THE IMPLICATIONS OF CLIMATE CHANGE FOR FOOD SECURITY IN BURKINA FASO: LOCAL RESPONSES TO GLOBAL CHALLENGES

BY
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LEGON          JULY 2013
Declaration

I, Anna Soper, hereby declare that this dissertation, of which no part has been submitted anywhere else for any other purpose, except for where duly acknowledged, is the result of original work conducted by me under the supervision of Prof. Emeritus E. Laing.

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Prof. Emeritus E. Laing
(Supervisor)

Date

Date
Dedication

This work is dedicated to everyone who is making a difference in the world.
Acknowledgements

To my newest friends in Burkina Faso - thank you for your hospitality and helpfulness. Without you I could never have completed this work.

To the “Valco Alliance” – you have made this year incredibly fun. Thanks for accepting me as one of your own.

To my friends and family in Canada – your support during the last year has been immeasurable. Thanks for the constant encouragement and interest in my work.

To my Rotary family in Canada & Ghana – thanks for believing in me and supporting me through this journey.

Finally, to my supervisor, Prof. Emeritus E. Laing - for taking the time to read through my drafts and providing corrective feedback which has enriched this work.
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<tr>
<td>CGIAR</td>
<td>Consultative Group on International Agricultural Research</td>
</tr>
<tr>
<td>CILSS</td>
<td>Comité Permanent Inter-Etats de Lutte contre la Sécheresse au Sahel</td>
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<td>CORESA</td>
<td>West African Food Security Council</td>
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<tr>
<td>CSIRO</td>
<td>The Commonwealth Scientific and Industrial Research Organization</td>
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<tr>
<td>ECOWAS</td>
<td>Economic Community of West African States</td>
</tr>
<tr>
<td>EIU</td>
<td>The Economist Intelligence Unit</td>
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<tr>
<td>EPA</td>
<td>United States Environmental Protection Agency</td>
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<tr>
<td>FAO</td>
<td>Food and Agriculture Organization of the United Nations</td>
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<td>FEWS NET</td>
<td>Famine Early Warning Systems Network</td>
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<tr>
<td>GDP</td>
<td>Gross Domestic Product</td>
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<tr>
<td>GIAHS</td>
<td>Globally Important Agricultural Heritage Systems</td>
</tr>
<tr>
<td>GMO(s)</td>
<td>Genetically Modified Organism(s)</td>
</tr>
<tr>
<td>GofBF</td>
<td>Government of Burkina Faso</td>
</tr>
<tr>
<td>HDI</td>
<td>Human Development Index</td>
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<tr>
<td>ICRAF</td>
<td>World Agroforestry Centre</td>
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<td>IFAD</td>
<td>International Fund for Agricultural Development</td>
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<td>IFPRI</td>
<td>International Food Policy Research Institute</td>
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<td>IO(s)</td>
<td>International Organization(s)</td>
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<td>IPCC</td>
<td>International Panel on Climate Change</td>
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<tr>
<td>IUCN</td>
<td>International Union for Conservation of Nature and Natural Resources</td>
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<tr>
<td>IRIN</td>
<td>Integrated Regional Information Networks</td>
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<tr>
<td>LDC(s)</td>
<td>Least Developed Country(s)</td>
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<td>MDG(s)</td>
<td>Millennium Development Goal(s)</td>
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<td>Acronym</td>
<td>Full Form</td>
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<tr>
<td>MECV</td>
<td>Ministere de l’Environnement et de Cadre de Die</td>
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<tr>
<td>NAPA</td>
<td>National Adaptation Programme of Actions</td>
</tr>
<tr>
<td>NASA</td>
<td>National Aeronautics &amp; Space Administration</td>
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<tr>
<td>NGO(s)</td>
<td>Non-Governmental Organization(s)</td>
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<tr>
<td>PRESAO</td>
<td>Programme de Renforcement et de Recherche sur la Sécurité Alimentaire en Afrique de l’Ouest</td>
</tr>
<tr>
<td>PRSP</td>
<td>Poverty Reduction Strategy Paper</td>
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<tr>
<td>UNDP</td>
<td>United Nations Development Programme</td>
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<tr>
<td>UEMOA</td>
<td>Union Economique et Monetaire de l’Ouest Africaine</td>
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<td>UNEP</td>
<td>United Nations Environment Programme</td>
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<td>United Nations Framework Convention on Climate Change</td>
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<td>UNICEF</td>
<td>United Nations Children Fund</td>
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<td>UNSD</td>
<td>United Nations Statistics Division</td>
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<td>USAID</td>
<td>United States Agency for International Development</td>
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<td>USGS</td>
<td>United States Geological Survey</td>
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<tr>
<td>WMO</td>
<td>World Meteorological Organization</td>
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<td>WFP</td>
<td>World Food Programme</td>
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Abstract

Climate change is a growing challenge for many countries around the world, particularly those whose livelihoods are highly dependent on favourable climate conditions. Those who depend on agriculture, both for consumption needs and as a source of income, are among the most vulnerable to climate change due to the inherent link between agricultural productivity and climate. This research examines the challenges of climate change and food security in Burkina Faso, a country in which rain-fed agriculture is vital for food security, and will remain so in the coming years. As such, adapting agriculture to suit the current conditions of climate change is a necessity for ensuring food security. To ensure the suitability and sustainability of adaptation measures, it is important to consider both scientific and local knowledge of climate change and climate adaptation. In this regard, interviews were conducted with farmers and households within Ouagadougou (the capital city) and its surrounding areas in June 2013 to gain a better appreciation of the situation on the ground. The research determined that in Burkina Faso, locally derived coping mechanisms are abound; however, the current rate of climate change and the need for agricultural adaptation require solutions that build on existing practices and incorporate new practices. By implementing effective measures at the local and national levels, food security and, therefore, human security can be strengthened for building a peaceful and prosperous region within Africa.

Key words: climate change, adaptation, Burkina Faso, agriculture, food security, local knowledge.
Chapter One

RESEARCH DESIGN

1.1 Introduction

The right to adequate food has been recognized as a human right since the creation of the Universal Declaration of Human Rights,\(^1\) which, in Article 25, recognizes food as a necessity for adequate health and well-being. Since 1948, the right to food has been further elaborated in various international and regional agreements, as well as in the legal systems of individual states. However, changes in the environment that have intensified over the last few decades have made ensuring this right more and more difficult. As such, food security has become a progressively relevant topic.

Since the World Food Conference, held in Rome in 1974, food security has been an increasingly important topic in the international development debate. International agreements, such as the MDGs, have made the alleviation of hunger and malnutrition top priorities for governments and NGOs from both developed and developing countries.

Unfortunately, the increased occurrence of climate changes have undermined local and international efforts towards alleviating poverty and hunger and improving food security. Most notably, climate changes like erratic rainfall patterns, warmer and cooler temperatures, water scarcity and desertification, among others, have negatively impacted food availability, access and utilization.\(^2\) This, therefore, threatens the stability of food systems. As such, hunger crises have been on the rise around the globe, translating into increased poverty and rampant food insecurity.

In Burkina Faso, climate change has put approximately 2 million people, or 15% of the population, at an increased risk of food insecurity.\(^3\) Earlier in 2013, the Global Food Security Index ranked Burkina Faso as 92 out of 107 countries studied in terms of food insecurity, attributing this weak status agricultural infrastructure, among other factors.\(^4\) As
explained by UNEP, “even small changes in precipitation and water availability could have a devastating effect on agricultural output and therefore on food security.” With lower harvest yields, the country’s traditional crops, which already do not fully support the population’s needs, are stretched to the limits, further worsening the situation. The resulting food insecurity challenge requires localized solutions, coupled with scientific knowledge and supportive government interventions, to cope with climate change and its impact on those living in Burkina Faso.

1.2 Problem Statement

The global food system is at risk due to climate changes which impact the availability, access and utilization of food. In Burkina Faso, climate changes have escalated, resulting in increased food prices and food unavailability for large portions of the population. Local solutions to climate change, such as irrigation techniques, exist from Burkinabé farmers and from various places in the world, many of which could be adapted to lessen the food security situation in Burkina Faso. However, a lack of coordination between governments and individuals, both locally and internationally, has not improved the situation and has, at times, made matters worse. Despite national and international efforts to address climate change and its effects on food security, food security remains a challenge in Burkina Faso. National efforts to address the food security challenge have been undertaken in Burkina Faso; however, locally devised and locally suited responses have not been sufficiently supported at the national level, which poses a significant threat to the sustainability of food security efforts at both the household and national levels.

1 Burkinabé is the demonym describing individuals originating from Burkina Faso
1.3 Research Objectives

The main objectives of this research are:

1. To explain why changes in the environment have hindered Burkina Faso’s food security;
2. To examine the local reactions to climate change and food insecurity in Burkina Faso;
3. To explore how public-private partnerships can improve food security in Burkina Faso; and,
4. To explore solutions to climate changes that have improved food security in other regions of the world that may be adapted to improve the situation in Burkina Faso.

1.4 Scope

The study will focus on the climate changes that have manifested in Burkina Faso and how these changes have contributed to the increasing food security challenge experienced by the population. In addition, it will look at the local responses that have been implemented in Burkina Faso, as well as other possible solutions, adapted from other regions of the world, for combatting food insecurity.

1.5 Rationale

Climate changes are both longstanding and inevitable. However, the current rate of climate change has increased dramatically, impacting all regions of the world. As such, it is essential that solutions are drawn to adapt to and to help mitigate some of the effects of climate change on food security to help ensure that all individuals are able to enjoy the human right to food.

Recognizing that a coordination of efforts between governments and the private sector will likely lead to effective and sustainable solutions, this research will propose strategies for coordination of efforts that have too often been ignored in previous reports and research into the topic area. As a result, this research hopes to provide NGOs and governments with a new
approach for bridging the gap between public and private interventions for long-lasting and viable improvements into the livelihoods of those in the Sahel.

1.6 Conceptual Framework

For this research, a human security approach is taken to explain the essence of the food security challenge and the importance of finding immediate solutions to curb the implications of climate change for food security. According to the Commission on Human Security, human security means:

protect[ing] the vital core of all human lives in ways that enhance human freedoms and human fulfillment. Human security means protecting fundamental freedoms – freedoms that are the essence of life. It means protecting people from critical (severe) and pervasive (widespread) threats and situations. It means processes that build on people’s strengths and aspirations. It means creating political, social, environmental, economic, military and cultural systems that together give people the building blocks of survival, livelihood and dignity.  

Moving away from the traditional state-centric approach to security, in which military means were used to protect borders and individuals, the human security approach puts individuals at the fore-front and seeks to protect them from both violent and non-violent threats. As such, “state security becomes a direct reflection on the perception of the security of the state’s citizens.”

The human security approach is multi-dimensional in that it is people-centered, emphasizing inclusivity and participation, and multi-sectoral in the sense that it recognizes that insecurity may manifest from “economic, food, health, environmental,” and other changes or challenges. “Moreover, human security emphasizes the interconnectedness of both threats and responses when addressing these insecurities.” Therefore, human security stresses the need for comprehensive solutions that “bring together the agendas of those dealing with security, development and human rights.” Furthermore, the concept of human security
security is prevention oriented, seeking to address the root causes of insecurity and providing protection and empowerment.\textsuperscript{11}

The human security approach, which emphasizes people-centered action, helps to ensure that strategies developed and implemented take local conditions into consideration and “promote an enabling environment where individuals and communities can be free from hunger.”\textsuperscript{12} As such, solutions to food insecurity as a result of climate change should be locally reflective and include the participation of the affected individuals and communities. At the same time, solutions should be supported by government, though the primary beneficiaries should be individuals. To address climate change and food security in a sustainable way, the human security approach helps to ensure that preventative strategies are equally utilized to “reduce risks, to address chronic vulnerabilities…and to strengthen community resilience,” thereby ensuring that food security goes beyond immediate relief.\textsuperscript{13}

Food insecurity leads to human insecurity and, therefore, state and international insecurity. This view has been expounded by the international community for years, and in 2011 the Secretary General of the UN declared “climate change not only exacerbates threats to peace and security, it \textit{is} a threat to international peace and security” (emphasis added).\textsuperscript{14} Hunger, for instance, is argued to be a greater threat to human life than deprivation of land or lack of political voice.\textsuperscript{15} Put in other words, threats to human well-being (i.e.: political participation, education, etc.) become immaterial when immediate human harm, such as that from hunger, is imminent. With roughly 1 billion people food insecure and many more living in poverty, the risk of price hikes for food supplies is a potential threat to individuals and their states. This has manifested in protests, riots and violence in several countries, such as Haiti and Madagascar, following food price hikes in 2007 and 2008.\textsuperscript{16} Governments and elites, seen to be protectors or agents for improving the living conditions of citizens, are threatened when people face constant hunger and food insecurity. This may also reduce
political legitimacy and states’ security. As such, ensuring food security is about more than just ensuring that people are no longer hungry. It is about creating the conditions necessary for a secure and prosperous state in which citizens are healthy enough and willing to work for the development of the state.

1.7 Literature Review

It is well noted in the literature that Africa is the continent that is most susceptible to the detriments of climate change.\textsuperscript{17} Climate changes can have a serious impact on key sectors, like agriculture and energy production. Agriculture is highly dependent on the climate, and individuals in Africa are highly dependent on agriculture. Most African countries derive large percentages of their GDP from agriculture, and the livelihoods of many rely on agriculture, as well. As such, changes in the climate have a direct link to the strains on the agricultural sectors of African countries. Because poverty remains high in Africa, it is difficult for individuals and countries to respond to changes in the climate and to adapt their agricultural practices to these changes.\textsuperscript{18} When changes in the agricultural sector occur, ensuring food security becomes an increasingly difficult task.

According to Anya \textit{et al}, climate change affects food security in more ways than just food production and harvest yields.\textsuperscript{19} Not only do yields decrease, but climate change affects soil quality and availability, jeopardizing the sustainability of the industry. Climate change also impacts consumption patterns because of the seasonal availability of food which impacts the time of year when food is or is not plentiful. This is further supported by research conducted by other scholars\textsuperscript{20} who assert that climate change affects production, stability of food supplies, accessibility of food supplies and the utilization of these supplies. However, despite some authors’ inclusion of these other dimensions of food security, namely production and accessibility, the literature largely examines how climate change has affected the production of food and its relationship with food security. As such, the food security-
climate change relationship has only been partially studied, leaving a noteworthy gap in the literature.

In previous decades, West African markets were opened up to increasing rice imports due to policy changes that, in many cases, undercut local production (Moseley et al, 2010). As Moseley et al explain, in many countries in West Africa, imported grains supplied more than 40% of the market requirements which made countries more vulnerable to global price fluctuations. Between 2007 and 2008, many citizens in West Africa “saw their ability to purchase food collapse.” In light of this, it is important to study how food security can be improved in countries which have become highly dependent on imported grains. Therefore, building on the study conducted by Moseley et al in which they examined the implications of imported food supplies for food security in the Gambia, Côte d’Ivoire and Mali, the research at hand seeks to identify how the public (i.e.: government) and private sectors (i.e.: individuals and NGOs) can collectively address food (in)security in Burkina Faso. In addition, the research conducted by Moseley et al emphasizes a key point in the current research – the need for local consultation when devising national strategies. In each of the author’s research countries (The Gambia, Côte d’Ivoire and Mali), planners failed to consider local advice, and the ignorance of socio-cultural norms undermined the success of projects.23

Ensuring food security requires efforts that ensure both individual and household food security, as well as that of the nation. As explained by Anya et al, this means that national governments must take action to lessen dependence on external food aid and that farmers, too, must take preventative and reactive measures.24 This is supported in a review completed by Ericksen et al of the 2008 Food Security and Environmental Change conference held at Oxford University. The authors contend that adaptive strategies require governance arrangements with policies and institutional capacity to support them.25 This is a central point of the current research – that supportive government policies are necessary in order to
ensure the sustainability of food security measures. That being said, it is not enough to have only favourable government action. It is important to ensure that there is a coordinated link between government policies and strategies, the work of NGOs and IOs, and the actions and inactions of farmers and communities. Without this, a sustainable food secure situation is unlikely.

Anya et al explain that in Africa, those engaged in the agricultural sector, particularly those in rural communities, who own small businesses or run family farms, require support to adapt to the quick changes they are experiencing and to contribute effectively to ensuring food security.26 As such, “farmers’ first priority should be to seek opportunities to make their existing livelihoods, like agriculture, more resilient.”27 The authors propose various solutions, such as crop diversification and changes in agronomic practices (i.e.: soil utilization and crop production practices), which are heavily supported in the literature. For example, in their study of the responses enacted by families in Burkina Faso following the 1997 drought, Roncoli et al describe diversification as a “crucial mechanism” for coping with climate change and food insecurity.28 The need for diversification is also supported in research conducted by Gregory et al who look at adapting to climate change to improve food security from three angles: (i) increasing food production; (ii) improving food distribution; and (iii) increasing economic access to food.29 Throughout each of these three angles the importance of diversification is identified - be it diversification in the sense of crops planted, transport mechanisms used, or policies and strategic plans set to improve adaptation and food security.30 However, while diversification is stressed throughout the research of Anya et al,31 Gregory et al,32 West et al33 and Roncoli et al,34 the research remains limited in the sense that there is insufficient reference to the financial and technical capacity that needs to be present in order to diversify.
Haile contends that climate prediction mechanisms are a key aspect of helping to ensure food security, shifting some of the burden away from farmers. The author emphasizes the importance of seasonal forecasts which can assist governments in proper planning, as well as providing information to farmers that can help in decision making about planting. The study also stresses the importance of agro-meteorological forecasting to continually assess the rainfall and agricultural system. In conjunction with the two former prediction mechanisms, pre-harvest crop assessments are necessary to determine an estimate of national production which can alert farmers to agricultural weaknesses. At the same time, governments and international organizations can respond in a timely matter if these predictions show potential crises. The challenge with the work is that there is no consideration of how to disseminate information from the prediction centres to communities and local farmers. While the author makes mention of the regional prediction centres, such as the PRESAO in West Africa which provides seasonal climate forecasts, there is little mention as to how countries can utilize this information to direct national policy or to guide farmers.

A study of literature related to farmers’ perceptions and adaptation practices in Sub-Saharan Africa conducted by Juana et al asserts that farmers and public agents both play a vital role in adapting to climate change. Awareness and adaptation can be strengthened by providing information to relevant populations, and technical developments and government insurances, to be provided by public agents, agribusiness and governments, can contribute greatly to improving the livelihoods of farmers. Given this assertion, their research is extremely relevant to the work at hand because it restates the point that both the public (i.e. government) and private sectors (i.e. farmers) play an important role in adapting to climate change and ensuring food security. A synthesis of relevant literature demonstrated that institutional factors (i.e.: access to climate information, etc.), among others, were a recurring challenge for farmers throughout Sub-Saharan Africa. As such, the authors conclude that
governments must enact policies that are supportive towards adaptation measures while, at the same time, governments and NGOs should invest in climate resilient projects. Farmers must also adjust their agricultural management practices and invoke other adaptation mechanisms in order to maintain and improve their productivity. This conclusion by the authors is fundamental in explaining the current work’s hypothesis – that a public-private partnership combats the effects of climate change on food security. However, because the work is merely a synthesis of information from around the African continent, further research must be conducted in specific locales, which will be done by the current research, in order to better understand individual circumstances and create strategies that are location specific, rather than general to all countries.

Research has articulated the importance of using both scientific methods and local perceptions in designing strategies for adapting to climatic changes. While previous studies have largely focused on the scientific factors of climate change, Lindskog & Tengberg, in their research conducted on land degradation in Burkina Faso, assert that it is equally important to look at individual perceptions of the environment because they form the basis for how individuals utilize the land and respond to changing environmental circumstances.

The author’s main research lies in the realm of desertification making their study relevant to the current research because desertification has significant repercussions for agricultural activities and, thus, impacts food security. It is therefore important to gain an understanding of the local perceptions of desertification. Lindskog & Tengberg (1994) conclude by stating the importance of bridging the gap between “scientific and traditional explanations of the causes of land degradation” to “make all external agents involved in development efforts aware of traditional explanations as well as to make people aware of their role in land management.” (374). The authors argue that doing so can help to increase motivation of individuals to practice improved land management and can also help to ensure
that supportive policies are made and development strategies build on local knowledge. This argument is a key factor in the current research – local knowledge and strategies should work in conjunction with national and international efforts to curb the effects of climate change and to ensure sustainable food security. However, because the research was conducted in the early 1990s, current climate trends have not been factored in. As such, it is important to build upon the work done by Lindskog & Tengberg (1994) by factoring in current climate trends and adaptation strategies for more than just desertification.  

Research conducted on climate change and adaptation strategies by Akponikpè et al in 5 West African countries (namely Ghana, Togo, Benin, Niger and Burkina Faso) further elaborates the point that scientific knowledge and local perceptions should be coordinated to produce adaptive strategies that best suit the needs of local inhabitants. Without doing so, lasting solutions to food security challenges will be impossible. The authors recognize that a ‘one size fits all’ approach for mitigation will not be sufficient, stating that the differences between climatic areas, even within individual countries, must be recognized to guide decision-making and policy. The weakness of their work is that, despite recognizing the importance of scientific and local knowledge in shaping policy, there is no other indication as to how policy can support scientific and local knowledge. In other words, the authors fail to explain how government action also plays a role in finding mitigation strategies.

A study by West et al further examines local perceptions in West Africa. In their research in the Central Plateau of Burkina Faso, West et al examine the perceptions of farmers on rainfall trends, discovering that drought adaptation strategies have become the norm amongst most farmers. The research findings from West et al are key to the current research given that it is one of few studies which incorporates local perceptions into scientific understandings of climate change. As the authors point out, “very little research has attempted to understand the nature of the Sahelian drought from the viewpoint of the people
most affected – its rural smallholder farmers and herders who play an instrumental role in ensuring food security.

Scientific findings can often be very different from the perspectives of local people. As such, it is important to develop research that considers both the scientific knowledge about climate change (i.e.: changes in rainfall patterns) and the perceptions of the individuals affected (i.e.: farmers). Not doing so could significantly impact how policy decisions are formed and whether or not they reflect the concerns and needs of the local population. It is, therefore, essential that adaptation measures are established with advice from government, scientific findings, and the perceptions of affected individuals to ensure a lasting and positive effect on food security.

The limiting factor of the research conducted by West et al, which the current research hopes to fill, is the concentration on changes in rainfall and its effect on local agricultural activities. Agriculture, while heavily reliant on rainfall, is affected by other climate changes as well, such as high winds, soil erosion, and temperature changes, to name a few. It is also important to note that climate changes are not the only changes that have impacted agriculture and thus food security. Farming practices themselves have contributed to erosion and soil infertility, which greatly impacts on the productivity of farming.

In their chapter *Food Security and Adaptation to Climate Change: What Do We Know?* Burke and Lobell examine farmer adaptations and planned adaptation methods that can be used to improve food security. They stipulate that “adaptations of farmers and markets will help” to improve food security, though planned interventions by governments and other institutions may also be needed to support farmer actions. These planned actions may include things like investing in crop development, improving irrigation infrastructure, and building social safety nets. Scientific information, as well as local knowledge, will be important in order to guide policy decisions like where, when and how to invest. The chapter is relevant to the work at hand because it emphasizes the necessity of planned actions...
by governments and institutions which will complement farmer adaptation methods. It is not sufficient to say that farmers alone should adapt – ensuring food security at both national and household levels requires a concerted effort between public and private enterprises.

Ensuring food security is one of the greatest challenges facing Sub-Saharan African countries; a challenge which is becoming even more difficult with the current rate of climate change. In light of this, a coordinated effort between individuals, governments, and private institutions is required in order to ensure a mutually beneficial and conclusive strategy for curbing the negative consequences that climate change brings to food security. Current adaptation methods, as shown in the literature, largely focus on either farmers’ adaptations or governmental/institutional initiatives, though a combination of the two is rarely considered. In light of this, research needs to be conducted that brings the two together. Furthermore, while individual country requirements vary, there are many parts of the world that have produced adaptation methods which could be adapted to suit the needs of other countries. As such, this should be incorporated into research that looks at public and private adaptation methods. A conclusive research of such a nature could produce a viable solution for improving food security in an ever changing world.

1.8 Methodology

This research adopts a case study approach to examine the implications of climate change for food security in the following areas of Burkina Faso: the village of Loumbila in the Plateau-Centrale Region, Oubritenga Province, Loumbila Department; the village of Tingongon (near Boulbi) in the Centre Region, Kadiogo Province, Komsilga Department; the villages of Nioko 1 and Boulimiougou on the outskirts of Ouagadougou; and various sectors within Ouagadougou. These areas were selected for study based on their differing geographic locations, in and around Ouagadougou, as well as the perceived source of income for the
majority of residents (for example, it was expected that farmers could be found in Loumbila and business workers/owners would be found within Ouagadougou’s various sectors).

Questionnaires were administered verbally to 8 farmers (see Annex A) – 6 of which were in rural areas with the remaining 2 found within the capital city - and to 8 households (see Annex B) – 5 of which were in the capital city (urban area) with the other 3 coming from rural areas. It was expected that this number of interviews would provide adequate information and opinions to support the research.

Interviews were conducted in both French and the local dialect, Mòoré, based on the abilities and/or language preferences of the participants. Given the language barrier stemming from the researcher’s inability to speak or understand Mòoré, a Burkinabé research assistant, fluent in English, French and Mòoré, was hired to assist with the administration of the questionnaires. Participant responses were recorded on individual questionnaire sheets and pictures were taken, where possible, to visually explain some of the recorded responses. Participants were asked to recall changes and trends over the past 10 year period (where possible), given that the most recent 10 year period is the most understudied in the literature.

To support the research on adaptation, specifically, heads of civil society organizations were also interviewed using written questionnaires delivered through e-mail. The questionnaire was written in both English and French, giving participants the option to answer in the language of their preference.

Secondary data was also obtained from books, journal articles, and reports from governments, regional bodies, and NGOs.

1.9 Arrangement of Chapters

The research will be divided into four chapters. Chapter one consists of the research design. Chapter two will provide an in depth exploration into climate change and food security as well as the link between the two phenomena. Chapter three will look at
perceptions on climate change and food security, as well as adaptations for mitigating the
effects climate change has on food security taken from Burkina Faso and around the world.
Chapter four will be comprised of the summary, conclusion and recommendations.
Endnotes

9 Ibid.
10 Ibid., p. 8.
11 Ibid.
12 Ibid., p. 44
13 Ibid.
16 Ibid.
19 Anya, M. I. et al., op. cit.
22 Ibid.
23 Ibid.
24 Anya, M. I. et al., op. cit.
26 Anya, M. I. et al., op. cit.
27 Ibid., p. 56.
29 Gregory, P.J., et al., op. cit.
30 Ibid.
31 Anya, M. I. et al., op. cit.
32 Gregory, P.J., et al., op. cit.
34 Roncoli, C. et al., op. cit.
36 Ibid.

Ibid.


Lindskog, P. & Tengberg, A. op.cit.

Ibid.

Akponikpè, P.B., et al., op.cit.

Ibid.

West, C.T., et al, op. cit. p. 289


Ibid.

Ibid.
Chapter Two

THE CLIMATE CHANGE & FOOD SECURITY PHENOMENA

2.1 Introduction

Food security and climate change have, in recent decades, gained notoriety in the international development arena. Climate change affects all parts of the globe and is occurring at an increasing rate, with varying effects on individuals’ livelihoods and survival. The most vulnerable populations in the world are those that depend on informal sectors, like agriculture. Unfortunately, these especially vulnerable groups have seen declines in both income (indicating their inability to buy food products) and food consumption.1 In places where agriculture provides employment to large percentages of the population, climate change has greatly impacted how farmers produce food, what is produced, and the success rate of crops, which in turn affects food security. Food security has, as a result, been compromised, affecting large segments of countries’ populations, entire states, or regions. When access to food, an internationally recognized right, is jeopardized, human security is also impacted. Because human security directly impacts state security, food security and climate change have become causes for global concern.

To address these challenges, various global strategies have been adopted by the international community. This is reflected in the MDGs which seek to halve the number of people who are affected by extreme poverty around the world. By addressing the MDGs, Goals 1 and 7 specifically, food security and climate change can be improved. Food specific agendas, such as the Rome Declaration on World Food Security of 1996 and the FAOs Right to Food Guidelines of 2004, also support the international movement to improve food security. At the same time, the international community has shown a collective effort to curb climate change with the adoption of the UNFCCC of 1992 and its related Kyoto Protocol of
1998. For these international efforts to be fruitful, national action plans have also been developed to address country specific challenges, to implement global goals and to target specific priorities or areas of risk. NGOs have also developed action plans to address distinct areas of concern or interest, supporting both national and international activities.

A challenge remains, however. Both climate change and food security are ambiguous terms. Without a clear-cut definition, it becomes difficult to develop strategies that adequately and wholly respond to the issues at hand. Therefore, it is important to define what is meant by these terms in order to take actions that fully encompass the points of concern.

### 2.2 What is Climate Change?

There has been an international debate as to whether or not climate change exists. This is coupled with the debate as to whether or not climate change is human induced, or if it is a naturally occurring phenomenon. This research does not seek to delve into the arguments of the debate but to examine how observed changes, or recent trends, have affected food security. As such, it is assumed that climate change does exist, having been recorded in many countries since their existence, and that there are both human and natural origins for these changes, with the most profound changes since the 20th century the results of human activity. This assumption largely reflects current scientific research in the field.²

Given the mixed understandings of climate change, various definitions for climate change have been proposed. The WMO, for instance, refers to climate change as “all changes in the climate system, including the drivers of change, the changes themselves and their effects.”³ On the other hand, the UNFCCC defines climate change as “a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is, in addition to natural climate variability, observed over comparable time periods.” However, the WMO definition is too broad for the work at hand,
while the UNFCCC limits climate change to those induced by human activity alone without accounting for any natural changes which may have occurred. As such, this work utilizes the IPCC definition which refers to climate change as “internal changes within the climate system or in the interaction between its components, or because of changes in external forcing either for natural reasons or because of human activities.”⁴ To eliminate year-to-year variations, 30-year consecutive periods are averaged, measured and analyzed for changes.⁵ The strength of this definition is that it recognizes both natural and human factors as having implications for climate change, allowing for a broader understanding of the causes of climate change.

Climate change is the product of various interplaying forces which have varying, sometimes positive and sometimes negative, effects on populations and the world at large. “Warming of the climate system has been detected in changes in surface and atmospheric temperatures and in temperatures of the upper several hundred metres of the ocean.”⁶ This warming trend may persist for decades or centuries, which has, historically been followed by trends in cooling. This is a natural cycle.

In more recent years, human activity has increased the rate of these changes in many parts of the world. Specifically, greenhouse gas emissions are primarily caused by human activities. These greenhouse gases include, but are not limited to, carbon dioxide, methane, and nitrous oxide, which have had a variety of manifestations and implications for climate change and food security. While carbon dioxide is a natural component of the atmosphere and is emitted in subtle ways like human respiration, the global industrial revolution and its associated burning of fossil fuels has greatly increased the prevalence of carbon dioxide.⁷ Like carbon dioxide, methane also has natural origins though human activities such as agricultural processes (particularly rice cultivation and the digestion processes of livestock) and decomposition of waste in landfills have escalated its presence in the atmosphere.⁸
Agricultural practices such as soil cultivation and the use of fertilizers have also increased the presence of nitrous oxide. These factors create a greenhouse effect which contributes to global warming and other climate changes.

### 2.2.1 Manifestations of Climate Change

Climate change manifests in diverse forms with implications for various sectors. In areas of low development, any climate change can have significant implications on local populations. While the exhibitions of climate change come in many forms, this work specifically looks at increasing temperatures, changes in precipitation patterns, and extreme weather as the key factors affecting agriculture and food security.

#### 2.2.1.1 Rising Temperatures

Temperature projections foresee averages rising around the globe, with some regions rising more than others. While the increases currently are within a few degrees and will likely continue to rise by one or two degrees, the impacts will be serious. According to Oxfam, this means that evapotranspiration, the process by which water is transferred to the atmosphere through evaporation, will increase and there will be less water in lakes, rivers and oceans and other natural reservoirs. As such, there will be less water available for human needs, such as consumption and irrigation, and less water available to sustain crops and livestock. Economies that depend primarily on natural resources, such as those in sub-Saharan Africa, will be the hardest hit. The growing season in itself can be affected by rising temperatures which changes the ways in which crops can be farmed. Rising temperatures also affect crops in the sense that some crops thrive at certain temperatures and changes in temperature may result in the development of inhospitable climates for certain crops. Changes in temperature, therefore, affect the suitability of lands for crops and livestock rearing. At the same time, however, rising temperatures may mean that certain crops may be able to flourish.
in new parts of the globe as rising temperatures in some places may create supportive environments for certain plant species or other food crops.

### 2.2.1.2 Changes in Precipitation

According to Anya *et al*, “[i]n Africa, about 8% of soil is found on fertile lands while 92% is found on marginal lands” with the prevalence of lands constrained for crop/livestock production on the rise. The FAO predicts that “arable land is likely to be lost owing to increased aridity (and associated salinity), groundwater depletion and sea-level rise.” This is due to a variety of factors, with changes in precipitation being one. In this regard, changes in precipitation refer to changes in the timing, duration, intensity and geographic location of rainfall.

In sub-Saharan Africa, the majority of agricultural production is reliant on favourable climate conditions. Most agricultural activities are rain fed and irrigation techniques have, in many places, remained limited. As such, changes in rainfall patterns have a strong impact on when, how, and where crops are produced. In addition, changes in precipitation affect the availability of good-quality water that is required for rearing livestock, supporting crops, and inland fish production, amongst other economic and livelihood activities. This reiterates the fact that countries that rely on rain fed agriculture will be hardest due to the fact that food supply is strongly correlated with rainfall. As such, “an increase in weather variability [is] likely to aggravate the precariousness of local food systems.”

Too little rain affects agricultural production in that there is not enough rainfall to facilitate crop growth; too much rain can wash out crops in key growth phases or destroy crops at harvest. In the Sahel region of West Africa, for example, projections, while varying, show that average rainfall will decline and will be accompanied by strong intra-seasonal variability. Shortened rainy seasons make harvesting difficult and may lead to production
shortfalls. As water availability fluctuates, the threat to human livelihoods increases. As water for household or individual consumption is limited, so too is water for industrial and agricultural usage. Not only does this threaten the ability to ensure food security, but human security as a whole is threatened because peoples’ basic needs become more difficult to meet. Furthermore, a drop in water availability or a reduction in water quality may result in competition over water resources. “The high degree of interdependence...of African countries with regard to water, combined with the poor level of awareness of decision makers and the general public of the impacts of climate, is conducive to tension and even conflict among states over water resources.” As such, climate change has implications for the human security of entire regions, not just for individual security or food security.

2.2.1.3 Extreme Weather Events

In sub-Saharan Africa, extreme weather events mainly take the form of droughts, heavy storms, and floods, among others, all of which have appeared to be on the rise in recent decades. A flood is understood to be an “excess of the amount of discharged water compared to the drainage capacity.” A drought results from the “accumulated effect of deficient, [less than the expected], precipitation over a prolonged period of time.” In other words, a drought is a condition of prolonged insufficient water supply.

With climate change, extreme weather events are likely to increase. Events like floods may wash out crops, damage transportation routes or markets, and force migration, limiting agricultural production and marketing which in turn affects food security. Droughts destroy crops and advance land degradation which plays a role in limiting food supplies, household incomes, and national profits from cash crops. Droughts also affect livestock rearing and lower productivity. Extreme winds further land erosion and soil degradation,
making agricultural production a more challenging field. Increases in the frequency, duration and intensity of dry spells/droughts, storms and floods in turn increase the vulnerability of the agricultural sector which puts further strains on the capacity to ensure food security. The result of these climate change manifestations is that agricultural systems become threatened. Specifically, the capacity for production of food crops is limited which in turn creates a strain on already stretched food systems.

2.2.2 Effects of Climate Change

Climate change has multiple effects that have created an increasingly onerous agricultural sector that is highly vulnerable to climate changes. Rising temperatures, changes in precipitation and extreme weather phenomenon have many repercussions which make sustaining a livelihood from agriculture increasingly difficult, thereby exacerbating the challenge of ensuring food security. Desertification “refers to land and soil degradation in arid, semi-arid, and dry sub-humid areas due to various factors, among them climate change and human activities.” Largely it is brought on by changes in rainfall and intensified land use. As explained by the IUCN, “recurrent drought, resulting from climate change and variability, accelerates desertification, which in turn contributes to the presence of drought. This cycle is likely to play a part in increased desert encroachment.” As a result, the land available for agriculture is maximizing, with large sections of farmland becoming arid and no longer conducive to agricultural production.

As temperatures rise, it is likely that pests and insects that threaten the success of agriculture will also rise. This point is further buttressed by the UNEP which states “[i]ncreased temperatures are expected to change the spread and occurrence of various diseases and pests, such as locusts, with potentially serious consequences for the health of plants and animals,” further undermining the strength of agricultural sectors and farmers’ ability to contribute to national food security. The occurrence of crop pests, particularly
locusts, undermines crop yields, leading to reductions in productivity and, therefore, food availability. The 2005 food crisis in Niger, for example, occurred as a result of drought and an invasion of locusts which reduced harvest yields and, therefore, food availability. As food supplies became increasingly scarce, food prices began to rise drastically and poor households were often unable to purchase the required food, leading to a situation of intense food insecurity.

At the same time, it is important to note that fighting these effects can also contribute to climate change, or worsen the climate change problem. As put by Oxfam, “[c]limate change not only threatens agriculture, the way we now farm also threatens climate.” Pesticides used to fight crop pests and fertilizers used to combat poor soil quality contribute to degradation in water quality, due to contaminated run off. In addition, pesticides and fertilizers increase the prevalence of nitrous oxide which, as previously mentioned, contributes to the greenhouse effect. Clearing of land for agriculture leads to deforestation and desertification and emissions of greenhouse gases. Cattle rearing, too, is one of the key contributors to methane in the atmosphere. While irrigation has become increasingly necessary for agricultural success, the practice also contributes to decreased groundwater availability which is necessary for supplying drinking water and other processes.

Furthermore, the global demand for food and the need to ensure food security also effect the environment “because the food system is a source of greenhouse gas emissions and nutrient loading, and it dominates the human use of land and water.”

2.3 What is Food Security?

Like climate change, food security is also associated with many definitional ambiguities. A 1992 study by Maxwell & Smith, for instance, counted 30 definitions for the term. For the purpose of this research, the definition put forth by the FAO will be used to
define food security as “[a] situation that exists when all people, at all times, have physical, social and economic access to safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life.” Related, food insecurity is defined as “A situation that exists when people lack secure access to sufficient amounts of safe and nutritious food for normal growth and development and an active, healthy life.” Unlike other definitions which focus mainly on food utilization, food access, and food availability, the FAO definition of food security includes food stability, providing for a more all-encompassing conception of food security. Furthermore, studies that focus only on a select number of the food security elements offer only a partial understanding of the relationship between food security and climate change. The weakness of the definition, however, is that it places the most emphasis on access to food, while in sub-Saharan Africa chronic hunger is largely related to low production.

2.3.1 Food Availability

The first element of food security, food availability, refers to the availability of sufficient food. In other words, food availability is related to “the overall ability of the agricultural system to meet food demand.” Climate change has a significant impact on food availability because of the nature of the agriculture sector in sub-Saharan Africa. Crops are rain-fed, relying on seasonal rainy and dry seasons at particular intervals. Also, extreme weather events, such as drought, affect agricultural productivity and harvest yields. Since the 1970s, the most significant food crises have been related to the effects of drought, with recovery from such events sometimes taking years. In many parts of sub-Saharan Africa, availability is undermined by other factors, such as the HIV/AIDS epidemic, which limit households’ ability to produce their own food because they do not have the adequate human power for the labour intensive nature of agricultural work. However, increasing [agricultural] production has always been an important strategy to help alleviate food
insecurity, and it still is today.\textsuperscript{38}

\textbf{2.3.2 Food Access}

The second element of food security, food access, looks at “access by individuals to adequate resources (entitlements) to acquire appropriate foods for a nutritious diet.”\textsuperscript{39} As Anya et al explain, “[p]hysical access to food relates both to the adequacy of supply and to the efficiency of the distribution system including storage, preservation, transport, marketing and processing.”\textsuperscript{40} At the same time, “[e]conomic access to food relates to the ability of individuals, households or communities to establish entitlement over a requisite amount of food.”\textsuperscript{41} Key to this is purchasing power of consumers and food prices, with changes in both having a significant impact on access to food. In addition, access must be to culturally acceptable food, not just to any food supply. Access is a challenge particularly for remote or isolated communities where access to markets is limited due to inadequate infrastructure.

To Amartya Sen, food access is related to one’s ability to purchase or produce food, seen as ‘entitlements’. For a farmer, entitlements are the means of food production, labour and land; for those who don’t farm, entitlements are incomes and prices (i.e.: how much food costs and how much money is available to purchase food).\textsuperscript{42} If incomes fall or prices increase, household or individual food security is impacted. Food security of farmers may fall when their entitlements of land and labour are diminished – this affects prices and, thus, household or individual food security.

\textbf{2.3.3 Food Utilization}

The third element of food security is food utilization, “[encompassing] all food safety and quality aspects of nutrition.”\textsuperscript{43} This means that an individual must have a high enough nutritional status (i.e.: is not constantly falling sick) to make use of the food.\textsuperscript{44} In other words, “[u]tilization is commonly understood as the way the body makes the most of various
Those with chronic conditions, such as HIV or those who are consistently malnourished (particularly children), face greater difficulties in ensuring adequate food utilization. Therefore, ensuring food security at this level is impacted by an individuals’ ability to ensure a healthy lifestyle.

### 2.3.4 Food Stability

The final element of food security, stability, “relates to individuals who are at high risk of temporarily or permanently losing their access to the resources needed to consume adequate food, either because these individuals cannot ensure *ex ante* [based on forecasts] against income shocks or they lack enough ‘reserves’ to smooth consumption *ex post* [based on results] or both” (Schmidhuber & Tubiello, 2007, p.19703). Although an individual may have adequate food intake one day, he/she may still be considered to be food insecure if inadequate access to food occurs on a periodic basis, risking a deterioration of the individuals nutritional status (FAO, 2008b). To ensure food stability, it is necessary for the other three elements of food security to be met – availability, access and utilization. Without one or more of these, ensuring stability is not possible. This is further explained by Figure 1 which also indicates the components of each food security element.
2.4 Causes of Food Insecurity

Food insecurity is caused by a multitude of factors – natural hazards, an underdeveloped agricultural sector, population growth, bad governance and conflict are but a few. Climate extremes, such as drought, contribute significantly to food vulnerability and food insecurity. In the Horn of Africa, for example, “there is no year or season in which the whole region receives normal rainfall and is free from climatic anomalies such as flood or drought.” In areas of agricultural production, changes in climate can lead to failures in the four elements of food security, particularly in regards to availability due to production decline.

The underdeveloped nature of the agricultural sector in Africa is another limiting factor for ensuring food security. Mwaniki explains that Africa’s agricultural sector is characterized by over-reliance on primary agriculture, low fertility soils, minimal use of external farm inputs, environmental degradation, significant food crop loss both pre- and post- harvest, minimal value addition and product differentiation, and inadequate food storage and preservation that result in significant commodity price fluctuation.

Furthermore, most agricultural activity is rain-fed, making the entire sector highly vulnerable to adverse weather conditions and climate change.

2.5 Who Food Insecurity Affects

There are roughly 1 billion food insecure people in the world due to the fact that individuals are too poor to buy food, too unhealthy to make use of it, or because food is unavailable. Economic advancement and improvements in agricultural productivity have decreased the food burden for many, though in many parts of the world the situation has not changed and has even gotten worse. Data shows that, since 1970, the overall number of food...
insecure and their percentage of the total population has declined; however, it is important to note that this decline is largely in Asia where economic growth has improved food security and poverty.\textsuperscript{51} In sub-Saharan Africa, however, progress has been discouraging with roughly 33\% of the continent’s population facing chronic food insecurity.\textsuperscript{52}

In sub-Saharan Africa, food insecurity largely affects those in rural areas with over seventy percent of the rural population considered food insecure.\textsuperscript{53} Ironically, the majority of Africa’s food producers live in rural areas, and are the individuals primarily considered to be food insecure. Figure 2 provides a breakdown of this. The poor are “the most vulnerable to environmental degradation because they depend on the exploitation of common property resources for a greater share of their incomes than richer households do.”\textsuperscript{54} Because they have limited financial resources to purchase new areas of land for growing in invest in agricultural supports, the same land is used over and over again which degrades the soil and makes agricultural activities increasingly difficult. For those who rely on subsistence farming, soil degradation greatly impacts food security. At the same time, the rural farmers who contribute to food supplies for the country or region have a greater difficulty doing so, threatening the food availability of large populations.

In urban areas, the urban poor are the most affected because they spend a disproportionate amount of their incomes on food.\textsuperscript{55} Most often, the urban poor are those engaged in the informal economy – economic activities which fall outside the legal and regulatory framework governing employment.\textsuperscript{56}
2.6 Link between Food Security and Climate Change

“Climate has always featured prominently in African development, and the continent’s populations have lived and adapted to a high degree of climate variability and its associated risks since time immemorial.”\(^57\) However, as the rate of climate change increases, Africa’s vulnerable people face increasing challenges from climate threats. While the impact of climate change on rising and falling temperatures and rainfall distribution continues to be contested, it has been accepted that it is the poor and vulnerable who will suffer the most losses from these changes.\(^58\) “This is particularly true for those communities in sub-Saharan Africa who rely largely or totally on rain-fed agriculture or pastoralism for their livelihoods. Such communities, already struggling to cope effectively with the impacts of current climatic variability, will face a daunting task in adapting to future climate change.”\(^59\)

2.6.1 Food Availability and Climate Change

The challenge for African countries stems from the fact that local agricultural production is one of the key contributors to ensuring food security. “Agriculture is important for food security in two ways: it produces the food people eat; and…it provides the primary
source of livelihood for 36 percent of the world’s total workforce” while at the same time contributing substantially to countries’ GDP. In many countries in sub-Saharan Africa, up to two thirds of the population depend on the agricultural sector - a sector in which success is conditional on favourable climate conditions. As such, if agricultural production in sub-Saharan Africa is limited by climate change, so, too, will the livelihoods of large numbers of the poor who are greatly at risk of food insecurity.

“The spectre of climate change…has increased concerns about achieving food security especially for poor people. There is also a concern that meeting the global demand for food…will further degrade the environment both through additional destruction of native vegetation and increased intensification of cropped areas.” While some climate change is evidently caused by pollution in large cities, the activities of farmers also have an impact. As previously discussed, the process of farming in itself is a great contributor to climate change. This, therefore, stresses the need for solutions that tackle food security and prevent further climate changes collectively.

Climate predictions often argue that while yields may decrease in tropical regions, other parts of the globe may see positive increases in yields due to climate change. While this could be positive for ensuring global food security, in reality the countries that will likely see declining yields, such as those in sub-Saharan Africa, do not have the capacity for international trade and, instead, rely heavily on local production to ensure their food requirements are met. Because food has become a global commodity, the international trade of food can be both a buffer an exacerbating factor in countries with high food insecurity. As Burke & Lobell explain, for example, a “country experiencing drought…may make up for shortfalls through imports, but cereal importing nations [such as those in sub-Saharan Africa] would pay higher food prices on the world market when large exporting countries suffer similar shortfalls.” Therefore, the efforts of poor countries seeking to meet
food shortfalls through imports would be greatly undermined, as high prices would make importing more costly and less feasible. As a result, it is necessary to find coping mechanisms and strategies for sub-Saharan African countries to ensure their food security and the resulting human security that is necessary for global peace and development.

2.6.2 Food Access and Climate Change

Based on Amartya Sen’s explanation of food access, climate change may affect access in a number of ways. Since agriculture is one of the sector’s most affected by climate change, those who are heavily reliant on agriculture are more sensitive to climate changes. A poorer agricultural season, for instance, would yield fewer food supplies and less family income to purchase (access) additional food inputs and other purchasable goods.

As previously stated, the global trade for food has greatly increased in recent years, and national and international food markets have, in many cases, become tightly integrated. Burke & Lobell explain that “a region that suffers large productivity losses under climate change but whose food markets are well integrated with the global markets could see little change in the price of food if it is able to import to cover food losses.” At the same time, a country that experiences minimal effects of climate change may see rises in food prices if its market is well integrated into the global system. Unfortunately for most sub-Saharan African countries, their domestic markets are poorly linked to the international system and, as such, importing food supplies is costly and often to the detriment of local food producers. As such, access is not improved through global trade.

2.6.3 Food Utilization and Climate Change

Climate is only one of the issues that effects food utilization, and it is one of the most understudied. However, climate affects the nutritional aspect of food for utilization and the prevalence of disease which limits food utilization. Climate change, as we have seen, may
affect the yields of important crops that provide the primary nutritional needs for consumers. In sub-Saharan Africa, for example, Vitamin A intake is almost wholly attributed to fruit and vegetable consumption. As such, if yields are changed due to climate change and the required nutritional crops are changed, individuals in sub-Saharan Africa may suffer from ailments due to changes in nutritional intake, such as blindness and immune deficiency which may occur as a result of inadequate Vitamin A.

Evidence suggests that climate change, particularly warmer temperatures, will increase the prevalence of pathogens and vector borne diseases. For example, increased rainfall can expand the areas of stagnant water where malaria carrying mosquitos thrive. As a result, malaria infections and are likely to increase. Because illnesses such as malaria have an impact on one’s ability to adequately utilize or consume food, this element of ensuring food security is limited. In another example, extreme rainfall events and the fact that developing countries have limited infrastructure to deal with surges of water, cholera outbreaks grow more common. Human activities that have deteriorated water supplies, coupled with poor sanitation practices and infrastructure, has increased the prevalence of diarrheal disease. These health challenges, among many others, have a growing link with climate change and, therefore, the utilization aspect of food security.

2.6.4 Food Stability and Climate Change

As explained above, food stability is heavily reliant on ensuring the other three elements of food security. Because climate change is seen to have an effect on food availability, access and utilization, climate change also has an effect on stability of food supplies and individuals’ ability to ensure food security.
2.7 Description of the Study Area

The Sahel region extends from the Atlantic Coast of Africa across to the Horn of Africa. This transitional zone between the Sahara desert to its north and the Sudanian rainforests to its south are home to desert and semi-desert lands in the northern countries of the Sahel, giving way to grasslands and savannah in the south. Burkina Faso is located in the Sahelian zone of West Africa, with Mali to the north, Côte d’Ivoire, Ghana, Togo and Benin to the south, and Niger to the west (see Figure 3). The northern parts of the country are considered the Sahelian zone, while the most southern parts are Sudanian fields of grasslands and woodlands. With the Sahara Desert to the north, savannah and coastal rainforests to the south, Burkina Faso is prone to various climate anomalies including chronic drought, flash floods, wind storms, and disease outbreaks. This, coupled with poor soil quality and its limited water holding capacity and desertification, Burkina Faso is one of the most fragile locations in West Africa.

As a landlocked country, transport is a significant challenge for Burkina Faso and, as such, good relations with its neighbours are vital. In this regard, Burkina Faso has fostered strong relations with its neighbours through regional integration efforts, such as its membership in ECOWAS and UEMOA. Despite sitting in a tumultuous sub-region of Africa, surrounded by reoccurring conflicts, Burkina Faso has remained largely peaceful since the 1987 coup which brought current president, Blaise Campaoré to power. Political stability has allowed resources to be targeted towards social and economic development, whereas many of the Burkina Faso’s equally poor neighbor countries have had to direct their limited resources to ensure political control. As such, Burkina Faso has been able to focus more on improving development levels and bolstering its most productive sectors. However, much remains to be done.
Burkina Faso is one of the poorest countries in the world, ranking 183 out of 186 countries on the 2012 HDI list. This is easily explained, in part, by the fact that Burkina Faso consistently records one of the smallest economies within Africa and the world, with approximately 80% of employment, albeit informal, linked to subsistence farming. Agriculture also contributes significantly to Burkina Faso’s GDP, accounting for approximately 35%. As such, the country and its population remain highly dependent on agriculture. Cash crops have traditionally been limited to cotton, although this sector has declined in recent years. Millet, sorghum, maize, groundnuts, rice, cowpea, Bambara beans groundnut, and yams are widely cultivated for local consumption, national and international sale. However, agriculture, in most instances, has not been modernized and remains a household venture for subsistence rather than a formal business. It is largely excess harvest, if any, that is sold for financial gain. As such, “Burkina Faso’s relatively undiversified economy is vulnerable to a number of external shocks, including declining
international cotton prices, regional locust infestations, effects of regional civil instability and the effects of the global financial crisis on remittance income from Burkinabé who live abroad.”

Burkina Faso occupies an area of 272,967 sq. km, with approximately 123,600 sq km used for agriculture. Of this, approximately 51% is considered arable land. “Only 15,000 hectares of the country’s 3.27 million hectares of farm land are irrigated.” With limited natural resources, Burkina Faso is faced with the constant challenge of ensuring food security and providing economic opportunity to its population of 16.97 million.

“Maize, sorghum and millet make up 85-90 percent of the staple diet in Burkina Faso, while in rural areas these cereals make up nearly 100 percent of consumption and little is ever marketed.” As such, food security is highly reliant on agricultural activities. Unfortunately, the agricultural sector is Burkina Faso inadequately supported by modern technologies to improve its productive capacity and, therefore, remains among the least productive in Africa. Because of these weaknesses, ensuring food security through combatting climate change must be a priority for Burkina Faso.

Ensuring food security, while a daunting task, is necessary to promote stability in Burkina Faso, within the ECOWAS sub-region, and within the African continent as a whole. Fortunately, the government and its international supporters have recognized ensuring food security as a priority area and, as such, efforts are being made to improve the agricultural sector and to curb the negative effects of climate change. Chapter three takes a deeper look into these practices.
Endnotes


5 FAOa, (2008), op.cit.


8 Ibid.


10 Ibid.


13 FAO. (2008a)., op. cit.


15 FAO. (2008a)., op. cit.

16 Ibid., p. 27.


18 Ibid.


20 FAO. (2008a)., op. cit.


22 Ibid.


25 Ibid. p.xi.


27 Ibid. p.34.


29 Gregory, P.J., (2005), op. cit.


33 FAO. (2001), op.cit., p.50.
37 Ibid.
38 Ingram, J. (2011), op. cit.
40 Anya, M.I., et al., op. cit.
41 Ibid., p. 55.
43 Schmidhuber, J. & Tubiello, F. (2007), op. cit. p.19703
46 Ibid.
47 Ibid.
50 Burke, M. & Lobell, D., op. cit.
51 Ibid.
52 Ibid.
53 Mwaniki, A., op. cit.
54 FAO. (n.d.), op. cit.
59 Ibid., p.25
60 FAO, (2008), op.cit., p.9
61 Ibid.
62 Gregory, P.J., op. cit.
63 FAO, (2008), op.cit.
64 Burke, M. & Lobell, D., op. cit., p. 21
65 Ibid.
66 Ibid., p. 25.
67 Burke, M. & Lobell, D., op. cit.
68 Ibid.
69 Ibid.
70 Brown, O. & Crawford, A., op. cit.
ibid, p. 2.
78 Ibid.
81 FAO, op. cit., para.2
Chapter Three

ADAPTING TO CLIMATE CHANGE FOR FOOD SECURITY

3.1 Vulnerability Profile of Burkina Faso

Vulnerability to climate change refers to “the degree to which geophysical, biological and socio-economic systems are susceptible to, and unable to cope with, adverse impacts of climate change.”¹ Therefore, a society relying primarily on rain-fed agriculture, like those in many sub-Saharan African countries, is much more vulnerable to climate change than a society that derives its main livelihood from labour. Many regions in Africa are considered to have highly vulnerable climates due to extreme variability in seasonal weather events, overexploitation of natural resources, and over-reliance on agriculture. Coupled with widespread poverty, low education and health levels, and ongoing conflict, Africa is very vulnerable to climate change. While there are general ways to improve Africa’s overall vulnerability, such as good governance and improving education, individual countries require individualized adaptation strategies. In order to find adaptation methods that are suitable to climate change in a particular area, it is important to understand the vulnerability profile of the specific country, or region, of study. It is in this light that the vulnerability profile of Burkina Faso follows.

3.1.1 High Level of Poverty

Burkina Faso has consistently been ranked by various poverty indexes as one of the poorest countries in the world. According to 2009 data from the World Bank,² 72.6% of Burkinabéés live in poverty. Oxfam attributes this high level of poverty to the dry climate and lack of water for agriculture and human consumption, the degradation of natural resources, and high demographic pressure.³ Low levels of education, weak transportation infrastructure, lack of access to adaptation technologies, and the absence of weather forecasts, all associated
with poverty, make it difficult for the citizenry to cope with the inevitable changes in the climate. This, therefore, adds significantly to the high vulnerability of Burkina Faso. Furthermore, Burkina Faso is a highly indebted country relying significantly on foreign aid to support national activities. As such, measures to address Burkina Faso’s vulnerabilities must, at the same time, address poverty.

3.1.2 Environmental Disasters

Environmental disasters in Burkina Faso are increasingly common, and are the key source of Burkina Faso’s vulnerability. The most significant include:

3.1.2.1 Drought

Drought affects more people around the world on an annual basis than any other natural phenomenon. Drought is a recurring problem in Burkina Faso, with significant effects on the population and the agricultural sector. Of recorded natural disasters between 1900 and 2013, severe drought, occurring more than 12 times, was the most significant environmental disaster in that it affected the greatest number of individuals (see Table 1).\(^1\)

<table>
<thead>
<tr>
<th>Date</th>
<th>Persons Affected</th>
</tr>
</thead>
<tbody>
<tr>
<td>December 2011</td>
<td>2,850,000</td>
</tr>
<tr>
<td>December 1990</td>
<td>2,600,000</td>
</tr>
<tr>
<td>November 1980</td>
<td>1,250,000</td>
</tr>
<tr>
<td>April 1969</td>
<td>975,000</td>
</tr>
<tr>
<td>1977</td>
<td>442,000</td>
</tr>
<tr>
<td>1988</td>
<td>200,000</td>
</tr>
<tr>
<td>December 1995</td>
<td>75,590</td>
</tr>
</tbody>
</table>

Table 1: Top 7 Instances of Drought by Number of People Affected, 1900-2013
Source: Adapted from EM-DAT (2013)

\(^1\) It is important to note that in order for a disaster to be entered into the EM-DAT database it must fulfill one of the following criteria: 10 or more people reportedly killed; 100 people reported affected; a call for international assistance; or a declaration of a state of emergency (EM-DAT, 2013). It is also important to note that some natural disasters, such as droughts, do not have an exact start or end date – as seen in 1977 and 1988 in Table 1.
3.1.2.2 Flooding

In general, West Africa has experienced a reduction in precipitation in recent decades. While water supply remains a challenge, there have been a number of large scale disasters due to flooding. In fact, next to drought, ironically, flooding has affected the greatest number of people in Burkina Faso over the 1900 – 2013 period. Although there were 16 large scale floods over the period, the floods in 2007 and 2009 caused the most significant damage, affecting 151,000 and 133,362 people, respectively. The 2007 flood saw 33,000 hectares of farmland engulfed by flood waters and the 2009 flood saw 22,220 hectares of farmland washed away by flooding rivers and lakes, resulting in the destruction of 42,000 homes. The effects of the flooding were exacerbated by the destruction of 15 dams. The combined total economic cost of these two floods was upwards of $150 million USD given that livelihoods were destroyed and infrastructure, including households, were washed away.

3.1.2.3 Wind Storms

The dry season in Burkina Faso lasts for approximately eight months in the north, and six months in the southern parts of the country. Towards the end of the dry season, typically between December and March, the harmattan winds (a dry, dusty wind originating in the Sahara) often bring damage to crops through their desiccating effect. The dry season is typically followed by a wet, or rainy, season which occurs in March-April in the south, moving north by June-July. The rainy season often brings wind storms, with wind speeds of over 100km/h. These winds exacerbate the challenge of desertification and further degenerate soil quality.

3.1.3 Disease Outbreaks

Not only have environmental events created significant vulnerabilities in Burkina Faso, so, too, have epidemics. In terms of numbers of individuals killed, epidemics in
Burkina Faso since 1900 have been the greatest natural disaster, and have occurred innumerable times (see Table 2). The majority of these outbreaks have been meningitis, cholera and diarrhea.\textsuperscript{10} At the same time, malaria is the second most common killer. Burkina Faso falls behind many other countries in terms of maintaining a healthy population and providing health services.\textsuperscript{11} As such, the disease burden becomes even higher when outbreaks occur. Health services in rural areas are even scarcer than in urban areas with patients travelling, on average, 10km to receive health care. Poor road infrastructure to connect towns, combined with the fact that the majority of the population lives in rural areas, makes dealing with disease outbreaks more challenging.

<table>
<thead>
<tr>
<th>Date</th>
<th>Persons Killed</th>
</tr>
</thead>
<tbody>
<tr>
<td>February 1996</td>
<td>4,071</td>
</tr>
<tr>
<td>February 1997</td>
<td>2,274</td>
</tr>
<tr>
<td>January 2001</td>
<td>1,525</td>
</tr>
<tr>
<td>January 2007</td>
<td>1,490</td>
</tr>
<tr>
<td>December 2001</td>
<td>1,447</td>
</tr>
<tr>
<td>January 2003</td>
<td>1,058</td>
</tr>
<tr>
<td>January 2010</td>
<td>841</td>
</tr>
<tr>
<td>January 2006</td>
<td>784</td>
</tr>
<tr>
<td>December 1981</td>
<td>650</td>
</tr>
<tr>
<td>January 2004</td>
<td>527</td>
</tr>
</tbody>
</table>

Table 2: Top 10 Instances of Disease Outbreak by Number Killed, 1900-2013
Source: Adapted from EM-DAT (2013)

As we have already seen, the prevalence of disease has been compounded by the growing climate change problem in Burkina Faso. Diseases like malaria and cholera thrive in areas where water stagnates following flooding. The harmattan often contributes to respiratory problems and can spread meningitis. The commonality of epidemics coupled with the fragile healthcare system, results in the food utilization aspect of food security being compromised due to the weak health of the population.
3.1.4 Reliance on Agriculture

Livelihoods based on agriculture and pastoralism provide the main source of income for much of the Burkinabé population. At the same time, these livelihood activities are intrinsically linked to environmental conditions. Climate change significantly affects the natural environment and, as such, many livelihoods are vulnerable when changes occur. Agriculture, for instance, requires favourable weather conditions at particular intervals to generate successful harvests; therefore, climate change, which alters these conditions, impacts on the profitability of agriculture and, thus, affects food security. More so, agriculture is a main source of income for many, threatening food access, and is a means to ensure food availability for large portions of the population. Imported food costs are high and much of the population lives in poverty, meaning that purchasing additional food stocks is not always feasible. In general, if a household is not able to grow their food, all elements of food security are jeopardized. Therefore, Burkina Faso’s vulnerability stems largely from the overdependence on rain-fed agriculture.

Although the 2012/2013 harvest recorded higher yields than the previous year, Burkina Faso is still trying to overcome the food price crisis that occurred as a result of three environmental shocks in a span of five years – particularly as a result of the 2011/2012 drought. Approxiately 1.8 million people still remain food insecure due to low purchasing power, low household agricultural production, and difficult access to food.

It is important to consider that Burkina Faso’s environmental vulnerability stems from both natural climate changes, as well as human induced climate changes. For example, unsustainable land management practices, such as over-cultivation of land with little action to sustain soil nutrient levels, contribute significantly to soil degradation. In many cases, it is small land holding farmers who tend to exploit, or overexploit, lands for their livelihood and nutritional needs.
3.2 Scientific Perceptions of Climate Change

3.2.1 Climate Trends

There is a high degree of uncertainty regarding climate projections in West Africa and, therefore, Burkina Faso. This is largely attributed to a weak meteorological network in countries. Although this uncertainty persists, some trends can be perceived and it may be inferred that climate change will increase weather variability and the occurrence of extreme weather events. Due to the agricultural nature of Burkina Faso, climate changes will have negative effects on the economy as well as food security of the entire country.

3.2.1.1 Changes in Precipitation

Data collected by the USGS shows that rainfall declined significantly and rapidly between 1950 and the mid-1980s, with a short recovery in the 1990s.\(^\text{16}\) By 2000, however, the recovery stalled and the average rainfall between 2000 and 2009 was about 15 percent lower than the 1920 – 1969 mean average.\(^\text{17}\) More recently, the rainy season of 2013, which is currently underway in Burkina Faso, has seen lower than average precipitation. This has created below-average vegetation conditions for this time of year, requiring several weeks of above average rainfall to eliminate the otherwise inevitable seasonal deficits.\(^\text{18}\)

3.2.1.2 Rising Temperatures

Data collected by the USGS also shows that temperatures have most noticeably increased since 1975. With rates of warming around 0.15° Celsius (°C) per decade, temperatures have increased approximately 0.6°C across most of Burkina Faso.\(^\text{19}\) It is projected that temperatures will increase by 3°C – 4°C by 2080 – 2099 as compared to 1980 – 1999, which is substantially higher than the global average.\(^\text{20}\) Such increases could have a significant impact on agriculture as water shortages and droughts become more likely.\(^\text{21}\) Most of Burkina Faso’s cereal crops can withstand temperature increases if water is available;
however, because irrigation remains limited and rainfall will likely decrease, it is projected that crop yields will decrease.\textsuperscript{22}

### 3.2.2 Explanations for Changes

Since the droughts of the late 1960’s and 1970s, scientific research has sought to explain the reasons for climate changes in the Sahel. In the mid-70s, it was thought that the occurrence of drought and other weather phenomenon were attributed to land clearing for agriculture and pastoral activities which led to overgrazing in many Sahelian countries.\textsuperscript{23} Empirical evidence of a drying trend in the region was presented in 1985 by Lamb and, fifteen years later, was reconfirmed by regional rainfall records.\textsuperscript{24} This was largely attributed to multiple decades of rainfall variability and extreme desiccation.\textsuperscript{25} In more recent years, some research suggests global warming and greenhouse gas emissions will lead to increases in rainfall while other human attributed factors may bring about drought. While changes and trends are distinguishable, solid evidence as to the causes of these changes, however, is harder to come by. As such, some researchers have tried to look at local perceptions of climate change and weather trends to establish an understanding of local realities that can lead to suitable adaptation measures.

### 3.3 Local Perceptions of Climate Change

#### 3.3.1 Climate Trends

In many studies about agricultural adaptation to climate change, the knowledge of local people, the individuals whom those changes most significantly affect, is missing. However, local knowledge often offers valuable insights into climate trends and how this has affected the activities of farmers and households.\textsuperscript{26} Therefore, fieldwork for this study sought to determine what Burkinabé thought of climate change. Both farmers and households were
interviewed and asked to identify what climate changes they had observed in the course of the last 10 years, and how they were coping with these changes, if any. The results of 16 interviews with people of varying backgrounds largely suggest climate changes of shorter rainy seasons, heavier winds, increased temperatures, and an increase in the prevalence of locusts and other crop pests.

### 3.3.1.1 Changes in Precipitation

Fieldwork conducted by West *et al*, taking place between 1998 and 2004, sought to attain local perceptions of rainfall variability to understand how climate information can help farmers to adapt to climate change and household adaptation measures.\(^{27}\) At the time, scientific analyses had demonstrated that the study area was experiencing a modest recovery in rainfall; however, this view was not echoed by farmers who had observed a long-term decline in rainfall as well as increased weather variability.\(^{28}\) Findings by West *et al* regarding rainfall are also supported by a similar study of five West African countries, including Burkina Faso, conducted by Akponikpé *et al*. Their analysis found that 86% and 81% of Burkinabé farmers interviewed perceived the rains to start later and end earlier, respectively.\(^{29}\)

This view about rainfall was supported in the recent fieldwork conducted for the current research in which farmers and households were asked to identify perceived climate changes. All farmers interviewed (eight) identified shorter rainy seasons, while six households identified the same. It was a common view among farmers that the rains may start well, albeit later, but stop sooner – sometimes at key growing times when rain is most needed for budding plants. Furthermore, one farmer reported that the rains started okay in 2013, although they were lighter than in previous years, but have stopped early and, although it may still continue to rain in the coming weeks, it will not be enough to meet agricultural needs. If this turns out to be the case, there could be devastating effects on the success of crops.
3.3.1.2 Extreme Weather Events

Various studies conducted in Burkina Faso demonstrate that locals have experienced extreme weather events for some time. For example, a study conducted by Lindskog & Tengberg indicates that “an increased wind impact” has been perceived by indigenous groups as a problem because it removes already deteriorating soils and causes damage to trees.30

These perceptions of extreme weather events, particularly flooding and heavy winds, were also reported in the recent fieldwork. Interviews with farmers conducted for this work show that it is a common perception that winds have become heavier and stronger in the last 10 years. At the same time, 5 households identified heavier winds as an exhibition of climate change. One respondent deemed the winds to be so strong that they are able to destroy houses (many of which are built out of mud) making these winds more dangerous than has been seen in the past.

Farmers were also asked to identify the most severe occurrences of perceived climate change in the last ten years. While poor rains were mentioned several times, six respondents recalled severe flooding in multiple years, with the most severe having occurred in September 2009. The flooding in 2009 was also reported, as discussed earlier in the chapter, as one of the most physically damaging and costly natural events since 1900.31 Respondents recall the flooding destroying crops as well as infrastructure like roads and houses. Due to flooding and extreme winds, innumerable houses have had to be rebuilt. Crops have been destroyed, and food supplies have been washed away.

3.3.1.3 Rising Temperatures

In Burkina Faso, Akponikpé et al found that 79 percent of those interviewed perceived temperatures to be growing hotter.32 In addition, farmers found that the overall number of hot days had increased.33 In the current research, all respondents but one reported hotter temperatures now, than ever before. According to one farmer, hotter temperatures
mean that they are not able to produce as much because they do not receive adequate rainfall necessary under conditions of hotter temperatures. During the field work, hotter temperatures were also seen to have ‘burnt’ plants that were in the early stages of growth (see photo 1). Farmers explained that the burning would not prevent the plant from developing entirely, but the amount of fruit was likely to decrease.

![Photo 1: Strawberry plant leaves 'burning' due to high temperatures](source: Researcher’s photograph taken during fieldwork, 2013)

3.3.1.4 Increased Insect Prevalence

Interviews with seven farmers during the course of the fieldwork for this work suggest that insects are becoming an increasing problem for agriculture. Caterpillars and beetles have been found in increasing numbers on farms. These insects eat the leaves and buds of plants, sometimes destroying them before they can be harvested (see Photo 2). While farmers are aware that pesticides are available to help deal with the problem of insects, many report being unable to finance the purchase of them.
3.3.2 Explanations for Changes

All respondents recognize that environmental changes are taking place in Burkina Faso. The nature of, and reason for, these changes remains to be debated amongst locals. However, the current research finds that more than half of the total respondents believe religion to be related to these changes. A common response was that it was God’s will for the changes to take place. Furthermore, some saw climate change to be attributed to the bad actions of human beings (such as murder and crime that have recently been common in the news in Burkina Faso) and God was, therefore, punishing them for people’s sins. This explanation was also common in Lindskog & Tengberg’s research in which many participants ascribed changes to God who was seen to be punishing man for his evilness. As such, people seem to accept climate change with some degree of indifference, although there remains some level of frustration due to the challenging nature of the agricultural sector, knowing that God has a plan for them.
Other respondents see the reported changes in the environment (i.e.: changes in precipitation, temperatures, insects, etc) to be attributed to global climate change which has presented itself in Burkina Faso. These responses, however, were much more common among those living in the capital city and finding employment outside of agriculture.

One unique response of the current research has been very well supported in the literature. A young (male) farmer believed that climate change is occurring due to human activities. He suggested that the ground has become “tired” due to overuse. While he was able to identify this as a reason for climate change and lower agricultural yields, he felt there was no alternative for many farmers because land access is difficult and exclusionist in Burkina Faso.

### 3.4 Government Interventions

Given the economic and social importance of the agricultural sector, Burkina Faso has been very proactive in addressing environment-related issues at the national as well as regional level. Despite its limited financial resources, Burkina Faso has taken the initiative to act as a regional leader to tackle environmental issues in West Africa and the Sahel region. As such, Burkina Faso plays host to several regional organizations that seek to combat climate change and improve food security in the region, including the CILSS and CORESA. Burkina Faso has also been authorized by ECOWAS and UEMOA to experiment with GMOs for the cotton sector. At the same time, Burkina Faso is active in South-South cooperation, being one of the first countries in West Africa to work with the Brazilian Technical Cooperation Agency which has sought to transfer agricultural technology from Brazil to countries in Africa.

Several policies and strategies have been developed by the Government of Burkina Faso. While many of these are multi-sectoral, food security and environmental stability are
addressed throughout. The Government has even gone so far as to create a Ministry that deals specifically with food security issues – the Ministry of Agriculture and Food Security *(Ministère de l’Agriculture et de la Sécurité Alimentaire).*

### 3.4.1 NAPA

Under the auspices of the UNFCCC, NAPAs allow LDCs, such as Burkina Faso, to prioritize action areas for responding to climate change. The NAPA, while focusing specifically on climate change, is linked with other national development strategies, like Burkina Faso’s PRSP and over a dozen other policy documents and strategies. Burkina Faso has used its NAPA as a means to leverage international support as well as the funding necessary to carry out the various projects identified. For example, initiatives addressing livelihoods have been mutually carried out by the Ministry of Environment along with UNDP.

Burkina Faso’s first NAPA, adopted in 2007, identifies 12 projects to combat climate change, five of which are directly related to improving food security (see Annex C). These five projects seek to: (1) improve irrigation technologies to increase cereal production; (2) strengthen farmers’ adaptive capacities to climate change to support livestock rearing; (3) support the livelihoods of pastoralists; and (4) strengthen coping skills for sustainable agriculture. The new NAPA of 2012 builds on lessons learned from the first plan, but seeks to pursue the same goals.

These projects have been operationalized through various other strategies, including a policy for irrigated agriculture *(Politique Nationale de Développment Durable de l’Agriculture Irriguée)*, which is a key policy for ensuring environmental sustainability and the productivity of food crops.
3.4.2 Saaga Programme

The Saaga Programme, Saaga meaning ‘rain’ in the Mooré language, was launched in 1998 to address the trend of decreasing rainfall. The purpose of the programme is to artificially modify the weather so as to increase rainfall. This is done through cloud seeding – a process in which aircraft are used to release salt-based chemicals into already forming clouds - this enlarges the water droplets and forces the clouds to shed rain. As such, the programme is highly suited to areas where water resources are limited and where agriculture is a key activity, such as in Sahelian countries like Burkina Faso.

Saaga’s initial objectives were to ensure drinking water supplies, to improve agricultural production particularly in low rainfall areas, and to transfer knowledge to citizens. Between its inception in 1998 and 2004, the Government of Burkina Faso reported an increase in cash earnings from agriculture of 10-15 percent. This is, in large part, due to the filling of reservoirs from increased rainfall that has allowed for year-round irrigated cultivation.

Some of the challenges associated with this programme include the fact that it, just like agriculture, is weather dependent. The programme cannot operate without already existing clouds – something that can be missing for long periods of time during dry spells. Therefore, it is also necessary to have sufficient meteorological stations to track cloud formation and movement. The programme also runs at a high cost, requiring skilled technicians and specialty equipment. As such, cloud seeding’s sustainability in a country like Burkina Faso which relies heavily on foreign aid, is weakened.

3.4.3 National Food Security Strategy

In 2003 Burkina Faso developed a national food security strategy, known as La Stratégie National de Securité Alimentaire (SNSA), which seeks to improve food security
and reduce inequality by 2015. The priority areas for the strategy include: (1) water management; (2) soil fertility; (3) pastoralism, fisheries, forestry and hunting; (4) energy; (5) improving production; (6) development of sectors with high potential for growth; (6) market development; (7) income generation; and (8) international cooperation. To operationalize this strategy, an implementation plan was developed, the *Strategie Operationnelle et Programme de Sécurité Alimentaire*. The first stage was conducted between 2003 and 2007, with subsequent stages ongoing.

### 3.4.4 Campagne Agricole

Burkina Faso “has been credited with being the first African nation to have adopted a national program of adaptation to climate change through a support to smallholder farmers.” In this regard, a national agricultural campaign, *Campagne Agricole*, is held annually giving supports to farmers and households both in seeds, fertilizers, and food stocks. Unfortunately, limited information can be found on this project, though recent newspapers in Burkina Faso showcasing the 2013 campaign have provided assistance to thousands across the country.

### 3.4.5 Government’s Challenges

Despite these endeavours, further efforts are required on the part of the Government to ensure that its policies and strategies are beneficial. One of the main challenges is policymakers’ unwillingness to ensure that the safeguards put in place are enforced and adhered to. Furthermore, while the Government has been a leader in some regards, translating rhetoric into action has been slow.

Another significant challenge is the dissemination of information from government to farmers or other beneficiaries. Because sufficient energy has not been put into educating the local population about policies, farmers tend to ignore even the most basic regulatory
policies. Therefore, many government activities go (largely) unnoticed and have a smaller impact than visualized during policy planning.

Fieldwork for this study strongly demonstrated this challenge. All farmer respondents interviewed reported having heard of government activities regarding climate change, agriculture, and/or food security. However, no farmer reported having his/her livelihood activities supported by any government programme. Although the specifics of these government programmes could not be explained by those interviewed, they were described as programmes to support those who cultivate rice or tutorials for new coping strategies.

Two respondents also made reference to a government feeding programme which provided reduced food prices (cereals) to individuals in certain locales; however, the respondents personally had not benefited. One of these respondents added that her family could have benefited from the reduced food price programme because their location was one of the targeted communities. However, on the day that they were told to bring their money to purchase the food products, the supplies were finished before she arrived. She attributed this to local government authorities who “redistributed” the food supplies to supporters, friends and family members rather than directing them to the intended beneficiaries.

3.5 Local Adaptations

Given the ever-changing environment in Burkina Faso, adaptation is a long standing practice and survival mechanism. It is in recent years, however, that Burkinabé adaptations have not been enough to cope with changes. According to Simonsson, traditional systems for adaptation in Burkina Faso may be insufficient because they are “overextended by other factors such as internal population dynamics and external pressures.” As climate changes worsen, it is likely that the coping capacity of individuals will be severely strained.
In addition to finding adaptive mechanisms suited to Burkina Faso, it is equally important to find ways to prevent and remove maladaptive practices. These maladaptive practices refer to practices that increase vulnerability rather than reduce it.\textsuperscript{31} Maladaptive practices include poor irrigation management and overuse of soil, among others. On the other side, supportive policies and programmes such as reforestation and water resource management can positively contribute to successful adaptations to climate change. As such, this research looks at the adaptation measures currently practiced in order to explore other options or possibilities to ameliorate the effects of climate change and to improve food security in Burkina Faso.

Within the context of the fieldwork conducted for this research, agriculture was the main source of income for the majority of respondents (N=10). Farmers (locally known as \textit{cultivateurs}) interviewed mainly grew their products for household consumption. However, the majority of respondents said that crops grown during the rainy season (mainly cereals: maize, millet, and sorghum) were stored and used for household consumption, while crops grown in the dry season (mainly vegetables/fruits: tomato, onion, cucumber, carrot, lettuce) were sold locally. If their produce became too much for household consumption or domestic sale, products were also sold internationally (mainly to Côte d’Ivoire).

\subsection*{3.5.1 Fertilizer}

The use of fertilizer has the potential to improve soil fertility to support plant growth. However, the use of inorganic fertilizer has the capacity to further degrade the environment. In countries like Burkina Faso where soil degradation is already a significant challenge to the agricultural sector, inorganic fertilizer should be promoted and used with caution. At the same time, low levels of fertilizer use (particularly organic fertilizers) contribute to soil degradation as lands are depleted of nutrients and minerals needed to sustain agriculture. Many scientists believe that the use of organic fertilizers is key to rebuilding soil quality
while at the same time improving harvest yields. Unfortunately, the availability of organic fertilizers is one of the limiting factors as to why fertilizer usage remains low.

In the current research, fertilizer usage was one of the most commonly reported coping mechanisms for farmers. Typically fertilizer used is a mix of imported fertilizer products bought in the markets and local, organic products like compost and manure. One farmer reported that, while fertilizer could help increase harvest yields and the health of crops, it still relied heavily on the rain, without which investment in fertilizer is wasted money. Another farmer complained that the price of fertilizer was increasing every day, gradually becoming less feasible for small-scale subsistence farmers. Farmers also explained that the use of fertilizer changes how crops are planted, for example using the zaï technique explained below in section 3.5.4. However, fertilizer usage, particularly imported chemical or mineral fertilizers, remains rather limited in Burkina Faso due to access and price constraints.

3.5.2 Irrigation

Irrigation is an important technique for agriculture, particularly in areas where inconsistent rains threaten the growing cycle of crops. However, in Burkina Faso, just as in much of sub-Saharan Africa, irrigation practices are insufficient to ensure a productive national food system. Out of 3.27 million hectares of farmland in Burkina Faso, only 15,000 hectares are irrigated.

Despite low overall usage throughout the country, along with fertilizer usage, the implementation of irrigation technologies was the most common adaptation mechanism employed by farmers interviewed. Farmers with lands near rivers or lakes, such as those interviewed in Loumbila, had the opportunity to dig trenches from the body of water to irrigate crops. Those further away from water bodies had to dig wells for watering crops (see Photo 3). However, despite the use of wells to water crops, one farmer reported that the
amount of water available is still not enough in the driest parts of the year. Furthermore, manual watering is a highly labour intensive process involving dropping a watering can into a well with many back and forth trips to water rows of plants – with each row of plants requiring watering 2-3 times per day. Some farmers had made collective investments in electric pumps to pump water from wells into watering cans to alleviate some of the labour required. One farmer was also observed to have invested in a pump and hose system which made watering fields a much quicker process (see Photo 4).

![Photo 3](image)

**Photo 3: A well for manually fetching water in Boulmiougou**
Source: Researcher’s photograph taken during fieldwork, 2013

### 3.5.3 Diversifying Crop Varieties

Coping with climate change to maintain the agricultural sector has often required that farmers change their crop varieties. This may involve changing varieties of one type of crop, for example switching to a sorghum variety with a shorter harvesting period, or changing the type of crop altogether, for example, planting millet instead of sorghum. In research conducted by Roncoli *et al* a drought in 1997 increased farmers’ interest in shorter duration varieties of crops. In some ways, this was a risk for farmers because the longer varieties were better suited to the climate – they are more productive, more resistant to weeds, pests
and water scarcity, and store better.\textsuperscript{56} However, the desire to shorten the hunger season was a strong incentive to switch to a variety with a shorter growing duration.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{watering_hose.jpg}
\caption{A watering hose attached to a motorized pump used by a farmer in Loumbila to irrigate crops}
\label{fig:watering_hose}
\end{figure}

\begin{quote}
\textbf{Photo 4: A watering hose attached to a motorized pump used by a farmer in Loumbila to irrigate crops}
\textit{Source: Researcher’s photograph taken during fieldwork, 2013}
\end{quote}

Also related to shortening the hunger season, Roncoli \textit{et al} observed more farmers planting maize because it can be harvested several weeks before other staple cereals.\textsuperscript{57} There was a rise from 33\% of households growing maize in 2007 to 76\% in 1998.\textsuperscript{58} However, maize is more vulnerable to water deficit, so planting it with no rain in site is not an option. In 1998, for example, an unexpected dry spell resulted in all the maize that had been planted wilting and dying. As such, due to its water requirement, maize is often a less appealing alternative to Burkinabé farmers’ desire to curb hunger.

In the recent fieldwork, four farmers reported changing their crop varieties as an adaptation strategy. This included buying different crop varieties (longer or shorter duration
seeds), as well as changing some of the crops from year to year. For instance, one farmer reported that if a crop is poor in year one, that same crop would not be grown in year two, but that they might try again in year three. This, for the most part, excluded staple crops and referred more to crops grown for local sale. Other farmers reported that changing crop varieties was also linked to availability of seeds, as some varieties cannot be locally purchased, or the cost is too high. Some seed varieties also require increased use of fertilizers which were seen as too expensive to be purchased; therefore, some farmers’ ability to change varieties, though they may have liked to, was limited by their financial status.

3.5.4 Change Planting Practices

Typically, farmers in Burkina Faso select and store seeds from their harvest to be used for planting from season to season. In dry years, or years with increased food insecurity, many farmers were forced to consume their seeds before planting. As a result, they were compelled to purchase seeds in the market. This is reported to be a risky measure, as one cannot be sure of the seed source, the conditions under which it has been stored, and even the variety. This finding was reiterated by respondents in the current study. Farmers reported on several occasions that purchased seeds, in recent years, have become poor. While their packages seemed to be of high quality, the seeds were discovered to be of poor quality once they were planted. Poor quality, according to farmers in Loumbila, meant that the variety of the seed was not suited to the climate or that the plant would yield limited or no produce.

Soil and water conservation techniques have also been implemented to adapt agriculture to the changing climate. The most commonly used is zaï, a traditional farming technique in which a small pit (10-20 cm in depth, 20-40 cm in diameter) is dug during the dry season, to which organic matter such as manure and crop waste is added. After the first rainfall, the seed is planted in the middle of the pit which is then covered with a thin layer of soil. Twigs, leaves and other debris are carried by the wind into the pits, triggering termite
activities which help water infiltrate into the soil and, therefore, contributes significantly to improving and rehabilitating soils. The practice serves to:

i. Capture rain and surface/run-off water;
ii. Protect seeds and organic matter against being washed away;
iii. Concentrate nutrient and water availability at the beginning of the rainy season;
iv. Increase yields; and
v. Reactivate biological activities in the soil to lead to an improvement in soil structure.

The challenge with this technique is that it is very labour intensive and requires quality organic matter that is not always easily accessible. Furthermore, it cannot be practiced year round, as zaï pits are most successful when created during the dry season. However, if properly executed, the zaï technique is reported to increase production significantly. Farmers interviewed for this work reported zaï to be an effective planting method as well as a means to help rejuvenate tired soil.

3.5.5 Alternative Livelihoods

Sometimes agricultural production is not enough to sustain households, particularly with the grave effects of climate change. Farmers who cannot grow enough for household consumption and local sale may be forced to turn to other sources of income to buy additional food supplies. In a study conducted by Roncoli et al the most common alternate livelihoods included migration and trading. Migration from Burkina Faso, mainly as farm labourers in Côte d'Ivoire, provides an additional source of income to families through remittances. This practice has several advantages, including additional income sent home to Burkina Faso and fewer individuals to provide food for at home. However, migration is also draining on local agricultural production in which some family labour is lost. In the recent research, migration was only reported three times as a means of adaptation, with several farmers and households confirming that the practice was seen as a loss for family labour. Migration is a
significant constraint for labour intensive practices, such as zaï, so is a less attractive form of adaptation for many.

Trading also serves as a coping mechanism in times of crisis. Data collected by Roncoli et al.\textsuperscript{68} and Delgado\textsuperscript{69} demonstrate that trading provides for one quarter of money spent on food. Agricultural families interviewed for this work reported selling stones for building houses and selling the surplus of their harvests.

Households, agricultural or not, also need to find ways to adapt because food prices are constantly rising, a complaint commonly raised by those interviewed. Interviews with households indicate that seeking additional livelihoods or sources of income was necessary to offset rising food prices and food unavailability at times. Non-agricultural families sought additional income to buy food products by selling building materials or seeking employment as domestic help or in other informal and formal service sectors. While this practice was not always permanent, most often carried out during the non-peak agricultural season, small-scale trading provided additional income when necessary.

\subsection*{3.6 International Adaptations}

In many cases, Burkina Faso’s traditional systems have become insufficient or over-utilized coping mechanisms, undermining their effectiveness. Hence, the known means of adapting are no longer providing the results required to ensure agricultural productivity and food security, as well as environmental sustainability. It is on this note that this research has sought to look at successful adaptation practices from other parts of the world that may have some success in Burkina Faso.

\subsection*{3.6.1 Africa}

Conservation agriculture is an alternative to traditional farming practices which derives multiple economic and environmental benefits. The practice is characterized by (i)
minimal soil disturbance, like tilling; (ii) maintenance of carbon rich organic matter, such as crop residue; and (iii) rotations or sequences of diversified crops. In Lesotho, this practice is known as likoti which has been successful in boosting agricultural yields and thereby improving food security. At the same time, the likoti method allows farmers to improve soil fertility and to combat erosion. Another advantage of the likoti method is that it can be used with different farming systems and different combinations and varieties of crops. In addition to adapting to climate variability, conservation agriculture like likoti paves the way for increased yields while at the same time requiring limited inputs, like fertilizer. The success of the practice, however, requires substantial training in order for farmers to realize the economic and environmental advantages.

3.6.2 Asia

In China, desertification is an ongoing and deep rooted problem. As the Gobi Desert continues to expand due to overgrazing, deforestation and drought, it eliminates farmland and rural settlements. Since the late 1970s, the Chinese government has been implementing programmes and activities to deal with desert encroachment and to combat climate change. Reforestation through the Great Green Wall programme, named so for its almost parallel location with the Great Wall of China, seeks to re-establish vegetation to act as a barrier against desertification. Overall, the target is to increase forest coverage in Northern China from 5 percent to 15 percent by 2050. The method used involves an outer shelterbelt of trees with a fence around the perimeter to restrain sand. Within the belt of trees, shrubs and other sand resistant vegetation are planted amongst gravel platforms which hold down sand in an attempt to develop a soil crust. Scientific studies conducted by Liu et al demonstrate that the 7,000km long and 400-1,700km wide Great Green Wall has been effective in improving soil moisture, decreasing wind speed, and increasing overall precipitation which is key to
halting deforestation and desertification and creating an area more hospitable to agricultural activities.77

Given the similar challenge with soil erosion and desertification in Burkina Faso, a similar approach could be deployed in which reforestation in a wall-like pattern could be used to prevent erosion. In fact, similar processes are practiced on a small scale in Burkina Faso where shrubs are planted in walls around agricultural lands to improve water retention and diminish soil erosion. On a larger scale where trees are used, it is likely that a shelterbelt could be useful in protecting substantial land areas from climate change.

The practice of rice-fish agriculture in China presents another opportunity for South-South knowledge transfer. In this method, rice fields are irrigated using water from streams with fish swimming throughout, creating an “ecological symbiosis.”78 Studies in Bangladesh also show that rice-fish agriculture helps in pest management because the fish help control aquatic weeds and algae and eat insects which serves as a means to limit water born diseases, such as malaria.79 The need for costly fertilizers is limited which helps preserve surrounding lands and water sources. At the same time, the practice helps communities to ensure a sustainable food supply and to contribute to ecological diversity. One of the advantages of this practice is that it is both a favourable cropping option as well as a means to shift towards a more balanced diet, which contributes greatly to the food utilization aspect of food security.80 The main challenge with this approach to rice cultivation is the fact that it requires a greater supply of water to meet the greater water depth necessary for fish culture.81 In a place like Burkina Faso, where water resources are already limited, the feasibility of this approach is reduced. However, in places where it can be adopted, such as areas close to water bodies, rice-fish agriculture offers many potential benefits.
3.6.3 The Americas

Like those in Burkina Faso, farmers in Peru and Bolivia face challenges with water retention while irrigation practices remain small scale for the most part. As such, national governments and NGOs have, since the 1980s, been promoting a traditional system of irrigation to improve cultivation.\(^2\) *Waru waru* (also known as *waru warn*) is a system of soil management for irrigation developed centuries ago in the ancient Inca Empire, now consisting of modern day Peru. The purpose is to facilitate water movement and storage and to increase the organic content of soil so as to improve its fertility for cultivation.\(^3\) Construction of embankments, used as raised beds, and canals, used for water storage, spaced about 30cm apart help with water retention to irrigate plants (see diagram 1).

![Diagram 1: Indigenous farming system *waru waru*](http://ugspace.ug.edu.gh)

Source: FAO, 2002

*Waru waru* is successful in providing moisture during droughts and drainage during rainy seasons and eases the movement of water.\(^4\) This practice is best suited to denser soils, like clay, rather than sandy soils which are too porous to retain water.\(^5\) As such, this practice is only suited to certain parts of Burkina Faso where sandy soil is less common, such as in the southern parts of the country. It is important to note that the lifespan of the embankments is relatively short, requiring periodic maintenance and overall reconstruction approximately every three years. However, the construction cost is low and has yielded positive results in the production of many agricultural products.\(^6\)
These practices described are just some of the potential solutions to address Burkina Faso’s climate change and food security problem. Because they have not undergone scientific and practical feasibility studies in various communities in Burkina Faso, their capacity to improve the situation is based on known similarities in the climate between Burkina Faso and the countries in which these practices are currently being applied. More study is required to understand how these practices will fare in Burkina Faso.

3.7 Public-Private Partnerships For Food Security

The most successful partnerships are those in which partners on all sides have made tangible investments. A public-private partnership is defined as a “collaborative mechanism in which public organizations and private entities share resources, knowledge, and risks in order to achieve more efficiency in the production and delivery of products and services.” Public-private partnerships allow the complementary strengths of governments and the private sector to merge, creating more sustainable actions for addressing food security.

One of the main ways in which public-private partnerships can positively contribute to agriculture and food security is through research. Research contributes to greater food security in several ways. For instance, it may help enhance agricultural productivity, quality and output, improve sustainability measures, and lower consumer prices of food. Developing countries, such as Burkina Faso, can greatly benefit from research conducted by private organizations. Unfortunately due to patent rights on many technologies and procedures, some innovative coping mechanisms are kept out of reach. Developing country public sector research institutions could work alongside the private sector with arrangements for transfer of technology in areas where a developing country’s use of the technology would not compete with targeted markets. An example of this is Monsanto’s former agreements with Kenya and Mexico to develop virus-resistant crops.
Public-private partnerships also offer new options for funding and implementing projects for agricultural adaptation, coping with climate change, and improving food security, or all three. A successful ‘bottom-up’ approach, for example, might involve funding from a national government with grassroots organizations providing training or other services to beneficiaries. Also, governments often use IOs or other NGOs as the means to implement policies. This was seen in the implementation of Burkina Faso’s NAPA in which UN agencies served as implementing bodies, while funding came from the national government and official development assistance.

To best structure a public-private partnership, an organizational design, independent from those of the various partners, is necessary. Most importantly, the partnership should “enable effective relationships between partners; facilitate decision-making, the organization of work, information flows, and monitoring and evaluation; and…allow the partnership to represent itself as a distinguishable entity to the outside world.” It is important to identify a common interest space in which activities are planned and coordinated from objectives shared by both partners.
Endnotes


7 ibid.

8 EM-DAT. (2013), op. cit.

9 Simonsson, L. (2005), op. cit.

10 Ibid.

11 Ibid.


13 Ibid.

14 Simonsson, L. (2005), op. cit.


17 ibid.


19 USGS. (2012), op.cit.


21 USGS. (2012), op. cit.


24 Ibid.

25 Ibid.


28 Ibid.


31 EM-DAT. (2013), op. cit.

32 Akponikpè, P.B. et al. op. cit.

33 Ibid.

34 Lindskog, P. & Tengberg, A. et al., op. cit.


37 ibid.

38 ibid.


44 IRIN, 2004, op. cit.
45 ibid.
48 ibid.
49 ibid.
50 Simonsson, L. (2005), op. cit.
51 UNFCCC. (2007). Climate change: impacts, vulnerabilities, and adaptation in developing countries. Bonn, Germany: Climate Change Secretariat, UNFCCC.
56 Ibid.
57 Ibid.
58 Ibid.
59 Ibid.
60 Ibid.
64 World Bank, (2005), op.cit.
65 see UNEP. (2011), op. cit.; World Bank, (2005), op.cit.
66 Roncoli, C. et al., op. cit.
67 Ibid.
68 Roncoli, C. et al., op. cit.
71 Ibid.
75 Levin, E. (2005), op. cit.
76 Ibid.

ibid.


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see OAS. (1997), op. cit.; UNFCCC. (2007), op.cit.


Hartwich, F. et al. op. cit.

ibid., p. 47.

Chapter Four

SUMMARY OF FINDINGS, CONCLUSION & RECOMMENDATIONS

4.1 Summary of Findings

This research has examined how climate change impacts food security within the context of Burkina Faso, and how local responses are being implemented. Due to the high level of vulnerability to climate change that exists in Burkina Faso, adaptation is extremely necessary so as to conserve environmental resources and, at the same time, to ensure the longevity and viability of local food production for food security and local livelihoods.

One unanimous definition for climate change has not been established. However, it is clear that it occurs due to various factors having both positive and negative effects on the world. More recently, climate change has been occurring at an alarming rate in many parts of the world, making it a very relevant topic for discussion. In countries with low coping capacities due to high poverty, rapidly expanding populations, and limited technologies among other factors, climate change is a debilitating force on the sustenance of large parts of the world’s population, affecting all aspects of life.

Food security is one of the points where climate change is a weakening factor. Food security includes availability, that is meeting the demand for food; access, referring to one’s ability to purchase food as well as the food distribution system; utilization, which includes the body’s ability to benefit from the consumption of food; and stability, which is derived from ensuring the other components of food security. Food insecurity is a current challenge for over one million people around the globe. In Burkina Faso, food insecurity is largely a product of the country’s vulnerability to climate change and its high reliance on rain-fed agriculture that feeds the majority of the population.
Scientific observations and local perceptions both indicate that climate changes are occurring in Burkina Faso due to both natural and human causes. The most commonly perceived changes include increasing temperatures, changes in precipitation, and the rise of extreme weather events such as droughts and heavy winds. These changes are attributed to many factors, with the most common local perception being that change is God’s will and, as such, people must adapt. At the same time, scientific findings point to the fact that climate change in Burkina Faso, and the entire Sahelian region for that matter, are cyclical; however, the current rate of change is most likely attributable to human activity. Regardless of the cause, climate change is making life more difficult for many in Burkina Faso and finding means to adapt is critical.

The government, in conjunction with its international partners, has championed several action plans and policies aimed at helping farmers and households adapt to climate change in order to ensure food security. While some success has been seen, food insecurity is a constant challenge and the country is always at the risk of food crises if an extreme weather event occurs. This was seen most recently in 2011/2012 when low rainfall levels severely constrained harvest yields leading to high food prices.

Government action on its own, however, is not enough. Individuals need to take action to ensure their own food security and to stabilize their livelihoods. In Burkina Faso, many farmers have turned to irrigation to help improve crop yields when rain is scarce. Others have turned to increase their use of fertilizers or change their planting practices or crop varieties. Households, too, need to adapt. Some have opted to seek additional employment. Finance, unfortunately, continues to remain a problem for both farmers and households because many adaptation measures require purchasing of additional supplies or products. Therefore, low cost but realistic solutions need to be explored.
Food security is a global challenge and, as such, coping strategies from other parts of the world exist. In southern Africa, for example, farmers have begun to practice conservation agriculture as a means to protect the environment and increase harvest yields at the same time. In Asia, farmers are coping with desertification by building shelterbelts to protect lands from desert encroachment. They are also implementing innovative farming practices, such as rice-fish agriculture, which seeks to improve yields and at the same time increases several aspects of food security. In Latin America, ancient agronomic principles are being utilized to cope with decreased rainfall and provide food supplies. A challenge persists – these strategies are underutilized and under-researched, meaning that their implementation remains largely small-scale.

To address these challenges that affect everyone, a collaborative effort into ensuring food security needs to be made. This must take into consideration local challenges, practices and suitability, while, at the same time, being innovative enough to yield and sustain a considerable impact.

4.2 Conclusion

Food security is a global challenge affecting individuals all around the world. As the world population rises, so too does the challenge of feeding everyone. Various factors, one of which includes climate change, affect food security. For those countries, like Burkina Faso, which derive substantial proportions of their national income from rain-fed agriculture and whose citizens heavily depend on agriculture to sustain their livelihoods, climate change poses a serious threat. It is a multi-sectoral problem that requires diverse responses.

Ensuring food security is key to development and has been on the international agenda for several decades. Since the Millennium Declaration, the international community has jointly sought to reduce global hunger by up to half by 2015. To address this goal, food security must also be ensured. At the same time, ensuring food security allows countries to
develop healthy workforces which are needed for industrialization and economic growth. Furthermore, a food secure population has a higher rate of human security in which people’s basic needs are met – this in turn promotes state security and a more peaceful international system. Clearly, ensuring food security in one country can have a positive impact on the entire international system and, therefore, addressing issues related to food security are key to ensuring a prosperous global community.

4.3 Recommendations

Food insecurity presents a potential cause of instability in any country. In countries with high poverty rates, too, such as in Burkina Faso, food insecurity is an additional burden which needs to be addressed in order to provide human security, translating into state security. Addressing food security requires a collaborative effort by many government ministries, civil society groups, the international community, and individuals. In this light, the following recommendations should be considered as means to grapple with Burkina Faso’s food security challenges.

Water resources are very limited in Burkina Faso. With the potential for decreases in rainfall threatening farmers, water resource management is key for ensuring food security. As such, it is important to examine sustainable irrigation strategies that make the most use of limited water resources. This also includes protecting water bodies from contamination from household waste, pollution, or agricultural run-off.

Food security requires addressing four areas: access, availability, utilization and stability. In order to improve access, investment needs to be made in road and other transportation networks to facilitate the purchasing and selling of goods. At the same time, food prices need to be stabilized so that prices are kept reasonably low and all components of the population, from the rich to the poor, can afford to buy the food they need.
To improve *availability*, there is a need to reduce vulnerability to natural disasters, such as droughts, which drastically reduce yields of essential crops. Ensuring high yields is key to ensuring that food is available to the population. Efforts, such as insurance schemes, also need to be made to recoup losses after extreme and destructive events.

To improve *utilization*, national investments need to be made into healthcare services. At the same time, research could be done into more nutritious and productive varieties of staple crops. By addressing these three factors, food *stability* will inevitably be addressed.

Investment into research needs to be supported by both the public and private sector. This research should seek to develop crop varieties that are adapted to the changing climate – increased climate variability, higher temperatures, and the occurrence of extreme weather events. Research should also delve into new planting and harvesting techniques that support high yields and environmental protection.

Ensuring food security in Burkina Faso requires multi-sectoral action. On one hand, the agricultural sector needs to be bolstered. At the same time, national action regarding healthcare needs to take place. Furthermore, there needs to be efforts to educate the populace on environmental conservation, climate change, and adaptation options to suit both households and those in the agricultural industry. Livelihood diversification needs to be made a feasible coping mechanism.

The most important point is that harmonized action is taken. This means that governments, NGOs, international donors, and individuals need to unify their efforts to collectively address the challenge of food security. This ensures a holistic approach that can be sustained at the local, national, and international levels.
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**Websites**


APPENDICES

Appendix A: Farmer Survey

1. Is agriculture your household’s *main* livelihood/source of income?
   a. Yes
   b. No (If no, is agriculture a secondary livelihood/source of income for your household? ________)

2. What crops do you plant on an annual basis?
   a. Maize
   b. Millet
   c. Sorghum
   d. Rice
   e. Groundnuts
   f. Okra
   g. Cassava
   h. Cowpea
   i. Other Vegetables
   j. Other Fruits
   k. Other: ______________________________________

3. Are your crops *mainly* for household consumption, local sale, or international sale?
   a. Household consumption
   b. Local sale
   c. International sale

4. Have you experienced changes in the climate over the past 10 years?
   a. Yes (If Yes, proceed to question 8)
   b. No (If No, proceed to question 5)

5. What weather changes have you experienced over the last 10 years? (Check all that apply)
   a. Shorter rainy seasons
   b. Longer rainy seasons
   c. Shorter dry seasons
   d. Longer dry seasons
   e. Fewer winds
   f. Heavier winds
   g. Increased occurrence of drought
   h. Decreased occurrence of drought
   i. Hotter temperatures
   j. Colder temperatures
   k. Increased prevalence of locust/other insect storms
   l. Decreased prevalence of locust/other insect storms
   m. Other: ________________________

6. Do you recall the most severe occurrences? (Approximate dates)
   a. ________________________________
7. What do you believe to be the causes of these changes? (Check all that apply)
   a. Climate change
   b. Religious factors
   c. Human attributed factors
   d. Other: _______________________

7.a. What do you believe is the main cause of these changes? _______________

8. Have you experienced any of the following in the last 10 years:
   a. Drought
   b. Flooding
   c. Rising Food Prices
   d. Food Unavailability
   e. Fire Outbreaks
   f. Pest/Insect Invasion

9. How have you adapted to these changes? (Check all that apply)
   a. Sought alternative livelihoods/sources of income
   b. Some family members have migrated to find employment
   c. Sold livestock
   d. Acquired loans/credit support
   e. Received government support
   f. Received NGO aid
   g. Increased use of fertilizer
   h. Changed planting practices
   i. Changed crop varieties
   j. Implemented irrigation technologies
   k. Other: ______________________________________________________

10. What has been your main adaptation strategy? _____________________________

11. Have you heard of any government policy/programme to benefit farmers?
    a. Yes (If yes, what was the policy/program?)
    b. No

12. Have you directly benefitted from any government policy/programme?
    a. Yes (If yes, what was the policy/program? When?)
    b. No

13. Have you heard of any NGO programme / activity to benefit farmers?
    a. Yes (If yes, what was the programme/activity?)
    b. No

14. Have you directly benefitted from any NGO programme/activity?
    a. Yes (If yes, what was the programme/activity? When?)
    b. No
15. Climate changes have a strong impact on food security.
   a. Strongly agree
   b. Somewhat agree
   c. Neutral
   d. Somewhat disagree
   e. Strongly disagree
Appendix B: Household Survey

1. How many family members are in your household?
2. How many family members live in your household?

3. What is your household’s main livelihood/source of income?
   a. Trading
   b. Agriculture
   c. Small or Medium Sized Business
   d. Large Business
   e. Public Service
   f. Remittances
   g. Other

4. What is your household’s secondary livelihood/source(s) of income?
   a. Trading
   b. Agriculture
   c. Small or Medium Sized Business
   d. Large Business
   e. Public Service
   f. Remittances
   g. Other:

5. Has your family ever been affected by increased food prices?
   a. Yes If yes, when? ____________________________
   b. No

6. Has your family ever been affected by food shortages?
   a. Yes If yes, when? ____________________________
   b. No

7. If you answered ‘Yes’ to questions 5 & 6, how has your family adapted to these changes? (Check all that apply)
   a. Reduced food consumption
   b. Sought alternative livelihoods/sources of income
   c. Some family members have migrated to find employment
   d. Selling of livestock
   e. Acquiring loans/credit support
   f. Receiving government support
   g. Receiving NGO aid
   h. Other: _____________________________________________________

8. Has any member of your family perceived changes in the climate over the past 10 years?
   a. Yes (If Yes, proceed to question 9)
   b. No (If No, proceed to question 11)

9. What weather changes have your family perceived over the last 10 years? (Check all that apply)
a. Shorter rainy seasons  
b. Longer rainy seasons  
c. Shorter dry seasons  
d. Longer dry seasons  
e. Fewer winds  
f. Heavier winds  
g. Increased occurrence of drought  
h. Decreased occurrence of drought  
i. Hotter temperatures  
j. Colder temperatures  
k. Increased prevalence of locust/other insect storms  
l. Decreased prevalence of locust/other insect storms  
m. Desertification  

10. What do you perceive to be the causes in these changes?  
   a. Climate change  
   b. Religious forces  
   c. Human Activities  
   d. Other: ________________________________

11. What food(s) do you consume on a weekly basis? (list)  

12. Does any member of your family have a chronic health condition?  
   a. Yes (specify: ________________________________)  
   b. No  

13. Climate changes have a strong impact on food security?  
   a. Strongly agree  
   b. Somewhat agree  
   c. Neutral  
   d. Somewhat disagree  
   e. Strongly disagree
## Appendix C: Burkina Faso’s NAPA Projects

<table>
<thead>
<tr>
<th>COUNTRY</th>
<th>Order of Project Priority</th>
<th>PROJECT TITLE</th>
<th>PROJECT SECTOR</th>
<th>SECTOR COMPONENT (S)</th>
<th>PROJECT COST (USD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Burkina Faso</td>
<td>1</td>
<td>Mitigating vulnerability to Climate Changes through the strengthening of a prevention and food crisis management system.</td>
<td>Early warning and Disaster management</td>
<td>Early warning</td>
<td>400,000</td>
</tr>
<tr>
<td>Burkina Faso</td>
<td>2</td>
<td>Securing cereal production through the promotion of supplemental irrigation in the following areas: North Region (Oudalan Province) and Centre- North region (Namentenga Province).</td>
<td>Food security</td>
<td>Agriculture</td>
<td>408,660</td>
</tr>
<tr>
<td>Burkina Faso</td>
<td>3</td>
<td>Restoration and management of Oursi pond</td>
<td>Terrestrial Ecosystems</td>
<td>Wetlands</td>
<td>275,000</td>
</tr>
<tr>
<td>Burkina Faso</td>
<td>4</td>
<td>Fodder production and development of fodder stocks for livestock in the Sahelian Region of Burkina Faso.</td>
<td>Food security</td>
<td>Livestock</td>
<td>330,000</td>
</tr>
<tr>
<td>Burkina Faso</td>
<td>5</td>
<td>Rehabilitation, sustainable management of natural vegetation, and valorisation of Non-timber Forest Products in the Eastern region of Burkina Faso.</td>
<td>Terrestrial Ecosystems</td>
<td>Forestry and Biodiversity</td>
<td>700,000</td>
</tr>
<tr>
<td>Burkina Faso</td>
<td>6</td>
<td>Control of sand encroachment/mud silting in the river basins of Mouhoun, Nakanbé and Comoé.</td>
<td>Water resources</td>
<td>River basin</td>
<td>352,000</td>
</tr>
<tr>
<td>Burkina Faso</td>
<td>7</td>
<td>Implementation of irrigated crops in Gourma, Namentenga, Tapoa and Sammatanga regions</td>
<td>Food security</td>
<td>Agriculture</td>
<td>443,300</td>
</tr>
<tr>
<td>Burkina Faso</td>
<td>8</td>
<td>Protection of pastoral-suited regions in the Sahelian and Eastern regions.</td>
<td>Food security</td>
<td>Livestock</td>
<td>320,000</td>
</tr>
<tr>
<td>Burkina Faso</td>
<td>9</td>
<td>Securing agricultural production through the use of appropriate technological packages in the South-East and East regions.</td>
<td>Food security</td>
<td>Agriculture</td>
<td>297,924</td>
</tr>
<tr>
<td>Burkina Faso</td>
<td>10</td>
<td>Promoting community-based fauna management in</td>
<td>Terrestrial</td>
<td>Terrestrial Biodiversity</td>
<td>810,000</td>
</tr>
<tr>
<td>Faso</td>
<td>the Mouhoun region.</td>
<td>Ecosystems</td>
<td>Conservation</td>
<td></td>
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<tr>
<td><strong>Burkina Faso</strong></td>
<td>11</td>
<td>Implementation of safety zones and backup devices to control pollution of underground and surface water catchment infrastructures (lakes, wells, boreholes) in the cotton belts of Burkina (Mouhoun, South-West, Comoé and the Eastern part of Nakanbé).</td>
<td>Water resources</td>
<td>Control of water pollution</td>
<td>330,000</td>
</tr>
<tr>
<td><strong>Burkina Faso</strong></td>
<td>12</td>
<td>Promoting the use of energy saving equipment (improved stoves, M’Bora stew pan) and renewable energy-based technologies (pressure-cooker, water heater and solar dryers, etc.)</td>
<td>Energy</td>
<td>Energy saving equipment</td>
<td>1,230,000</td>
</tr>
</tbody>
</table>

Source: UNFCCC, 2013