of emigration as a means of adapting to the harmful effects of environmental degradation.

3.2.2.3. Data treatment process

➤ **Identification of the socioeconomic and environmental driving forces of Savannah population emigration**

Migration is a phenomenon that is prevalent in most regions of the world, with varying contributing factors. Environmental change, while not creating a completely new migratory phenomenon, can impact migration by affecting the existing drivers. In order to tackle this

issue, a framework has been devised to explain the drivers of migration and to determine how global environmental change may influence them. This framework is structured as a pentagon, categorizing migration drivers into five distinct groups: social, political, economic, environmental, and demographic (Figure 4) (Foresight, 2011).

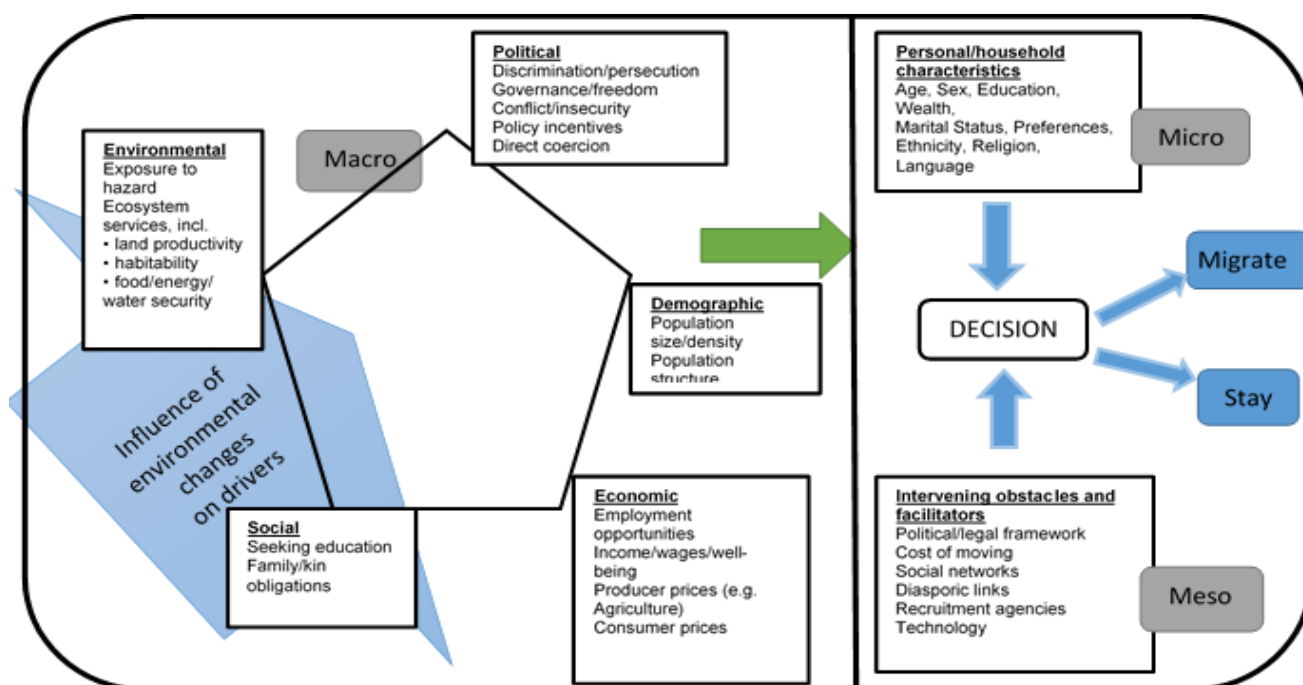


Figure 4: Conceptual framework showing the drivers of migration

Source: Adapted from Foresight: Migration and Global Environmental Change (2011)

Final Project Report, the Government Office for Science, London

A descriptive analysis was implemented to scrutinize the socio-demographic data of respondents, and the survey questions. Regression logistics was used to determine the potential drivers of out-migration and the relation between those drivers and the “decision to migrate” consider in this study as the dependent variable. Before running the regression model, a multicollinearity test was run to remove variables that show collinearity.

➤ Analyses of the opportunities of migration as an adaptation to environmental change in the Savannah Region

Descriptive statistics was used to reveal the reasons why the household head and the migrants see an emigration as an adaptive strategy. Different reasons are enumerated, and according to the advantages or disadvantages selected, the respondent can evaluate the adaptive strategy of an emigration. To investigate the choices of adaptation strategies among migrants and non-

migrants, the adaptation level was determined by the number of adaptation strategies implemented (Bhatta et al, 2016).

➤ **Enumerate the sustainable strategies to inform climate-induced migration management.**

This section examined if Togo has:

- Policies that may be interpreted as 'mitigating the effects of global environmental change on migration' encompass measures such as decelerating the pace of environmental transformation, mitigating its repercussions, and augmenting resilience;
- Policies that are conceptualized as strategic measures to anticipate and react to migration patterns triggered by global environmental fluctuations encompass a range of initiatives such as bridging gaps in protection, devising plans for urban expansion, and alleviating social strife and discord;
- The policies that acknowledge migration as a mechanism for adaptation to environmental changes encompass population resettlement, the construction of new urban settlements, and the facilitation of migration as a strategy of adaptation.

➤ **The documentary analysis also was done by studying available national policy documents (population policies, urban and rural development policies, etc).**

3.2.2.4. Secondary data collection

➤ **Climatic data**

The climate data considered are rainfall, air temperatures (minimum, average and maximum) from 1981 to 2019, a period of 39 years. These data were selected at daily, monthly, seasonal and annual time steps. They are from two (02) national synoptic meteorological stations (Dapaong and Mango). The climatological data used were provided by the General Directorate of National Meteorology (DGMN).

➤ **Satellite images**

Concerning the data used, the main sources of information are constituted of three satellite scenes that are: Landsat MSS (Multispectral Scanner System), Landsat TM (Thematic

Mapper), ETM (Enhanced Thematic Mapper) and OLI & TIRS (Operational Land Image (OLI) and Thermal Infrared Sensor (TIRS) respectively acquired in 1981, 1991, 2001, 2011, and 2020.

Additional data were used to validate the different classification. These are cartographic data such as topographic maps of the study area (savannah region) established at a scale of 1:200,000 and the background map of land degradation in Togo at a scale of 1:200,000. The background map of the structuring axes of the savannah region, extracted from the Open Street Map portal and then converted to the WGS 84 UTM 31 North reference system was also used.

3.2.2.5. Data treatment

- **Examination of the trends in climate and land use change patterns in the Savannah region in Togo**
- ❖ **Trends analysis of rainfall and temperature to assess climate change (1981 – 2019)**

The Mann-Kendall statistical method was used to ascertain if any noteworthy alterations have taken place in the precipitation and temperature trends in the designated research region. The statistical evaluation was conducted at a significance level of 5% on the time-series data. The monthly precipitation and temperature data available were compiled into both monthly and yearly average data sets. Any absent data points were supplemented by means of linear interpolation, using the corresponding months' data from adjacent years surrounding the missing value.

- ❖ **Distinction of dry years from wet years**

To define the wet or dry nature of the seasons in the study area, the Standardized Precipitation Index (SPI) was used. The McKee et al. (1993) proposed the development of the SPI index as a means to measure the deficiency in precipitation. The computation, regardless of location, relies on the historical record of precipitation spanning the same duration as the period under investigation. The fundamental strength of SPI is that it can be calculated for a variety of time scales (1, 3, 6, 12, 24, and 48 months). The primary advantage of SPI lies in its versatility of being computed across a range of timeframes, including 1, 3, 6, 12, 24, and 48 months. To determine the SPI, the initial step involves fitting a long-term precipitation record of the specified station to a probability distribution, such as gamma distribution. This distribution is then converted to a normal distribution, ensuring that the mean SPI is zero. It is expressed mathematically as follows:

$$SPI = \frac{(x_{ij} - \bar{X})}{\sigma}$$

In which, X is the seasonal precipitation at the i^{th} rain gauge and the j^{th} observation: $\bar{X}$ the long-term seasonal mean and σ : standard deviation.

❖ **Extent and land use change map**

The use of satellite remote sensing in our study is explained by the lack of geographical data available from the state services. From the multitemporal data, supervised classifications were performed for each of the available images.

The methodological approach adopted is based on an analytical and diachronic cartographic approach that relies on the use of satellite remote sensing data and GIS (geographic information systems) data.

The processing and analysis of satellite images were used to produce land use maps and determine anthropic activities.

Thus, to cover the study area, four LANDSAT images were used depending on the year; Landsat images of 1981, 1991, 2001, 2011 and 2020 (30x30m) were used because they are available for free and with an average spectral resolution at various band ranges (B, G, R, NIR, SWIR1, and SWIR2). These satellite images are downloaded from the earthexplorer.usgs.gov website.

To reduce cloud coverage, dry season's data only will be acquired (preferably from December to February). Here are the four Landsat scenes that cover my study area: **194/052; 194/053; 193/052; 193/053**

Remote sensing techniques are utilized for the purpose of establishing a map of land cover and land use. This map serves as a basis for obtaining essential input parameters such as vegetation cover and characteristics of land use.

▪ **Image Pre-processing**

Image pre-processing is a set of operations that are performed in order to make the data sets readable and superimposable. These are geometric and radiometric corrections.

The radiometric correction corrects the effects of the various artifacts that disturb the radiometric measurement, while the geometric correction makes it possible to superimpose on other reference cartographic documents (Shlien, 2014). In our study, the latter was not necessary, as the images obtained are already projected in the Universal Transverse Mercator (UTM) system.

These are the procedures executed on the images prior to any treatment, with the aim of collecting images of a particular location on a given date and then arranging them in a layer stacking format, while also extracting the study area. The vector file of the Savannah Region will be used in ENVI to extract the correspondent image of the study area.

The pixel size was altered in ENVI with the intent of achieving superimposability between the images of the four dates. It required the resizing of 1981, 1991, 2001, 2011, 2020 images that have 30 x 30 m pixel. . The images that have already been georeferenced was linked to one another in an automated manner, in accordance with their precise location on the earth's surface. Corrections (atmospheric and radiometric) were performed on the images to acquire the essential information.

▪ **Image Processing**

It consisted of establishing a correlation between the constituents of a visual scene captured in the image, typically represented by their radiometric measures, and predetermined or indeterminate value categories. The act of correspondence was executed by means of discriminant functions that adopted the form of a decision rule, namely the "maximum likelihood" of probabilities, or geometric distances. The "maximum likelihood" was chosen as the classification algorithm because the probabilistic approach presents a distinct advantage. Data processing is marked by mosaicking, extraction of the study area, composition of spectral bands and definition of classes.

The mosaic is a process that allows to join several georeferenced images to form an image covering a larger area. It is indeed most often used when the extent of the area to be mapped exceeds the field of an aerial photograph or a remote sensing image.

In the case of our study, mosaicking was necessary because the study area is covered by four Landsat image scenes (193- 52 and 193- 53; 194- 52 and 194- 53). It consisted of juxtaposing the identical bands of the scenes together to form a larger one (Jobin et al, 2007; Wiederkehr, 2013). The images were enhanced to standardize the hues of the spectral bands (Leboeuf & Paquet, 2013).

To avoid information loss during processing, we adopted the Nearest Neighbor resampling option which according to Caloz et al (1993), preserves the original radiometric values of the image.

The data processing was done in two steps using ARCGIS 10.8 and ENVI 5.3 software. Thus, the first step, consisted in the composition of the image bands and the mosaic with the software

ENVI 5.3. Subsequently, we proceeded to the extraction or cutting of the study area by extract by mask from an existing shapefile of the savannah region through the software ARCGIS 10.8. Color compositions combining bands 3-2-1 for Landsat MSS, TM and ETM and the combination 4-3-2 and 6-5-2 for Landsat OLI-TIR were made in order to have a synthesis of information for a good discrimination of land use units.

For the definition of the nomenclature of objects to be mapped, seven classes were defined: built-up areas, forest, savannah, crops or fallow land, bare soil, wetlands and watercourses.

These different identified themes were respectively extracted from satellite images of the years 1981, 1991, 2001, 2011, 2021 for the elaboration of the land cover map. Subsequently, a creation of colored composition and the choice of training plots were operated. Thus, on the images of 1981 and 1991, 2001, 2011, 2020, samples were selected. The coordinates of these samples were recorded in a GPS for verification and consolidation in the field. In addition, a classification of the images was made. It consisted in transforming the spectral information contained in the satellite images into a land cover map. Among the existing classification techniques, we have opted for the supervised classification, for the elaboration of land cover maps because of its good performance. As a classification algorithm, we used the maximum likelihood.

The latter is based on the Bayesian probabilistic theory which assumes that the classes follow a Gaussian distribution. Pixels are therefore classified according to the probability of belonging to a given class, based on the spectral information contained in samples provided upstream of the classification.

The evaluation of the classification's quality was performed through an assessment of the parameters derived from the confusion matrix, namely the global accuracy and the Kappa coefficient (Congalton, 1991; Girard & Girard, 1999). The matrix of confusion presents the statistical information regarding the degree of misclassification among the various classes in an image, particularly the accuracy of classification. It is calculated with values expressed in pixels and in percentage.

The last step of satellite image processing led to the realization of the land use map and the elaboration of statistical data. It includes operations such as: vectorization, integration of results in a GIS database and the realization of maps. The vectorization consists in converting classified images from raster mode to vector mode (Polygon). To facilitate their management in GIS analysis software, as was the case of ARCGIS 10.8 that we used in our work.

The GIS manipulation is a step during which, spatial analyses are made. During our study, the use of this step allowed us to calculate the areas of the different units of land use and to elaborate maps.

Indeed, the images were vectorized through the ENVI software and exported in shapefile to be reused in a GIS software Arcmap.

The statistical operations consisted in determining, through attribute tables, the areas of land use types in 1981, 1991, 2001, 2011 and 2020.

- **Extraction of plant formations from land use in 1980, 1990, 2000, 2010 and 2020**

The plant formations were obtained from the land cover maps of each year. In this regard, the extraction of the formations was executed with the analytical tools of ArcGIS (Analysis Tools - Extract - Select).

- **Analysis of the evolution of the areas of the plant formations of the Savannah Region between 1981-1991; 1991-2001; 2001-2011 and 2011-2020.**

The results of the classification of the four periods of time has facilitated the examination of the spatial dynamics of plant formations from 1981 to 1991; from 1991 to 2001; from 2001 to 2011 and from 2011 to 2020. This was achievable through the implementation of the change detection approach in ENVI. Before commencing with the "Detection of Change" the process of "Masking" was carried out to precisely delineate the study area.

Conclusion

The justification of the study area selection were firstly described in this chapter. The methodological approach utilized to accomplish the objectives of this research was appropriately describe. The human components of the study area such as the ethnic and religious group was documented. As main source of income, agricultural activities are predominant in the Savannah region. This chapter also exposed the necessary data, the data collection method, and the data analysis process. The methodological framework, based on field investigations, was defined for the purpose of collecting the required information for this study.

This part allowed us to specify the conceptual and methodological framework in which this research is situated. The conceptual framework included the problem, objectives, hypotheses, clarification of concepts and literature review.

CONCLUSION TO PART I

The part I of this thesis began with the conceptualization of the research topic-causes of migration and its opportunity as an adaptation strategy in the Savannah region of Togo. This part focused on the conceptual and methodological framework; it put the subject matter into context by giving an understanding of the causes of migration worldwide down to locally. It is sure that migration is a major concern at a global level.

The methodological approaches used in this study were clearly defined to make the research and its results scientific and accurate; it began with the depiction of the study area, its physical, human and socioeconomic characteristics. The Savannah region present a diversity from the physical and human point of view. The diversity clearly shows that the ecosystems are subject to anthropogenic pressure which contributes to the degradation of landscapes and environment. Both primary and secondary data used, their method of collection and analysis were documented.

PART II: RESULTS AND DISCUSSION

INTRODUCTION TO PART TWO

The segment dedicated to "Results and Discussion" represents a pivotal component of scientific investigations. The results are unpacking of the finding of the researcher after analyzing the data collected either on field or documented. The results are the description of the findings related to the objectives set by the study. The discussion is giving meaning to the findings reported in results section; it put the findings into context by comparing them to other findings of similar studies. The goal of the comparison is to corroborate or refute their stands. This part entitled "Results and Discussion" is made up of three chapters, and each chapter addresses the research objectives of the study.

Chapter IV presents the finding on the trends in climate, land use and land cover change patterns in the Savannah region in Togo. It demonstrates through the Mann-Kendall test, the change in the trend of climate parameters. The dry years are shown as well via the Rainfall Anomaly Index. Climate variability is proved in the study area.

Chapter V identifies the impacts of socioeconomic and environmental driving forces of Savannah population migration; understanding the factors that trigger the population movement in the study area. The regression is used to detect factors that are in relation with the decision to migrate and the percentage of respondents that agree on those factors as push factors. To detect the exact proportion of emigrants that depart from the study area, Cross tabulation is processed.

Chapter VI documented the finding and discussion on how migration (emigration) could be an adaptation or coping strategy to population that are experiencing unfavorable conditions (socioeconomic and environmental) in the Savannah Region; the migration decision is subject to many factors that are contextual and, individual. This chapter enumerates the sustainable strategies as well to inform climate-induced migration management.

CHAPTER IV:
THE TREND IN CLIMATE, LAND USE,
AND LAND COVER CHANGE
PATTERNS IN THE SAVANNAH
REGION

Introduction

Climate change, environmental degradation, and disasters resulting from hazards are profoundly altering contemporary migration patterns across the globe in various ways. The majority of individuals migrate due to a confluence of social, political, economic, environmental, and demographic factors, all of which are, and will continue to be, impacted by environmental and climate change. The impact of climate change on migratory flows is evident, despite uncertainties. Countless individuals are migrating due to the adverse effects of climate change. However, in numerous instances, those who are most vulnerable are those who are trapped and lack the means or opportunities to leave the degraded zones. This chapter presents findings on the trends in rainfall and temperature in the Savannah Region, demonstrating the variability of climate in the study area. Additionally, it highlights changes that have occurred in land use and land cover. This serves as the foundation for any study seeking to establish a correlation between human migration and environmental changes.

4.1. Results

4.1.1. Empirical finding on rainfall and temperature trend and variability analysis

4.1.1.1. Rainfall time series analysis

The present investigation undertakes a trend detection analysis on the annual and seasonal datasets to assess the effect of climate change, or climate variability in the study area.

Specifically, the study focuses on analyzing the rainfall and temperature patterns in the Savannah Region of Togo, utilizing the weather stations of Mango and Dapaong (as shown in Table 5) and employing the Mann-Kendall statistic test.

Table 5: Characteristics of stations for recorded rainfall and temperature data in the Savannah region

Stations	Latitude	longitude	Elevation AMS ^L * (m)	Study period	Number of years
Mango	10.22	0.28	146	1981-2019	39
Dapaong	10.51	0.12	300	1981-2019	39

Source: General Directorate of National Meteorology, 2019

The dataset spans a time period of 39 years (1981-2019) and the Mann-Kendall test is performed at a 5% significant level on time series data to identify any significant changes in the variables of interest. The available monthly rainfall and temperature data were converted

into monthly and annual averages, respectively. Linear interpolation of the same month's data of contiguous years was used to fill in any missing data.

The principal methodology employed in this study is the statistical analysis of rainfall, as documented in Table (6).

Table 6: Formulae for statistical parameters

Description	Symbol	Formulae	Explanation
Arithmetic mean	Xavg	$\sum X_i / n$	X is the rainfall magnitude in mm, i=1, 2, to n and n is the length of the sample
Standard deviation	Σ	$[\sum (X_i - X_{avg})^2 / (n-1)]^{1/2}$	X is the rainfall magnitude in mm, i=1, 2, to n and n is the length of the sample
Coefficient of Variation	Cv	$100 \times (\sigma / X_{avg})$	Xavg is the Mean σ is the Standard deviation

Source: Author, 2022

In the present investigation, an analysis is conducted on the monthly and yearly trends of precipitation and temperature for two weather stations situated in the Savannah region. The daily records of rainfall and temperature were procured from the weather stations of Mango and Dapaong spanning from 1981 to 2019, and were subsequently employed to scrutinize the fluctuations and variations in the aforementioned meteorological parameters.

4.1.1.2. Testing for serial correlation

To identify trends in a time series, it is customary for statistical tests to assume the independence of subsequent data in the series. However, the efficacy of trend tests is heavily impacted by the existence of serial correlation in the data, as noted by Yue et al (2002) and Onyutha (2016). In fact, a positive serial correlation can lead to the wrongful rejection of the null hypothesis of no trend, resulting in a type I error. Conversely, a negative serial correlation can lead to the acceptance of the null hypothesis of no trend, resulting in a type II error. In order to detect serial correlation in the data, it is customary to calculate the lag-1 serial correlation coefficients, as proposed by Kendall et al (1967) and Anderson (1942). Many trend studies have employed this approach of testing for serial correlation in the data by computing the lag-1 serial correlation coefficient (p_1), as observed in Chattopadhyay et al (2020) and Basistha et al (2009).

For any time series $X_i = x_1, x_2, \dots, x_n$, lag-1 serial correlation coefficient (p_1) is calculated as

$$P_1 = \frac{\frac{1}{n-1} \sum_{i=1}^{n-1} (x_i - E(x_i))(x_{i+1} - E(x_{i+1}))}{\frac{1}{n} \sum_{i=1}^n (x_i - E(x_i))^2} \quad (2)$$

Where $E(x_i)$ is the mean of the sample and n is the sample size

$$E(x_i) = \frac{1}{n} \sum_{i=1}^n x_i \quad (3)$$

The probability limits for P_1 on the correlogram of an independent series is given by Anderson (1941) as

$$P_1 = \begin{cases} \frac{-1+1.645\sqrt{n-2}}{n-1}, & \text{for the one-tailed test} \\ \frac{-1\pm 1.96\sqrt{n-2}}{n-1}, & \text{for the two-tailed test} \end{cases} \quad (4)$$

Significance of serial correlation was evaluated by comparing the ρ_1 value with the critical values of Student's t-distribution values.

The result indicated that at Mango, only one (1) series was found to be serially correlated. The critical value is ± 0.347 for any series with 39 observations (Figure 5).

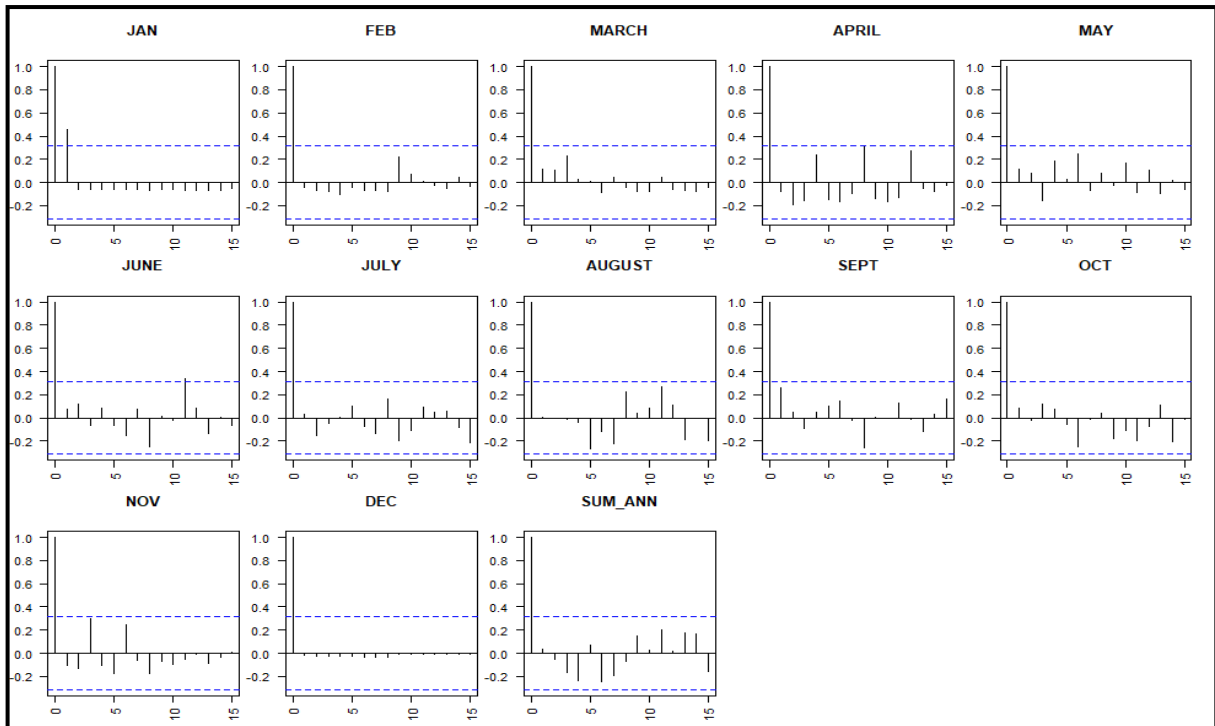


Figure 5: Autocorrelation test on monthly and annual rainfall (Mango weather station)

Source: Mango weather station, 2019

At Dapaong, two (2) series out of 13 were found to be serially correlated at 95% (Figure 6).

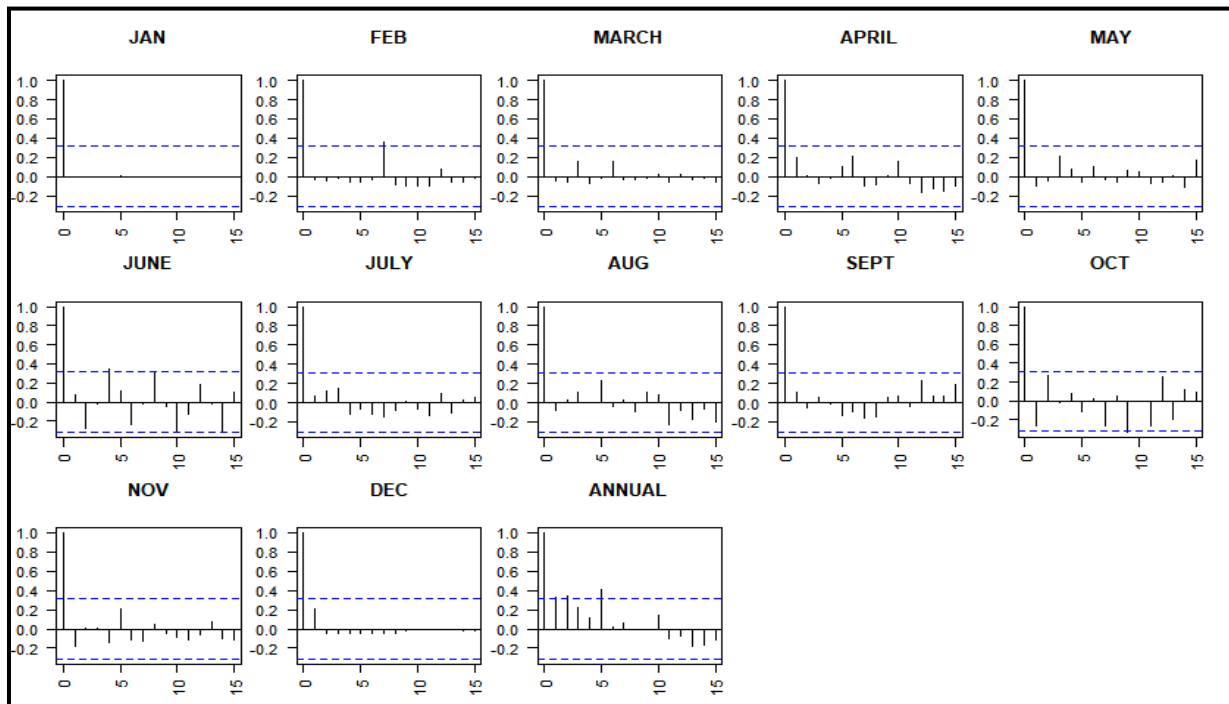


Figure 6: Autocorrelation test on monthly and annual rainfall (Dapaong weather station)

Source: Dapaong weather station, 2019

The critical value is ± 0.347 for any series with 39 observations; this implies that for all the series of data above this value, there is an existence of serial correlation in the data.

4.1.1.3. Trend tests

Trends tests are employed on time series data to ascertain noteworthy positive or negative trends. In case the time series are serially independent, the Mann–Kendall test (Mann, 1945; Kendall, 1955) was applied to test for trends. This test is known in detecting the trends and is commonly used in literature. The trend's magnitude was estimated using Sen's slope method, as proposed by Sen (1968). However, it has been observed in literature that there exists no resolution to adequately address the issue of serial correlation within time series; therefore, it is prudent to employ statistical tests to scrutinize the patterns in data that exhibit serial correlation. In this research, the following modified version of the Mann-Kendall test was implemented, in instances where a significant serial correlation was detected in the time series: variance correction technique proposed by Yue and Wang, (2004), (MMKY).

❖ Mann-Kendall Test

The Mann-Kendall test, which was primarily formulated by Mann in 1945 as a non-parametric test for trend discovery, has found widespread usage in various studies aimed at detecting statistically significant trends in hydrologic and climatic variables in light of climate change. In 1975, Kendall presented the distribution of the test statistic for assessing non-linear trend and inflection point. Notable studies that have employed this test include those conducted by Yu et al (1993), Douglas et al (2000).

The utilization of this test offers two notable benefits. Firstly, it is a non-parametric test that obviates the necessity for data to possess a normal distribution. Secondly, the test demonstrates minimal sensitivity to sudden breaks arising from inhomogeneous time series. The null hypothesis H_0 posited by this test supposes the absence of a trend, while the alternate hypothesis (H_a) assumes a significant change or a clear increasing or decreasing trend in the time series.

$$S = \sum_{i=1}^{N-1} \sum_{j=i+1}^N \text{sgn}(x_j - x_i) \quad (5)$$

Where S is the Mann-Kendall's test statistics; x_i and x_j are the sequential data values of the time series in the years i and j ($j > i$) and N is the length of the time series.

$$\text{sign}(x_j - x_i) = \begin{cases} +1, (x_j - x_i) > 0 \\ 0, (x_j - x_i) = 0 \\ -1, (x_j - x_i) < 0 \end{cases} \quad (6)$$

In the present investigation, non-parametric Man-Kendall test along with the Sen's Slope Estimator (Q_i) was employed to perform trend analysis and estimate slope magnitude. The purpose of this analysis was to identify the annual and monthly variability of rainfall and temperature in the Savannah region, wherein two weather stations were considered.

A positive S value signifies an upward trajectory, while a negative value indicates a downward trend in the data set. The variance of S , in situations where there may be ties (where x values are equal), can be derived as follows:

$$\text{Var}(S) = \frac{n(n-1)(2n+5) - \sum_{i=1}^m t_i(t_i-1)(2t_i+5)}{18} \quad (7)$$

Where m is the number of tied groups in the data set and t_i is the number of data points in the i^{th} tied group. For n larger than 10, Z_s approximates the standard normal distribution and computed as

$$Z_s = \begin{cases} \frac{S-1}{\sqrt{\text{var}(S)}}, & \text{if } S > 0 \\ 0, & \text{if } S = 0 \\ \frac{S+1}{\sqrt{\text{var}(S)}}, & \text{if } S < 0 \end{cases} \quad (8)$$

The assessment of the existence of a statistically significant trend was conducted through the utilization of the Z_s value. In the circumstance of a two-sided test for trend, it is imperative that the null hypothesis H_0 be accepted if $|Z_s| < z_{1-\frac{\alpha}{2}}$ at a given level of significance $\alpha=0.05$.

$|Z| < z_{1-\frac{\alpha}{2}}$ is the critical value of Z_s from the standard normal table; for 5% significance level, the value of $z_{1-\frac{\alpha}{2}}$ is 1.96

The examination of the null hypothesis at the 95% level of confidence is conducted for the datasets pertaining to rainfall and temperature. Should the p value be found to be lesser than the predetermined significance level of α (alpha) = 0.05, the null hypothesis, H_0 , is dismissed. The rejection of H_0 is indicative of a pattern in the time series, whereas acceptance of H_0 suggests the absence of any such trend.

❖ Sen's Slope Estimator Test

The method expounded upon by Sen (1968), which is non-parametric in nature, was implemented to gauge the extent of trends in the time series data. The calculation of the slope for "n" pairs of data was executed with the utilization of the subsequent formula

$$\beta = \text{Median} \left(\frac{x_j - x_i}{j - i} \right) \quad j > i \quad (9)$$

Where β denotes Sen's slope estimator, x_j and x_i represent the data values at time j and i (where $j > i$), respectively. The "n" values of β are arranged in ascending order and the median of "n" values of β is Sen's slope which is expressed as follow

$$\begin{cases} \beta_{[\frac{(n+1)}{2}]} & \text{If } n \text{ is odd} \\ \frac{1}{2} \left\{ \beta_{[\frac{n}{2}]} + \beta_{[\frac{(n+2)}{2}]} \right\} & \text{If } n \text{ is even} \end{cases} \quad (10)$$

A negative β coefficient signifies a downward or declining trend; a positive β coefficient denotes an upward or increasing trend in the time series.

Statistical Mann-Kendall test and Sen's Slope Estimator Test were executed, using Addinsoft's XLSTAT 2021 software.

❖ Variance Correction Approaches

In a context of a time series $X_t = x_1, x_2, \dots, x_n$ which comprises of n number of observations, the pertinent details is encapsulated in n^* observations. The sample size that is effective, denoted n^* , is inevitably smaller than the initial sample size n . In the event of the existence of positive or negative serial correlation, it is observed that the variance of the Mann–Kendall test statistic S tends to increases or decreases, correspondingly. However, this influence can be mitigated by computing the modified variance $V^*(S)$.

$$V^*(S) = V(S) * CF \quad (11)$$

The correction factors (CF) put forth by Hamed and Rao (1998) and Yue and Wand (2004), which are designated as CF1 and CF2, respectively, are worthy of examination.

$$CF_1 = 1 + \frac{2}{n(n-1)(n-2)} \sum_{k=1}^{n-1} (n-k)(n-k-1)(n-k-2)r_k^R \quad (12)$$

$$CF_2 = 1 + 2 \sum_{k=1}^{n-1} \left(1 - \frac{k}{n}\right) r_k \quad (13)$$

where r_k and r_k^R are the $lag - k$ serial correlation coefficients of data and ranks of data respectively and n is the total length of the series. In the instance of a given case of CF_1 only significant correlation coefficients are utilized. For the calculation of CF_1 , the serial correlation coefficient $lag - 1$ is executed. The determination of the Mann–Kendall trend test is established through the application of the corrected variance $V^*(S)$.

Statistical properties of the annual and monthly rainfall series were tested and presented below:

❖ Dapaong and Mango weather stations

The statistical characteristics of both the yearly and monthly precipitation datasets were subjected to testing. To illustrate, Figure (7) graphically depicts the average rainfall for twelve months during the timespan of 1981 to 2019 at the weather stations of Dapaong and Mango.

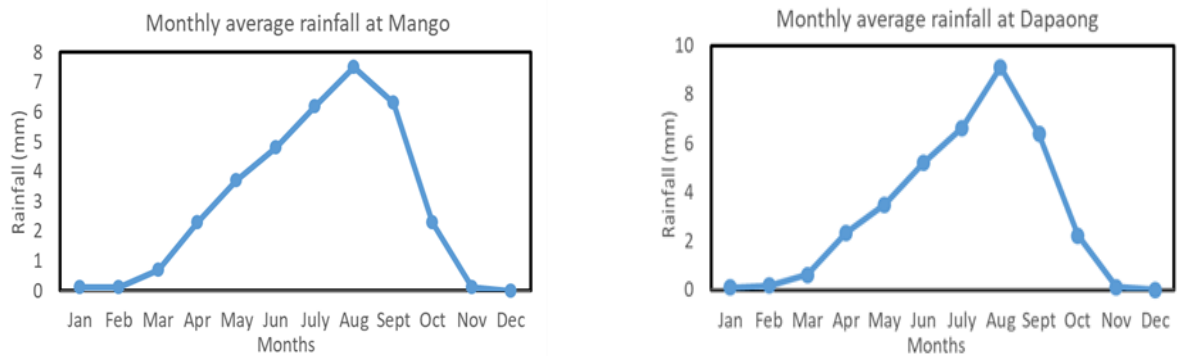


Figure 7: Monthly average rainfall in Mango (a) and Dapaong (b) weather stations

Source: Dapaong and Mango weather stations, 2019

They show one yearly peak in August which reveals the monomial pattern of rainfall in the study area.

The table (7) is a statistical summary of monthly rainfall in Dapaong and Mango. Most of the rainfall is recorded during the months of May to October.

Table 7: Statistical summary of monthly rainfall in Dapaong and Mango weather stations

Time series	Minimum		Maximum		Mean	
	Dapaong	Mango	Dapaong	Mango	Dapaong	Mango
Jan	0	0	98	33.8	2.5462	1.55
Feb	0	0	70.1	42.4	3.9333	3.56
March	0	0	220	127.4	20.528	22.39
April	0	4.4	196.8	209.3	64.005	67.98
May	22.5	24.7	306.9	285.3	104.79	113.56
June	68.1	57.9	247.1	265.7	146.07	143.20
July	54.7	50.1	984.4	417.8	211.35	191.87
August	4	94.2	784.7	440	272.18	232.144
September	3.5	4.8	348.8	342.9	188.96	188.54
October	0	0	182.8	197.5	60.297	72.19
November	0	0	51.1	42.2	4.4436	3.26
December	0	0	29.8	47.1	0.959	1.21

Source: Dapaong and Mango weather services, 2019

The climatic year is divided into two main seasons according to rainfall criteria: a dry season and a rainy season. The maximum rainfall is related to the presence of the intertropical convergence zone. The classic rainfall regime then has only one maximum, which occurs in August in Dapaong and Mango. The months of highest rainfall are July, August and September.

The outcomes of the statistical examination at the 95% confidence threshold for the monthly and yearly precipitation statistics, as determined by the Mann-Kendall analysis, display a combination of positive and negative trends (Table 8)

Table 8: Mann-Kendall test results of monthly and annual rainfall at Mango and Dapaong weather

Time series	P-value		Sen's slope		MK	
	Dapaong	Mango	Dapaong	Mango	Dapaong	Mango
January	0.042	0.258	0	0	0.272	0.150
February	0.098	0.282	0	0	0.207	0.133
March	0.903	0.344	0	-0.300	-0.015	-0.107
April	0.122	0.943	0.526	0.040	0.174	0.009
May	0.022	0.010	1.092	1.513	0.258	0.289
June	0.371	0.141	0.726	-0.830	0.101	-0.166
July	0.561	0.471	-0.700	0.816	-0.066	0.082
August	0.699	0.486	0.406	0.7	0.045	0.080
September	0.095	0.014	1.733	-2.487	0.188	-0.275
October	0.432	0.121	0.540	0.173	0.089	0.173
ANNUAL	0.050	0.701	5.500	-0.937	0.220	-0.045

Source: Dapaong and Mango meteorological services, 2019

In Dapaong station located at the north of the Savannah region, results showed an increasing and significant trend in the annual rainfall ($p < 0.05$). The months of April, May, June August, September and October showed an increasing trend, while July showed a decrease trend; but only the trend of May is statistically significant. In Mango station located at the south of the Savannah Region, the trend in the annual rainfall showed a decrease, but is not significant; the months of April, May, July, August, September and October showed an increasing trend, while June displayed a decreasing trend. The trend was significant for the months of May and September. Rainfall in Dapaong was found to have an increase of (5.50 mm/ year) whereas in Mango, it has decreased (-0.93mm/ year). The linear trend for the 39 years rainfall data is shown in Figure (8).

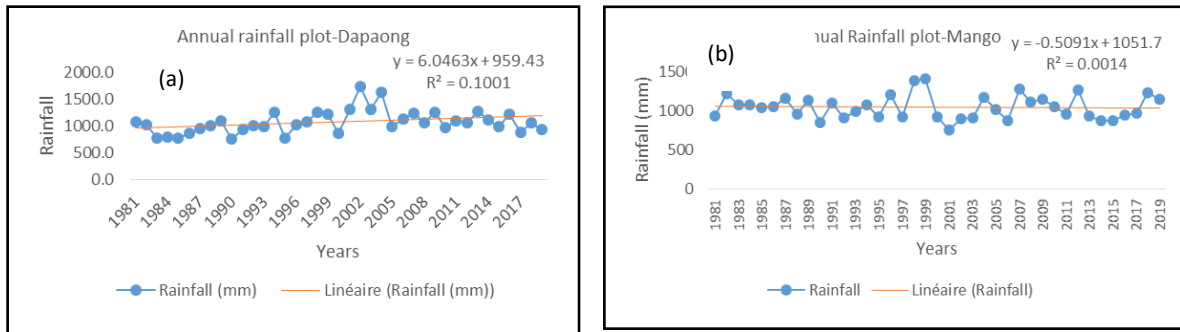


Figure 8: Linear trend corresponding to rainfall data at Dapaong (a) and Mango (b) weather stations

Source: Dapaong and Mango weather services, 2019

The trend line indicates an increase in annual rainfall between 1981 and 2019 for Dapaong weather station and a decrease for Mango weather station over the same period.

When a series is subject to the influence of serial correlation, a modified version of the Mann-Kendall test is employed to investigate the trends. The outcomes of the modified Mann-Kendall test applied to the serially correlated series at a confidence interval of 95% is depicted in the Table (9)

Table 9: Modified Man-Kendall test results of monthly and annual rainfall at Mango and Dapaong weather stations

Time series	Corrected Zc		New P-value		Sen's slope		MMKY	
	Dapaong	Mango	Dapaong	Mango	Dapaong	Mango	Dapaong	Mango
April	2.900	0.237	0.003	0.812	0.525	0.400	0.174	0.009
May	5.917	7.170	0.000	0.000	1.091	1.513	0.021	0.288
June	2.004	-2.977	0.045	0.002	0.725	-0.830	0.101	-0.165
July	-1.091	1.576	0.275	0.114	-0.700	0.815	-0.066	0.082
August	0.697	1.772	0.485	0.076	0.405	0.700	0.044	0.079
September	4.788	-7.100	0.000	0.000	1.733	-2.486	0.187	-0.276
October	2.089	3.632	0.036	0.000	0.540	0.840	0.089	0.171
ANNUAL	2.551	-1.236	0.010	0.216	5.500	-0.937	0.219	-0.039

Source: Dapaong and Mango meteorological services, 2019

The months of April, May, June August, September and October showed an increasing trend at Dapaong weather station, but only the trend of July is statistically insignificant. The trend in annual rainfall was found to have an increase (5.5mm/year) and is statistically significant. Only the month of July shown a decreasing trend that is not even significant statistically. At Mango weather station, the months of April, May, July, August and October have an increasing trend, but only May and October are statistically significant. The months of June and September

display a statistically significant decreasing trend. Annually, the trend in rainfall is showing a statistically insignificant negative trend (-0.93mm/year).

Based on the study, it is evident that, within the 39-years period examined, the stations of Mango and Dapaong had 16 and 12 years, respectively, with total precipitation exceeding their respective averages, as depicted in Figure (9).

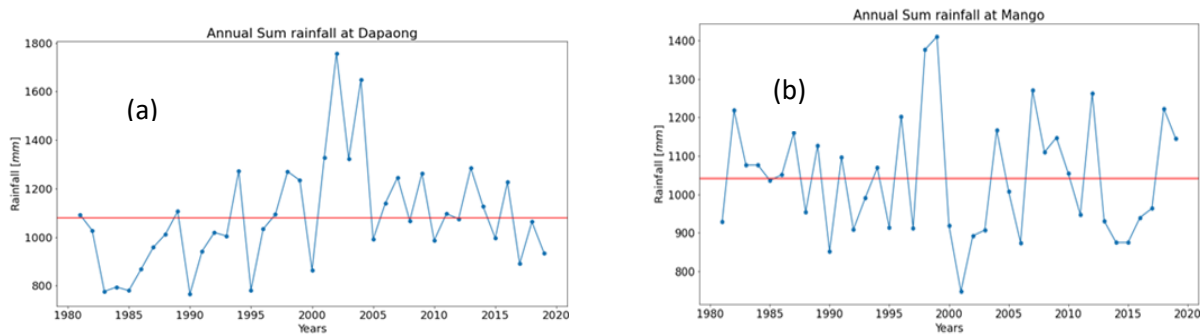


Figure 9: Annual rainfall plot at Dapaong (a) and Mango (b) weather stations (1981-2019)

Source: Dapaong and Mango weather services, 2019

The study reveals that the long-term annual mean total rainfall for Mango and Dapaong stations were 1041.51 and 1080.35 mm, respectively. It is worth noting that the majority of the total annual rainfall was below the average annual rainfall of 1041.51 mm for the Mango station and 1080.35 mm for the Dapaong station. The annual rainfall at Mango station ranged from 747.4 mm in 2001 to 1376.5 mm in 1998, while at Dapaong station, it varied from 765.3 mm in 1990 to 1756.6 mm in 2002. This highlights the region's low rainfall.

4.1.1.4. Variability analysis

❖ Coefficient of Variation (CoV %)

The coefficient of variation, refers to a statistical measure that denotes the ratio between the standard deviation and the mean, serves as a valuable tool in assessing the degree of variation between data series, even when there are significant differences in their means. As highlighted by Canchola et al (2019), the Coefficient of Variation finds application in evaluating the variability of rainfall data concerning its standard deviation and is conventionally expressed as a percentage.

$$\text{❖ } CoV = \frac{\sigma}{\mu} \quad (14)$$

The Coefficient of Variation, commonly abbreviated as CoV, is defined as the ratio of the standard deviation to the long-term mean rainfall, symbolized as μ . In accordance with Hare's

(2003) findings, the CoV values can be categorized as less variable if they are below 20, moderately variable if they lie between 20 and 30, and highly variable if they exceed 30. This information is presented in Table (10).

Table 10: Interpretation of coefficient of variation.

Emitter type	Manufactures Coefficient	Interpretation
Point source	<0.05	Excellent
	0.05-0.07	Average
	0.07-0.011	Marginal
	0.11-0.15	Poor
	>0.15	Unacceptable
Line source	<0.10	Good
	0.10-0.20	Average
	>0.20	Marginal to

Source: ASAE/ASABE Standard 405.1, 2005

The analysis of the coefficient of variation across considered stations indicates that the inter-annual variability of rainfall in the region is low, as evidenced in Table (11).

Table 11: Coefficient of Variation at the Mango and Dapaong weather stations

Mango station			Dapaong station		
Months	Stdev	CoV	Months	Stdev	CoV
Annual	152.506	0.146	Annual	217.922	0.2017
Jan	6.798	4.375	Jan	15.688	6.161
Feb	9.441	2.647	Feb	12.829	3.262
March	29.342	1.310	March	39.254	1.912
April	48.14	0.708	April	39.074	0.61
May	50.845	0.448	May	50.047	0.478
June	54.783	0.383	June	54.313	0.372
July	75.284	0.392	July	143.15	0.677
August	72.261	0.311	August	126.07	0.463
September	73.853	0.392	September	73.224	0.388
October	51.601	0.715	October	41.836	0.694
November	7.884	2.417	November	10.454	2.353
December	7.541	6.205	December	4.8934	5.103

Source: Mango and Dapaong weather stations, 2019

The coefficient of variation (CoV) for rainfall variability at Mango stands at 14%, whereas at Dapaong it is observed to be 20%. At Mango station, the annual variability of rainfall is lower, while at Dapaong station, the annual variability of rainfall is moderate. The months spanning from April to October exhibit a Coefficient of Variation exceeding 0.20 (CoV>20%); the

rainfall exhibits a considerable degree of variability during these months that correspond to rainy season. The aforementioned variability is an outcome resultant from climate change and presents a formidable obstacle for farmers who are presently unable to adequately oversee the growth cycle of their crops.

❖ Rainfall Anomaly Index (RAI)

From the available precipitation data, the Annual Rainfall Anomaly Index (RAI) was computed to undertake an analysis of the frequency and intensity of the dry and rainy years within the study area. The use of the Rainfall Anomaly Index is commonplace in analyzing the frequency and intensity of historical dry and wet years. This metric is derived through the calculation of the difference between the total annual rainfall of a specific year and the long-term average precipitation records, which is then divided by the standard deviation of the long-term data. Positive anomalies in rainfall signify an increase in precipitation levels beyond the long-term mean, indicating a wet year. Conversely, negative anomalies in rainfall indicate a decrease in precipitation levels below the long-term mean, signifying a dry year. RAI is one of the major drought indices and extensively used to analyze the drought severity, intensity, and frequency. RAI is characterized by two anomalies: Positive anomalies and Negative anomalies. The classification scheme, as outlined in Table (12), was devised by Rooy (1965) and subsequently modified by Freitas (2005), and comprises the following:

$$RAI = 3 \left[\frac{\bar{N} - N}{\bar{M} - \bar{N}} \right] \quad \text{For positive anomalies} \quad (15)$$

$$RAI = 3 \left[\frac{N - \bar{N}}{\bar{X} - \bar{N}} \right] \quad \text{For negative anomalies}$$

Where: N = current monthly/yearly rainfall, in order words, of the month/year when RAI will be generated; (mm); $\bar{N}$ = monthly/yearly average rainfall of the historical series (mm); $\bar{M}$ = average.

Table 12: Classification of Rainfall Anomaly Index intensity

Rainfall Anomaly Index (RAI)	RAI range	Classification
	Above 4	Extremely humid
	2 to 4	Very humid
	0 to 2	Humid
	-2 to 0	Dry
	-4 to -2	Very dry
	Below -4	Extremely dry

Source: Freitas (2005) adapted by Araújo et al. (2009)

From (Figure 10), it can be noticed that the extremely humid years are only 2, the very humid years are 4, and the humid are 13. The extremely dry years are 1, the very dry are 9 and the dry months 10. From 1981 to 1990, Dapaong experienced mostly dry years with 6 that are extremely dry. It can be noticed that only 11 years are wet years with 2 that are extremely humid, 3 that are very humid and 6 that are humid. Mango is more watered than Dapaong and this result gives an aspect of drought that is threatening the Savannah region

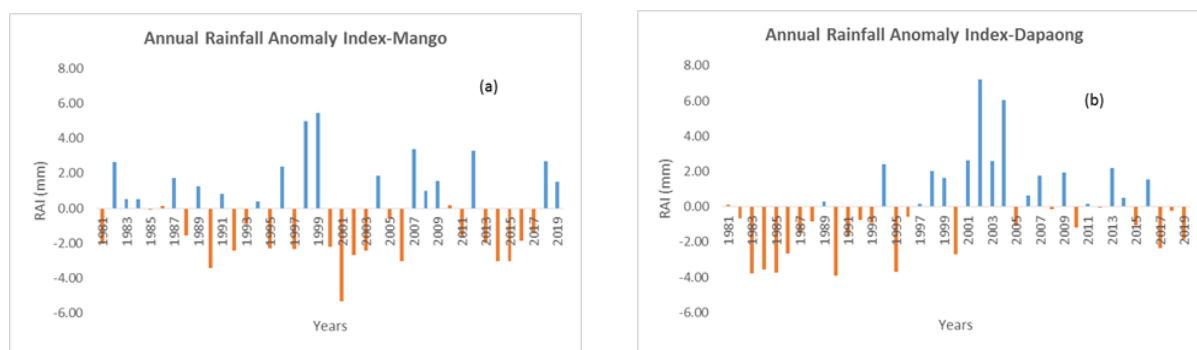


Figure 10: Annual Rainfall Anomaly Index at Mango (a) and Dapaong (b) weather stations

Source: Mango (a) and Dapaong (b) weather stations, 2019

In both stations, the annual negative anomaly surpassed that of the positive anomaly; additionally, there was high variability, characterized by the occurrence of a wet year followed by a succession of two or three dry years, which, in turn, were subsequently replaced by wet years. The frequency of negative anomalies in Mango area increased since 2000, while in Dapaong area, it was the positive anomalies that increased the same time. The findings suggest that as a consequence of prolonged periods of aridity, the agricultural output and dietary provisions within the area have been impacted. The result aligns with the claim posited by Gadedjisso et al. (2021) that the variability of rainfall and temperature exerts a noteworthy influence on the productivity of cereal crops in the northern region of Togo.

4.1.2. Temperature time series analysis

On conducting the Mann-Kendall test on minimum temperature data at Dapaong weather station (Table 13), the Sen's slope provides conclusive evidence of a positive trend in annual series.

Table 13: Mann-Kendall test results of annual and monthly minimum temperature at Dapaong weather station

Months	Man Kendall Statistic (S)	p-value (two tailed test)	alpha	Sen's slope Estimate	Test Interpretation
Jan	0.169	0.133	0.05	0.029	Accept H0
Feb	0.132	0.240	0.05	0.027	Accept H0
March	0.299	0.008	0.05	0.029	Reject H0
April	0.071	0.529	0.05	0.006	Accept H0
May	0.070	0.536	0.05	0.004	Accept H0
June	0.144	0.203	0.05	0.009	Accept H0
July	0.220	0.053	0.05	0.015	Accept H0
Aug	0.275	0.016	0.05	0.014	Reject H0
Sept	0.097	0.395	0.05	0.006	Accept H0
Oct	0.044	0.698	0.05	0.001	Accept H0
Nov	0.263	0.020	0.05	0.026	Reject H0
Dec	0.129	0.255	0.05	0.020	Accept H0
Annual	0.164	0.143	0.05	0.008	Accept H0

Source: Dapaong weather station, 2019

The outcomes reveals that the null hypothesis was agreed for the yearly temperature trend (p-value= 0.143). Thus, a statistically significant positive trend cannot be find for the annual temperature during the period of record.

On running the Mann-Kendall test on minimum temperature data at Mango weather station (Table 14), the Sen's slope indicates evidence of a positive trend in annual series.

Table 14: Mann-Kendall test of annual and monthly minimum temperature at Mango weather station

Months	Man Kendall Statistic (S)	p-value (two tailed test)	alpha	Sen's slope Estimate	Test Interpretation
Jan	0.188	0.095	0.05	0.032	H0 accepted
Feb	0.340	0.002	0.05	0.053	H0 rejected
March	0.417	0.001	0.05	0.058	H0 rejected
April	0.275	0.014	0.05	0.030	H0 rejected
May	0.280	0.012	0.05	0.033	H0 rejected
June	0.481	0.0001	0.05	0.038	H0 rejected
July	0.562	0.0001	0.05	0.032	H0 rejected
Aug	0.612	0.0001	0.05	0.030	H0 rejected
Sept	0.535	0.0001	0.05	0.035	H0 rejected
Oct	0.564	0.0001	0.05	0.038	H0 rejected
Nov	0.357	0.001	0.05	0.056	H0 rejected
Dec	0.230	0.040	0.05	0.033	H0 rejected
Annual	0.625	0.0001	0.05	0.040	H0 rejected

Source: Mango weather station, 2019

The result highlights that the null hypothesis was rejected for the annual temperature trend (p-value= 0.0001). Thus, a statistically significant positive trend is got for the annual temperature over the time period of record at Mango station.

The linear trend for the 39 years annual minimum average temperature data is depicted in Figure (11).

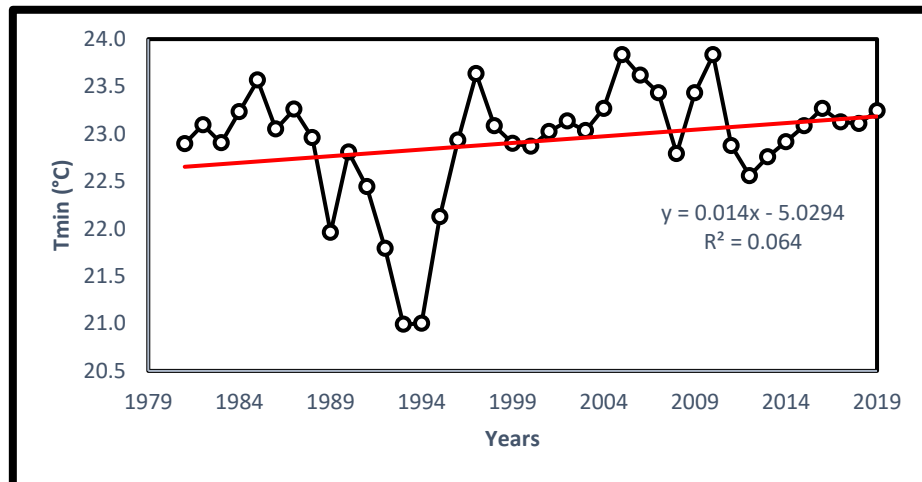


Figure 11: Linear trend line corresponding to annual minimum temperature data at Dapaong weather station (1981-2019)

Source: Dapaong weather station, 2019

The trend line shows an increase in annual minimum average temperature amount between 1981 and 2019 for Dapaong weather station.

The Figure (12) represents the linear trend for the 39 years temperature data at Mango weather station.

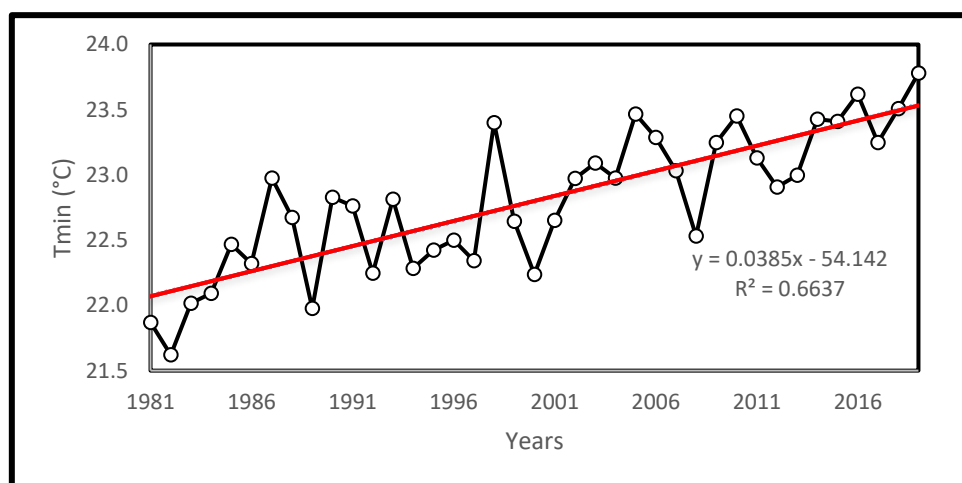


Figure 12: Linear trend line corresponding to annual minimum temperature data at Mango weather station (1981-2019)

Source: Mango weather station, 2019

The trend line indicates an increase in annual minimum average temperature amount between 1981 and 2019.

On conducting the Mann-Kendall test on maximum temperature data at Dapaong (Table 15), the Sen's slope shows evidence of a positive trend in annual series.

Table 15: Mann-Kendall test of annual and monthly maximum temperature at Dapaong weather station

Months	Man Kendall Statistic (S)	p-value (two tailed test)	alpha	Sen's slope Estimate	Test Interpretation
Jan	0.125	0.270	0.05	0.017	Accept H0
Feb	0.157	0.164	0.05	0.023	Accept H0
March	0.260	0.023	0.05	0.030	Rejected H0
April	0.114	0.309	0.05	0.014	Accept H0
May	0.082	0.467	0.05	0.012	Accept H0
June	0.129	0.255	0.05	0.040	Accept H0
July	0.156	0.167	0.05	0.015	Accept H0
Aug	0.133	0.244	0.05	0.010	Accept H0
Sept	0.060	0.594	0.05	0.005	Accept H0
Oct	-0.033	0.771	0.05	-0.005	Accept H0
Nov	0.286	0.011	0.05	0.040	Reject H0
Dec	0.267	0.018	0.05	0.043	Reject H0
Annual	0.295	0.008	0.05	0.022	Reject H0

Source: Dapaong weather station, 2019

The obtained outcome indicates that the null hypothesis was refuted for the yearly temperature trend (p-value= 0.008). Thus, a positive trend with statistically significance has been identified in relation to the annual average maximum temperature over the recorded time period.

On running the Mann-Kendall test on maximum temperature data at Mango (Table 16), the Sen's slope shows an evidence of a positive trend in annual series.

Table 16: Mann-Kendall test of annual and monthly maximum temperature at Mango weather station

Months	Man Kendall Statistic (S)	p-value (two tailed test)	alpha	Sen's slope Estimate	Test Interpretation
Jan	0.255	0.022	0.05	0.040	H0 rejected
Feb	0.246	0.028	0.05	0.040	H0 rejected
March	0.389	0.001	0.05	0.048	H0 rejected
April	0.162	0.147	0.05	0.027	H0 accepted
May	0.089	0.425	0.05	0.014	H0 accepted
June	0.304	0.006	0.05	0.034	H0 rejected
July	0.397	0.001	0.05	0.040	H0 rejected
Aug	0.162	0.147	0.05	0.014	H0 accepted
Sept	0.166	0.137	0.05	0.010	H0 accepted

Oct	0.049	0.663	0.05	0.004	H0 accepted
Nov	0.378	0.001	0.05	0.039	H0 rejected
Dec	0.386	0.001	0.05	0.056	H0 rejected
Annual	0.455	0.0001	0.05	0.032	H0 rejected

Source: Mango weather station, 2019

The result indicates that the null hypothesis was rejected for the annual temperature trend (p-value= 0.0001). Thus, a statistically significant positive trend is found for the annual average maximum temperature over the time period of record.

The linear trend for the 39 years annual average maximum temperature data at Dapaong weather station is pictured above (Figure 13).

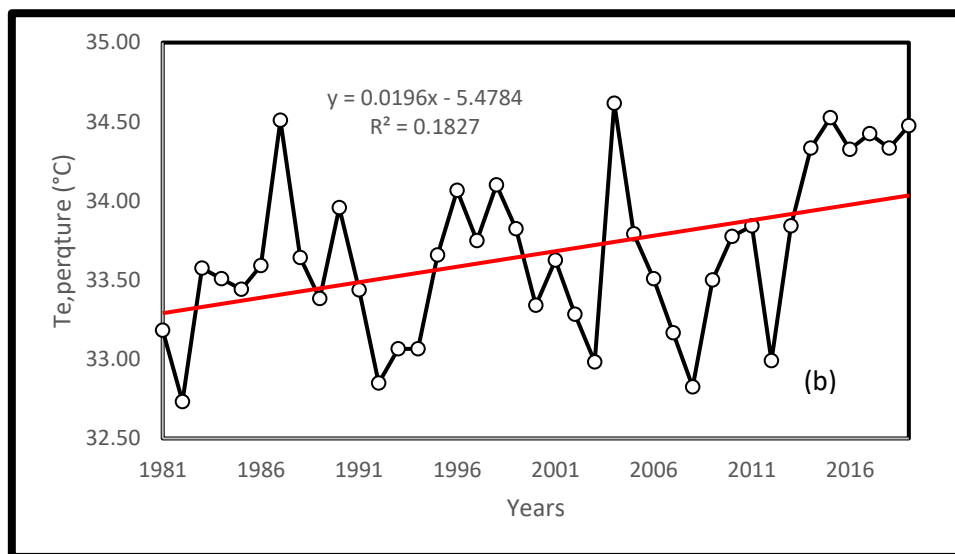


Figure 13: Linear trend line corresponding to annual average maximum temperature data at Dapaong weather station (1981-2019)
Source: Dapaong weather station, 2019

The trend line indicates an increase in annual maximum average temperature amount between 1981 and 2019 at Dapaong weather station.

The linear trend for the 39 years annual average maximum temperature data at Mango weather station is shown above (Figure 14).

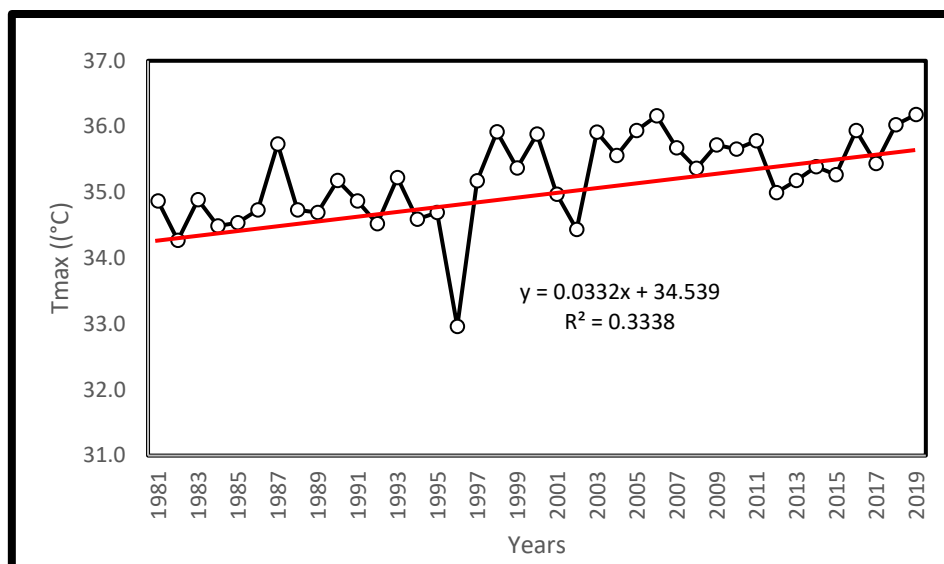


Figure 14: Linear trend line corresponding to annual average maximum temperature data at Mango weather station (1981-2019)

Source: Mango weather station, 2019

The trend line indicates an increase in annual minimum average temperature amount between 1981 and 2019.

4.2. Community perceptions of climate variability

According to West et al. (2008); Orlove et al. (2010), the perception of communities on climate variability and change is of significant importance in the search for adaptation measures.

4.2.1. Rainfall variability

The table (17) is depicting the respondents' opinion on the change in the quantity of rainfall.

Table 17: Respondents opinion on change in rainfall quantity

Change in rainfall quantity					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	decrease in rainfall	591	75.7	75.7	75.7
	increase in rainfall	146	18.7	18.7	94.4
	stable	44	5.6	5.6	100.0
	Total	781	100.0	100.0	

Source: Field work, April 2021

Household heads, by comparison of years, have an idea of the evolution of the climate in recent decades; 75.7% noticed a change in rainfall quantity. In fact the rainfall quantity has been decreasing in the last decades.

To prove the decrease in the length of rainy season, the table (18) is painting the responses of the interviewees.

Table 18: Trend of rainfall season length

Trend of the length of rainfall season					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		28	3.6	3.6	3.6
	decrease in length of raining season	611	78.2	78.2	81.8
	increase in the length of rainy season	142	18.2	18.2	100.0
	Total	781	100.0	100.0	

Source: Field work, April 2021

Based on the results, there is an evidence of a decrease of the rainy season length, since 78.2% of the respondents have the same opinion.

4.2.2. Major hazards

To get the community perception on major hazards threatening the Savannah Region, the table (19) and (20) serve as a sum up of the opinion poll of the targeted population.

Table 19: Respondents opinion on strong wind as major hazard

Strong wind as major hazard					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	139	17.8	17.8	17.8
	yes	642	82.2	82.2	100.0
	Total	781	100.0	100.0	

Source: Field work, April 2021

The outcome showed clearly that the major hazards that threaten the Savannah region are the strong wind and drought.

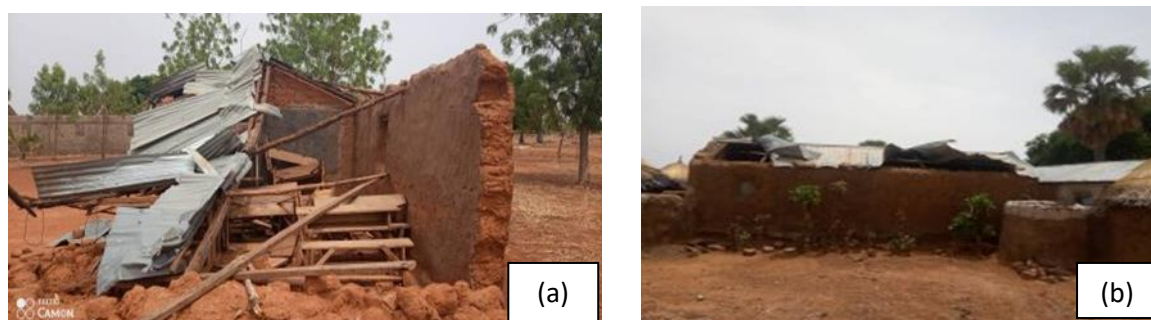
Table 20: Respondents opinion on drought as major hazard

Drought as major hazard					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	99	12.7	12.7	12.7
	yes	682	87.3	87.3	100.0
	Total	781	100.0	100.0	

Source: Field work, April 2021

In fact, 82.2% and 87.3% of respondents, respectively attested that strong wind (Table 19) and drought (Table 20) are the major hazards threaten the population of Savannah region. The picture below (photo 3) illustrates the consequence of strong winds in a community of Naki-Ouest.

Photo 3: Classrooms (a) and houses (b) destroyed by strong wing



Source: Author, April 2021

It shows a classroom and houses that collapse completely with numerous material damages.

4.2.3. Causes of climate variability and change

To detect the causes of climate change or climate variability in the study area, respondents' point of view were compacted in table (21).

Table 21: Respondents opinion on human cause of climate change

Human cause of climate change					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	176	22.5	22.5	22.5
	yes	605	77.5	77.5	100.0
	Total	781	100.0	100.0	

Source: Field work, April 2021

The effects and impacts of climate variability and change are visible in the Savannah region. For proof, 77.5% of respondents said that human are the causes of these changes due to their activities such as trees cutting for firewood and charcoal production, agriculture purposes.

4.2.4. Correlation between community perception and scientific observations about the variability of climatic parameters.

From their lived experiences, most farmers (aged 40 and over), compared over the years, have an idea of how the climate has changed in recent years. 75% of respondents say they feel change in rainfall quantity. Speaking about the manifestation of this variability, 78.2% emphasize reducing the amount of precipitation. The local populations' vision of the late start of the season is consistent with the analysis of rainfall data which mostly shows great variability.

The rainy season lasts 4 to 6 months, whereas previously it lasted 6 to 7 months. From all the statements collected, it emerges that farmers effectively identify climate variability in their area.

Among the household head, 79% mentioned the high intensities of heat in recent years. According to them, the months of intense heat have not changed, but they are excessively hotter than in the past.

The interviewees tried to explain the causes of the reduction in precipitation; they believe that this phenomenon is due to the disappearance of forests, since trees attract rain. They also spoke of the anger of the gods due to the fact that young people nowadays neglect tradition. In the same sense they think that there are certain men who call themselves holders of the rain or master of the rain who stop the rains in the rainy season for certain reasons, including the obligation to offer them gifts and sacrifices. For some respondents, the cause of the deficit would be the natural.

4.3. Land Use-Land Cover Change

Land classification is susceptible to errors that may arise from geometric inaccuracies, misclassifications, and the presence of undefined classes. To precisely measure these discrepancies, a stochastic sampling of pixels extracted from the categorized maps was executed for the purpose of creating a confusion matrix. The utilization of the kappa coefficient K, which is a discrete multivariate technique frequently utilized in the assessment of thematic maps, is a highly effective approach for extracting valuable information from the confusion matrix, as stated by Viet et al (2011).

The levels of agreement and accuracy in this study were evaluated using the kappa coefficient. A value of $K > 0.80$ was indicative of strong agreement and good accuracy, whereas a value ranging from 0.40 to 0.80 was considered to be middle, and a value < 0.40 was deemed to be poor (Carletta, 1996). Results of the study revealed that for the years 1986, 2000, and 2014, the kappa coefficients were respectively $K_{1986} = 81.5\%$, $K_{2000} = 89\%$, and $K_{2014} = 84.5\%$, indicating strong agreement. The classification of LULCC was generally accurate and consistent, with strong agreement being achieved.

The examination of the Savannah region has revealed a substantial rate of transformation in land use and land cover, over the course of time, as indicated by the accompanying maps. They describe land use and land cover change over 1985, 1995, 2005, 2015 and 2022. The categorization of the area into seven (7) principal land use/ cover classes was accomplished through supervised and unsupervised image classification. These classes include built-up (settlement), forest, shrubland, grassland, water bodies, cropland, and bare land, as presented in Table (22).

Table 22: Description of LULC classes used in this study

Land use classes	Description
Forest	A forest or forest massif is a relatively large wooded area made up of one or more stands of trees, shrubs, and also other associated native plants.
Shrubland	Land covered by a diverse array of greenery, including small trees measuring at a height of approximately 5 meters, interspersed with bushes and shrubs, in addition to a mixture of grass vegetation (Efrem Garedew Æ Mats Sandewall Æ Ulf et al. 2009)
Grassland	A vast open area covered with grass, especially one used for pasturage
Bare soil	Soil or sand lacking coverage from grass, sod, other live ground covers, wood chips, gravel, artificial turf, or similar covering.
Built-up	A concrete area characterized by scattered dwellings in bloc with a spacing of around 5 m per houses
Water body	Permanent or temporary water bodies such as small dam, rivers or stream.
Cropland	Cultivated formations with or without scattered trees (canopy coverage 20%).

Source: USDS database

The graph of contingency which has been acquired from the classification based on remote sensing, portrays the extent of each type of land use/ cover class at different study periods of the area (Table 23).

Table 23: Extent of Land Use and Land Cover from 1985 to 2022

Value	Classes	1985	1995	2005	2015	2022
1	Forest	8,765.1	4,356.3	10,420.3	20,397.7	20,150.6
2	Shrubland	311,146.6	268,767.7	129,341.3	198,534.6	109,004.9
3	Grassland	230,331.9	207,310.1	278,298.8	164,274.6	314,473.1
4	Cropland	322,739.2	356,544.5	412,861.6	445,206.8	385,393.7
5	Other	19,336.9	54,416.6	56,253.5	60,315.7	61,315.7
6	Water	753.3	1,523.2	5,897.5	4,343.6	2,735.0
Overall Accuracy		89.9	86.9	85.2	81.1	93.5
Kappa		83.1	75.3	81.6	74.2	91.4
Other: Bare soil, Built-up						
Values area in ha						

Source: USDS database

In 1985, the extent of forest is 8765.1, shrubland is 311146.6, grassland is 230331.9, cropland is 322739.2, and water 753.3 (Figure 15).

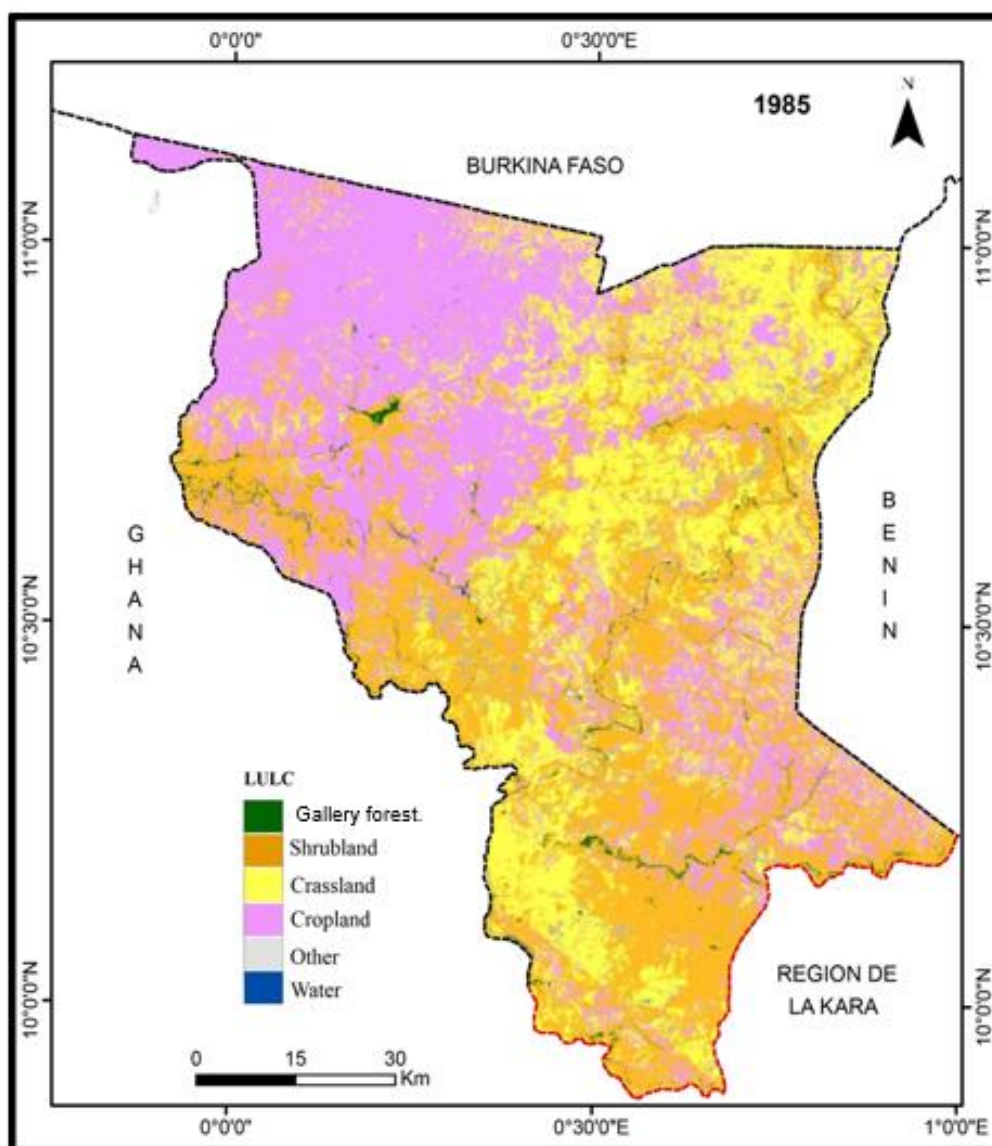


Figure 15: Land Use-Land Cover maps in 1985

Source : USGS database

During period of 1985 to 1995, forest area decreased by 50.29%, giving an extent of 4356.3; this decrease may be explained by the politic instability that Togo experienced in 1990. Indeed, in the 1990s, Togo experienced a political and socioeconomic upheaval. This instability caused the destruction of several natural resources including fauna and flora. Thus, the institution that regulated the cutting of trees and the exploitation of forest resources were almost non-existent and the population took over the forest resources in a savage manner. The consequences were deplorable with large areas of forest destroyed. The invasion of the protected area (usually

forest area) resulted in the installation of villages within core protected areas, threatening ecosystem integrity and biobiodiversity. The shrubland reduced to 268767.7, equaling a decrease of 13.62%. Before 1985, began in Togo a rural development policy which promote a development of agriculture. In the desire to have land, surely the populations started by cutting down the trees, thus reducing the forest areas. The grassland covered an extent of 207310.1 meaning a decline of 10%. The reduction of the shrubland and increase of cropland areas during this period may due to the search of sufficient land for agriculture purpose. The water body extended to 1464.2 signifying an increase of 94.27% (Figure 16).

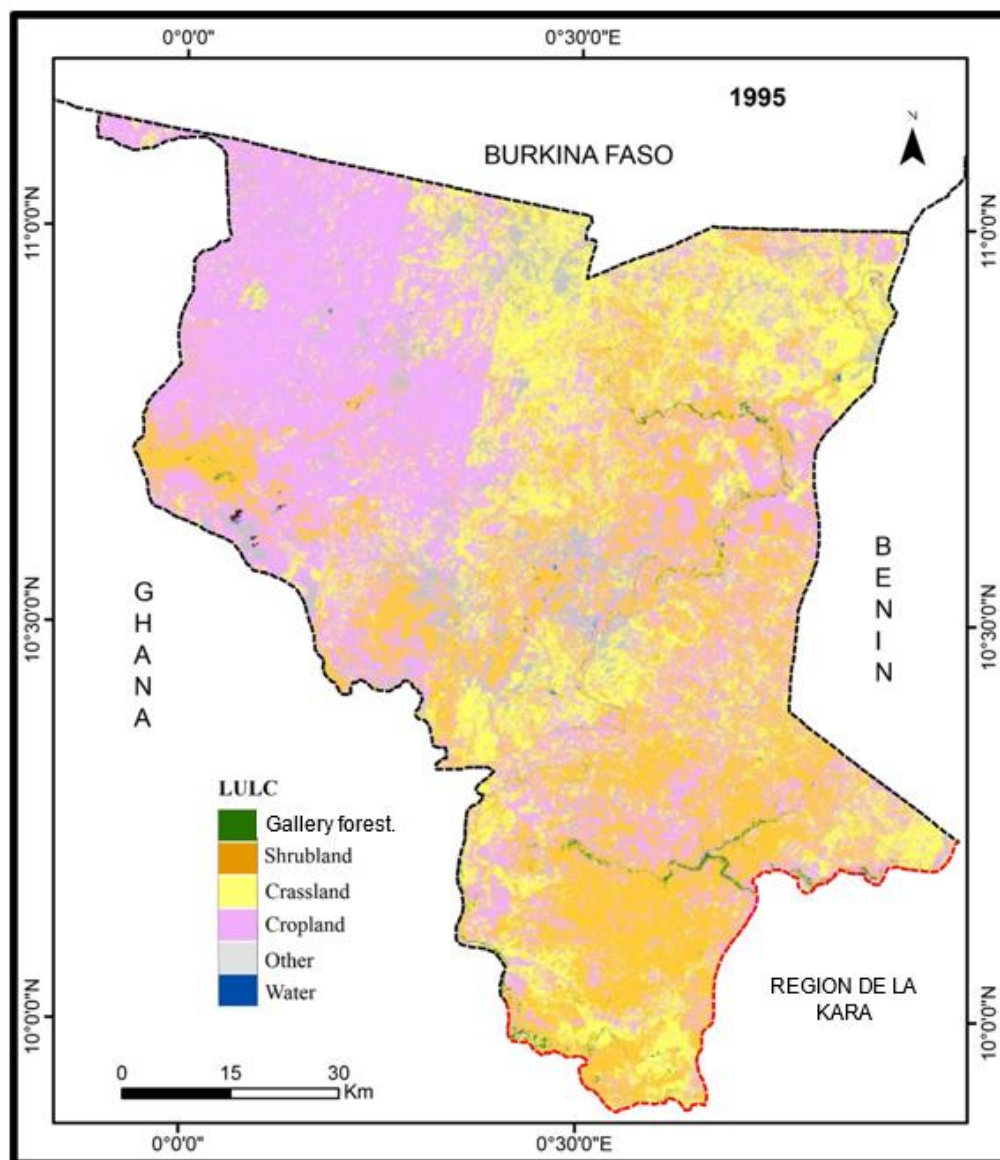


Figure 16: Land Use-Land Cover maps in 1995

Source : USGS database

From 1995 to 2005, there is an increase of 138.70% in the forest extent, reaching 10420.3. The increase in forest area is probably due to the Plan of National Forest Actions worked out in 1994 which, probably enable the protection of forest, even if this plan was not implemented. The shrubland decrease by 51.87% . The Grassland rate raised by 34.24%. The cropland increased by 53.43%, surely caused by the increase of farming population. (Figure 17).

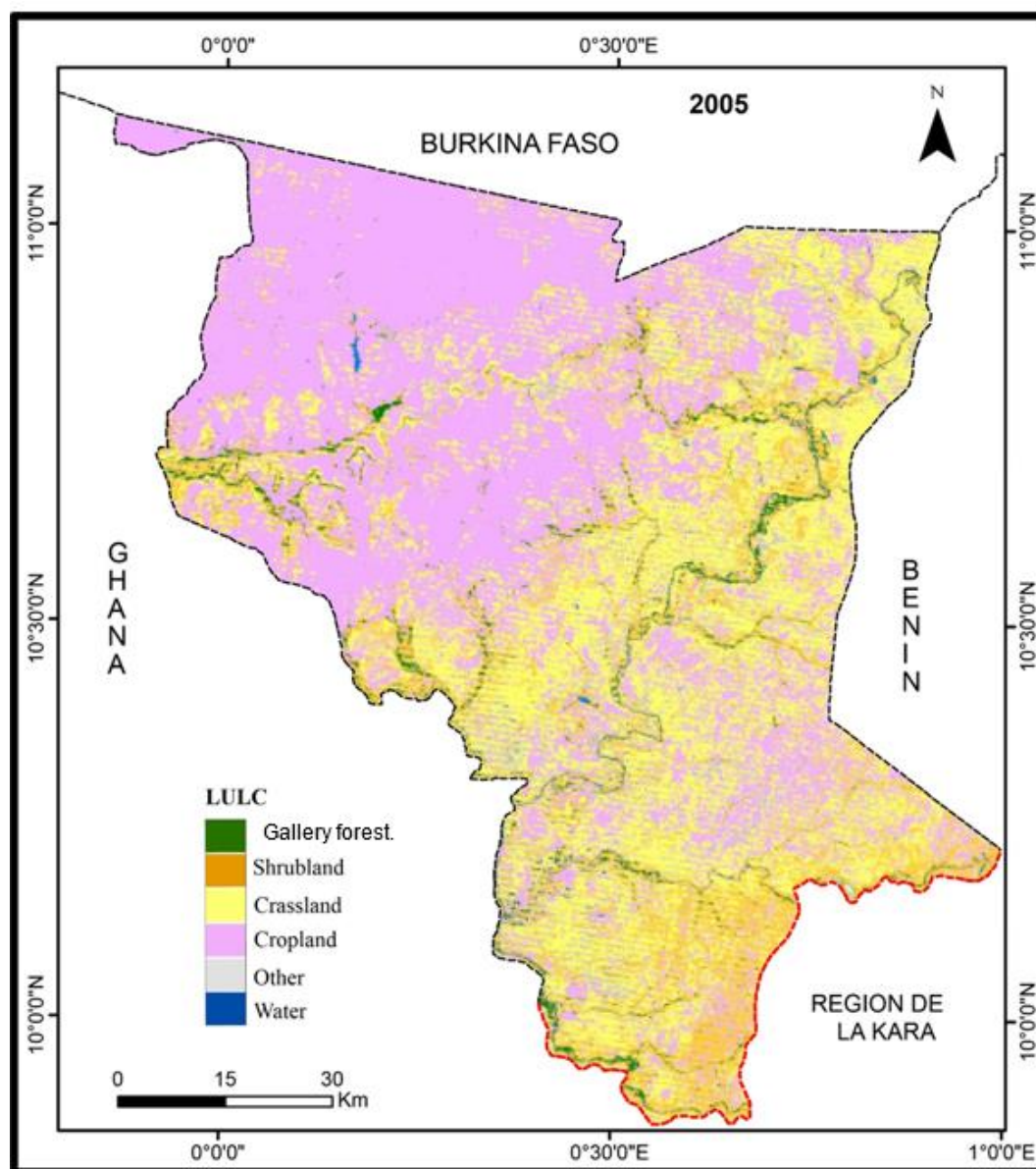


Figure 17: Land Use-Land Cover maps in 2005

Source : USGS database

The period from 2005 to 2015 is characterized by an extension of forest, shrubland, and cropland areas by 113.04%, 53.49%, 19.94% (Figure 18). In 2008, it was estimated that poverty increased by 8.4% because of the increase in food prices and floods in 2007 and 2008. The

household earnings were not enough to offset price increases. The main economic activities in rural areas being farming (crops and livestock), there is great pressure for access to fertile land. Other rural activities include collection of fuelwood, charcoal manufacture. International transhumance plays an important role especially in the northern parts of the country.

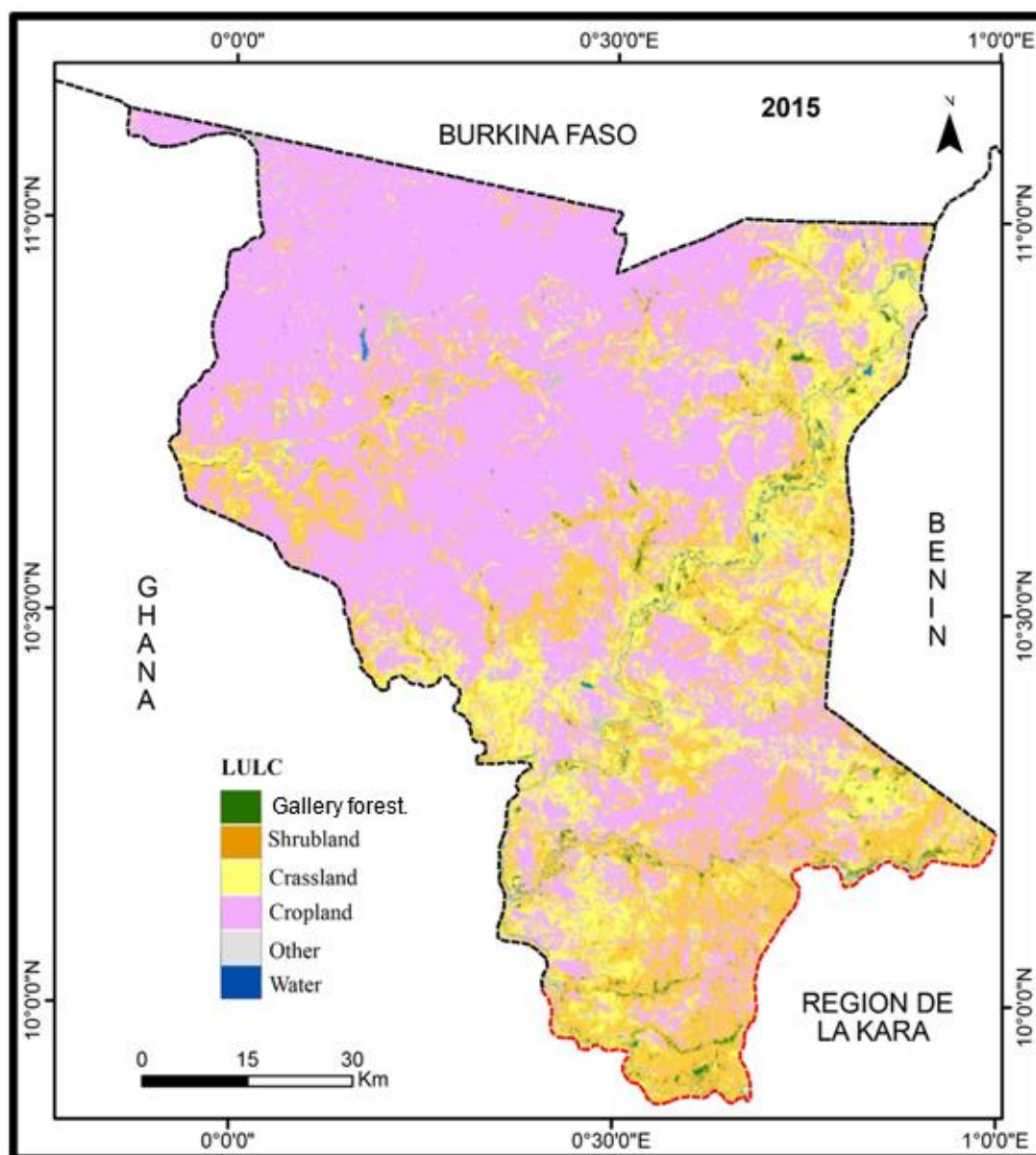


Figure 18: Land Use-Land Cover maps in 2015

Source: USGS database

The period of 2015 to 2022 has seen a decrease in forest area by 9.08% and an increase in grassland area extent by 44.58%. In the same period, the extent areas of shrubland, cropland and water bodies have reduced by 45.09%, 12.07% and 36.28% respectively (figure 19).

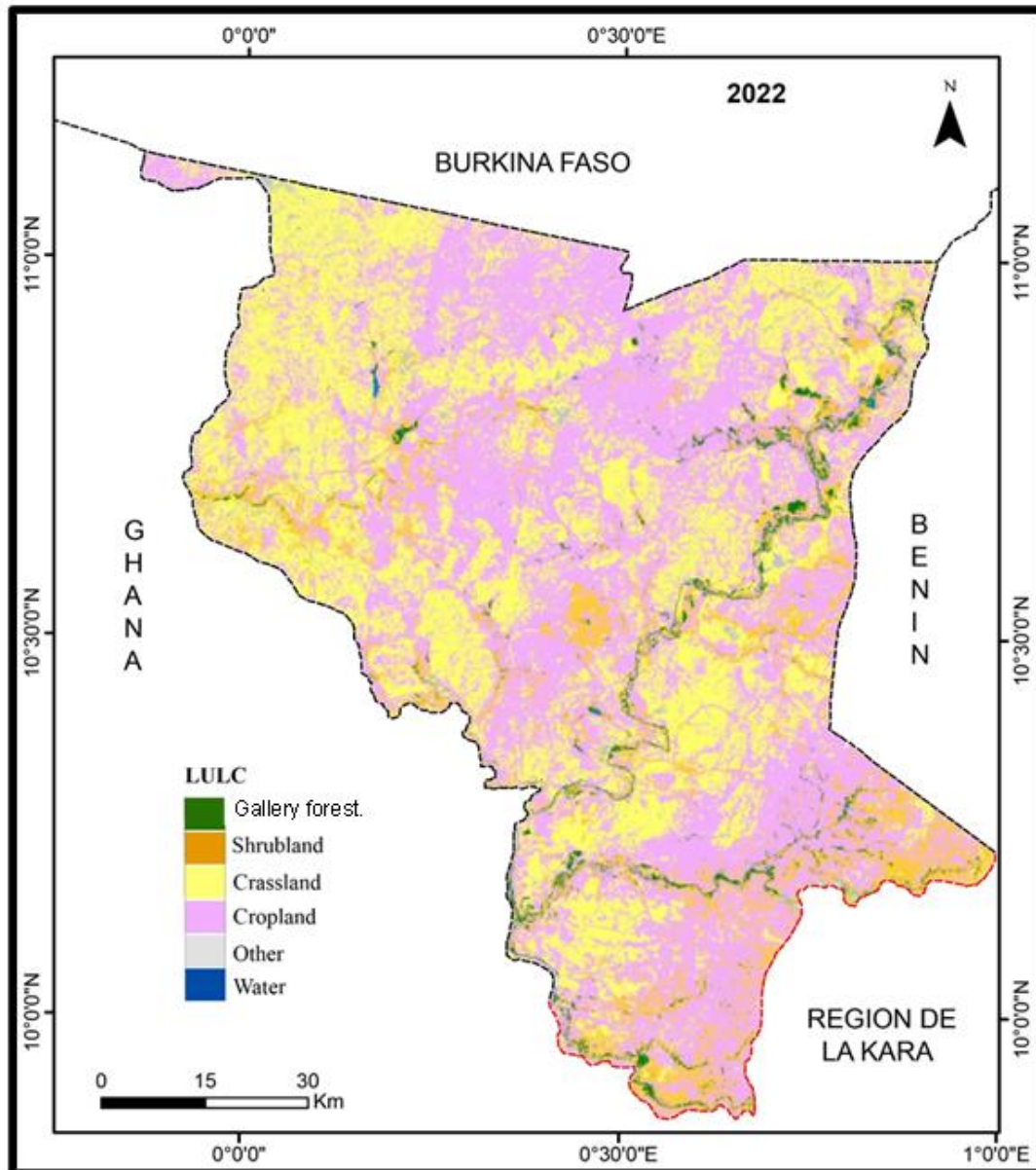


Figure 19: Land Use-Land Cover maps in 2022

Source: USGS database

The changes of the grassland area through the different period of the years could be explained by the changes in the rainfall pattern. Indeed, the increase from 1995 to 2005 by 34.24% and from 2015 to 2022 by 44.58% may be related to the relatively abundant rainfall that the region experienced in these same periods; in contrast, the decrease during the period 1985 to 1995 by 9.99% and 2005 to 2015 by 37.37% might be explained by the low rainfall amount of these ranges of period. In overall, the grassland area increased by 31.45%.

The area covered by shrubland decreased by 58.43% and 45.09% in the period of 1985 to 2005 and 2015 to 2022 respectively, in contrast, we noticed an increasing from 2005 to 2015 of

53.49%. The decrease of the shrubland (savannah) in this case, could be explained by the cutting of trees for firewood and charcoal production. The increase noted is probably due to projects of forests restoration (beginning of 2005) that constitute in trees planting. Furthermore, the period of 2005-2015 is rainfull in the Dapaong area. In general, the shrubland decreased by 50.03%.

From 1985 to 2015, the cropland area increased up to 53.43% and decreased on the other hand by 12.07 % from 2015 to 2022. The increase of the area would be due to the ever-increasing number of farmers who represent the highest rate of active people and to the fact that agriculture is the economic activity that was the main source of income. On the other hand, the decrease in cropland area may be due to the fact that many young people have given up working the land, which is no longer profitable and which they find very tedious. Despite the challenges faced by agricultural activities, the cropland area increased by 41.36%.

The bare soil and the built-up or settlment areas extended by 181.14% from 1985 to 1995 and from 2015 to 2022 by 9.05%. On the other hand, this class decreased by 80.93% from 1995 to 2015. The expansion of the built-up may be described by the increase and the settlement of the population; contrary, the decrease period coincided with the moment of sociopolitical unrest of the country may forced people to leave the area. In brief, the built-up and bare soil widened by 109.26%.

Water bodies area increased from 1985 to 2015 by 469.83% and decreased by 36,28 % from 2015 to 2022. The variability in water bodies ares may be related to the variability of rainfall pattern. In short, the water bodies area enlarge by 433.55%.

Discussion

The significant increase of trend in annual rainfall at Dapaong weather station in Northern Togo is similar to findings contained in a study conducted by Gadedjisso et al (2021). In fact, considering four weather stations (Kara, Niamtougou, Mango, and Dapaong) in Northern Togo, he reported an increase in the annual rainfall at all the locations for the time series of 36 years, from 1977 to 2012. Contrary to his finding, at Mango weather station, the trend in annual rainfall showed a decrease, even if it is insignificant.

The rising trend in rainfall throughout the growing period at Mango in April, May, June, August September, and October is consistent with the finding of Gadedjisso et al (2018); in his study, only in the months of May, June and October, the rainfall showed an increasing trend in the

growing season, with a significant trend at 5% for the month of May only, while in this case, the trend is significant for the months of May and September.

The study of the interannual variability of the climate has shown the decrease in total rainfall in northern Togo. The different trends indicate that the region experienced a rainfall recession despite a slight recovery in rainfall from the 1990s (Pilabina, 2019). On a temporal scale, the analysis of annual rainfall over the period 1981-2019 shows an irregularity which is characterized by high variability as confirmed by Pilabina (2019) who carried out a study on rainfall in the central and savanna regions over the period 1950-2015. Annual rainfall varies quite strongly from year to year. These findings exhibit resemblance to the outcomes reported by Sahani (2012), Donat et al. (2013).

In their research on southern and western Africa climate conditions, New et al. (2006) have shown that, globally, these regions experience a drop in total annual precipitation and in the number of rainy days. The results of analysis done by Aguilar et al. (2006) on Central African rainfall between 1955 and 2006 came to the same conclusions. The average rainfall regime experienced alternating wet and dry periods between 1981 and 2019, with a general downward trend in annual precipitation and an increase in temperature. This same observation was made by Alidjao (1997); Dalouba, (2004); Lemou (2014); Pilabina (2015); Badjana et al. (2017) who considered the period of 1950 to 2015.

Other authors have mentioned the decrease in rainfall in the center-north of Burkina Faso (West et al, 2008; Sarr et al, 2011). This general decrease in rainfall has important consequences on the availability of water resources (Servat et al, 1998). Albergel and Valentin (1988) observed a drying trend in the small Sudanian watershed of Kogneré (Namentenga) in 1984, as was the case in the Kara basin (Pilabina, 2015; Badjana et al, 2017).

The consequences of climate change on African countries' economies (IPCC, 2007) and more particularly in northern area of Togo are undeniable. According to Houghton et al. (2001), extreme climatic events should become more frequent with global warming. The rise in temperatures, like the modification of the rainfall calendar, will have a negative impact on water resources, with the modification of its cycle. This would limit its availability, accessibility and supply. With the variability of the climate and the decrease in precipitation, rainwater, surface and groundwater are under enormous pressure (Totin, 2010). At the same time, the thermal increase may unbalance the hydrological balance through an intensification of physical

evaporation and evapotranspiration from the plant cover, resulting in an increased need for irrigation.

The drought observed from 1981 is confirmed by Pilabina (2019) who noticed a dramatic drought that started from the 1970s and ended in the course of the years 1990, without, however, reaching the pre-drought rainfall totals. This return to wetter conditions had been suggested by Ozer et al. (2003) and is confirmed almost everywhere in West Africa such as Senegal (Sarr et al, 2013), Burkina Faso (Lodoun et al, 2013), Niger (Ozer et al, 2009) and at the level of Niger River Basin (Descroix et al, 2013). In the same way, the significant decrease in rainy days is also observed in the sub-region as well as in central and northern Togo. However, this return to near-average annual precipitation appears to be influenced by extreme events. This results are consistent with the conclusions of the IPCC report (2013) on a global scale, namely unchanged extreme precipitation in a global context of desiccation.

The research findings indicate a significant spatiotemporal alteration in Land Use and Land Cover (LULC) types over the past 39 years (1981-2019). The observations disclosed a process of transformation and competition among diverse categories of land use and cover namely cropland, tree savanna, shrub savanna, water bodies, and settlement. The prolonged rainfall variability induced by anthropogenic activities such as the clearing of forests and shrub savanna can be perceived as a climate change indicator. Such changes in climatic conditions have been pointed as the causative agents of land degradation. The majority of respondents have identified various factors that significantly contribute to land degradation, including overexploitation, overgrazing, poor agricultural practices, heavy erosion, and excessive demand for firewood. Population growth was also mentioned as a significant factor.

The expansion of human population is an imperative element that exerts an impact on the modifications in both land usage and coverage, along with the deterioration of land. When the populace surpasses the critical point of the support structure or carrying capacity of the ecosystem, it assumes a noteworthy role in advancement, yet it also becomes a substantial determinant of environmental deterioration.

According to Ouedrago et al (2009, 2010), a significant cause of the declining utilization of fallows and the increasing fragmentation of land in Burkina Faso is the growth and density of the population. The savannah region is predominantly rural, with most of the land dedicated to agricultural and settlement purposes. The expansion of agriculture to sustain a burgeoning population has resulted in direct consequences, including soil erosion, changes in soil salinity,

and to some extent, soil fertility loss. The investigation region underwent a significant modification in human population concentration throughout the examination period, and consequently, the observed decline in land coverage and alteration in land utilization is connected to the escalating human undertakings across the entire study duration. As a result, augmented population densities give rise to the partition of land into unprofitable parcels, thus aggravating the strain on the region's accessible ecological reserves.

The phenomenon of high population density exerts significant pressure on the existing environmental resources, which may result in the utilization of natural resources in a non-sustainable manner, leading to depletion and environmental deterioration. Particularly, the strain on available arable land is notably caused by the high population growth and density observed in rural areas. This results in fragmentation, encroachment into marginal lands, reduction of fallow periods, and cultivation methods that induce land degradation. The increase in the population has compelled individuals to extend their agricultural land in order to fulfill the fundamental requirements of sustenance for the society. The process of transforming tree and shrub land into cultivated land neglects the endurance of natural resources, in light of the fact that the trees and shrubs which have been ravaged are not replaced. The Savannah region in Togo experiences the highest rate of population growth (3%) among all the economic regions, and its fertility rate is also higher, with six (6) children per woman. The exponential increase in the population has noteworthy implications on the labor market, joblessness, and the need for societal amenities. It places a greater demand on arable land with access to irrigation and the availability of water resources, thereby presenting the possibility of inducing social transformations and discord in the forthcoming period.

Simonson (2005) asserted that augmented population densities, particularly in metropolitan areas, exert greater pressure on the environment and can have severe consequences like soil, water, and air pollution if not managed appropriately. Linar et al (2010) contended that population increase results in the expansion of human habitations and a surge in requisition for sustenance, energy, and construction resources. Unrestricted fulfillment of human needs has led to the degradation of habitats and diminution of species diversity. The reduction of vegetation cover due to anthropogenic activities in the research area holds a noteworthy implications for the deterioration of habitat and the decline in biodiversity, ultimately resulting in environmental decline. Additionally, heightened human population density has resulted in significant surge in the need of energy for household consumption.

The surge in energy consumption in the area has caused substantial modifications and decline in coverage of tree and shrub savanna, leading to land degradation. Bationo et al. (2006) have reported that unsustainable agricultural operations are responsible for 24% of the total land degradation in rural areas of Nigeria. They have further identified overgrazing (49%), deforestation (14%), and overexploitation of vegetative cover (13%) as the primary factors responsible for land degradation in most rural areas of Africa. The depletion of soil fertility and nutrient mining in the majority of the smallholder farms is a crucial biophysical underlying cause of reduced per capita food production in the area. This has significantly led to both poverty and food insecurity within the region.

Furthermore to the increase in population, overgrazing has been identified as a significant factor in the alteration of land use cover. This is due to the excessive consumption of grasses, shrubs, and tree fodder, as well as the grinding of topsoil by animal clogs. The future may see an escalation of population pressure on resources, thereby posing a significant threat to the survival of plant and animal habitats, as well as the well-being of Malians and the impoverished. This is particularly salient in the current context of climate change. The act of grazing undertaken by the immense population of animals surpasses the forest lands' carrying capacity, thereby imposing an enormous burden on forestland and leading to its degradation. Farmers tend to maintain a higher number of livestock than the capacity of their land, leading to the consumption of not only grass but also other vegetation by the animals. This practice renders the ground bare, making it vulnerable to soil erosion agents and ultimately resulting in land degradation. The exposure of bare ground to the sun during the dry period may lead to the desiccation of soil particles, rendering it vulnerable to wind erosion. Consequently, the fertile topsoil is removed, resulting in significant degradation. The act of removing protective vegetation and the trampling of bare soils by livestock hooves have been found to greatly diminish land biological productivity, resulting in a marked decrease in water infiltration and storage, while concurrently increasing soil compaction and erosion.

According to Ministry of Environment estimates, each year in Togo, 4.14% of the national land succumbs to the phenomenon of degradation; as a result, 48% of the land is deteriorated, and 52% is in the process of degradation (Ministry of the Environment, 2020). More than 80% of cultivable soils in the savannah region (northern Togo), are deficient in potassium, phosphorus and in organic matter. According to the soil degradation map of Togo established in 2017 by CILSS in collaboration with the Ministry of Environment, forest areas have been ravaged and the soil is bare.

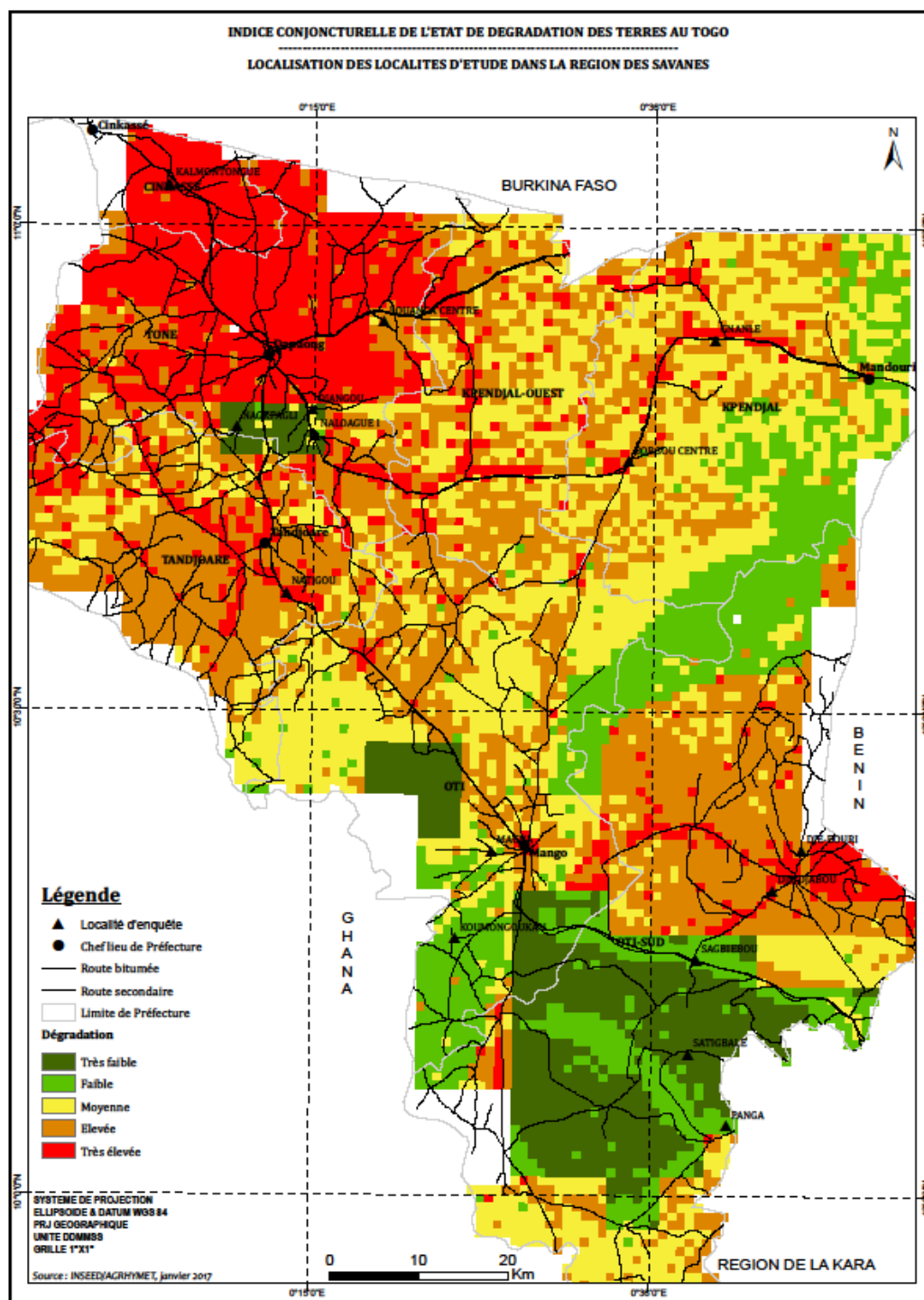


Figure 20: Map showing land degradation aspect in Savannah region

Source: INSEED/AGRHYMET, 2017

"Because the soil is bare, it is exposed to the sun's rays and rainwater, which exacerbates the degradation through runoff. Nowadays, practically all regions have signs of red soil, although Togo was completely green 20 or 30 years ago, with only the Vogan area and certain area, of Cinkassé (Figure 20) showing red spots of degradation" (ITRA, 2019).

The causes of soil degradation are physical, chemical, and biological, but when all of these elements are considered, it is man who is at the center of all these issues through poor agricultural methods.

Conclusion

The Savannah region experiences rainfall variability. The analyses have shown that over the study period, pockets of drought alternate with periods of rain. Minimum and maximum temperatures are growing at both weather stations. Precipitation shows a general downward trend while temperatures increase. Central and northern Togo is located in the intertropical part characterized by warm temperatures throughout the year. On a day-to-day basis, it can be reasonably assumed that dry days will tend to be warmer than rainy days (Doukpolo, 2014). Thermal stress due to heat is a bigger problem than thermal stress due to cold because minimum temperatures do not usually fall below 15°C. Spatial dynamics reveal that the heaviest precipitation begins in April and ends in October. During these months, the south of central and northern Togo is always wetter than the north. The examination of the influence of climate change on migratory patterns is of noteworthy significance as it has instigated a discourse between those who underscore the direct effect of the environment on population displacement and those who emphasize the socioeconomic and political milieu within which these movements transpire

CHAPTER V:
ROLE OF SOCIOECONOMIC
FACTORS IN MIGRATION
DYNAMICS

Introduction

The migration process is a multifaceted and intricate occurrence that is shaped by numerous dynamic variables and cannot be ascribed solely to the influence of any one particular form of transformation. It is widely recognized that migration is associated with various demographic and socioeconomic variables, including but not limited to the age-sex structure of the population, education levels, and income. This chapter covers the assessment of socioeconomic factors influencing the population movement in the Savannah Region of Togo. It is obvious that many socioeconomic factors are playing a role in population displacement and this chapter serves to evaluate the important of each factor considered in the human migration in the study area.

5.1. Result

5.1.1. Migration dynamics in the Savannah Region

Migration phenomenon is a reality in the Savannah Region. Like the poor regions of developing countries, the Savannah Region has a net migration balance, which means the number of people entering into the region is much lower than the number of people leaving the region. Following surveys and interviews, the study revealed that the number of emigrants is significantly higher than the number of immigrants. Regarding the age group of emigrants, the results show that young people (female and male) who engage in adventure are mostly between 15 and 44 years old (Tables 24 & 25), which correspond to the age group where physical strength is still available to engage in activities.

Table 24: Age group of female emigrants

FEMALE EMIGRANTS * EMIGRANTS' AGE Crosstabulation							
Count							
		EMIGAGE					Total
		>55 years	15-24 years	25-34 years	35-44 years	45-54 years	
EMIGFEM	0	14	109	239	137	77	576
	1	9	25	52	54	23	163
	2	3	3	19	8	4	37
	3	0	2	0	0	0	2
	4	0	0	1	0	0	1
	6	0	1	0	0	0	1
Total		26	140	311	199	104	780

Source: Authors' analysis, April 2021

Table 25: Age group of male emigrants

MALE EMIGRANTS * EMIGRANTS' AGE Crosstabulation							
Count							
		EMIGAGE					Total
		>55 years	15-24 years	25-34 years	35-44 years	45-54 years	
EMIMALE	0	3	6	20	15	6	50
	1	11	88	192	121	58	470
	2	8	30	73	44	24	179
	3	4	11	14	17	13	59
	4	0	1	7	1	3	12
	5	0	4	3	0	0	7
	6	0	0	2	1	0	3
Total		26	140	311	199	104	780

Source: Authors' analysis, April 2021

N.B: EMIMALE: Male emigrants

From the study, at the level of continents, three main destinations emerge: Africa, Europe and, USA (Figure 21).

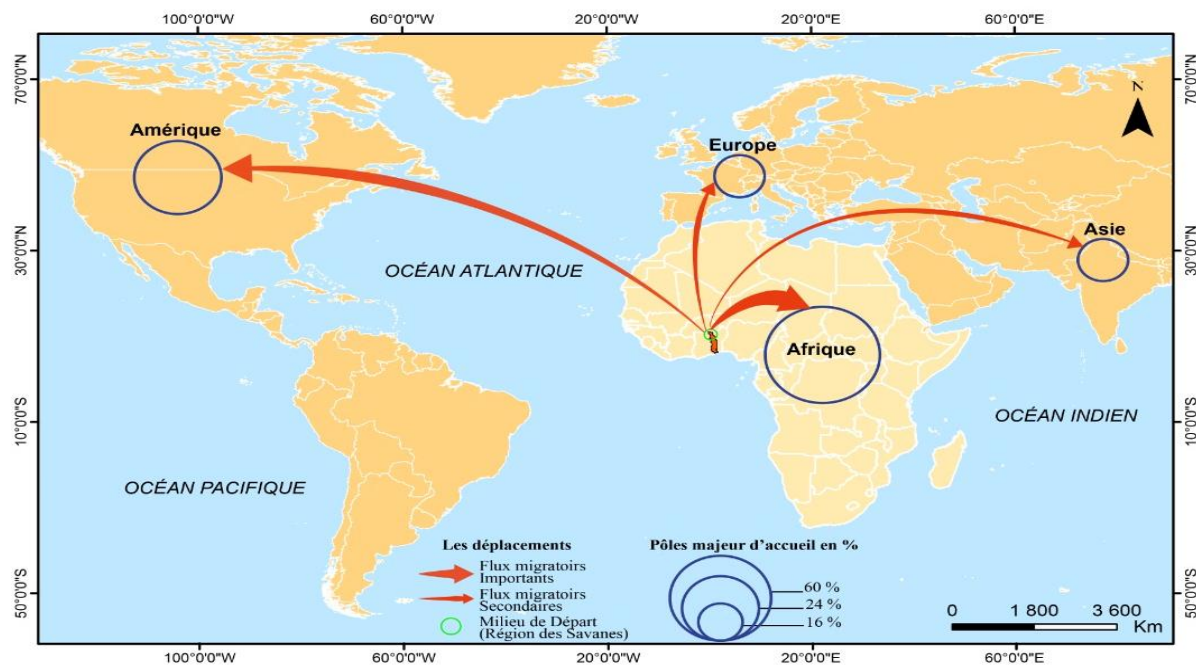


Figure 21: Map showing the destination of emigrants at continental level

Source: Komlagan, April 2021

The destination of the USA is mainly explained by the immigration policy (Lottery Visa), initiated by the American State since 1991. The countries of destination of emigrants are shown on Figure (22).

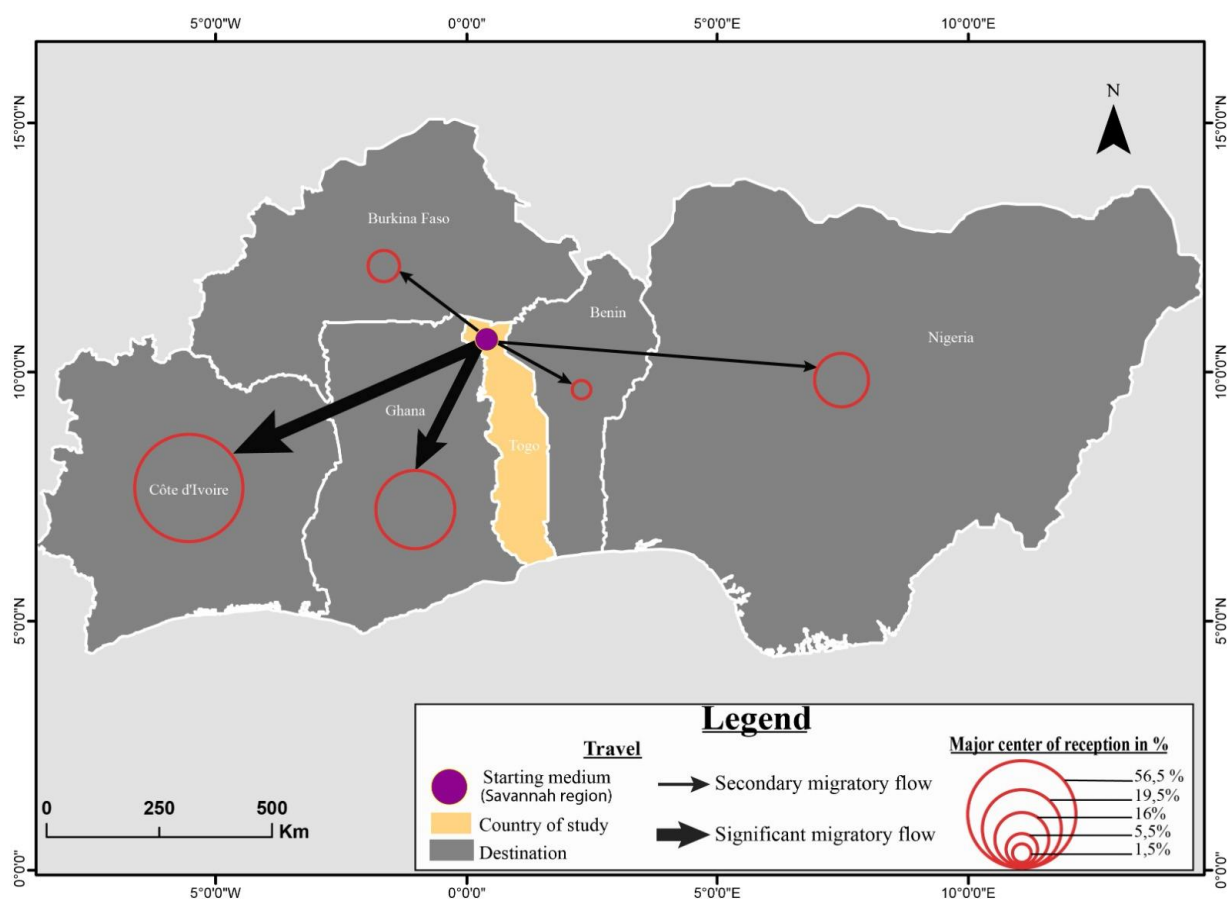


Figure 22: Map showing the destination of emigrants in Africa
Source: Komlagan, April 2021

The table (26) reflect the preferred destination of emigrants in Africa.

Table 26: Destination of emigrants

EMIGRANTS DESTINATION					
		Frequency	Percent	Valid Percent	Cumulative Percent
	Asia	2	.1	.1	.3
	autre	125	9.2	9.2	9.5
	Cote d'Ivoire	409	30.1	30.1	39.6
	Europe	12	.9	.9	40.5
	Ghana	337	24.8	24.8	65.3
	in another city of the country (Lomé)	331	24.4	24.4	89.7
	Nigeria	140	10.3	10.3	100.0
	Total	1358	100.0	100.0	

Source: Author, April 2021

Based on the surveys, the preferred destination of emigrants in Africa is Cote d'Ivoire followed by Ghana and Nigeria; the trend is 30.1% for Cote d'Ivoire against 24.8% for Ghana and 10.3% for Nigeria (Table 26).

5.1.2. Socioeconomic characteristics of the respondents

The socioeconomic characteristics of the respondents gave an overview of the interviewees and therefore a general view on the population of the Savannah Region, the target population taken into account in this study.

➤ Marital status

The Table (27) displays the respondents' marital status.

Table 27: Marital status and respondents' status

Variable	Frequency	Percentage
Marital status		
Single	63	8.1
Married	646	82.7
Divorced	19	2.4
Widow	17	6.8
Respondent status		
Head of household	615	78.7
Adult household member	166	21.3

Source: Authors' analysis, April 2021

The study has established that about 82% of the respondents are married. While few 2.4% of them are divorced, 6.8% are widowed. The results equally indicate that the majority 78.7% of the respondents were household heads. The higher percentage of married respondents implies that they are more likely to migrate for earning extra money to take care of their family since the family charges are increasing, especially when the children grow up.

➤ Age and occupation of the respondents

The survey population is composed of different age groups; the Table (28) illustrates the different categories of respondent age and their economic activity.

Table 28: Age and respondents' occupation

Variables	Frequency	Percentage
Age		
<20 years	7	0.9
>60 years	66	8.5
20-40 years	338	43.3
40-60 years	370	47.4
Respondent occupation		
Farmer	584	74.8
Trader	84	10.8
Artisan	49	6.3
Salaried worker	26	3.3
Breeder	23	2.9
Student	11	1.4
Unemployed	3	0.4
Veterinary	1	0.1

Source: Authors' analysis, April 2021

The study established that majority (47.4%) of the respondents are between the age of 40-60; about (43.3%) are between the age of 20-40, while few (8.5%) and (0.9%) of them had the age of 60 and above, and less than 20 respectively. The role of age in explaining migration is crucial in the sense that it is linked to the active period and to the decision of migration. Furthermore, because of their attachment to culture, elder persons do not consider migration as an adaptation strategy rather, it is a form of irresponsibility. The economic activity of the respondent is important for migration decision, particularly, under the effects and impacts of climate change that threatens at different level the activity sectors.

The study shown that most (74.8%) of the respondents are farmers, 10.8% are traders, 6.3% are artisan, 3.3% are civil servant, 2.9% are breeder and only 1.4% are students. Considering the activity sectors, the economy of Savannah region is essentially based on agropastoral production, the population is about 72% agricultural (Aguey, 2021).

➤ **Education level of the respondents and their household size**

Education being crucial for migration decision making, the Table (29) exhibits the percentage of respondents that falls into each group of education level, as well as the size of households that were considered in this study.

Table 29: Education level and household size

Variables	Frequency	Percentage
Education level		
Illiterate	459	58.8
Primary	180	23.0
Secondary	106	13.6
High school	22	2.8
University	14	1.8
Household size (Mean=9.23)		
1-9	467	59.8
10-19	287	36.7
20-29	22	2.8
30-40	5	0.6

Source: Authors' analysis, April 2021

The analysis has shown that more than half (58.8%) of the interviewees has never been to school or never had any formal education, 23% of them frequent the primary, 13.6% reached the secondary level, only 2.8% went to high school and 1.8% attended the university. The education level is fundamental in analyzing life situations like taking decision to migrate. Taking some serious decisions require a maturity that could be gained in attending higher education. Low intellectual level may contribute to poor decision making. Muttarak and Lutz (2014) argued that education exerts a direct impact on risk perception, competencies, and cognition, as well as an indirect effect on mitigating impoverishment, augmenting wellbeing, and facilitating access to information and resources. As literacy rates improve, migration gradually expands and becomes an international phenomenon. However, beyond a particular threshold, further increases in the average education level of the country of origin would diminish migration. According to empirical evidence, individuals in developing countries who fall within the lower

spectrum of income distribution consider increased education and rising income levels as push factors for emigration.

The results indicate that a majority of the participants, comprising 59.8%, possess a household size within the range of 1-9 individuals. Following this, a smaller percentage of the respondents, representing 36.7%, had a household size within the range of 10-19 individuals. A limited number of respondents indicated that their household size was within the range of 20-29 and 30-40, representing 2.8% and 0.6%, respectively (Table 29). The average household size was found to be 9, with a minimum of 1 and a maximum of 39. Consequently, it can be inferred that a considerable number of respondents have a relatively large family size. This may result in younger individuals migrating to acquire resources due to a shortage of resources for the family.

➤ Gender

It is acknowledged that the gender identity of an individual has a profound impact on every facet of the migration journey. Table (30) exposes the gender of the household heads interviewed. Majority of household heads are men (79.8 %).

Table 30: Gender

Variables	Frequency	Percentage
Gender		
Female	158	20.2
Male	623	79.8

Source: Authors' analysis, April 2021

Gender plays a pivotal role in shaping the motives for migration, determining who migrates and where they migrate to, specifying the modus operandi of the migration process and the networks employed, as well as delineating the opportunities and resources that are accessible at the destination. Additionally, gender has a significant bearing on the relationships that are maintained with the country of origin. (<https://www.iom.int/gender-and-migration> retrieved on June 13, 2022). Usually, because of the responsibility of women (taking care the children), their migration is not acceptable or even prohibited.

5.1.3. Socioeconomic determinants of emigration according to “decision to migrate”

The Table (31) is showing the correlation between the Independents Variables (IVs). The Dependent Variable (DV) is “decision to migrate” while the independent variables are: marital

status, age (20-40 years), gender, education level and the occupation of the respondent (either he is a farmer or not). These variables were selected because that are already proven in the literature to be related to migration

Table 31: Correlation matrix of socioeconomic variables

		Correlation Matrix					
		Constant	Marital status of the respondent	Sexe of the respondent	Age the respondent	Education of the respondent	Occupation of the respondent
Step 1	Constant	1.000	-.374	-.280	-.312	-.486	-.402
	Marital status of the respondent	-.374	1.000	-.164	-.012	-.024	-.184
	Gender of the respondent	-.280	-.164	1.000	.131	-.238	-.305
	Age the respondent1	-.312	-.012	.131	1.000	-.118	.039
	Education of the respondent	-.486	-.024	-.238	-.118	1.000	.337
	Occupation of the respondent	-.402	-.184	-.305	.039	.337	1.000

Source: Authors' analysis, April 2021

From the table (31), it can be noticed that the correlation falls into -0.1 and 0.2, that is according to literature, a weak correlation (<https://explorable.com/statistical-correlation>, <https://explorable.com/>)

The table (32) exposed the results obtained after running the logistic binary regression with “Decision to migrate” as a Dependent Variable (DV) and marital status, age (20-40 years), gender, education level and the occupation of the respondent (either he is a farmer or not) as Independent variables.

Table 32: Socioeconomic variables logistic regression results

		Variables in the Equation							
		B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I. for EXP(B)	
								Lower	Upper
Step 1 ^a	Marital status of the respondent	-.730	.218	11.172	1	.001	.482	.314	.739
	Gender of the respondent	.723	.230	9.861	1	.002	2.060	1.312	3.234
	Age the respondent1	1.217	.164	55.009	1	.000	3.376	2.448	4.656
	Education of the respondent	.143	.090	2.534	1	.111	1.154	.967	1.376
	Occupation of the respondent	.190	.211	.817	1	.366	1.210	.800	1.829
	Constant	-1.637	.305	28.739	1	.000	.195		
a. Variable(s) entered on step 1: Marital status of the respondent, Gender of the respondent, Age the respondent1, Education of the respondent, Occupation of the respondent.									

Source: Authors' analysis, April 2021

➤ Marital status

From the result (Table 32), it can be noticed that there is a negative relationship between marital status and “decision to migrate”, and is statistically significant at 5%. This aligns with our expectation. The negative relationship between marital status and emigration means that singles are more expected to migrate since they are not attached officially to any children or any women, then going on an adventure is a way to search himself, to earn enough money to return and start new life by building his own family. According to Folger (1953), individuals who are single likely possess the least amount of connections within the community, whereas those who are married generally exhibit the greatest number of social attachments, thereby impeding any potential migration.

The table (33) reflects the outcome of cross tabulation between “marital status” and “decision to migrate”.

Table 33: Cross tabulation between variables "marital status" of the respondents and "decision to migrate"

Marital status of the respondent * Decision to migrate Cross tabulation				
Count				
		Decision to migrate		Total
		no	yes	
Marital status of the respondent	not married	74	60	134
	married	445	201	646
Total		519	261	780

Source: Authors' analysis, April 2021

The proportion of unmarried person that is not ready to migrate is about 55.22% against 31.11% of married people that are willing to migrate. Considering the respondents from marital status angle, 66.53% do not want to leave their region.

➤ Age

The results (Table 32) indicate that age (20-40 years) is positively related to migration decision, and this is statistically significant at 5%. This is in line with a prior expectation. This means, young people are those who migrate most. This because, this range of age is the most active age, and most of young men are willing to discover a new horizon and to be established in life. The phenomenon of aging has been found to potentially diminish the rate of migration, as the elderly demographic cohort is prone to engaging in migration to a lesser extent than their youthful counterparts. Moreover, the aging process could potentially cause a decrease in the frequency of migration amongst workers of any age group, owing to the reduced demand for labor provided by migrants. Consequently, the trend of aging could have detrimental ramifications for labor markets and welfare, given the concomitant reduction in migration. (Zaiceva, 2014).

To have more details on “group of age” in relation to “decision to migrate”, a cross tabulation showing the exact percentage of age who decides whether to migrate or not is presented (Table 34).

Table 34: Cross tabulation between variables age of the respondent and decision to migrate

Age of the respondent * Decision to migrate Crosstabulation				
Count				
		Decision to migrate		Total
		no	yes	
Age of the respondent	not between 20-40 years	345	98	443
	between 20-40 years	174	164	338
Total		519	262	781

Source: Authors' analysis, April 2021

Two tranches of age is considered in the study: the active tranche (between 20-40 years) and the non-active tranche (not between 20-40 years). The active tranche is composed of people that can have strength to work, especially in farms. The results are showing that among people between 20-40 years, more than 51% do not want to migrate and 77.87% of people, not between 20 and 40 do not want to migrate. All ages combined, 66.45% of people do not want to migrate.

➤ Gender

Table (32) presents the findings that demonstrate a positive relationship between gender and the decision to migrate, with a statistically significant correlation at the 5% level. This outcome aligns with expectations, given that men are more inclined to migrate, irrespective of their marital status. The primary motivation for male migration is economic reasons, whereas females tend to migrate primarily for family-related reasons, particularly when they are married. The available statistics on international migration indicate that young women's migration rates are substantially lower than men's, despite expressing a comparable desire to migrate. Furthermore, although women are more likely to leave their homeland than men, their participation in economic migration remains restricted. Female migration patterns concentrate on family reunification and marriage, whereas male migration focuses on securing employment and improving living standards (Bouchoucha, 2010).

To get more insight on the relationship between “decision to migrate” and “gender”, the table (35) recaps the intentions of female and male on the decision to migrate.

Table 35: Cross tabulation between variables gender of the respondent and decision to migrate

Gender of the respondent * Decision to migrate Crosstabulation				
Count				
		Decision to migrate		Total
		no	yes	
Gender of the respondent	female	117	41	158
	male	402	221	623
Total		519	262	781

Source: Authors' analysis, April 2021

Female heads of household heads (74.05 %) refuse to migrate and 64.52 of male heads households heads took the same decision. In total, 66.45%, taking into account all kind of gender is against emigration.

➤ Occupation of the respondents

The result reflects that occupation of the respondent is positively related to the decision of migration, but is not statistically significant at 5%. That means, farmers are more likely to migrate compare to the other activities sector. This confirms our assumption because, though, climate change affects all the activities sectors, its threat on agriculture is more expressive because of the rainfed agriculture that practice the farmers and the considerable number of people that this sector drains. On the contrary, the statistical insignificance of the variable suggests that not only farmers decide to migrate, practitioners of the other activities sectors may also decide to migrate (Table 32).

To know the proportion of respondents, based on their occupation that decide to migrate or not, a cross tabulation was done between “decision to migrate” and “occupation of the respondent”, and the results summarizes in (Table 36)

Table 36: Cross tabulation between variables occupation of the respondent and decision to migrate

Occupation of the respondent * Decision to migrate Crosstabulation				
Count				
		Decision to migrate		Total
		no	yes	
Occupation of the respondent	non-farmers	129	67	196
	farmers	389	195	584
Total		518	262	780

Source: Authors' analysis, April 2021

Most of the population practice rainfed agriculture, because the Savannah region is a rural area. Out of non-farmers, 65.81% are not willing to migrate, as also decide by 66.60% of farmers. 66.41 % of all workers considered do not express their desire to migrate.

➤ Education

The results show that the education level of the respondents is positively linked to their decision to migrate, but is not statistically significant at 5%. This is contrary to our assumption because, taking a decision to migrate required a deep analysis, therefore, illiterate would decide to remain in one place, because he will not have probably access to enough information which can help him in the search for better living conditions. The statistically insignificance result from the fact that, even educated people find decide not to migrate, not because they do not have sufficient information, but because they have other reasons or constraints (Table 32).

The table (37) spreads out the number of respondents that may decide to migrate or not regarding their education level.

Table 37: Cross tabulation between variables education of the respondent and decision to migrate

Education of the respondent * Decision to migrate Crosstabulation				
Count		Decision to migrate		Total
		no	yes	
Education of the respondent	none	324	135	459
	primary	110	70	180
	secondary	68	38	106
	high school	13	9	22
	university	4	10	14
Total		519	262	781

Source: Authors' analysis, April 2021

No matter the category of the respondent education, the number of people who do not want to emigrate exceeds the number of people who want to leave their area. 70.58% against 29.41% for the illiterate category, 61.11% and 38.88% for primary group, 64.15% versus 35.84% for

secondary class, 59.09% against 40.91% for high school unit and, 28.57% versus 71.42 % for University squad.

5.1.4. Socioeconomic causes of out-migration

The Table (38) is showing the collinearity between the Independents Variables (IVs). The dependent variable is “total number of emigrants” while the independent variables are: family problems, age of the emigrants (20-55 years), more gain. The dependent variable being a numeric variable, linear multiple regression was run.

Collinearity refers to a linear relationship between two predictors, while multicollinearity occurs when two or more predictors display a high degree of linear correlation. It is widely accepted that the presence of multicollinearity is indicated by an absolute correlation coefficient exceeding 0.7 among two or more predictors, as asserted by Rekha in a publication on Clairvoyant Blog on Jul 15, 2019.

Table 38: Collinearity among independent variables (age of emigrant, low income, family problem, lack of job, more gain)

Collinearity Diagnostics ^a									
Model Dimension		Eigenvalue	Condition Index	Variance Proportions					
				(Constant)	Age of emigrants	Low income	Family problem	Lack of job	More gain
1	1	5.605	1.000	.00	.00	.00	.00	.00	.00
	2	.192	5.409	.00	.47	.07	.00	.00	.07
	3	.086	8.062	.00	.24	.09	.01	.62	.08
	4	.053	10.238	.00	.01	.78	.03	.02	.57
	5	.046	11.018	.05	.15	.00	.42	.34	.25
	6	.018	17.814	.94	.14	.05	.54	.01	.02

a. Dependent Variable: TOTEMIG

Source: Authors' analysis, April 2021

The result depicts that, there is no multicollinearity among the predictors. Even though, a slight collinearity is noticed between “low income” and “more gain”, the model is run. The predictors were selected base on empirical finding on factors that triggered the population mass movement from Savannah region (Table 38).

The analysis did through linear multiple regression has been contained in the table (39).

Table 39: Coefficients of regression

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	2.146	11.353		.189	.850
	Age of emigrants	-.161	1.741	-.003	-.092	.926
	Low income	-7.844	4.794	-.068	-1.636	.102
	Family problem	2.253	4.768	.018	.472	.637
	Lack of job	-4.624	3.629	-.047	-1.274	.203
	More gain	11.777	4.834	.102	2.436	.015
a. Dependent Variable: TOTEMIG						

Source: Authors' analysis, April 2021

The results are commented based on values in red color:

➤ **Age of the emigrants**

From the table (39), it can be noted that there is negative relation between age of emigrants and the total emigrants number, although it is not significant statistically at 5 %. The number of emigrants is decreasing while the emigrants grow in age. That is the expected result; while one becomes old, he loses the taste for adventure and prefer staying at one place; he approaches retirement and lose physical strength, even those who are abroad prefer to come back and enjoy their old age in their native country.

Using descriptive statistics, the table (40) inform us on the age group of the emigrants.

Table 40: Emigrant age as cause of emigration

		EMIGRANT AGE			Cumulative Percent
		Frequency	Percent	Valid Percent	
Valid	>55 years	44	3.2	3.2	3.2
	15-24 years	283	20.8	20.8	24.1
	25-34 years	566	41.7	41.7	65.8
	35-44 years	316	23.3	23.3	89.0
	45-54 years	149	11.0	11.0	100.0
	Total	1358	100.0	100.0	

Source: Authors' analysis, April 2021

Most of the emigrants has an age comprises between 15 and 44 years, that corresponds to an active age (Table 40).

➤ **Low income**

From table (39), it can be noticed that “low income” and the total emigrants number are negatively correlated, even if it is not statistically significant at 5 %. This result fit our expectation. Usually, when the income of a person is decreasing, instinctively, that person wants to look for a better place, where he can get another better source of income. No matter activity you are involve in, by the time you realized that your income is becoming insufficient, you start thinking of gaining more money.

The table (41) shows the percentage of respondents that consider “low income” as push factor to migration

Table 41: Low income as cause of emigration

LOW INCOME					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	371	27.3	27.3	27.3
	yes	987	72.7	72.7	100
	Total	1358	100.0	100.0	

Source: Authors’ analysis, April 2021

From the survey, 72.2% of the emigrants depart from their zone of residence because of low income (Table 41)

➤ **Family problem**

Based on table (39), the results indicate that the family problem and the number of emigrants are positively related, although it is insignificant at 5 %. This aligns precisely with the expectation. Family problems is usually a booster to emigration; when it becomes a load, the best solution is to leave the family. Family problems implies conflict between young men and old people about decision-making, forced marriage, etc.

From the table (42), the frequency of household heads that consider family problem as cause of emigration can be known.

Table 42: Family problem as cause of emigration

		FAMILY PROBLEMS			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	1154	85.0	85.0	85.0
	yes	204	15.0	15.0	100.0
	Total	1358	100.0	100.0	

Source: Authors' analysis, April 2021

The Table (42) indicates that 84.97% emigrants do not quit Savannah Region because of “family problem”.

➤ More gain or earning

Gaining more money is positively related to the number of emigrants and is significant at 5 % (Table 39). This result meets the a priori expectation. Earning more money has been more often the idea behind migration. Human beings nature is to look for a better living conditions that requires a certain financial resources. The table (43) paints the frequency of interviewees that pointed “earning more gain” as factors that can trigger off their departure.

Table 43: Earning more gain as cause of emigration

		MOREGAIN			
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	392	28.9	28.9	28.9
	yes	966	71.1	71.1	100.0
	Total	1358	100.0	100.0	

Source: Authors' analysis, April 2021

The Table (43) is confirming the above result because 71.1% of people departed from the region, are in search of more money.

5.2. Discussion

The emigration of the Moba-Gurma started at the beginning of the 19th century with the development in Ghana of cocoa farming, which would constitute an important attraction for the workforce. Surveys conducted in 1976 by Pontie (1980) show that 36% of men over 55 listed in 5 Moba-Gurma cantons (Naki-Est, Korbongou, Namoudjoga, Lokpanou, Bombouaka) had migrated to Ghana at least once. If the study estimated that the first migration took place around

the age of 18-20, it could be said that most men over the age of 55 in 1976 had gone to Ghana before 1940. Often, when growing, young people experience enormous economic difficulties and constitute a burden on parents with low purchasing power. The precarious economic conditions of households push the population, especially young people, to decry the very expensive living conditions. From this perspective, to solve these economic problems, young people decide to take their fate into their own hands and choose adventure in search of well-being (Kokou, 2018).

Kokou (2018) indicated that the destinations chosen by emigrants are influenced by their level of education; the tendency is for very low-level emigrants to be found more in Africa. This is confirmed by this study, given that the majority of emigrants have a low intellectual level or have never set foot in school (Table 44).

Table 44: Destination of emigrants

PAYS	NOMBRE DES EMIGRES	POURCENTAGE
Dans une autre ville du pays	326	24
Côte d'Ivoire	409	30,1
Ghana	337	24,8
Nigéria	140	10,3
Burkina Faso	81	6
Benin	43	3.2
Europe	12	0,8
Amérique	5	0.3
Asie	2	0,1
Autre	125	9,2
Total	1356	100

Source: Authors' analysis, April 2021

The respondents' socioeconomic characteristics play a crucial role in the quality of the information collected at their level. Thus, the choice of these characteristics is linked to the study objectives and the information to be gathered. This survey takes into account marital status, age, profession, literacy level, household size in this specific scenario.

❖ **Marital status**

It can be noticed that the marital status plays an important role in migration process because, this study confirmed that the unmarried people are more likely to migrate, since they are not bind by any family responsibilities such as wife or children; then they are free from any movement.

Marital status is considered because marriage confers responsibility for decision-making and family management. Married men or women probably have more duties than single people, because they must take care of their partner and children, and any decision to migrate must take the partner's advice into account. On this matter, individuals who are not in a partnership are more inclined to report higher levels of contentment with the relocation than those who are in a relationship. This is due to the fact that unmarried individuals are more likely to have control over the process of making the decision to migrate and are therefore not constrained by the desires of a partner. Because of the obligations that come with marriage, those who are married have fewer opportunities for migration than those who are not. It is believed that couples are more likely to migrate for work-related purposes and to earn more income as a consequence of their move. As unmarried people are relieved of multitude of the financial obligations that accompany marriage, they are more likely to migrate for the purpose of enhancing their standard of living or non-work related reasons. Consequently, they may end up generating an equivalent or reduced income subsequent to their relocation. In couples, men have a greater influence on the decision-making process regarding migration than women. This is due to the fact that men usually hold more powerful positions in society, wield greater sway in social and economic spheres relative to women, and therefore, are more prone to assume the responsibility of migration within the context of marriage. In most couples, the determination to move to a new locale is typically reached by the male or by both individuals in a partnership, with a lesser probability of being initiated by the female counterpart. It has been observed that men exhibit a greater likelihood to respond to job-related factors when considering a relocation, as they typically take on the role of the primary provider. In contrast, women, who have traditionally been associated with expressive roles, tend to prioritize non-job related reasons when making the decision to relocate. Consequently, the anticipated correlation between the relocation decision and its underlying cause with the gender of the decision-maker has been posited by Williams et al (1986).

❖ Age

From the various socioeconomic factors that potentially exert an influence on the relative incidence of migration, such as gender, age, income, occupation and education, age stands out as arguably the most significant. This is due to the fact that a robust empirical regularity exists in the form of a monotonically decreasing correlation between the frequency of migration and the age of working-age adults, as posited by Shaw (1975). Lewis (1970) demonstrated through the utilization of an average immigration rate for a sample of twenty states in the United States

of America that the rate of migration for both the nation and a representative sample of twenty states consistently decreases as age advances up to the 65-69 year age category (Table 45). The observed marginal escalation may be attributed to the retirement migration phenomenon, as posited by Miller (1967). This correlation has been affirmed in various countries, as evidenced by the OECD economic surveys done in Sweden in (1966).

Table 45: Average immigration rates for twenty-state sample 1965-1970

Age Class	Mean	Range
20-24 years	40.8	30.2-57.0
25-29 years	37.1	27.3-54.1
30-34 years	28.0	20.2-42.7
35-39 years	20.9	10.7-33.1
40-44 years	15.4	11.1-25.4
45-49 years	12.3	8.3-19.9
50-54 years	10.0	6.7-16.3
55-59 years	8.4	5.6-13.8
60-64 years	7.7	5.5-13.0
65-69 years	8.1	5.6-14.1
70-74 years	7.1	5.2-11.7
75-79 years	7.0	5.0-11.0
80-84 years	7.9	5.4-12.8
85 years and over	9.6	6.5-14.8

Source: derived from data from US Bureau of the Census 1970

Moreover, the association remains consistent for observations made on individual states. Out of the 20 states that were sampled for age classes ranging from 20-24 years to 60-64 years, there were only five instances (out of the 180 relevant comparisons) where the rate increased with the increase in age class.

❖ Gender

Gender plays a pivotal role in all dimension of migration for the 200 million individuals worldwide who reside outside their native country, in addition to the substantial number of people who migrate within national boundaries. It affects the motives for migration, the selection of individuals who will relocate, the nature of migration, social networks, the encounters with integration, and the probable job opportunities in the target country for migrants. Here are five reasons why gender should not be disregarded in the context of migrants' rights.

❖ Gender discrimination

The migration process can be significantly impacted by gendered expectations, power dynamics, and relationships associated with identifying as a man, woman, boy, girl, or as a member of the LGBTI community. LGBTI individuals may choose to migrate to locations with greater anonymity or greater legal protection and socially advanced norms. However, they may also encounter additional mistreatment upon arrival, particularly when seeking asylum based on their gender identity or sexual orientation. Women may engage in migration to flee various constraints on their liberty, while men may flee to avoid being forcibly conscripted into military service.

❖ Gender norms

Household and societal gender norms impose distinct patterns of behavior on certain groups while directing others to remain stationary. The gendered dynamics and hierarchies inherent within households are known to influence decisions surrounding migration, including who migrates, for how long, and to which countries. Women, in particular, may encounter challenges when attempting to exert influence over such decisions. The process of international migration is highly gendered, with governmental immigration regulations playing a critical role. Furthermore, migration can challenge entrenched gender norms; the nonexistence of one partner, for example, may provide the other with greater decision-making power, financial autonomy, or liberty.

❖ Gender-based violence

The issue of gender-based persecution is a noteworthy aspect for understanding the reasons for migration. Specifically, the apprehension of being forced into marriages, female genital mutilation, or sexual abuse during wartime are pertinent reasons for migration. It has been observed that political jurisdictions and international organizations often fail to impart adequate knowledge to women regarding their prerogatives to seek asylum. In addition, it can be observed that females who are able to present an asylum plea grounded on gender-associated oppression are confronted with considerable obstacles in verifying the legitimacy of their plea. During the process of migration, it is not uncommon for women to face a range of distinct risks and hazards. These risks may include instances of physical or sexual violence, which can be perpetrated by a variety of individuals, including transporters, male fellow travelers, or even border guards. It is worth mentioning that females exhibit a heightened vulnerability to

experiences of sexual violence within displacement or refugee camps, as well as from hostile local communities.

❖ **Families on the move**

There exists evidence indicating that women who enter a nation as 'dependent spouses' may encounter challenges when attempting to secure employment that is commensurate with their qualifications. Men, similarly, migrate for various reasons, which encompasses the possibility of reuniting with family in nations that heavily rely on female migrants, such as those employed in domestic service. Owing to their differing entry statuses, women may experience reduced benefits in the country of destination, such as with regards to healthcare, education, and access to language training. The rights of women as 'dependents' may be contingent upon their husband's migration and residency status, and this can result in some women remaining in violent situations.

❖ **Economic power**

The potential and ability to migrate are impacted by an individual's economic resources and labor prospects in the nation they intend to depart from. Segregation of the labor market by gender in the target country presents dissimilar opportunities and motivators for both sexes; those jobs frequently performed by males are considered skilled, whereas those typically undertaken by females are classified as unskilled, with skilled laborers being granted greater advantages. Women might perceive a sense of empowerment by engaging in paid employment in a foreign land and gaining a fresh level of respect on account of the remittances they can transmit back to their homeland, but this is contingent on the terms and compensation of the work that they obtain (Bridge, 2015).

❖ **Education**

The impacts of education on the proclivity to relocate are obvious. Higher education graduates are nearly twice as likely as elementary school to move within their country and five times more likely to go internationally. This situation is explained by graduate-specific migration incentives such as higher educational returns (some countries place higher value on talents), a lower relative cost of migration (graduates have larger and more transportable funds), greater access to information, or different preferences. Another key explanatory factor is the educational selectivity of migration policies. As a result, in a number of receiving countries

(e.g. Canada and Australia), immigrant admission is based on a points system in which education level plays a central role.

❖ **Income**

Low income is one the drivers inducing migration in the Savannah region. Due to the high poverty rate of the population, people, especially young men leave the region in search of a better source of income. While the median farm incomes in industrialized nations exceed the median non-farm incomes, developing countries experience relatively lower farm incomes compared to the average incomes of non-farm households. The governments of developed countries often provide subsidies to their farmers; however, governments of developing countries generally impose taxes on farmers through the creation or allowance of monopolies to sell essential inputs such as seeds and fertilizers at exorbitant prices.

Governments may opt to procure commodities from farmers at rates that are lower than the market price. The dearth of options for upward mobility in agriculture coupled with low farm incomes drives laborers, particularly the young, to migrate from rural areas to urban centers within the same nation, thereby creating a trend of internal rural-urban migration. Although such internal rural-urban mobility constitutes the bulk of migration in the agricultural sector, instances of agricultural migration across national borders do occur in order to fill positions in developed countries. This approach of relocating workers instead of farm produce across national borders serves to boost the value of farmland in wealthier countries whilst simultaneously preserving other high-end employment opportunities such as farm-related packing and transportation jobs in those countries (Philip, 2010).

❖ **Search for more gain**

The search for more gain as an incentive factor for migration has been confirmed by Kokou (2018). Indeed, the economic vulnerability of the populations of the West of the Plateaux region becoming more and more increasing, the youngest see their situations threatened. Indeed, the peasant in the West of the Plateaux Region derived most of his income from the sale of coffee and cocoa. But the income not only fell, it also fluctuated from year to year. The average income from the sale of coffee and cocoa increased respectively from 75,143.5185 F CFA in 2010-2011 to 94,131.2384 F CFA in 2012-2013 and then to 63,803.3395 F CFA in 2013-2014. These average incomes are low and insufficient to cover the expenses of producers and the maintenance of coffee and cocoa plantations. These results are also confirmed by Kola (2008). To get out of this crisis, the population decided to emigrate in search of better living conditions.

An increasing body of literature has analyzed the correlation between drought and migration, and the majority of scholars have reached the consensus that the migration resulting from drought seldom follows a direct push-pull or stimulus-response pattern. The migration that arises from drought is rather context-specific, and it is influenced by local and regional factors, encompassing economic, political, and social dimensions, as well as other non-environmental determinants which shape the adaptive and migratory reactions of populations. Several non-climatic factors are significant in influencing the outcomes of land management practices. These factors include but are not limited to land availability and tenure, family size, gender, education and income levels, livestock ownership, and conflicts (Wondimagegnhu & Zeleke, 2017; Mastrorillo et al, 2016). The potential for out-migration to either escalate, diminish, or persist unaltered rests upon the degree of drought severity and the current socioeconomic conditions in the impacted region (Hermans, 2019; Nawrotzki & DeWaard, 2017; Nawrotzki & Bakhtsyarava, 2016). Additionally, migration results within the affected vicinity may diverge from one household to another. Mersha and Laerhoven (2016) made a noteworthy discovery indicating that, during times of scarcity, domiciles headed by males manifested greater mobility rates than those headed by females in the Ethiopian Highlands. Additionally, the researchers observed a decline in the occurrence of female marriage-related migration, which suggests that droughts negatively impact the capacity of households to finance wedding expenditures and establish fresh households.

Ocello et al (2014) discovered in Tanzania that the level of educational attainment predicts the likelihood of individuals migrating during drought periods, with lower levels of education being associated with a greater tendency towards migration. Similarly, Mastrorillo and colleagues (2016) indicated that in times of drought, individuals in South Africa who are of Black ethnicity and have lower income are more inclined to relocate.

At the regional level, diverse outcomes have been observed, owing to the employment of varied research methodologies. Hummel (2016) conducted a survey among rural migrants residing in destination cities in Senegal and ascertained that food security constitutes a significant impetus for migration, corroborating with other studies that suggest that rural migration in developing countries is closely related with disturbances to agricultural systems (Falco et al, 2019). Utilizing a variety of qualitative and quantitative data sources that differ in terms of scale and units, Drees and Liehr (2015) formulated a Bayesian Belief Network (BBN) to scrutinize the interrelationships between socioeconomic and environmental factors (such as land degradation) and migration in the Sahel, drawing upon the findings of Hummel and Liehr et al (2016). These

research endeavors have identified land degradation as a pertinent factor in the process of migration induced by drought, however, the outcomes are inconclusive and preclude any universal inferences.

Hummel (2016) demonstrated that the foremost impetus for migration is the aspiration for financial gain and employment prospects in Senegal (58%) and Mali (71%), predicated on a survey conducted in Mali and Senegal on migration motives and trends. However, there exist significant dissimilarities in the allocation of rationales when socioeconomic characteristics such as gender and education are taken into account. Males are more inclined than females to migrate in pursuit of pecuniary and occupational opportunities (73% versus 49%), while female participants cite "family" and "visits" as principal incentives for migration.

According to Van Der Land and Hummel's (2013) research, a significant number of respondents without any formal education or only primary education (64% in both cases) cite 'pursuit of money/employment prospects' as a primary impetus for their initial migration, while merely 17% of those with elevated educational qualifications exhibit similar motivations.

Conclusion

The present chapter delves into the socioeconomic aspects of migratory patterns in Savannah Region Togo. It reveals that the region possesses a distinctive attribute of high mobility, which warrants thorough examination with regards to its historical dynamics. Long-term migration has been a continuing pattern that has endured over time. The individuals who are subject to migration phenomenon have restricted access to financial capital. For those individuals, migration may, in fact, represent the sole means to get a better living conditions by gaining more financial resources. Evidently, the youth residing in rural locales, especially those with higher levels of education, are endeavoring to enhance their living standards and explore opportunities that transcend conventional agricultural practices.

CHAPTER VI:
**ROLE OF ENVIRONMENTAL DRIVERS
IN MIGRATION DYNAMICS
CONSIDERED AS AN ADAPTATION /
COPING STRATEGY TO SOCIOECONOMIC
AND ENVIRONMENTAL CHANGES**

Introduction

Human mobility linked to environmental drivers is not new, but global climate change is triggering more internal and international migration and displacement. Mobility is one response to the impacts of climate change, but not an inevitable one, nor is this movement always a negative development. As climate change makes livelihoods harder and disasters more severe, displacement is likely to grow and become more unpredictable, although government action can help individuals remain in place or move in safer, legal ways. Climate change is not the main reason why people move, but it is increasingly part of the story. Environmental issues are generally minor factors in people's migration decisions, typically far behind economic imperatives even in highly climate-affected countries. This reflects a key challenge in understanding how climate change affects migration. Environmental factors clearly play a role, but not a clear-cut one.

6. Results

6.1. Environmental causes of the migration according to “decision to migrate”

The correlation matrix (Table 46) demonstrates that there is no correlation between Independent Variables (drought trend increasing, land degradation, decrease in rainfall quantity, and increase in temperature).

Table 46: Correlation Matrix

VARIABLES	Constant	DROUGHTTREN D	LANDDEGR	CHANQUARAI N	CHANGTEMPE R
Constant	1.000	-.535	.000	.023	-.818
DROUGHTTREND	-.535	1.000	.000	-.084	-.032
Step 1 LANDDEGR	.000	.000	1.000	.000	.000
CHANQUARAIN	.023	-.084	.000	1.000	-.016
CHANGTEMPER	-.818	-.032	.000	-.016	1.000

Source: Authors' analysis, April 2021

The logistic regression run with the Dependent Variable (DV), “Decision to migrate” and the Independent Variables (IVs), drought trend increasing, land degradation, decrease in rainfall quantity and, increase in temperature displays this result:

Table 47: Variables in the equation

VARIABLES	B	S.E.	Wald	df	Sig.	Exp(B)
DROUGHTREND	-.361	.245	2.176	1	.140	.697
LANDDEGR	22.149	4680.649	.000	1	.996	4159350275.768
Step 1 ^a CHANQUARAIN	-.510	.195	6.824	1	.009	.601
CHANGTEMPER	-.675	.643	1.103	1	.294	.509
Constant	.543	.785	.477	1	.490	1.721

a. Variable(s) entered on step 1: DROUGHTREND, LANDDEGR, CHANQUARAIN, CHANGTEMPER.

Source: Authors' analysis, April 2021

➤ Drought trend increasing

The result reflects that increase in drought trend is negatively related to decision to migration and is not statistically significant at 5% (Table 47). This runs counter to the commonly held assumption that increase in drought trend is inversely associated to decision to migration. This implies that when there is an increase in drought trend, many people decide not to migrate. In fact, the migration is a decision stimulated by many factors. In this case, respondents are the persons that decided to stay instead of migrate. Usually, the increase in the drought trend may not be the main problem, rather, the decrease in rainfall quantity. If the drought may last for eight (8) months, but within the remaining four (4) months, there is a sufficient rainfall quantity, crops can be grown. Reason why, people living around water bodies do not care about drought, the presence of water is the essential.

To detect how the “trend of the drought” may affect the “decision to migrate”, a cross tabulation between these two variables is betrayed in the table (48).

Table 48: Cross tabulation between variables “trend of drought” and “decision to migrate”

Trend of drought * Decision to migrate Crosstabulation				
		Count		Total
		Decision to migrate		
		no	yes	
Trend of drought	decrease	58	40	98
	increase	344	194	538
Total		402	234	636

Source: Authors' analysis, April 2021

Among respondents that agree that the trend of drought is increasing, only 36.05% is willing to migrate (Table 48).

➤ Increase land degradation

From the Table (47), “land degradation” and “decision to migrate” are positively related, though it is insignificant at 5%. This aligns with our initial anticipation. When land degradation rate is increasing, it is obvious that decision to migration increase too. Most of respondents being farmers, land degradation hinders their activities and therefore, may decide to migrate. The statistical insignificance results in fact that land degradation is insufficient in migration decision taking.

The cross tabulation between “land degradation” and “decision to migrate” is disclose in the table (49).

Table 49: Cross tabulation between variables “land degradation” and “decision to migrate”

Land Degradation * Decision to migrate Crosstabulation				
		Count		Total
		Decision to migrate no	yes	
Land Degradation	no	519	183	702
	yes	0	79	79
Total		519	262	781

Source: Authors’ analysis, April 2021

Among respondents that are ready to migrate, only 30.15 % accept land degradation as a push factor (Table 49).

➤ Decrease in rainfall quantity

The result in Table (47) indicates an existence of negative relation between decrease in rainfall and decision to migrate, but it is statistically significant at 5 %. This outcome aligns with the anticipated expectation. Rainfall is crucial for farming activities, no matter the inputs, without sufficient rainfall, there is no good harvest. Therefore, in case, the rainfall quantity is decreasing, the farming activities are seriously disrupted and famers could see in migration a solution of adaptation.

The table (50) is reflecting the number of respondents that see decrease or increase of rainfall as factor that can trigger migration.

Table 50: Cross tabulation between variables “change in rainfall quantity” and “decision to migrate”

Change in the rainfall quantity * Decision to migrate Crosstabulation				
		Count		Total
		Decision to migrate		
		no	yes	
Change in the rainfall quantity	decrease	364	227	591
	increase	155	35	190
Total		519	262	781

Source: Authors’ analysis, April 2021

From table (50), 86.6 % of respondents that may decide to migrate, highlight decrease in rainfall as sufficient factor.

➤ Increasing in temperature

The results in table (47) show that increasing in temperature is negatively related to the decision of respondents to migrate and is statistically insignificant at 5 %. This is contrary to the expectation because when temperature increases, people are not willing to migrate. The study area, which is savannah region (bordering the Sahel zone), experiences high value of the temperature, and people living in that zone are already used to a high temperature. Therefore, increasing in temperature is not really causing the migration.

To know if among the respondents that decide to migrate, increase or decrease in temperature is their triggered factor, a cross tabulation was run between “nature of change in temperature” and “decision to migrate” (Table 51).

Table 51: Cross tabulation between variables “Increase in temperature” and “decision to migrate”

Nature of change in temperature * Decision to migrate Crosstabulation				
		Count		Total
		Decision to migrate		
		no	yes	
Nature of change in temperature	increase of temperature	500	258	758
	decrease of temperature	19	4	23
Total		519	262	781

Source: Authors’ analysis, 2021

Expecting that the increase in temperature should cause migration, 65.96% of interviewees who said the temperature in the area is increasing are not intending to displace (Table 43).

6.2. Environmental drivers of out-migration

The table (52) exposed the correlation between the dependent variable “number of migrants” and the independent variables “climate harshness, flood, lack of arable land lands, degradation of the environment, drought, decrease of land production.”

Table 52: Correlation between the dependent variable "number of migrants" and the independent variables "climate harshness, flood, lack of arable land, degradation of the environment, drought, decrease of land production

Model	95.0% Confidence Interval for B		Correlations			Collinearity Statistics	
	Lower Bound	Upper Bound	Zero-order	Partial	Part	Tolerance	VIF
(Constant)	-47.810	22.738					
Climate harshness	27.427	63.185	.051	.176	.173	.154	6.481
Flood as cause	-14.253	19.699	.008	.011	.011	.973	1.027
Lack of arable land	-2.315	11.990	.028	.048	.046	.939	1.065
Degradation of the environment	17.399	48.629	.055	.147	.145	.213	4.700
Drought as a cause	-76.572	-33.715	-.025	-.179	-.176	.107	9.344
Decrease of land production	-35.747	-4.307	-.025	-.089	-.087	.195	5.126

a. Dependent Variable: TOTEMIG

Source: Authors’ analysis, April 2021

In the domain of multiple regression analysis, the variance inflation factor (VIF) serves as a crucial metric to gauge the presence of multicollinearity. This computational tool is determined to be the inverse of the tolerance parameter, signified as $1 / (1 - R^2)$.

In order to achieve more favorable outcomes in multiple regression analysis, it is the preference of researchers to have lower levels of VIF. This is due to the well-known negative impact that higher levels of VIF can have on said results. Numerous recommendations pertaining to acceptable VIF levels have been published within the literature. A commonly cited maximum

VIF value is 10, as suggested by a variety of sources such as Hair, Anderson, Tatham, and Black (1995), Kennedy (1992), Marquardt (1970), and Neter, Wasserman, and Kutner (1989). This VIF recommendation of 10 is equivalent to a tolerance recommendation of .10 (i.e., $1 / .10 = 10$). The results in table (52) have been commented based on the value in red:

➤ **Climate harshness**

Climate harshness is positively related to total emigrants number and is statistically significant at 5 %. The result meets the a priori expectation. When the climate becomes harsher (dry in this case), external migration rate may increase especially when most of emigrants' activities are influenced by climate factors (Table 52). In order to know the number of household heads that can leave the Savannah Region because of climate harshness, the table (53) is drawn.

Table 53: Climate harshness as cause of emigration

CLIMATE HARSHNESS					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	555	40.9	40.9	40.9
	yes	803	59.1	59.1	100.0
	Total	1358	100.0	100.0	

Source: Authors' analysis, April 2021

From the table above, almost 60% of emigrants left their zone of origin because of climate harshness.

➤ **Flood trend increase**

Flood trend increase is positively related to number of migrants and is statistically significant at 5 % (Table 52). This finding is in line with the expectation because any hazard leads to the displacement of the affected people. The table (54) displays the outcomes of the descriptive statistics regarding the analysis of the respondents answers on the causes of emigration.

Table 54: Flood trend increase as push factor

FLOOD					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	1325	97.6	97.6	97.6
	yes	33	2.4	2.4	100.0
	Total	1358	100.0	100.0	

Source: Authors' analysis, April 2021

From the results exhibited in the above table, 97.6% of emigrants do not quit their zone of residence due to the fact that only restricted area of the Savannah region is under the threat of flood.

➤ **Lack of arable land**

The result indicate that there is positive relation between lack of arable land and the number of emigrants, and is statistically significant (Table 52). This finding aligns with the preconceived expectation. This means when degraded land expands, the probability of emigration also increases. The table (55) is the outcome of the statistics showing the proportion of respondents that are willing to depart from the Savannah Region, because of lack of arable land.

Table 55: Lack of arable land as cause of emigration

FERTILE LAND					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	922	67.9	67.9	67.9
	yes	436	32.1	32.1	100.0
	Total	1358	100.0	100.0	

Source: Authors' analysis, April 2021

Surprisingly, from the above table, 67.9 % of emigrants do not live their origin because of lack of arable land (Table 53).

➤ **Degradation of the environment**

The results indicates that degradation of the environment is positively related to number of emigrants and is statistically significant. This outcome matches the expectation. This means more the environment is degraded, more people may migrate (Table 52). Below is the table exposing the percentage of household heads who crave to depart from the Savannah Region because of “degradation of the environment” (Table 56).

Table 56: Degradation of environment as cause of out-migration

DEGRADATION OF ENVIRONMENT					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	513	37.8	37.8	37.8
	yes	845	62.2	62.2	100.0
	Total	1358	100.0	100.0	

Source: Authors' analysis, April 2021

The table (56) is confirming the role of degraded environment in migration because the degraded environment caused the displacement of 62.2% of emigrants.

➤ Drought

Drought is negatively related to number of emigrants but is statistically significant. This is contrary to the expectation (Table 52). This result signifies that increase in drought trend may decrease the number of emigrants. Drought itself is not the problem of the emigrants. Despite of the drought, if they can have enough income, emigrants should not leave the country. To admit the role of “increase in drought” as cause of out-migration, a descriptive statistics bring out results contained in table (57).

Table 57: Increase in drought as cause of out-migration

DROUGHT					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	550	40.5	40.5	40.5
	yes	808	59.5	59.5	100.0
	Total	1358	100.0	100.0	

Source: Authors’ analysis, April 2021

Indeed, table (57) points that 59.5% of emigrants were oblige to displace because of increase in drought trend.

➤ Decrease in land productivity.

Decrease in land productivity is negatively related to number of emigrants and is statistically significant (Table 52). This outcome fits the expectation. Most of the population being farmers, decrease in land productivity may lead to a massive displacement of population. To support the “decrease in land productivity” as cause of out-migration, a demonstration has been done and the table (58) summarizes the results.

Table 58: Decrease in land productivity as cause of out-migration

DECREASE OF LAND PRODUCTIVITY					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	563	41.5	41.5	41.5
	yes	795	58.5	58.5	100.0
	Total	1358	100.0	100.0	

Source: Authors’ analysis, April 2021

The percentage of emigrants that departed from Savannah region because of decrease in land productivity is 58.5% (Table 58).

6.3. Opportunities of migration as an adaptation strategy to socioeconomic and environmental changes

The definitions of “adaptation”, although numerous, all pertain to adaptations made to a system in reaction to the impacts of climate change. These adaptations, however, are fundamentally imbued with a multitude of variables and attributes (Ober, 2014).

To have an idea on the opportunity of migration as an adaptation strategy, responses of household heads have been subjected to descriptive statistics (Table 59).

Table 59: Migration as an adaptation strategy

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	don't know	162	20.7	20.7	20.7
	no	207	26.5	26.5	47.2
	yes	412	52.8	52.8	100.0
	Total	781	100.0	100.0	

Source: Authors' analysis, April 2021

According to the survey, almost 53% of the respondents attested that migration is an adaptation strategy, 27% do not have the same conception and 21% do not have any idea (Table 59).

6.3.1. Migration as an adaptation strategy to socioeconomic and environmental changes

For the tranche of people, that consider migration as adaptation strategy, these are the reasons backing up their idea: (i) emigrants send money, (ii) emigrants live in better conditions, (iii) emigrants parents live in better conditions, (iv) emigrants achieve great things in their origin.

6.3.1.1. Remittance sent by emigrants

The table (60) highlighted that 269 out of 412 respondents that consider migration as an adaptation strategy, representing 65.2 % accepted migration as adaptation measure, because of the remittance sent by emigrants.

Table 60: Percentage of respondents receiving remittance from emigrants

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		369	47.2	47.2	47.2
	no	133	17.0	17.0	64.3
	yes	279	35.7	35.7	100.0
	Total	781	100.0	100.0	

Source: Authors' analysis, April 2021

This discovery aligns with the outcome of a survey executed in Ireland during the year 2009. The examination of migrant nurses demonstrated that a regular 87% of the individuals involved in the study sent remittances. As per the respondents, remittances had a significant impact on the lives of their relatives residing in their country of origin. These remittances were utilized to guarantee that their family members were able to access health and educational services. Furthermore, they were utilized to provide a source of income for family members who were either unemployed or retired (Niamh et al, 2009).

6.3.1.2. Better living conditions of emigrants

Almost 280 people representing 67.7% of respondents, agreed that the better living condition of emigrants in their home country, whenever they are back, is a sufficient reason for considering migration as an adaptation strategy (Table 61).

Table 61: Percentage of respondents agreeing on “better living conditions of emigrants” as reason to consider migration as an adaptation strategy

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		369	47.2	47.2	47.2
	no	143	18.3	18.3	65.6
	yes	269	34.4	34.4	100.0
	Total	781	100.0	100.0	

Source: Authors' analysis, April 2021

This finding, nevertheless, has a tricking side which was revealed by a study conducted in United Kingdom. Utilizing survey data gathered from a cohort of 129 Ghanaian migrants situated in the United Kingdom, a Living Condition Index (LCI) was generated by Richmond et al. (2021) through the assessment of six distinct statements pertaining to the living conditions experienced by these migrants in their host country. A hierarchical multiple regression model was subsequently specified, in which the migrants' LCI values were regressed upon the

regularity of their remittance, while controlling for a host of demographic, migration, employment, and remittance-related factors. The findings of this study indicate a reduction of almost 20% in the LCI of migrants who remit more than £150, thus lending support to the formulated hypothesis. Furthermore, the improved living conditions of emigrants within their country of origin may belie the true living conditions experienced by these individuals in their host country.

6.3.1.3. Emigrants' parents living in better conditions

More than half of the heads of household, numbering 267, representing 64.8%, confirmed that migration is an adaptation strategy because the parents of emigrants live in better conditions (Table 62).

Table 62: Better living conditions of emigrants' parents

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	no	369	47.2	47.2	47.2
	yes	145	18.6	18.6	65.8
	yes	267	34.2	34.2	100.0
	Total	781	100.0	100.0	

Source: Authors' analysis, April 2021

For the individual and community levels, the economic lifelines for migrant households are the remittance flows. On the occasion of the International Day of Family Remittances on 16 June, it is of paramount importance to deeply reflect upon the profound effects that these inherently personal financial transfers have on households. The International Fund for Agricultural Development (IFAD) cited by William (2018) reported that a substantial quantity of 800 million individuals across the globe are presently receiving direct sustenance from remittances provided by their kin and acquaintances residing overseas. Remittances have the capacity to alleviate destitution, ameliorate the state of health and nourishment, augment educational prospects for young ones, promote housing and sanitation, foster entrepreneurship, and reduce inequality.

6.3.2.4. Emigrants' great achievement

The great achievements of emigrants such as houses, cars, shops, lands, etc. is a reason for considering migration as adaptation strategy (Table 63).

Table 63: Emigrants' great achievement

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		369	47.2	47.2	47.2
	no	64	8.2	8.2	55.4
	yes	348	44.6	44.6	100.0
	Total	781	100.0	100.0	

Source: Authors' analysis, April 2021

The respondents, numbering 348, equivalent of 84.4% agreed. This finding is in line with the results of a doctorate study conducted in western Plateau region of Togo where, as for real estate investments, 13.23% of the funds are intended to repair or build a house against 10.55% of the funds which are used rather to acquire building land and 6.20% to acquire agricultural land for crops (Kokou, 2018).

6.3.2. Migration as a failed adaptation strategy to environmental changes

The phenomenon of migration has often been characterized as a modality of climate change adaptation, as evidenced by studies conducted by Black et al. (2011a, b), Gemenne & Blocher (2017), and Kniveton et al (2012). However, accounts of migration in the context of climate change are positioned along a spectrum ranging from migration being viewed as a fruitful form of adaptation to it being considered as an ineffective strategy as noted by Vinke et al (2021). The present investigation seeks to demonstrate the inadequacy of migration as a viable adaptation tactic by highlighting the reasons for its shortcomings.

6.3.2.1. Emigrants do not send remittances

To know the percentage of respondents that do not consider migration as an adaptation strategy because “emigrants do not send remittances”, the table (64) has been analyzed.

Table 64: Percentage of respondents considering migration as a failed adaptation strategy because emigrants do not send remittances.

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		574	73.5	73.5	73.5
	no	171	21.9	21.9	95.4
	yes	36	4.6	4.6	100.0
	Total	781	100.0	100.0	

Source: Authors' analysis, April 2021

From the Table (64), thirty-six respondents (36), representing 17.39 % of respondents regard migration as a failed adaptation strategy, because the emigrants do not send remittances home and do not return with money.

6.3.2.2. Emigrants become loads

The table (65) represents the outcome of descriptive statistics to which a variable “emigrants become loads” has been submitted to.

Table 65: Emigrants become loads

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		574	73.5	73.5	73.5
	no	155	19.8	19.8	93.3
	yes	52	6.7	6.7	100.0
	Total	781	100.0	100.0	

Source: Authors’ analysis, April 2021

Fifty two people, representing twenty five percent (25%) of those who considered migration as non-adaptation strategy, attested that the emigrants become loads because, when they could not succeed in the host country, parents are obliged to assist them for their survival (Table 65).

6.3.2.3. Emigrants’ departure makes their parents anxious.

The departure of emigrants makes anxious their family members in the home country. In the Moba customs, the departure of young people specifically, is source of depression to the biological parents, who never ceased to think of the well-being of their child; especially, in Africa, particularly in the Moba tribe where the social network is very strong and important (Table 66).

Table 66: Percentage of respondents regarding migration as a failed adaptation strategy because “Emigrants departure makes anxious”

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid		574	73.5	73.5	73.5
	no	72	9.2	9.2	82.7
	yes	135	17.3	17.3	100.0
	Total	781	100.0	100.0	

Source: Authors’ analysis, April 2021

From the table (66), one hundred and thirty five, standing for 65.21 % of households heads considered migration as a failed adaptation strategy, since the emigrants departure makes their family anxious

6.3.2.4. Reduction of labor force due to emigration

All active persons, work primarily to ensure the subsistence of all members of Soukala; therefore, migration of young people is obviously a loss of labor force that surely, put pressure and burden on the chief of the Soukala. To consider the “reduction of labor force due to emigration” as reason to stand for migration as failed adaptation strategy, a statistical analyzis of the respondents answers have been done (Table 67).

Table 67: Percentage of respondents considering migration as a failed adaptation strategy because of “the reduction of labor force”

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid no	574	73.5	73.5	73.5
yes	53	6.8	6.8	80.3
Total	154	19.7	19.7	100.0
	781	100.0	100.0	

Source: Authors’ analysis, April 2021

From the above table, one hundred and fifty four, illustrating seventy five percent (75%) of the household heads agreeing on migration as non-adaptation strategy, consider a labor force reduction as one of their proofs (Table 67).

6.3.2.5. Depravity of morals

The depravity of morals is one of the reasons why 31.4% of household heads, out of 207 do not consider migration as an adaptation strategy (Table 68).

Table 68: Percentage of respondents considering migration as a failed adaptation because of “the depravity of morals of emigrants”

	Frequency	Percent	Valid Percent	Cumulative Percent
Valid no	574	73.5	73.5	73.5
yes	142	18.2	18.2	91.7
Total	65	8.3	8.3	100.0
	781	100.0	100.0	

Source: Authors’ analysis, April 2021

6.4. Discussion

Detection and attribution of migration linked to land degradation

Neumann et al. (2015) conducted a global-scale investigation utilizing cluster analyses on a diverse set of spatially specific environmental and migration data. Their findings demonstrate that in the southern Sahel, semi-arid southern Africa, northeastern Brazil, and the Argentinian and Paraguayan pampas, rural out-migration is more strongly linked to land degradation as expressed by NDVI change than to drought or mean precipitation change. Nebie and West (2019) made a noteworthy discovery that the adoption of soil and water conservation strategies in the northern region of Burkina Faso, aimed at tackling the issue of land degradation, corresponded with a notable decline in the frequency of emigration from arid areas susceptible to drought.

Call and Gray (2020) discovered that climatic stress is the primary determinant of land quality or degradation that drives migration in Uganda. This finding was achieved through the integration of soil quality measurements that were sensitive to management, observed anomalies in climate, and migration data at the level of households over a period of time.

Hermans-Neumann et al. (2017) have identified the drought-susceptible highlands of northern Ethiopian as a potential hub for migration by employing population census data in conjunction with spatially detailed time-series rainfall and NNP data. Further, research conducted on the said area has revealed that the deterioration of land, which is intensified by the paucity of resources allocated soil restoration activities, insecurity of land tenure, and inadequate institutional backing, adversely affects agricultural output, thereby prompting subsistence farmers to migrate (Groth et al., 2020, 2021). Migration represents a commonly employed livelihood strategy utilized by households in pursuit of remittance income and as a means of alleviating the pressures of scarce land resources within this particular region. However, it is crucial to mention that the manner in which migration is employed tends to fluctuate considerably (Haeffner et al, 2018).

Migration is a prevalent means of securing a livelihood in the region, which is utilized by households to generate remittance income and alleviate the strain on limited land resources, although its application varies (Wondimagegnhu & Zeleke, 2017). For instance, temporary and short distance labor migration by young men tends to escalate in the wake of land deterioration, crop failures, and water shortage, while the migration of young women is less likely owing to their caregiving responsibilities towards children (Mersha & Laerhoven, 2016).

Simultaneously, some individuals who may choose to migrate are incapable of doing so due to health or household duties, rendering them immobile, whereas others prefer not to migrate owing to their attachment to a particular place (Hermans, 2019).

Wiederkehr et al (2018) in their published work titled "Environmental change, adaptation strategies and the relevance of migration in Sub-Saharan drylands", noted that nearly half of the reviewed studies identify various migration forms as responses to environmental change. The study also pointed that approximately 23% of the interviewed households reported engagement in some form of human mobility. Thus, migration, along with food-related strategies, and various forms of revenue diversification, ranks among the most significant approaches after agricultural and resource management. Furthermore, Osbahr et al (2010) classified various forms of migration, which include temporary/short-term migration, permanent migration (Zampaligre et al, 2014), migration in exode (McKune & Silva, 2013), economic/labour migration (Snorek et al, 2014; Opiyo et al, 2015), and rural-urban migration (Mersha & Laerhoven, 2016). Despite its lack of explicit framing as 'economic,' migration is frequently linked with job search or remittances, which implies economic motives. Antwi-Agyei et al. (2014) have discovered that temporal migration remains a significant strategy predominantly employed by the younger generation to partake in wage labor within vulnerable farming communities in northern Ghana. Interestingly, Eriksen et al (2005), Silvestri et al (2012), Dahgbeto and Villamor (2016), Tambo (2016), cited by Wiederkehr et al., (2018), have qualitatively analyzed out-migration and described it as a prevalent phenomenon or household strategy in the Sub-Saharan drylands. However, they have not explicitly considered it as either coping or adaptation strategies. In the context of smallholder farmers in Ethiopia, it is widely held among the majority of survey participants that climate change has exacerbated migration. Nonetheless, the frequency of respondents using migration as a climate change adaptation strategy is exceedingly rare, as stated by Tesfaye and Seifu (2016). Moreover, Mertz et al. (2009), quoted by Wiederkehr et al, (2018), in their cross-country study, acknowledge migration as a dual phenomenon of being a climate change impact and serving as a coping mechanism for households.

Due to erratic precipitation patterns, extended periods of aridness, and fragile ecological systems in the Sahel region, human migration in diverse forms has become the prevalent approach to deal with the volatile weather conditions.

Population mobility in the form of various types of migration is a prevalent method in the Sahel zone for coping with climate variability, characterized by irregular rainfalls, extended drought

periods, and fragile ecosystems. This necessitates a significant level of adaptation from the inhabitants residing in the region. For decades, the practice of nomadic pastoralism and transhumance has made a valuable contribution to the sustainable utilization of the Sahel by travelling in search of new pastures and land, in addition to trade and exchange of ideas. Rain (1999) further noted that circular migration in the Sahel zone involves migrants migrating from rural to urban areas to seek revenue during the dry season and returning home during the rainy season to engage in agricultural activities. Remittances sent by migrants contribute to their families' income while they are away.

Since the early 1970s, there has been a significant rise in emigration in the semi-arid regions of Mauritania, Senegal, and Mali. This can be attributed to the adverse effects of unprecedented droughts in the Sahel from the late 1960s to the 1990s, which caused a 40% decline in annual rainfall compared to the previous three decades (IPCC, 2007). According to Bates et al (2008), the Sahelian droughts represent some of the most substantial climate changes globally. The decrease in the availability of fresh water has put the adaptive capacities of affected communities to the test. In the Sahel, rain-fed agriculture and livestock are heavily relied upon for economic sustenance, making it challenging to differentiate between environmental and economic migration, particularly in cases of transbordering migration. Long-term migration is typical as it requires significant resources and a more extended period to pay off (McDowell & de Haan, 1997). Sahelians who migrate across borders generally maintain strong links with their home countries, sending money home and projecting to return. Remittances sent home from nations with stronger economies are typically higher due to increased salaries and powerful currencies (Bollard et al, 2010). On average, immigrants from Africa contribute twice the amount of remittances as compared to the immigrants from other developing countries (Bollard et al., 2010). Malians and Senegalese residing in France transfer 10-15% of their monthly earning, while in the Senegal River valley, migrant remittances provide for 65% of households' cash income (ADB, 2007; Findley & Sow, 1998). Nonetheless, it is essential to note that information on remittances are approximations since 25-80% of all transfers are done through informal channels such as hand delivery (ADB & W.B., 2018; Page & Plaza, 2005; Sow & Alissoutin, 2010).

Migration is perceived as a means of adapting to new environments by taking into account co-development and migrants networks. In France, sub-Saharan African migrants have established organizations and launched co-development initiatives with a focus on constructing schools, clinics, drinking water, and irrigation systems. According to Gonin (2001), health care and

education were the primary areas of concentration for 36% of the projects initiated and funded by migrants from Senegal River valley residing in France, while 23% of the projects were directed towards water and agriculture. Furthermore, Babu & Asenso-Okyere (2010) have highlighted the significance of innovation and knowledge transfer, in addition to physical and social capital invested in co-development. Sall (2005) cites the example of the Diaspora Association of Engineers for the Development of the Sahel, which provided guidance and support for more than 200 projects in the Kayes region of Mali.

The Guidimakha region, known for its mountainous terrain and situated in Southern Mauritania, is regarded by the State as the most marginalized area with substantial emigration. A majority of the men, aged 25 years and above, leave the region to support their families' revenue. According to Avalua (2008), the international Diaspora's remittances provide a stable foundation for the local economy. Bouanze, a community in Guidimakha comprising 10,000 inhabitants, suffered significant losses due to the drought in the 1970s that triggered a massive exodus to urban areas and transborders. In 1975, the Bouanze emigrants established the diaspora organization AFUB with the aim of bolstering development in their homeland, supporting the remaining families, and discouraging young men from emigrating by creating more occasions at home. In partnership with local power, NGOs, and aid organizations, AFUB has implemented several developmental initiatives, including projects in water supply and waste management. A well that supplies drinking water to individuals and institutions such as mosques, hospitals, and dispensaries was constructed between 2004 and 2006, through collaboration with the Spanish NGO SPS (Santa Perpetua Solidaria), with a considerable grant from the Catalan Cooperation Fund for Development. Prior to its construction, drinking water in Bouanze was obtained from traditional wells located about 10 km away from the village. The quality of water was often poor and contaminated, creating health problems for the villagers who mostly relied on women to collect it. Moreover, the distance they had to cover to get water was quite extensive. AFUB also manages a women's agricultural cooperative, which during the dry season produces fruits and vegetables, eliminating the need for imports (Avalua, 2008). The Bouanze emigrants pooled all their available resources to complete the project. They donated over 13,000 Euros in financial capital and utilized their social and cultural capital in both origin and destination countries to construct and maintain the well. Bouanze emigrants have been involved in the facilitation and oversight of hydro-geological and geophysical studies, managing and maintaining the project, and providing employee training. AFUB continues to be actively involved in monitoring the supply of water, maintenance, the procurement of

replacement parts, and has played an instrumental role in the installation of solar panels to improve energy supply for the pump. As a result of the well's construction, two technicians and fifteen people worked at the distribution points (Avalua, 2008).

According to the findings of De Haas (2007) and Sow (2002), emigration is a crucial strategy employed by households in Senegal. This assertion was reinforced by Plaza et al. (2011) whose survey indicated that two-thirds of the households surveyed had at least one migrant, both domestically and internationally. In 2010, Senegal received the highest amount of remittances in terms of GDP, which amounted to approximately 1.16 billion USD. Notably, remittances from international emigrants are a significant contributor to the national economy, surpassing foreign aid (Tall, 2002). In addition, Grillo & Riccio (2004) identified the Senegalese Diaspora as a well-organized group that supports local communities in their host countries and fosters developmental projects in Senegal. Panizzon (2008) further observed that Senegalese migration policy promotes co-development via remittances, investment, and the repatriation of emigrants. Governmental institutions are actively promoting investments from Diaspora groups in infrastructure projects that are managed by the state. Additionally, they are leveraging the business contacts and professional networks established by Senegalese residing overseas. Furthermore, it is the intention of the non-governmental organization, FES (La Fondation des Emigrés Sénégalais), to direct investments from the diaspora into Senegal, with the backing of the Ministry of Senegalese Abroad and Spain. The Agrobiotech program of the Return to Agriculture Program REVA (Retours vers l'agriculture) endeavors to incorporate return migrants into the modernization of agricultural activities, thereby "reintegrating" them. This program specifically focusses on the highly skilled professionals from Senegal residing abroad and offers them opportunities to return. The French Priority Solidarity Funding (FSP), which is part of the French-Senegalese co-development pact signed in 2000, even co-finances 25% of projects managed by migrants.

Water management development, collection, and supply are indispensable measures to adapt to climate change, particularly in regions where drought has led to a decline in rain-fed agriculture, reduced seasonal flooding of wetlands, constrained economic growth, and amplified poverty (Oyebande & Odunuga, 2010). Since the 1970s drought, the regions of Podor, Matam (North), and Bakel (South-East) in the Senegal River Valley have witnessed high emigration (Carim, 2010), and a survey was conducted on forty migrant organizations from these regions in France (5800 members) to evaluate their contribution to water development. Each organization represented one or more villages, with a combined population of nearly 400,000 (Drevet, 2000).

The project budgets ranged from 3000 to 136,000 Euro (Drevet, 2000). Only 30% of all water projects were co-financed, and 70% were entirely funded by migrant organizations. Almost 70% of all organizations initiated at least one water project between 1996 and 2000 (Drevet, 2000). Other endeavors primarily focused on education and healthcare services, with a lesser emphasis given to mosque construction and agriculture. The majority of the organizations concentrated on the management of the water service in their respective home villages.

The act of migration has deep roots in Malian society. It can be traced back to the millennial Trans-Saharan trade, as well as a vulnerable environment and wars. Additionally, labor demand in Malian gold mines, plantations in Senegambia and Ivory Coast, and the automobile sector in France have also contributed to migration (Findley, 2004). It is worth noting that officially recorded remittances transferred to Mali are higher than FDI. According to Gubert (2009), Malian remittances have the capacity to reduce poverty rates and the Gini coefficient by 5%. In 2004, FSP conducted a survey of 42 migrant organizations with 11,000 members, representing 31 communities in Mali with a collective population of 135,000 (FSP, 2004). These organizations have successfully executed 250 developmental projects, with the majority of them being directed toward education. It is important to note that programs sponsored must include at least 30% co-financing from migrants, as emphasized by Galatowitsch (2009).

According to Azam and Gubert's (2006) research, the region of Kayes in Mali exhibits the highest rate of emigration. This may be attributed to the region's susceptibility to desertification and drought, as well as its history of extended trade. In the aftermath of independence, France encouraged temporary migration to address labor shortages in its automobile industry, attracting wealthier Soninke individuals who viewed migration as a noble pursuit. Ammarrasi's (2005) findings indicate that remittances account for 80% of Kayes' household resources, while collective projects represent 60% of its infrastructure (World Bank, 2005). Additionally, Galatowitsch's (2009) research suggests that migrant organizations have co-financed a significant portion of the development projects in the Kayes region, including water systems, dikes, health centers, schools, cooperatives, grain mills, transportation, and other initiatives. Immigrants have donated 7.8 million USD to developmental projects in Kayes between 2000 and 2004 (FSP, 2005).

Between 1980 and 1995, the number of health-care institutions in the region was quadrupled by migrants, according to Daum (2007). In the late 1980s, educational facilities were severely lacking. However, by 2005, practically every village within the region had its own school,

thanks largely to the contributions made by emigrants. Migrants play a critical role in the execution and administration of projects, contributing financially to support these efforts.

Given the limited access to electricity in rural Mali, Diaspora organizations in Kayes are actively engaged in electrification projects in their region. In collaboration with the Malian NGO "AND DEFAR" and the affiliated French NGO "ADER", Diaspora organizations are implementing multiple initiatives that utilize solar power, which provide first-time electrification for private households and public buildings. Almost 8000 private households now have solar panels installed, and 30,000 people are benefiting from the electrification of public facilities. Immigrants residing in France have established a company that provides solar hardware, with local technical and financial operators collaborating under contractual agreements with "AND DEFAR". The program trains indigenous technical support teams and offers credits for the emigrants to fund the projects. Another electrification project in the region was launched in 1999 by migrants living in Paris, who were federated within the Sahel Development Immigration Organization (IDS) and collaborated with the Rural Energy Services Company (RESCO), which was funded by French Energy Companies EDF (70%) and TOTAL (30%). The migrants pay 70% of the connection and the monthly fees for the clients in Mali. Between 1999 and 2005, RESCO provided electricity to 510 private households (10,200 people) in four communities and their public facilities (UNDP, 2007).

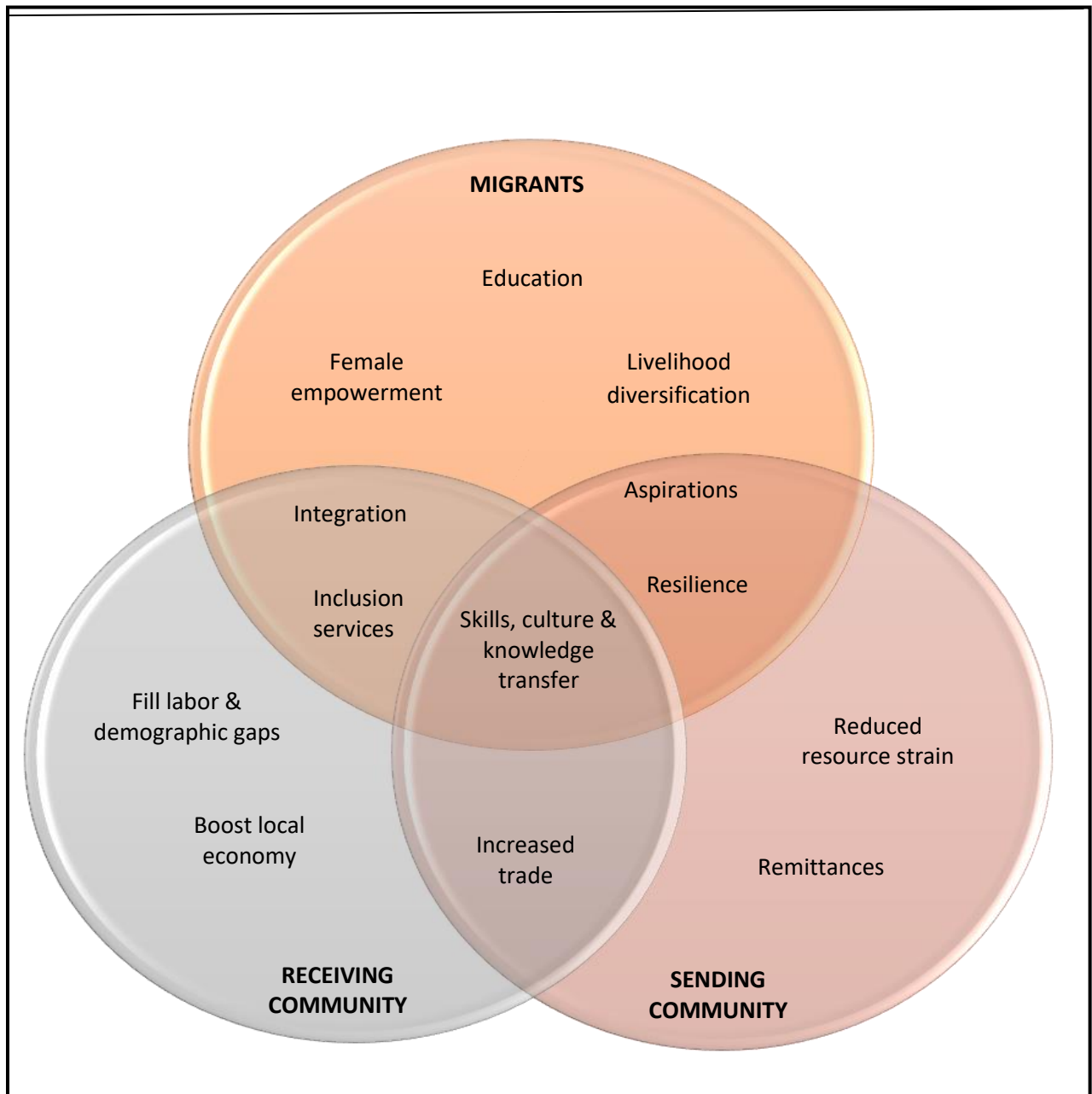
De Haan et al. (2000) demonstrated that in the face of climate change, despite local efforts towards adaptation and protection, communities may resort to migration as a reasonable adaptive response to seek opportunities elsewhere. Such a strategy involves sending individual members abroad before families are transferred, with the aim of diversifying income, developing knowledge, spreading risk, and gathering capacities to sustain a community. It also includes acquiring goods to insure against potential shocks and pressure. The result is a coping mechanism that mitigates population pressure, diminish the demand on limited resources, enables risk reduction, and enhances the probability of survival. However, this also signifies the deprivation of crucial workforce, earnings, assets, and expertise that are essential to support a community's livelihood and adaptive ability (Wiederkehr et al, 2018). When migrant movements occur rapidly, unexpectedly, and on a large scale, communities and governments may encounter significant obstacles that surpass their management capacities and incite discord. However, problems are easier to manage when migration is moderate and migrants are assimilated within the target region. To avoid disputes and assist in the relocation of

immigrants, institutions can establish relationships and advantages with host communities (Wiederkehr et al, 2018).

In numerous countries, there are active environmentally successful projects carried out by young professionals who have received training in the field. These individuals possess a comprehensive understanding of the socio-ecological conditions within their respective localities, and as a result, are adequately equipped to provide support to their communities. The application and transfer of technology serve to promote resource efficiency, the development of new natural resources and crop varieties, the provision of long-term energy solutions, and the management of disasters. Governance and institutions play a pivotal role in facilitating collaborative development and management of natural resources and agricultural systems, thereby contributing to the improvement of the quality of life of individuals (Wiederkehr et al., 2018). Developing countries have witnessed a significant increase in migrant remittances, which have emerged as a crucial source of revenue (World Bank, 2011). If these remittances are utilized for the preservation of natural capital or to safeguard against climate-related threats, it presents opportunities for both environmental and developmental progress.

Remittances, conversely, possess the capacity to exacerbate income disparity and exhibit partiality towards unassertive, unproductive factions that allocate this revenue stream towards consumption instead of investment, as asserted by Adger et al (2002) and De Haas (2006).

Figure 23: The benefits of migration as an adaptation strategy



Source: USAID, 2022

Although migration might be viewed as a chance for adaptability, there are still significant challenges for proactive initiatives. Migration, according to Kirmayer et al. (2015), can expose migrants to exploitation, trafficking, and a limited access to fundamental services. Furthermore, family separation, isolation, and discrimination can cause anguish and unfavorable mental health effects for migrants. Migration can also have a negative influence on sending communities and put a strain on receiving communities' resources. The development

community is likewise struggling to overcome impediments to supporting migration as an adaptation strategy.

Regrettably, as per Weiss (2013), owing to deficient urban planning, feeble administration, and inadequate resources and capacity, numerous municipal administrations are ill-equipped to fulfill the prerequisites of burgeoning migrant populations. Consequently, migrants in underserved urban areas frequently confront scarcities of services, food insecurity, and restricted employment prospects, as stated by Islam & Shamsuddoha (2017) and USAID (2021). In areas with limited institutional capacity and resources, tensions between migrants and receiving communities may emerge, as highlighted by FAO (2017). Such tensions may give rise to xenophobia and discrimination, as asserted by IOM & UN Habitat (2021), since migrants can impose additional pressure on infrastructure, services, and natural resources.

Migrants who relocate to cities are often confronted with restricted accommodations and are compelled to reside in unregulated settlements, which are susceptible to extreme heat, flooding, landslides, and sea-level rise, as noted by USAID in 2021. Migrants who establish themselves in urban and peri-urban areas that are vulnerable to climatic changes may evade potential hazards in their places of origin, but could potentially face supplementary hazards in their new destination. For instance, as stated by C40 & McKinsey in 2021, over 90% of metropolitan areas are located on the coast, placing vast populations in danger of the repercussions of sea-level rise.

Migrants who relocate to urban areas are often presented with limited housing alternatives, and consequently adopt the practice of residing in informal settlements that are at risk of being exposed to various hazards such as excessive heat, flooding, landslides, and sea-level rise (USAID, 2021). The aforementioned hazards are likely to be encountered by the migrants in climate-vulnerable urban and peri-urban regions, thereby negating the benefits of leaving their original communities. For example, more than 90 percent of urban areas are situated along coastlines, which places the residents at high risk of being affected by the adverse effects of sea-level rise (C40 & McKinsey Sustainability, 2021).

Migration has the potential to induce familial separation, dismantle social safety nets, and significantly modify the demographic makeup of sending communities, as noted by the World Food Programme (2017). In turn, depopulation may generate shortages in labor and skills, thereby negatively impacting the local economy, as elucidated by Vinke et al. (2020).

Migration from agricultural societies may give rise to workforce shortages during crucial planting and harvesting seasons, which can have a detrimental impact on food production (Sunam & Adhikari, 2016). In regions where migrants are predominantly male, their migration may lead to the feminization of communities (FAO, 2017).

While the granting of additional decision-making power to women can be beneficial (World Bank, 2019), it may also prove to be a daunting prospect for women who are compelled to undertake new responsibilities (WFP, 2017). In situations where more individuals depart, communities may encounter difficulties with maintaining their social harmony and customary livelihoods, which are integral to their cultural identities (Cascone et al., 2016).

In their statement, Chami et al. (2018) caution that despite the considerable benefits remittances offer to sending communities, they may also give rise to detrimental consequences, and certain economists have voiced concerns regarding a potential "remittance trap."

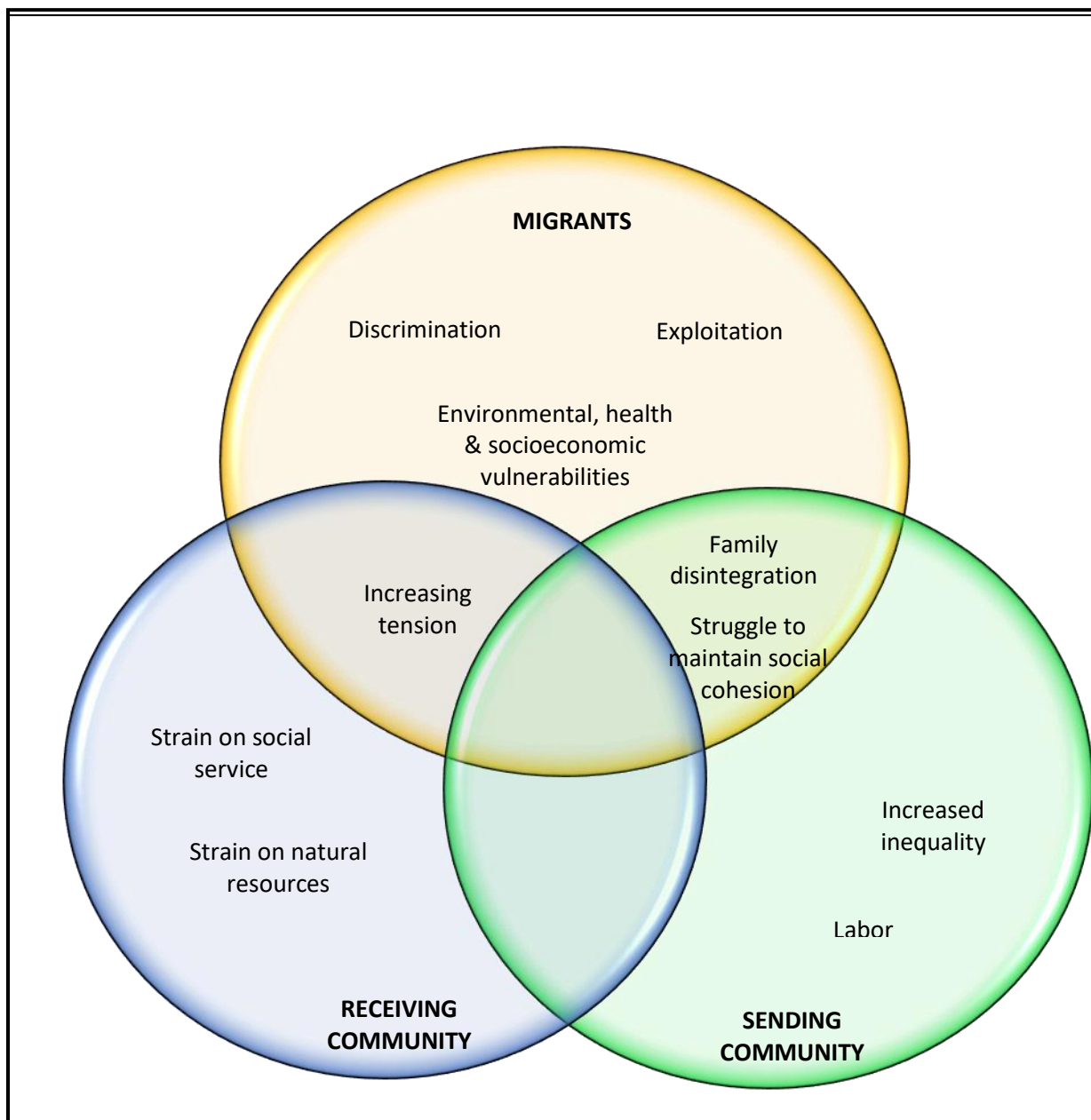
In the event that economies that send migrants become trapped in a "lower-growth, higher-migration treadmill," compounded by the loss of human capital and decreased incentives to work, such circumstances may arise. According to Carling et al. (2015), some contend that the arrival of remittances alleviates pressure on local governments to provide essential services to citizens, and this effect is exacerbated when migration deprives sending communities of the very voices necessary to advocate for improved services. Le De et al. (2015) raised concerns about the contribution of climate-related migration, specifically the gap between those in sending communities who receive and those who do not receive remittances.

Children whose parents migrate and get remittances may be more vulnerable to targeted violence (Government of Honduras, Sub-Secretariat of Security in Prevention, Secretariat of Security, 2019).

Throughout history, migration has often been perceived as an unsuccessful outcome of development initiatives, whereas reduced migration is considered a positive indication of program effectiveness (Ober, 2014; Bakewell, 2008). In the realm of development projects, efforts to dissuade migration are common by targeting specific geographical regions and populations (Tesfaye, 2021). When it comes to adaptation planning, migration is often disregarded and viewed primarily as a phenomenon to be prevented and discouraged in both National Adaptation Plans (NAPs) and National Determined Contributions (NDCs) (Chazalnoel & Mach, 2016). The political discourse surrounding migration frequently portrays it as a threat to physical and economic security.

Migrants are often subjected to censure for their alleged proclivity to appropriate job opportunities, exploit governmental financial assistance, and excessively consume resources. Additionally, concerns pertaining to security are often grounded in a fallacious conviction that migrants are predisposed to engage in criminal activities (Bogdan et al., 2021). Moreover, the notion that scarcity of resources may provoke discord between migrant and host communities is propagated through the discourse of securitization (Hartmann, 2010).

Figure 24: The challenges of migration as an adaptation strategy



Source: USAID, 2022

Conclusion

The phenomenon of climate change has the ability to erode the quality of life for individuals residing in various parts of the globe, potentially necessitating migration if conditions become intolerable. Conversely, migration represents an adaptive strategy that could mitigate the strain of climate hot spots and confer potential benefits.

The phenomenon of migration harbors the latent potential to enhance the aptitude and fortitude of individuals, households, and communities. Nonetheless, the ramifications of migration are contingent upon the efficacy of institutions, systems, policies, and programs in fulfilling the requirements of migrants and the communities of origin and destination. This encompasses the proficiency to proffer assistance to migrants and communities at pivotal junctures throughout the migrant trajectory.

Migration, as a strategy for adaptation, can serve to advance national and regional stability, diversify the economy, and afford secure and more productive migration imbued with dignity. Migration represents a strategy for adaptation that mitigates pressure whilst simultaneously presenting potential opportunities in areas affected by climate change. It is crucial to recognize, however, that migration is no panacea and may be detrimental (McLeman, 2009). The pursuit of alternative livelihoods via migration does not invariably yield a more secure way of life. It follows that, as exemplified by migration, autonomous adaptation cannot be regarded as a universal solution.

Policymakers should adopt a more proactive approach towards providing assistance to individuals who are experiencing difficulty in movement, particularly those who are 'stuck' (Black et al, 2011), in order to avoid maladaptive solutions. However, the manner in which these policies will be implemented remains unclear. Additional and alternative funding may be allocated towards initiatives such as education and information dissemination, thereby enabling migratory choice, as well as the creation of infrastructure for peri-urban and informal communities, which are likely to emerge. In summary, development organizations may be undervaluing the importance of migration as a significant and critical adaptation technique by neglecting to address it. Furthermore, they may also exacerbate power imbalances (Kates, 2000) and fail to provide adequate support to the most vulnerable members of society.

Migration is approved or rejected as an adaptation technique based on its benefits and drawbacks.

Most of the family in the study area do not consider migration as an adaptation strategy because of their culture and their attachment to the family. Even though some emigrants improve the life of their family in the departure zone, it is considered as a dislocation of the family. In Togo, migration policies are under implementation, and particularly, migration, seen as caused by environmental degradation or climate variability is not yet taken into account in the country policies.

CONCLUSION TO PART II

The analysis showed that the Savannah region is experiencing changes in climate parameters in addition to land cover and land use. It demonstrates that these changes are triggers of out-migration in the study area. The questionnaire administrated deals on one hand with the household head (i.e people that do not migrate) and on the other hand, with migrants. This part is about the causes of out-migration seen by the household heads and the migrants. Regression analysis is used to describe the relationship among variables. To show the relationship between the “decision to migrate” of respondents and the socioeconomic variables, a logistic linear binary is run with “decision to migrate” as dependent variable, and “marital status, gender, age, education level and occupation of the respondents” as independent variables. From the results, it can be noticed that “marital status” and decision to migrate are negatively linked and statistically significant. The “age” is positively related to migration decision, and this is statistically significant at 5%. The gender and decision to migrate are positively related and is statistically significant at 5%. The occupation of the respondent is positively related to the decision of migration but is not statistically significant at 5%.

To have more insight on how respondents perceive the triggers of out-migration, a cross tabulation was run separately between the independent variables and the dependent variables. The results depict clearly, the percentage of respondents that agree on a variable as a cause of out-migration.

To detect the adaptation characteristics of migration, reasons showing its advantages and benefits were highlighted. Nevertheless, migration present challenges if it is not well handled. Governments must include migration policies in their politics for benefits of proactive migration.

GENERAL CONCLUSION AND RECOMMENDATIONS

This study was carried out to provide a better understanding on population out-migration triggers in the communities of Savannah region, Togo, and how migration can be avoided or well managed as an adaptation strategy to socioeconomic and environmental changes. This section presents a summary of the key findings, the conclusions and recommendations regarding each specific objective.

☞ General conclusion

➤ **Research objective 1: Determine the trends in climate, land use and land cover change patterns in the Savannah region in Togo**

In general, there is rainfall-thermal variability from one year to another and from one station to another. Also, five wet months were noted, namely May, June, July, August and September, which constitute the essential months for the development of agriculture, the main activity of the populations of central and northern Togo. The spatial dynamics as well as the temporal evolution shows that the period from 1970 to 1990 is marked by a drought with a general decrease in precipitation in almost all the rainfall stations studied and the last one which begins from 1990 shows a recovery in precipitation over most of the study area.

Information from land cover analysis is always useful in identifying appropriate strategies to better manage the state of land use. The diagnoses reveal a regression of the plant cover coupled with the loss of both animal and plant biodiversity; physical and chemical degradation of soils leading to a reduction in their agronomic potential. In these reports, the causes of the regression are attributable to human action. The most frequent types of degradation are the following: water erosion, in particular sheet erosion; physical degradation or reduction in the thickness of the humus layer, destabilizing the structure of topsoil aggregates, compaction of this layer and crusting of the soil surface; chemical degradation or loss of nutrients for plants and acidification then biological degradation or decrease in organic matter content and biological activity in the soil. At the origin of these different types of degradation, the following causes can be identified, all of which are linked to human activities: unsuitable agricultural practices (shortening of fallow time, continuous cultivation without amendments, no anti-erosion measures, etc.); deforestation and deforestation; overexploitation of vegetation for domestic uses; late and uncontrolled bush fires; overgrazing; commercial and industrial activities.

➤ **Research objective 2: Identify the socioeconomic of migration dynamics in the Savannah region of Togo.**

Even though the study shows that climatic and environmental conditions have indeed effects on human mobility still, human mobility is traditionally a part of the culture and everyday life in the study area. It appears that the Savannah Region is a real basin of emigration of populations to the outside of Togo, generating significant socioeconomic benefits in the region. By being part of a prospective logic intended to analyze the socioeconomic implications generated by the emigration of populations, the study has made it possible to understand that the movements of populations are one of the solutions to the economic difficulties due in part to the economic crisis. Thus, the economic crisis to which is added the degradation of the natural environment and the dynamism of the human environment have drained a large part of the populations of the Savannah Region to the outside of Togo in search of better living conditions. The age of the respondents has more effect on the decision to migrate, followed by the occupation of the respondent, his education level. The gender of the respondent and his marital status have less effect on his decision to migrate. For the causes leading to the populations departure, earning more gain is the main factor causing the out-migration in the Savannah Region, followed by low income and lack of job. The family problems and the age of emigrants are the secondary causes of emigration in the study area.

➤ **Research objective 3: Determine the role of environmental factors in migration dynamics in the Savannah region of Togo**

The analysis of the various parameters of the natural environment of the Savannah Region presents constraints to agricultural development, the climate marked by rising temperatures and the declining rainfall regime. This is a limiting factor in agricultural production. Added to these climatic factors is the regressive dynamics of the plant cover. These bioclimatic factors hinder the development of cereal crops, especially maize, millet and sorghum leading to low yields. These low yields generate low incomes and as a result, the economic vulnerability of the populations becomes more and more increasing and the latter find in emigration one of the means of survival. Emigration in the Savannah Region is essentially characterized by population movements to African countries. The research results suggest that the emigration of the Savannah Region populations is mainly oriented towards the West African countries. Most go to Nigeria, Ghana, Côte d'Ivoire, Burkina and Benin as favored countries in the sub-region. At the level of Western countries, Europe remains the large basin that welcomes these emigrants. It is followed by America. The migrant population is characterized by predominantly

married male emigration. The emergence of an increasingly young population with a relatively low level of education is essential. Surely the sectors of activity in the host countries are characterized by sectors requiring less qualification. Service activities are dominant. The basis of this emigration of the Savannah Region populations finds its explanation through socioeconomic motives, in particular a low income added to a recurrent drought which does not facilitate agricultural activities since water availability and management becomes difficult or even impossible. From the analyzes of the various environmental factors impacting the decision to migrate of the respondents, land degradation ranks first, followed respectively by increase in temperature and decrease in rainfall. The increase in drought trend affect less the decision to migrate. Regarding the environmental drivers that cause emigration on the study area, in first place comes drought, respectively followed by decrease in land productivity and climate harshness. Then come degradation of environment and flood.

➤ **Research objective 4: Analyze emigration as adaptation strategy to unfavorable conditions in the Savannah Region and propose the sustainable strategies for migration management.**

The remittances and achievements of emigrants contribute to the improvement of the living conditions of the populations of their localities of origin. Remittances made by migrants are an essential source of foreign currency for the Savannah Region in Togo. According to surveys, emigrants contribute to the socioeconomic development of their grassroots communities through remittances to their families. Whether sent to preserve social unity in the home community, funds flow from a migrant to their family. Remittances have a priori an impact at the microeconomic level, in the recipient family and those around it. The transfers allow families who benefit from them to increase their consumption of goods and services produced locally or imported, to save and invest more or less productively. We observe that the majority of transfers are consumed. They make it possible to meet daily needs but also health, education and other expenses. Migrants also build more or less modern houses in their departure area, giving a civilized aspect to towns or villages. The emigration of populations is struggling to become a real source of foreign currency for the socioeconomic development of the countries of origin of immigrants. In addition to these structural problems, there are sociological problems, in particular the problems of spiritual attacks on emigrants, cultural uprooting, the crisis of confidence of emigrants vis-à-vis their families, conflicts of interest, internal quarrels between the different communities of origin and the exacerbated degradation of the

communication routes serving the different localities in the western part of the Savannah Region.

The study showed that Togo does not yet have a well-made migration management policy, especially when it comes to migration linked to the effects of climate change. It is difficult to implicate emigration solely to the effects and impacts of climate variability, but for activities that are exposed to the effects of climate change such as agriculture, adaptation strategies must be put in place to force the arms able to benefit from this activity. In view of the constraints linked to local development and the various challenges to be met, an awareness and manifest will of all the actors involved in the management of the emigration of populations to the outside of Togo is necessary. A more sustained mobilization of emigrants is important to make them one of the sources of socioeconomic development of the western part of the Savannah Region and of all of Togo, in general.

This study aimed to depict the causes of out-migration in the Savannah region of Togo. It also enabled to analyze an out-migration as a perfect adaptation strategy to socioeconomic and environmental changes. Lastly, the migration policy in Togo was assessed to identify gaps and how to solve them.

The first part of this thesis presents the fundamentals of this research. Initially, the conceptual bases of the research were presented through the problem, the justification of the subject, the objectives and the hypotheses of the research then a methodological approach. This methodology focused on statistical techniques in order to identify the climatic variability of northern Togo. To identify the drivers of out-migration, a regression was run, and a cross tabulation was drawn to get the real appreciation of respondents on the triggers of out-migration.

Regarding the climate variability, a change is noticed in temperature and rainfall patterns. The trend in temperature is increasing both at Dapaong and Mango weather stations. For the rainfall, a slight increase is noted in Dapaong, while, at Mango, there is a decrease. Over the study period, an annual sequence of dry period and wet period was noted. But the dry periods predominate over the wet periods, affirming the Sahelian character of the study area.

Emigration as an adaptation strategy is not unanimous. Even if we are aware of the advantages of emigration, it also has disadvantages that should not be overlooked.

Recommendations for stakeholders

For better management of human mobility improvement in the context of climate and other environmental changes in Togo, prescriptive measures can be extrapolated to advance the resolution of the predicaments linked to mobility induced by climate change.

➤ The linkages between climate change and human mobility still need to be better understood in the region.

The acknowledgment of migration, displacement and planned relocation as consequences of climate change should be accompanied by a coherent set of domestic policies and legal frameworks that have clear definitions, dispositions, and well-established responsibilities to safeguard the human rights of vulnerable populations. A comprehensive national legal framework is needed, which should encompass specific guidelines regarding the management of various forms of mobility, as well as mechanisms for interaction between institutions and policies. The implementation of efficient global governance arrangements such as the UNFCCC's Task Force on Displacement can enable national responses. Although the TFD's agenda needs to give stronger acknowledgement to the interconnectedness between human mobility and slow onset phenomena, as well as non-economic losses and damages (see Serdeczny, 2017), the implementation of its subsequent phase and corresponding Plan of Action (since April 2019) holds great potential to address this issue in a critical manner.

➤ It is critical that national environmental plans also address slow-onset processes and other dimensions of human mobility, rather than just focus on extreme events and displacement.

Slow-occurring phenomena possess the capability to accentuate the impact of other catalysts that instigate calamity and friction. This implies that they can culminate in a catastrophe, propelled by an abrupt event, which heightens the susceptibility of societies and ecosystems to the effects of climate change. Furthermore, this may result in a sequence of perils, frequently compelling populations to relocate involuntarily.

➤ The impacts of climate change need to be better understood to encompass broader socio-environmental impacts.

Climate-risk assessments ought to be founded on the consultation and participation of affected individuals to enhance the resilience of communities. Appropriate policy responses should entail measures that are collaboratively developed and encompass diverse perceptions of risk

as a means to forestall maladaptation processes and promote movements that facilitate improved adaptation to the effects of climate change. Additionally, policies should address migration, displacement, and planned relocation when and where it emerges. In light of the challenges presented by the COVID-19 pandemic, it is particularly relevant to concentrate on diminishing or avoiding unsafe and irregular migration processes. In this context, an impending economic crisis may also have ramifications on government initiatives and investments aimed at protecting people from climate risks and impacts. This, in turn, may exacerbate pre-existing vulnerabilities, diminish resilience and adaptation capacity, and consequently increase the risk of population movements.

➤ **Establishing a strong knowledge base for data collection, management and dissemination is key for preparedness measures and the comprehensive management of (forced) mobility patterns.** Gaps in existing data on the topic hamper proactive response measures and effective decision-making.

☞ **Recommendations for local communities.**

The local communities must fight against the climate change effects and impacts by having a good behaviors. They must stop cutting trees anyhow; they have to educate their children in trees planting; they must implement a sustainable source of energy for cooking in order to reduce drastically the use of firewood and charcoal.

Before the intervention of the government, they can start building small reservoirs by relying on the diaspora.

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ANNEXE 1: QUESTIONNAIRES

MIGRATION DYNAMICS IN THE SAVANNAH REGION, TOGO: THE ROLE OF SOCIOECONOMIC, POLITICAL AND ENVIRONMENTAL FACTORS

This study aims at assessing the role of socioeconomic, political, and environmental factors in migration dynamics, considering the Savannah region of Togo as a case study. It is part of the requirements for the award of Doctorate in Climate Change and Disaster Risk management at the Université de Lomé, Togo. Information obtained through this study is purely meant for academic purpose. You are assured of the confidential treatment of the valuable information provided.

Thank You.

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IDENTIFICATION

Name of the community: **Interviewer's Name:**

Have you or any member of your household migrated	1. In the past 6 months?	1. Yes[]	0. No[]	EXPMIG
	2. In the past 1 year?			
	3. In the past 2 years?			
Note: if No=0, end the interview If Yes=1, continue				
Last name: Surname:				
Respondent (HH head=1; Adult HH member=2)		1. []	2. []	RESPOND
Sex		F []	M []	SEX
Date of interview				DINT

SECTION 1: Socio-economic and demographic characteristics of interviewee

1	How old are you? (in completed years)		AGE
2	How many of your household members have migrated within the past	1. Six months..... members-women/girls []; men/boys [] 2. One year.....members- women/girls []; men/boys [] 3. Two years.....members- women/girls []; men/boys []	NUMMIG

INSTRUCTION: IF MORE THAN FOUR MEMBERS IN 2, LIST THE MOST RECENT CASE IN 3.....

3	No	Name (in capital)	R' ship to resp. (refer to **)	Sex (M/F)	Age	Occupation (refer to ***)
3a	Person 1					
3b	Person 2					
3c	Person 3					
3d	Person 4					

**** Self=1; Relative= 2; husband=3; wife=4; friend=5; other (specify) =6**

***** Subsistence farmer=1; Large scale farmer=2; Farmer too old to work=3; retired salary worker=4; Trader=5; Artisan=6; Retired worker=7**

4	What is your educational level?	1. None..... [] 2. Primary..... [] 3. Secondary..... [] 4. High school..... [] 5-University[]	EDUC
5	What is your marital status?	1. Married [] 2. Never married..... [] 3. Divorced..... [] 4. Widowed..... []	MARSTU

		5. Separated..... [] 9. Other (specify).....	
6	What is your occupation?	1. Subsistence farmer..... [] 2. Large scale farmer..... [] 3. Trader..... [] 4. Salaried worker..... [] 5. Artisan (specify)..... [] 9. Other (specify).....	OCCUP
7	How many people live in this household (eat in the same pot)	Number of people.....[]	HHSIZE
8	Do you own a farmland?	1. Yes [] 0. No []	
9	If Yes in 8, how many hectares?	1. <1ha..... [] 2. 1ha..... [] 3. 3ha..... [] 4. >3ha..... [] 9. Other (specify).....	

SECTION 2: Decision of the interviewee to migrate

10	Do you want to migrate?	1. Yes..... [] 0. No..... []	
11	If Yes in 10, give reasons that push you to depart from the area	1. Jobless..... [] 2. Decrease of land productivity..... [] 3. Family problems..... [] 4. climate rudeness..... [] 5. Unlivable environment..... [] 9. Other (specify)	

			
12	If No in 10, give reasons that encourage you to stay in the area	1.Aged..... [] 2.Can't leave my family..... [] 3.Attached to my culture..... [] 4.Financial stability..... [] 5.Activities are flourishing..... [] 6.Climate and environment are favorable....[] 9.Other (specify).....	

SECTION 3: Household baseline survey

13-State of housing (observe)

13a	Does the household have a modern design?	1. Yes..... [] 0. No..... []	MODESIGN
13b	Which type of materials are used for the buildings (walls and roofs) the rooms?	1.Clay roof with zinc..... [] 2.Clay roof with straw..... [] 3.Clay plastered with cement..... [] 4.Clay with cement foundation..... [] 5.Brick roof with zinc..... [] 6.Slab house..... [] 9.Other (specify)	

14-Household goods and assets

Does any member of your household own the following items (functioning?) (Code 00 if No, 1 if Yes)

Item	Yes / No	If yes, how many?	
------	----------	-------------------	--

14.1-Motor vehicle (cars, tractor, motor bike)			MOTVEH
14.2-bicycles			BICYCLE
14.3-TV			TV
14.4-Radio			RADIO

SECTION 4: Socio-economic and demographic characteristics of the migrants

15	What is his educational level?	1. None..... [] 2. Primary..... [] 3. Secondary..... [] 4. High school [] 5.University []		EDUC
16	What is his marital status?	1. Married [] 2. Never married..... [] 3. Divorced..... [] 4. Widowed..... [] 5. Separated..... [] 9. Other (please specify).....		MARSTU
17	Does he own a farmland?	1. Yes []	0.No []	OWNFARM
18	If Yes in 17, how many hectares?	1-<1ha.....[] 2-1ha.....[] 3-3ha.....[] 4->3ha.....[] 9-Other (specify).....		
19	Are you in contact with the migrants?	1. Yes []	0.No []	
20	If Yes in 19, is it possible to have his address?	1. Yes []	0.No []	

21	If Yes in 19, how many?	1-Often.....[] 2-Not often.....[] 3-Rarely.....[]	
22	Does he own any of the following items (functioning?) (Code 1 if Yes; 0 if No)	1-Motor vehicle (cars, tractor, motor bike).....[] 2-Bicycles.....[] 3-TV.....[] 4-Radio.....[]	

SECTION 5a: Perception of climate change

23	How many rainy seasons and dry seasons do you experience in your area?	1.Two (2) rainy seasons and 2 dry seasons..... [] 2.One rainy season and 1 dry season..... [] 9.Other (specify).....
24	Have there been any changes in the rainfall distribution in the last 10 to 15 years?	1.Yes [] 0.No []
25	If Yes (1), what is the nature of the change?	3.Increase in rainfall.....[] 4.Decrease in rainfall.....[] 5.Fluctuation in rainfall distribution.....[] 9.Other (specify).....
26	If the trend is the increase of rainfall, how long does the rainy season last?	1.< 6 months (specify)..... 2.6 months [] 3.7 months [] 4. >7 months (specify).....
27	If the trend is the decrease of raining season, how long does the dry season last?	1.< 6 months (specify)..... 2.6 months [] 3.7 months [] 4. >7 months (specify).....
28	Have there been any change in temperature in the last 10 to 15 years?	1.Yes [] 0.No []
29	If Yes (1) Which of the nature of the change?	1.Higher temperature..... []

		2.Lower temperature..... [] 9.Other (specify).....
30	Have there been any change in the length of the rainy season?	1.Yes [] 0.No []
31	If Yes (1) in 30, what is the nature of the change?	1.Increase in length of raining season [] 2.Decrease in length of raining season [] 3.Irregular rainfall distribution []
32	If (3) in 31, what is the irregularity of the rainfall distribution?	1.Early onset, late cessation [] 2.Early onset, early cessation [] 3.Late onset, late cessation [] 4.Late onset, early cessation []
33	What is the daily occurrence of the rains?	1.Continuous [] 2.Intermittent []
34	In case of intermittent rain, what is the average duration of rain in the day?	1.An hour [] 2.More than an hour (specify how long).....
35	What can explain this change according to you?	1.Natural causes..... [] 2.Human causes (deforestation)..... [] 3.Both (1&2)..... [] 4.I don't know..... [] 9. Other (specify).....

SECTION 5b: Climate change impacts/consequences

36	What are the hazards occurring in the village?	1.Flood [] 2.Storm (Strong wind) [] 3.Bush fire [] 4.Drought [] 5.Heat waves [] 9.Other(specify).....
37	What has been the trend of floods in your community over the past 10-15 years	1.Increasing 2.Decreasing 3.No change
38	What has been the trend of drought in your community over the past 10-15 years	1.Increasing 2.Decreasing 3.No change

39	What is the frequency of the hazard?	1.More frequent [] 2.Less frequent 3.No change [] 4.Don't know []
40	Does these hazards affect your activities?	1.Yes [] 0.No [] (If No go to 43)
41	If yes , how?	1.Income increase [] 2.Income decrease [] 3.Changing activity [] 9. Other (specify).....
42	What make(s) you vulnerable to climate change?	1.Land degradation [] 2.Poverty [] 3.Rain-fed agriculture [] 4.Single source of livelihood [] 9. Other (specify).....

SECTION 5c: Adaptation to climate change

43	What are the adaptation strategies related to drought?	1.Water harvest [] 2.Mulching [] 3.Drought resistant varieties [] 4.Agroforestry [] 5.Drip irrigation [] 6.Not applicable [] 9. Other (specify).....
44	What are the adaptation strategies related to flood?	1.Stone-line [] 2.Sand bag 3.Levee/Embankment [] 4.Drainage channel[] 5.Reservoir [] 6.Not applicable 9. Other (specify).....
45	What are the adaptation strategies related to windstorm (strong wind)?	1.The use of windbreak [] 2.Strengthening the roof-top [] 9. Other (specify).....
46	What are the adaptation strategies related to bush fire?	1.Fire belt [] 2.Respect to law []

		3.Early warning system [] 9. Other (specify).....
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SECTION 6: Drivers of migration

47	Which of these factors do you think can lead to migration?	1.Exposure to drought [] 2.Decrease of land productivity [] 3.Food insecurity [] 4.Water shortage [] 5.Family problems [] 6.Seeking education [] 7.Unemployment [] 8.Decrease of income [] 9.Decrease of producer prices (farmers) [] 10.Tribal conflicts [] 11.Political insecurity [] 12.Power in hands of elders []
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SECTION 7: Migration as adaptation strategy

48	Do you think Migration is an adaptation strategy to environmental change	1.Yes [] 0.No [] 3.Do not know
49	If yes (1) in 48, give reasons that push you to say so	1.Migrants send money to home..... [] 2.Migrants live change when they are back... [] 3.Migrants come back with a better life..... [] 4.Migrants do great things at home..... []

ANNEXE 2: FOCUS GROUP DISCUSSION

I-IDENTIFICATION

Region		
District		
Sub-District		
Number of participants	Male	Female
Date of discussion realisation		
Starting hour	_____ H	_____ mn
Ending hour	_____ H	_____ mn
Language used in discussion		

II-INTRODUCTION

Hello, be the welcome (s) in this focus group. My name is _____.
 My colleague here with me is called _____. I'm a student who wants to know more about migration in your area. Thank you for agreeing to participate in this meeting despite your many duties.

We will discuss about migration, its causes and impacts. You are invited to discuss freely, but one after another. There is no right or wrong answers, all answers are welcome. The information you provide is very important. That's why we ask you to answer honestly and truthfully to questions. During the discussion, my colleague will try to take notes. You will be designated by the numbers in front of you in the allocation of speech.

Because he cannot log everything and as we do not want to lose any of your ideas, we would like to record our discussion with your permission. I want you to know that anything said will remain confidential and will be treated anonymously.

THEMES	QUESTIONS	RESPONSES
1. Historical aspect of migration in the locality	1.1. What are the demographic challenges you suffer from in your locality?	
	1.2. Rank them from the most severe to the least	
	1.3. Ask for the causes of the first 3 demographic challenges.	
	1.4. Do you think migration is a major one? Why?	
	1.5. What has been the trend of population migration cases over the past 10 to 15 years in your community?	

	1.6. Which group or category of people are mostly affected by migration?	
2. Causes and consequences of migration	2.1. What are the causes of migration?	
	2.2. What is the effect of environmental degradation on migration?	
	2.3. What are the negative consequences of migration on your households?	
	2.4. What are the positive consequences of migration on your households?	
	2.5. Do you think that migration is beneficial?	
	2.6. Can you advise your children or other young men to migrate?	
3. Climate and migration	3.1. Is there any link between migration and climatic seasons?	
	3.2. In which season do you notice young people migration?	
	3.3. In which months do you suffer more from malaria episode?	
	3.4. What is the link between climate change and migration?	
	3.5. When do you notice more youth migration: during floods or droughts.	
	3.6. What are the reasons behind this departure of young men during the occurrence of the hazard?	

4. Perception on climate change	4.1. Have you ever heard of “climate change”?	
	4.2. What is your perception about climate change?	
	4.3. How is it manifested in your locality?	
	4.4. Do you notice any change in the seasons in your area?	
	4.5. Is there an extension of dry season?	
	4.6. Do you notice any change in the rainfall distribution?	
	4.7 What are the causes of climate change according to you?	
5.Climate change and farming activities	5.1. Does the climate change affect your farming activities? How?	
	5.2. Does the climate change affect your income? How?	

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