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CLIMATE CHANGE ADAPTATION INTERVENTIONS BY NON-GOVERNMENTAL ORGANISATIONS IN SAVELUGU MUNICIPALITY AND WEST-MAMPRUSI DISTRICT IN NORTHERN GHANA: IMPLICATIONS FOR LIVELIHOODS OF SMALLHOLDER FARMERS

BY

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10240040

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JULY, 2019

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DECLARATION

I do hereby declare that this thesis is the result of my own original research and has not been presented by anyone for any academic award in this or any other university. I bear sole responsibility for any shortcomings in this work.

23/04/2021

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CERTIFICATION

I hereby certify that this thesis was supervised in accordance with procedures laid down by the University of Ghana.

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DEDICATION

This thesis is dedicated to:

1. My late grandmother, Ayishetu Sakunde
2. My late father, Alhaj Tahiru Mahama
3. My Mum, Hajia Safura
4. My sweetheart Farida A. Dallas

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TABLE OF CONTENTS

DECLARATION i
CERTIFICATION ii
DEDICATION iii
ACKNOWLEDGEMENTS iv
TABLE OF CONTENTS v
LIST OF TABLES ix
LIST OF FIGURES x
LIST OF ACRONYMS xi
ABSTRACT xiii

CHAPTER ONE 1
INTRODUCTION 1
1.1 Background of the Study 1
1.2 Statement of The Problem 3
1.3 Research Objectives 5
1.4 Research Questions 6
1.5 Significance of the Study 6
1.6 Scope of the study 7
1.7 Outline of Chapters 8

CHAPTER TWO 9
LITERATURE REVIEW 9
2.1 Introduction 9
2.2 Mapping the Conceptual Terrain 9
2.2.1 Climate Change 9
2.2.2 Livelihood 11
2.2.3 Adaptation to Climate Change Strategies 12
2.2.4 Smallholder Farming Households 13
2.3 Climate Change in Ghana: Evidence, Impact and Consequences 17
2.4 Vulnerability of Farmers to Climate Change 19
2.5 Climate Change Adaptation Strategies and Sustainable Livelihoods 22
2.6 The Ghana Climate Change Adaptation Strategy 25

University of Ghana http://ugspace.ug.edu.gh

2.7 Institutions and Climate Change Adaptation: Will or Exigencies? 26
2.7.1 NGOs and Climate Change Adaptation: Procedural or Due Diligence?.....32
2.7.2 Climate Change Interventions in Northern Ghana 32
2.8 Effects of Climate Change Interventions on Farmers' Livelihood 33
2.9 Factors influencing Farmers' Participation in Climate Change Interventions.....35
2.10 NGOs Climate Change Adaptation Interventions: Any Challenges? 36
2.10.1 Challenges in Accessing Support from Institutions: Farmers Perspective.....36
2.10.2 Challenges in Providing Support: Insights from NGOs 38
2.11 Empirical Review.....42
2.12 In Pursue of Theoretical Framework 45
2.13 Sustainable Livelihood Framework: A Framework for Analysis 48
2.14 Gaps in the Literature.....52

CHAPTER THREE 55
METHODOLOGY 55
3.1 Introduction.....55
3.2 The Study Area 55
3.3 Walking Through the Philosophical Foundations of Social Research.....58
3.4 The Choice and Appropriateness of the Pragmatic Paradigm 60
3.5 Research approach 61
3.6 The Case Study Design.....63
3.7 Concurrent Mixed Method Design 63
3.7.1 Steps in conducting mixed research method 66
3.8 Sampling Procedure 68
3.9 Sources of Data 70
3.10 Data Collection Instruments.....71
3.11 Validity and Reliability of Instruments.....73
3.12 Data Management and Analysis 74
3.12.1 Climate Change Interventions Implemented by NGOs.....75
3.12.2 Effects of NGOs Interventions on Livelihoods of Smallholder Farming Households 75
3.12.3 Factors Influencing Farmers' Participation in NGOs Climate Change Interventions.....81

University of Ghana http://ugspace.ug.edu.gh

3.12.4 Constraints of NGO Climate Change Adaptation Interventions 82
3.13 Ethical Considerations 84
3.14 Conclusion 85

CHAPTER FOUR 86
NGOs' CLIMATE CHANGE INTERVENTIONS IMPLEMENTED IN NORTHERN GHANA 86
4.1 Introduction 86
4.2 Socio-demographic Characteristics of Respondents 86
4.3 NGOs' Climate Change Interventions 91
4.3.1 NGOs Climate Change Interventions Implemented in Northern Ghana 91
4.4 The Nexus between NGOs Interventions and the National Climate Change Adaptation Strategy 100
4.5 Conclusion 104

CHAPTER FIVE 106
IMPLICATIONS OF NGOs' CLIMATE CHANGE INTERVENTIONS ON FARMERS' LIVELIHOODS 106
5.1 Introduction 106
5.2 Implications of NGO's Climate Change Interventions on Farmers' Livelihood 106
5.2.1 NGOs' Climate Change Interventions: Implication on Human Resources of Farmers 110
5.2.2 NGOs' Climate Change Interventions: Implications on Natural Resources of Farmers 117
5.2.3 NGOs' Climate Change Interventions: Implication on Social Resources of Farmers 121
5.2.4 NGOs' Climate Change Interventions: Implication on Financial Resources of Farmers 124
5.2.5 NGOs Climate Change Interventions: Implication on Physical Resources of Farmers 128
5.3 Computed Indices for Main Livelihood Indicators 130
5.4 Propensity Score Matching Results of the Effects of Farmers' Participation on Livelihood 135

University of Ghana http://ugspace.ug.edu.gh

5.5 Conclusion 138

CHAPTER SIX 139
DETERMINANTS OF HOUSEHOLDS PARTICIPATION AND CHALLENGES IN NGOs' CLIMATE CHANGE INTERVENTIONS 139
6.1 Introduction 139
6.2 Determinants of Households' Participation in Climate Change Interventions 139
6.3 Challenges of NGOs' Implementation of Climate Change Interventions 146
6.4 Conclusion 156

CHAPTER SEVEN 157
SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS 157
7.1 Introduction 157
7.2 Socio-Demographic Characteristics of Respondents 157
7.3 Summary of Key Findings 158
7.4 Conclusions 163
7.5 Recommendations 166
7.6 Contribution to Knowledge 167
7.6 Suggestions for future research 168

REFERENCES 171

APPENDICES 187

University of Ghana http://ugspace.ug.edu.gh

LIST OF TABLES

Table 3.1: Sample Size Distribution by Communities and Districts 70
Table 3.2: Research matrix of research objectives, data collection instruments and analysis. 73
Table 3.3: Measurement of main and sub-indicators of livelihood 78
Table 4.1: Descriptive Statistics of respondents' socio-demographic characteristics 88
Table 4.2: Descriptive statistics of continuous variables 90
Table 4.3: Selected Climate Change Interventions Implemented by NGOs in Northern Region 98
Table 5.1: Computed Sub – Indicators of Livelihood by District 107
Table 5.2: Computed Main – indicator and Livelihood Indicator Indices 131
Table 5.3: Results of Propensity Score Matching on the Effect of farmers' participation in climate change interventions on their livelihood 137
Table 6.1: Results of binary Logit regression on factors influencing households' participation in climate change interventions of NGOs 140
Table 6.2: Ranked constraint in the implementation of NGOs' climate change interventions 148
Table 7.1: Summary of key findings Religious 162

University of Ghana http://ugspace.ug.edu.gh

LIST OF FIGURES

Figure 2.1: UNDP Sustainability Livelihood Framework 51
Figure 3.1: Map of Savelugu Municipality and West Mamprusi District Showing Study Communities 58
Figure 4.1: Main crops grown by households in study area 91
Figure 5.1: Radar diagram showing the main livelihood indicators for farming households 135
Figure 6.1: Households views on constraints in implementing NGOs' climate change interventions 147

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LIST OF ACRONYMS

ADB -	Africa Development Bank
AGRA -	Alliance for a Green Revolution in Africa
AIEI -	African Impact Evaluation Initiative
CHANGE -	Climate Change Adaptation in Northern Ghana Enhanced
CIDA -	Canadian International Development Agency
CSIR -	Council for Scientific and Industrial Research
DfID -	Department for International Development
EPA -	Environmental Protection Agency
FAO –	Food and Agricultural Organisation
GEMP -	Ghana Environmental Management Project
GIZ –	German Society for International Development (Gesundheit-Informations-Zentrum)
GSS –	Ghana Statistical Service
ICRISAT -	International Crops Research Institute for the Semi-Arid Tropics
IFAD –	International Fund for Agricultural Development
IITA -	International Institute for Tropical Agriculture
IPCC -	Inter-governmental Panel on Climate Change
LI –	Livelihood Index
MESTI –	Ministry of Environment, Science. Technology and Innovation
MMDAs -	Metropolitan Municipal and District Assemblies
MoFA -	Ministry of Food and Agriculture
NCCAS -	National Climate Change Adaptation Strategy
NFPDP -	National Forest Plantation Development Programme
NGO -	Non-Governmental Organisations
RAINS –	Regional Advisory and Innovative Network Systems

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SARI - Savannah Agricultural Research Institute

SLF - Sustainability Livelihood Framework

UNEP - United Nations Environment Programme

UNFCCC - United Nations Framework Convention on Climate Change

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ABSTRACT

The growing phenomenon of climate change poses severe threats to the livelihood of smallholder farmers in rural African communities such as in Northern Ghana. To avert this challenge, various governments have intervened to assist smallholder farmers to overcome the hurdles posed by climate change on their livelihood. Non-governmental Organisations (NGOs) have played a significant part in complementing government efforts to boost farmers' capacity to adapt to climate change in Northern Ghana. This study investigates NGO-led climate change interventions and their implications on livelihood adaptation among farmers in Northern Ghana. Situated in the general context of Ghana's National Climate Change Adaptation Strategy, the study explored factors influencing farmers' participation in these interventions and their effects on their livelihood along with the key constraints militating against the implementation of these NGO-led interventions. Using a concurrent mixed method, the study collected quantitative data from 80 households that had benefitted from NGO interventions and 180 households which had not. This was complemented by community-focused group discussions and interviews with NGO staff and other key informants. The quantitative data was analysed using livelihood index, propensity score matching, binary logit regression and Kendall's Coefficient of Concordance while the qualitative data was analysed using thematic analysis.

The study established that climate change interventions implemented in Northern Ghana after the year 2000 were mainly aimed at increasing agricultural productivity, strengthening farmers' adaptive capacity through climate change awareness, diversification of the sources of livelihood and promoting indigenous practices. Household participation in climate change interventions was significantly influenced by gender of the householders, household income, average household farm size, households' participation in decision-making at the community level and membership of farmer-based organisations. The major constraints to implementation of climate change interventions are high illiteracy among beneficiary households, shortage of land, difference in household needs, adverse weather conditions, short duration of interventions and corruption by NGO staff. The study recommends coordination among NGOs in the implementation of climate change interventions in the region to avoid duplication of resource and foster the achievement of all objectives of the Ghana National Climate Change Adaptation Strategy. Also, farming households should form groups to promote their participation in climate change interventions. This will make it possible for them to access the market, credit sources and other farming inputs for effective climate change adaptation.

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CHAPTER ONE

INTRODUCTION

1.1 Background of the Study

This study explores the impact of climate change adaptation interventions (henceforth CCAI) of non-governmental organisations (henceforth NGOs) on smallholder farmers in the Savelugu Municipality and West Mamprusi District of Ghana. The study comes on the back of increasing calls for studies into NGO-led CCAIs in vulnerable communities as a means of helping to build the capacity of farmers to improve their farming activities. Farmers, particularly those in rural communities, are more susceptible to climate change impact due to their dependence on rain-fed irrigation (Bawakyillenuo *et al*., 2016; Yaro *et al*., 2014; Akudugu *et al.*, 2012).

Globally, agriculture is negatively affected by climate change and its related erratic rainfall patterns, which results in droughts, floods, and bushfires. The decline in moisture levels of the soil leads to decreased agricultural productivity with negative implications on farmers' incomes (Molua & Lambi, 2006). As noted by Al-Hassan and Poulton, (2009), the perennial occurrence of floods, droughts and bushfires heightens farmers' struggles for food every year, especially in the periods between March and July. These effects of climate related shocks on livelihoods however differ based on agro-ecological regions within countries, as well as socio-economic clusters such as gender differentials (Akudugu *et al.*, 2012 p5). Consequently, regions such as Northern Ghana, which rely heavily on rain-fed and subsistence agriculture have high climate-sensitive agricultural systems, and are more vulnerable to climate change. Farmers in these regions struggle with poverty, food insecurity, health, and other basic social needs (Yaro *et al*., 2014; Akudugu *et al.*, 2012). There is a general decline in economies of such regions placing them at the high end of the climate change vulnerability spectrum (Alhassan *et al*., 2017; Nti, 2012).

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It is pertinent to note however, that the underlying factors which determine vulnerability to the influence of climate variability, are also linked to the level of development of communities (Bawakyillenuo, *et al*., 2016). These peculiar and contextual factors influencing vulnerability of communities, particularly those in the developing world, require effective approaches to help communities adapt to these impacts. In essence, reducing the vulnerabilities of local farmers, requires adaptation measures that are carefully designed and effectively rolled out. This has brought increased attention on various actors and interventions on climate change adaptation among vulnerable groups and communities.

The peculiar role of NGOs in climate change adaptation is crucial, as they have been found to be effective in pro-poor interventions (Tahiru et al., 2019; Musah-Surugu *et al*, 2018; Bawakyillenuo, *et al*., 2016; Yaro et al., 2014). NGOs have been instrumental in climate change adaptation programmes in a number of ways, including exerting pressure on policy makers to adopt climate adaptation related interventions, embarking on outreach programs and campaigns to educate small-holder farmers, as well as the development of resilience measures aimed at reducing vulnerability of small-holder farmers to the impacts of climate change (Tahiru, 2019; Serdeczny, 2017; Fitzpatrick & Molloy, 2014).

In Ghana, there are several international and local NGOs. A number of them operate in the Northern parts of the country, with interventions to bridge the North–South development gap (Tahiru et al., 2019; Andrews & Luikart, 2014). The Savelugu Municipality and West Mamprusi District have several of these NGOs with interventions on climate change adaptation measures to help improve livelihoods of smallholder farmers. These districts are characterized by few infrastructural facilities serving the social, educational, health, and economic needs of the people in the districts, reflecting its peri-urban and rural nature.

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This study examines the key CC adaptation interventions of selected NGOs and the implication for the livelihoods of smallholder farmers.

1.2 Statement of The Problem

The evidence of the impacts of CC is grounded in several theoretical and empirical studies (Tahiru et al., 2019; Yaro *et al*., 2014; Akudugu *et al*., 2012). Existing research underscores CC as a major threat to livelihood, particularly in vulnerable settings like Africa, where there is high dependence on rain-fed agriculture amidst fragile ecosystems. This is worsened by the inability of mandated state and local agencies to help small-holder farmers adapt to the impacts of climate change. Issues such as lack of skills, capacities, human and financial resources, have been found to constrain government's efforts in assisting farmers to adequately respond to the impact of climate change (Satterthwaite *et al*., 2007; Burton and Dredge, 2007). These challenges exacerbate pre-existing social, economic, cultural and political inequalities and vulnerability to climate change (UNDP 2017; FAO, 2015; World Bank, 2013).

In the context of the challenges, NGOs have become important players in climate change adaptation efforts. Acting alone or in concert with state agencies and local governments, they have rolled out interventions to reduce the vulnerabilities of smallholder farmers to climate change and implemented planned adaptation measures to ensure sustainability of farmers' projects, and enhance their socio-economic development (Smit & Wandel, 2006; Huq *et al*., 2003).

In spite of the numerous interventions implemented by NGOs however, there is a dearth of literature on their activities. In the research so far, the role of this important non-state actor in adaptation interventions and their underlying constraints, have not been adequately explored by scholars (Etwire *et al*., 2013; Nti, 2012; Hedger et al., 2008). A study into

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these interventions and constraints would enhance understanding of the overall role of these in CC interventions.

Also, at the heart of the research on adaptation is the extent to which interventions impact the livelihoods of smallholder farmers in the long run (Smucker et *al.*, 2015; Rahn *et al*, 2014; Taylor, 2014). While CC adaptation has received a lot of scholarly attention over the years, there appears to be generally less interest in the manner in which these interventions influence farmers livelihoods (Farnworth et al., 2016; Shahadu, 2016). In the case of developing countries, there is much less literature on the impact of these adaptation interventions, even though they remain hot-spots for impact of climate change, with inland flooding, drought periods, and their subsequent consequences on people (Asiedu et al., 2017). Paradoxically, this is the region where economic activities are significantly at the mercy of climate elements. In the particular case of smallholder farmers, Mutabazi *et al*, (2015), observe that their success or failure is tied to rainfall and temperature, and when there is variability, their livelihood is impeded. And yet, very little, if any academic research has been conducted to comprehend the nature of these planned adaptations and the scope of performance indicators used to measure NGOs performance. This study therefore seeks to fill the gap, by examining the role of NGOs in climate change adaptation efforts, as well as their implications on smallholder farmers' livelihoods. The study investigates climate change adaptation interventions undertaken by selected NGOs in the Northern Ghana, with particular focus on how these interventions have influenced livelihoods of smallholder farmers in these areas.

Within Ghana, the particular case of the Northern Ghana warrants research attention, because climate change has been found to have resulted in decreasing yields and crop failures in the area, and have caused further impoverishment of farmers (UNDP 2018**).** The choice of the two districts of Savelugu Municipality and West Mamprugu District for

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this study, both in Northern and North-East regions respectively, is based on the knowledge that these areas have benefitted from several NGO interventions on climate change (Bawakyillenuo et al., 2016; Yaro et al., 2014), and therefore serve as useful cases for assessing the impact of interventions. The districts are covered by the Guinea Savannah, with unfavourable natural resource characteristics (soil type, water, rainfall pattern), sparsely populated, and falling below the national average of per capita income with high variation in climatic conditions affecting the agricultural sector (Dorurugu, 2010). Farmers in these districts are therefore susceptible to crop failure, reduction in crop yields, loss of livestock due to shortage of water, and lack of insurance schemes to mitigate the effects (Assan *et al.* 2009; Hesselberg & Yaro, 2006; Dietz *et al*, 2004).

1.3 Research Objectives

The overall objective of the study was to investigate the implication of NGOs' climate change interventions on the livelihood adaptation of farming households in Northern Ghana. To achieve this broad objective, the following specific objectives were pursued;

1. Examine the various NGO interventions on climate change adaptations in the context of Ghana's National Climate Change Adaptation Strategy.
2. Explore the factors influencing farmers' participation in NGOs' climate change adaptation interventions.
3. Examine the effects of NGO interventions on livelihoods of smallholder farmers.
4. Assess the key constraints to the implementation of NGO-led climate change adaptation interventions.

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1.4 Research Questions

In pursuit of these objectives, the following specific research questions steered the research.

1. What climate change adaptation interventions have NGOs introduced to farmers, and to what extent are they consistent with the Ghana National Climate Change Adaptation Strategy?
2. What factors influence farmers' participation in NGOs' climate change interventions?
3. How do NGO interventions on climate change affect livelihoods of farmer's households?
4. What are the challenges to the implementation of NGO led climate change interventions in the area?

1.5 Significance of the Study

This study is significant in three main respects: literature, policy, and practice. In terms of literature, the study contributes new empirical evidence on climate change adaptation and demonstrates how NGO interventions influence livelihoods of smallholder farmers from a developing country context. The study does not only highlight the influence of a previously overlooked actor, namely NGOs in the climate change adaptation discourse, but also, the impact of their interventions on farmers in a developing country context.

In terms of policy, the study's examination of the various climate change interventions implemented in northern Ghana by NGOs, and how they contribute to the achievement of the Ghana climate change adaptation strategy provides a policy relevant information for national CC policy. By detailing the effects of adaptation interventions on livelihoods of farmers given the heavy investments being made by these NGO's, the study provides

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insights on how these interventions benefit farmers, and whether the interventions are sustainable enough.

Findings of the study also bring to the fore the role of NGOs in building a resilient society, and also serves as an evaluative mechanism for seeking further funding by NGOs based on the successes.

In terms of practice, the study unveils of the direction and intensity of the effect of climate change on farming households' livelihoods, and provides stakeholders with adequate information to improve the livelihood of beneficiaries. By identifying the factors influencing farmers' participation in NGOs' climate change interventions, stakeholders will be informed on the right strategies to employ during the formulation and implementation of interventions, in order to ensure that the target beneficiaries participate and benefit from interventions implemented in the study area.

1.6 Scope of the study

The study was conducted within the Savelugu Municipality and West Mamprusi District in Northern Ghana. As has been indicated earlier, it focused on NGOs-led climate change interventions in northern Ghana mainly due to the vital role they play in development assistance provision, after the adoption of the Millenium Development Goals. With specific regards to the study area and the issue of climate change adaptation, there are a number of NGOs currently engaged in various forms of adaptation strategies in the two Districts. These NGOs assist farmers in developing their capacities to adapt to climate change, and also help them meet the challenges of their livelihood activities. The study identified the NGOs' climate change interventions in the context of the climate change document of Ghana dubbed "Ghana Climate Change Adaptation Strategy". It also

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investigated the factors influencing farmers' participation in these interventions, how farmers' livelihoods are affected by these interventions, and the challenges hindering the implementation of these interventions. Data collection was limited to primary sources solicited from farmers, staff of NGOs, MoFA staff and also focus group discussions.

1.7 Outline of Chapters

The study is organised into eight main chapters. Chapter One introduces the study and outlines what constitutes the research problem. The problem is then formulated into research objectives and questions to guide the study. The chapter also has themes on the rationale and scope of the study.

Chapter Two reviews the theoretical and empirical literature on climate change interventions and its nexus with livelihood. This is done to bring the study up to speed on work done in the field so far and identify grey areas that require scholarly attention. A theoretical framework is also developed at the end of the chapter to guide data collection and analysis.

Chapter Three outlines the research methodology employed for the study including research design, sources of data, sampling size determination and sampling procedure, sources and instruments of data collection, methods of data analysis, validity and reliability of data collection instruments, and ethical issues.

Chapters Four to Seven present the results and discussions of findings in accordance with the study objectives. The study ends with Chapter Eight, which sums up the findings, and distils the necessary conclusions, recommendations and suggestions for future studies.

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CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter reviews literature on climate change interventions, and other associated themes. The chapter is relevant in identifying existing gaps in the literature as a basis to position the current study, and subsequently provide a basis to contribute to knowledge. The chapter begins by defining the key terminologies in section 2.2, after which the evidence of climate change in Ghana and consequences of climate change, are presented in sections 2.3 and 2.4, respectively. Section 2.5 presents farming households' vulnerability to climate change, followed by section 2.6 which presents climate change adaptation strategies and sustainable livelihood. Section 2.7 presents institutions and climate change adaptation while NGOs and climate change adaptation are presented in section 2.8. Section 2.9 presents institutions and climate change adaptation in northern Ghana with section 2.10 presenting the challenges to NGOs' climate change adaptation intervention. The theoretical and conceptual frameworks for the study are presented in section 2.11 and 2.12, respectively.

2.2 Mapping the Conceptual Terrain

2.2.1 Climate Change

The concept of climate change is vibrant in various strands of literature, and yet there is no unanimity among the scientific community as to the most acceptable definition. This is largely due to the fact that different scholars and institutions on different occasions, have emphasised different aspects of climate change in their effort to understand the phenomenon. Nonetheless, there exists shared themes among the definitions offered by these institutions. According to the IPCC, climate change is "the significant deviation in

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either the average state of the climate or in its variability, which exist for a number of years normally decades" (IPCC, 2001, p.4). Similarly, Lambrou and Nelson (2010 p10), conceptualise climate change as the "long-term change in the state of the climate, which is intensified by changes in the averages and or changes in the variability, or changes in the occurrences or intensities of extreme events". This is very much in line with the IPCC and the United Nations Environment Programme (UNEP) definitions which also emphasise the long-term nature of the change and its identification by mean level and variability.

On their part, the Food and Agricultural Organization, (FAO, 2006) also describes climate change as any variation in climate over a period of time regardless of the basis of the variation. In a more current definition, Alhassan et al., (2018) defined climate change as the continuing changes in the global climatic system. This results primarily from human caused global warming as a consequence of the increase and on-going emission of greenhouse gasses and the loss of vegetation cover and other carbon sinks. It refers to gradual changes in climate standards.

According to ISDR/UNEP (2009), climate change may surface from natural events (internal processes or external forces) or through any activities of humans that changes the composition of the atmosphere or land use. The United Nation Framework Convention on Climate Change, UNFCCC (2001) states that climate change is a variation in weather, which occurs as a result of indirect or direct human activities that modify the composition of the universal atmosphere and which is in addition to natural climate variability observed over comparable time periods. The definition provided by UNFCCC is somehow incomplete, since it captures only those changes which occur as a result of indirect or direct human activities. What happens to the natural causes of climate variability? This has been silent in the definition.

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2.2.2 Livelihood

As with other concepts in the social sciences, the term 'livelihood' is complex, and defies a universally accepted definition (DFID, 2000). Some common definitions have however, been developed through extensive use of the term in various disciplines. The most widely used definition of livelihood is from the work of Chambers and Conway (1992) who define it to comprise people, their capabilities, and their means of living, including food, income and assets. The authors indicate that livelihood has a tripartite relationship, where people survive by using their capabilities to make productive uses of their assets, which are both tangible (resources and stores) and intangible (claims and access).

Lakwo (2006), broadens Chambers and Conway's definition by indicating that livelihood comprises the capabilities, assets (i.e., stores, resources, claims and access) and activities required for a means of living. These assets are also generally recognised within sustainable livelihoods theory as also identified by Carney (1998) and Ellis (2000) and are summarized below:

- Natural (environmental) capital: natural resources (land, water, wildlife, biodiversity, environmental resources, and others).
- Physical capital: basic infrastructure (water, sanitation, energy, transport and communications), housing and the means and equipment of production.
- Human capital: health, knowledge, skills, information, ability to labour.
- Social capital: social resources (relationships of trust, membership of groups, networks, access to wider institutions).
- Financial capital: financial resources available (regular remittances or pensions, savings, supplies of credit).

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These assets can also be stored, accumulated, exchanged, or depleted and put to work to generate a flow of income or other benefits (Rakodi, 2002). It underscores the totality of individual assets capability contributing to wellbeing and activities required for a means of living. Against this background, this study, adopts the definition of Lakwo (2006) and Murray (2001) as a lens through which livelihood would be assessed.

2.2.3 Adaptation to Climate Change Strategies

Adaptation to climate variability is the adjustment in human or natural systems in response to actual or anticipated climatic stimuli or their effects, which lessens damage or exploits beneficial prospects. The main aim of adaptation is to minimize the negative effects of unavoidable climate variability, through actions targeted at the vulnerable system, and these may include both on-farm and off-farm activities. One of the fundamental ways of reducing vulnerability to climate variability is increasing the physical resilience of the system (FAO, 2011). Adaptation could also involve taking measures to seize new opportunities brought about by climate variability (Fussel & Klein, 2006).

Adaptation of farmers can be planned or spontaneous (autonomous); public or private; and reactive or proactive (anticipatory) adaptations (IISD, 2003; IPCC, 2007; UNEP, 2009). While proactive adaptation is when a system is amended long before experiencing the effects of climate variability, reactive adaptation is when a system amends at the onset of experiencing the effects of climate variability. Adaptation is spontaneous, when it is as a result of changes in the natural ecological systems and changes in the markets or welfare of human systems rather than by conscious efforts of an individual. On the other hand, planned adaptation is the result of a deliberate policy resolution based on changed or anticipated change in conditions which needs to be restored to a desirable state (IPCC,

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2014). Thus, the difference between planned and spontaneous adaptations is that the former is intended and deliberate, the latter is not.

In this study, adaptation refers to the process by which smallholder farming households either adjust their practices or put measures in place to adjust to climate change and variability. This can either be self-improvised mechanisms by the farmers (indigenous adaptation strategies) or recommendations backed by research from governmental and non-governmental organisations (introduced adaptation strategies). This conceptualization of adaptation is in line with the definitions by Fussel and Klein (2006) and the IPCC (2014).

2.2.4 Smallholder Farming Households

Smallholder farmers have been defined in various ways depending on the context, country and even ecological zone. The term 'smallholder' is often used interchangeably with 'small-scale' 'resource poor' and sometimes 'peasant farmer' (Calcaterra, 2013; Berdegué & Fuentealba, 2011). However, authors like Cousins (2010) argue that 'smallholder' and 'small-scale' cannot be used interchangeably because smallholder farming households have land holdings of three hectares or less and the average land holding of peasant farmers as is the case in Northern Ghana is about two hectares. In this regard, Morton (2007) defined smallholder farming as the agricultural activities undertaken mostly by family labour in which the outputs are the main source of income for the family. This is, however, not synonymous with subsistence farming, in that the latter is a livelihood strategy where the main output of agricultural activity is consumed directly.

Other scholars have argued that there is a strong relationship between smallholders, agriculture and rural poverty. Kydd (2002), for instance, shows that the majority of the world's extremely poor live in rural areas and have livelihoods which are bound closely to

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smallholder agriculture as farmers, labourers, transporters, marketers and processors of produce and as suppliers of non-agricultural services to households whose income is principally agriculture-derived. Smallholders are often considered as forming part of the 'rural poor', together with subsistence producers and landless households. The emphasis is often on commonalities rather than differences (e.g., in assets, income, investment and class identity) (Cousins, 2010).

Since Chayanov published the theory of the peasant economy in 1925, there has been some general acknowledgment that the main "feature of the agricultural smallholder sector is its reliance on family labour that leads to linking the operation of the family farm to the family's consumption and labour circumstances and demographic cycles" (Chayanov, 1986 p9). Authors such as Lipton (2005), and the World Bank (2007), have forged a solid consent that the characterisation of this type of agriculture comprise but not limited to the following: small farms, family-operated, no or limited non-family hired labour (Nagayets, 2005; Wiggins *et al.*, 2010; Hazell *et al.*, 2010; IFAD, 2010). However, Berdegué and Fuentealba (2011) argue that there are limitations with this definition, given that it fails to properly account for the qualitative aspect of the concept.

The definition of smallholders could also be characteristically based on agricultural activities, or on size of land operated. Thus, the definition could be done subjectively (qualitative criteria) or objectively (quantitative criteria). According to Calcaterra (2013), farm size (quantitative criteria) is a frequently used indicator; however, the relevance of one fixed number may differ across sectors and countries (e.g., a 25-ha sugarcane farmer in Rwanda may be considered as a large-scale farmer, while a 200-ha soyabean farmer in Brazil as a small-scale farmer). One could also choose a definition which includes other indicators, such as labour input, farm management and income or other several indicators

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such as fixed thresholds, regional averages, their production capacities, market orientation, labour input and household income, farming system, legal aspects or land tenure.

Calcaterra (2013), further attempts to classify smallholder based on landholding by presenting the following landholding thresholds:

1. Large farm: 75 ha – 500 ha
2. Small farm: 10 ha – 74.99 ha
3. Micro farm: < 10 ha

Multilateral Organisations such as FAO, World Bank and the Africa Development Bank (ADB) generally defined smallholders as farmers with 2 hectares of lands (FAO, 1991; World Bank, 2003; Dixon *et al.*, 2003). Thapa (2009) updates this definition by saying that smallholders are farmers with 2 hectares of lands who mostly depend on labour from household members. The ADB seeks to adapt its smallholder definition to agro-ecological zones that eventually affect farming activities and the composition of farming portfolios.

Most studies that have attempted defining smallholder farmers often limit their definitions of the concept to the numbers of hectares of lands cultivated, usually 2 hectares or below. An amplified definition was given by ADB (2010) to include population density, as well as variable for land size holdings of smallholders. In areas with a high population density, smallholders usually cultivate less than one hectare, which may increase up to 10 ha in more sparsely populated semi-arid areas (Tanyeri-Abur & Wattenbach, 2003 cited in Calcaterra, 2013). Given the lack of veracity and subjectivity in defining the term smallholder farmer by different scholars in different disciplines, it is only appropriate to conceptualise the term to suit your field of work (Calcaterra, 2013). Cousins (2010) feared that the term is used in an erratic manner, referring, *inter alia*, to producers who sometimes retail products for cash as a complement to other springs of income; to those who

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frequently market a surplus after their household chores have been met; and to those who are small-scale commercial farmers, with a primary focus on production for the market.

Smallholder farmers can easily be identified by the traditional method of farming such as the use of basic and obsolete technologies, low revenues, high seasonal worker oscillations and women farmers performing the vibrant role in production. In turn, "Smallholder farmers differ in individual characteristics, farm size, resource distribution between food and cash crops, livestock and off-farm activities, their use of external inputs and hired labour, the proportion of food crops sold and household expenditure patterns" (Tahiru et al., 2019 p6). Department of Agriculture, Forestry and Fisheries (2012) observes that smallholder farmers play critical roles by creating liverlihoods for rural poor. Existing definitions of smallholder farming tend to obscure significant differences among households involved in agriculture. Previously, 'peasant' was the term used to describe smallholder farmers who engage in small scale farming depend typically on family labour and retail some part of the farm produce for cash (Akram-Lodhi & Kay, 2009; Thapa, 2009; Ploeg, 2008; Hebinck & van Averbeke, 2007).

Within the national context, MOFA maintains that agriculture is predominantly on a smallholder basis in Ghana with about 90% of farm holdings less than 2 hectares (MoFA, 2006). Indeed, smallholders in Ghana, as elsewhere, are widely considered to be the largest as well as the most vulnerable component of the rural sector (Chamberlin, 2007, Alhassan et al. 2017; Alhassan et al., 2019). Various definitions of smallholders are accompanied by differing estimates of such things as their contribution to the agricultural economy and incidence of poverty. Nyanteng and Saini (2000) state that over 90% of the country's food production is derived from holdings of 3 ha or less land.

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Chamberlin (2007) has also argued that the term connotes limited land availability. Other dimensions may sketch a broader view of 'resource-poor' farmers such as those with limited capital (including animals), fragmented holdings and limited access to inputs. On the contrary, Ghana Poverty and Social Impact Analysis implicitly argue that for Ghanaian farmers, different resource and risk conditions better define smallholders than simple measures of landholdings. Chamberlin (2007) further argues that more nuanced conceptualizations of smallholders, however, tend to be more difficult to measure.

Smallholder farming households have been defined in this research to include farming households with a farm size of three hectares or less and rely heavily on family labour for their farming activities and also have limited resource in terms of land, labour, crop yields, capital and technology.

2.3 Climate Change in Ghana: Evidence, Impact and Consequences

Most countries in the tropical sub-region in which Ghana is located are very vulnerable to climate variability (Etwire *et al*., 2013). The Word Bank (2010) after conducting an assessment of the intra and inter annual rainfall pattern in Ghana concluded that Ghana's annual rainfall is highly erratic. Available historical data on rainfall indicates that the high amount of rainfall experienced in Ghana in the 1960s significantly declined between the late 1970s and early 1980s. Thus, Ghana experienced decreased rainfall trends between 1960 and 2006, with an average annual reduction of 2.3 millimeters. Kankam-Yeboah *et al.* (2011) observed a significant change in Ghana's climate with a 1ºC rise in temperature over 30-years. The high temperatures which were hitherto experienced in March are now being experienced as early as January. According to Alhassan (2016), the onset and offset of the rainy season keeps on varying every year. Initially, April was noted for the start of the rainy season in the Northern Region, while September always marked the end of the

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rainy season. The region now receives its first rain in late June to early July, mostly experiencing heavy rainfalls between September and October, associated floods destroy produce, lives and other properties. The rains usually end abruptly, resulting in drought (Alhassan et al., 2018).

Although Ghana's annual rainfall and temperatures amounts are anticipated to vary, the projected trend of temperature between 2010 and 2050 shows that all regions of the country are expected to be warm. However, northern Ghana is expected to experience the highest increase in temperature. For instance, under the Ghana dry climate scenario, temperatures are expected to increase by 2.1-2.4 °C in the three regions of the north by 2050 compared to 1.7-2.0°C and 1.3-1.6 °C for the forest and transitional zones respectively (World Bank, 2010).

Ghana is already distressed by climate change with the drying up of some major rivers in the dry season which hitherto were perennial. This results in low water levels of the Akosombo dam for hydro-electric power generation (Kankam-Yeboah *et al.*, 2011). Climate change in Ghana is evident with the numerous floods such as 23rd April 2008, 24th June 2009 and 3rd June 2015 in some parts of Accra due to unprecedented heavy rainfalls that destroyed property and lives (Alhassan *et al*., 2018; Etwire *et al*., 2013; and Kankam-Yeboah *et al.,* 2011). The 2007 flood which rendered over 332,600 people homeless with 56 deaths in northern Ghana, could be attributed to climate change (Etwire et al., 2013). The erratic rainfall pattern in the form of late or early rains with varied amounts which affects the productivity and output of agriculture negatively in the region are the result of climate change.

The effect of climate change differs among gender and space. It distresses food insecure homes in diverse ways depending on socio-demographic factors such as age, education

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and health (FAO, 2011). Dunlap and McCright (2010) opined that women easily express understanding of climate change and show more concern about adaptation than men, and yet, their knowledge and capabilities are often underestimated. Lambrou and Piana (2006) reported that whereas men are usually in control of irrigation projects and mechanized agriculture, women are usually engaged in subsistence agriculture and labour-intensive farming, which exacerbates their susceptibility to climatic variability. World Bank (2010) opined that gender disparity worsens vulnerability to climate change, with female farmers being most affected based on discrimination in terms of rights abuse, household responsibilities, access to production resources and decision making. In Northern Ghana, farming households usually do not have adequate access to and/or control over economic resources such as land. This accounts for their high vulnerability to climatic change. Lambrou and Nelson (2010) opined that the preferences for long term adaptation measures vary between men and women. For instance, whereas males often migrate to cities for work, women often prefer local wage labour as a measure to adapt to climate change.

2.4 Vulnerability of Farmers to Climate Change

Most scholars measured vulnerability in the context of natural hazards (Kelly & Adger, 2000; Downing *et al.*, 2001; Turner, 2003; Parmesan & Yohe, 2003). The term vulnerability is used in many diverse ways by various intellectual communities, such as poverty and food security analysis, as well as natural hazards research, and each of them conceptualise it differently (Bryan *et al.*, 2009). In other words, there seems to be no unanimity among scholars as to what constitutes vulnerability. Different scholars provide a variety of explanations for the term vulnerability.

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Contemporary literature (see IPCC, 2014; IPCC, 2007; Smith *et al.,* 2009; FAO, 2009; UNEP, 2009; FAO, 2006) have provided similar definitions of vulnerability to climate change and variability. These researchers define vulnerability as the extent at which geophysical, biological and societal systems are and unable to deal with the negative effect of climate change and variability.

The IPCC (2001) defines vulnerability to climate change as the degree to which a system is liable, or incapable to survive under negative effects of climate change and variability. FAO (2006) has suggested that vulnerability to climate change differs across space and time, due to the numerous contributory factors. Authors (example, IPCC, 2007; Williams *et al*., 2008; FAO, 2009; UNEP, 2009) also reported that the vulnerability level of a system to climate change and variability, is dependent on the character, degree, and the rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity.

Exposure to climate variation is a "function of geography" (IPCC, 2007 p5). Many scholars have attributed exposure to climate change to a specific location. For instance, communities along semi-arid areas are likely to be more exposed to drought, whereas coastal communities may have a higher exposure to sea level rise and cyclones (IPCC, 2007).

Sensitivity is considered as the extent to which a system is somewhat negatively or positively, directly or indirectly, affected by climate change and variability (IPCC, 2007). For example, a tropical ecosystem will be less sensitive to a decrease in rainfall than a fragile, arid or semi-arid one, due to successive influence on water flows. Also, a mining community is less sensitive to changing rainfall pattern than one dependent on rain-fed agriculture for livelihood (IPCC, 2007). Adaptive capacity is how a system is able to lessen

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temperate levels, the possible effects of climate change and variability by either taking advantage of prevailing opportunities or undertaking measures to deal with its consequences (IPCC, 2007; FAO, 2009).

Adaptive capacity is dynamic and is dependent on economic and natural resources, social networks, entitlements, institutions, and governance, human resources, and technology (Barnett & Adger, 2007). Adaptation is the process by which entities such as smallholder farming households, etc. alleviate the adverse impacts of climate on their livelihoods. It also involves modifications in lifestyle and economic structure in order to reduce the vulnerability of a system to climate change and variability (Smith *et al.,* 2000). International efforts at finding solutions to climate change have recognized the role of adaptation as a policy option (Ford & Smith, 2004; Pielke, 2007) due to the active behaviour of adaptation responses (Below *et al.*, 2012). Adaptation is employed in this study to denote how maize farming households respond or put in measures to deal with the negative effect or the impact of climate variation.

Although a global phenomenon, the trend towards increased spatial climate variability and its effects are particularly remarkable in the Ghanaian context. The country has been affected by a reduction in rainfall over the Sahel, which is characterized by widespread occurrences of droughts and erratic rainfall patterns that are even more profound in the northern parts of the country (Owusu *et al.*, 2008; Padgham *et al.* 2015). Ghana's average temperature is noted to have risen by 1˚C with a concomitant decrease in mean annual rainfall, and increased variability in all the agro-ecological zones over the past four decades (1960-2000) (EPA, 2011). The average rate of rise in temperature has been 0.21˚C per decade, with more rapid increases in the Northern Savannah regions (MESTI, 2013). This has culminated in a reduction in agricultural production over the past decade and this serves as am ample demonstration of Ghana's struggle against climate change (FAO,

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2015). The vulnerabilities of climate change, food production systems and rural livelihoods are projected to be severely impacted by climate unpredictability and variation (World Bank, 2013). Rural communities in Ghana are particularly noted for high degrees of exposure to droughts, dry spells, high temperatures high levels of sensitivity due to over-reliance on climate-sensitive (over 90% rain-fed agriculture) economic and livelihood systems (MoFA, 2011: Padgham *et al.,* 2015). At the same time, rural areas have limited adaptive capacity to mitigate the adverse effects of climate variability and change (Niang *et al.*, 2014; Antwi-Agyei*et al.*, 2015a).

Some studies have examined African smallholder farmers' experience of climate change and adaptation mechanisms (West *et al.*, 2008; Yaro, 2013; Roncoli *et al.,* 2001). For instance, Roncoli *et al.* (2001) examine how farmers in Sahel use a variety of local indicators to predict rains and adapt their resource management strategies accordingly. In Ghana, a recent study by Yaro (2013) examined climate change perceptions among farmers in southern Ghana. These studies, however, do not discuss the role of NGOs in climate change adaptation interventions, and how these influence livelihoods of smallholder farmers. This is one of the gaps identified in the literature, which this study sought to fill.

2.5 Climate Change Adaptation Strategies and Sustainable Livelihoods

Climate change impacts affect all sectors and levels of society. Nonetheless, while the effects are quite devastating and sometimes universal, it is acknowledged that effective planning and preparation for the climate change can mitigate its effects on humanity. Therefore, adaptation strategies, which refer to the process by which individuals, communities and countries institute measures to cope with the consequences of climate change, has thus become extremely important in the whole climate change discourse. The

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same can be said of the process of adaptation. The idea of incorporating the sustainability of adaptation interventions in relation to future climate risk into policy-making is not new (Brooks et al., 2011). However, while the pressing need for climate change adaptation is well acknowledged and very much pursued by governments and development partners, there appears to be less emphasis on how sustainable these strategies are (Yaro et al., 2013). Thus, while understanding of climate change and its potential impacts has become clearer, the availability of sustainable indicators or practical regulation or policy on sustainability has not kept pace. At the same time, how society and policy makers judge the efforts towards achieving the success in the fight against the climate change stressors is also blurred and there is no unanimity on the accepted indicators to measure the success, effectiveness and sustainability of adaptation. This should be what development and policy makers working on adaptation should aim at accomplishing.

For the developing world, reducing vulnerability to the effects of climate change occupies center stage at policy and development fora because not only do developing countries lack the means to cope with climate hazards, but their economies also tend to be dependent heavily on climate-sensitive sectors, such as agriculture, water, and coastal zones. Besides, the persistently high impacts of climate change on individuals, households, communities in Africa are partly shaped by societies' values, culture, perceptions, and power structures (Popke *et al.,* 2014). Therefore, the contention that vulnerability is not only determined by biophysical factors (floods/droughts) but also by social vulnerability stressors, which include socio-cultural, structural and institutional factors that may include, gender, age, disability status, ethnicity, level of education, political affiliation and land (the main asset) is widely shared (Heltberg *et al.*,2009). These factors determine the adaptive responses of different social groups (Heltberg *et al.,* 2009) by shaping their levels of asset base, access to services and infrastructure, level of dependence on climate sensitive livelihoods and

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political agency (Padgham *et al.*, 2015).Thus, it is problematic as existing literature largely appears to gloss over the experiences of NGOs intervention in their quest to help smallholder farmers adapt to climate change as well as their implications on livelihoods. It is therefore crucial to examine the extent to which the programs achieved its intended purpose while evaluating the successes of the adaptation interventions churned out by these important stakeholders in climate change.

Scholars have advocated an approach to the evaluation of the sustainability of adaptation success that syndicates assessment of how well climate threats to progress are managed by institutions ('upstream' indicators) (Smit & Wandel, 2006: Adger et al., 2007, Westerhoff & Smith, 2009, Engle, 2011), with assessment of how successful adaptation interventions are in reducing vulnerability and keeping development 'on track' in the face of changing climate hazards ('downstream' indicators) (Adger et al., 2007). What is problematic about the current approach to adaptation interventions, policy and practice as a whole, is the over-emphasis exclusively on improving the ability to cope with current climate variability and to address the incremental changes or effects of existing climate-related risks in the near term. But, very little discussion on NGOs' interventions and implications for livelihoods is covered, since the latter should be the overarching goal of these climate change interventions (Thomas, Twyman, Osbahr & Hewitson, 2007; Orlove, Roncoli, Kabugo, Krantz & Grote, 2010). One could possibly suggest existing studies in the literature have largely concentrated on improving the ability to adapt or handle current climate variability, and not the long-term sustenance and implication on climate change. However, adaptation interventions are supposed to be longer-sighted which normalises and conceptualise s sustainability into the adaptation framework (planning, implementing and assessing the adaptation interventions).

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Again, the problem of how to evaluate the impacts of adaptation interventions on development outcomes in the face of rapidly evolving stresses and risks that change the contexts in which development takes place (the 'shifting baseline' problem) calls for a rethinking of assessing the sustainability of adaptation interventions to match with future risks. An undeniable fact is that investments in adaptation interventions demand robust assessments of the expected and actual returns. Therefore, it is imperative to know how effectively adaptation interventions keep pace with development, and equally importantly, how equitably adaptation costs, and how benefits are distributed. Adaptation to climate change stressors is now fully established in the scientific literature as necessary and complementary to mitigate efforts (NRC, 2010; Holdren, 2008; IPCC, 2007). The world of policy and practice at all levels of government, in business, and in civic society is also rapidly waking to that reality. The occurrence of extreme climate and weather events has played a role in bringing adaptation to the fore (IPCC, 2012).

2.6 The Ghana Climate Change Adaptation Strategy

Despite a surge of scientific studies on adaptation interventions, governments, development planners and managers of the resource have not been able to find a common ground on how to measure adaptation success (livelihoods improvements) and the sustainability of adaptation interventions. Central to this study, therefore, is how does successful adaptation look like? How we assess and negotiate trade-offs between adaptation intervention and sustainable adaptation intervention, must account for current adaptation interventions.

In an attempt to curb the menace of climate change, the Ghana National Climate Change Adaptation Strategy (GNCCAS) aimed at enhancing Ghana's current and future development to climate change impacts by strengthening its adaptive capacity and building

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resilience of the society and ecosystems. This strategic document (GNCCAS) was formulated by the Government of Ghana in 2013 as a policy guide for all projects and programmes aimed at combating the effect of climate change and variability in the country. The strategic objectives of GNCCAS (2013) include the following:

1. Build and strengthen capacity of local farmers to increase agricultural productivity and awareness of climate issues
2. Build and strengthen capacity of extension officers on new farming technologies in order to enhance their support for farmers
3. Enhance the living standards of vulnerable groups through acquisition of alternative livelihoods skills
4. Protect the environment through the promotion of agricultural biodiversity
5. Promote cultivation of crops and rearing of animals adapted to harsh climatic conditions
6. Document existing indigenous knowledge and best practices
7. Train trainers to promote post-harvest technologies to minimize losses of farm produce.

2.7 Institutions and Climate Change Adaptation: Will or Exigencies?

The capacity of a community or region to adapt to climate change is dependent on many factors. These include their economic wealth, technology, information and skills, equity and institutions (Smit & Pilfisova, 2001). Amongst these indicators, the role of institutions in adaptation cannot be underestimated. This is because institutions possess the character of bringing people together to make them act collectively to achieve results and also have the ability to combine the elements that result in the achievement of adaptive capacity (Agrawal, 2010; Agrawal & Perrin, 2008; O'Riordan & Jordan, 1999). Adaptation to

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climate change has been identified as a socio-institutional learning process that distinguishes stakeholder goals and processes, and uses information at various levels and in many ways (Ziervogel & Ericksen, 2010).

Adaptation cannot, therefore, be achieved without any form of institutional support or linkage, as they provide the needed environment for the implementation of adaptation options (Moser & Ekstrom, 2010). This therefore makes institutions - especially those at the community level - in the climate change discourse very important, as they are vital in shaping adaptation and improving capabilities of the most vulnerable social groups within the society (Agrawal & Perrin, 2008; Penalba *et al.*, 2012). A study by Smit and Pilfisova (2001) shows that countries that have well developed institutions possess greater adapting capacity than countries whose institutions lack effective institutional set-ups. This is because the political process and power relations among and within countries and communities affect the efficiency of the institutions (Kelly & Adger, 2000). Agrawal and Perrin (2008) and Rodima-Taylor (2012) describe institutions to be omnipresent and serve diverse purposes in the course of adaptation, and therefore are essential in ensuring a successful adaptation. Again, institutions affect individual and community behaviour through their sets of norms and procedures that legalize behaviour and control its effects, thereby creating incentives for adaptation (Agrawal *et al.*, 2010). Institutions have also been identified to structure environmental risks and vulnerability through their research, skill-building functions and collaboration with other decision makers (Agrawal & Perrin, 2008).

However, within the social system, there are different types of institutions that control human interaction (Uphoff & Buck, 2006; Agrawal, 2010; Agrawal & Perrin, 2008; Agrawal *et al*., 2010; Gortner *et al.*, 2007). From the literature, three types of institutions were identified: these are private, public and civic or participatory institutions (Uphoff &

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Buck, 2006; Agrawal & Perrin, 2008; Agrawal *et al*., 2010). However, Gortner *et al*. (2007) in their study of institutions and organisations argue that, institutions exist on a continuum which sometimes overlaps, as it appears there is no definite difference between the private, public and the middle range institutional types. Private institutions, on the other hand, possess for-profit goals, have more financial resources and are more likely to venture into adaptation strategies that promote market exchange and, in a few cases, communal pooling (Agrawal, 2010). Civic and participatory organisations due to their flexibility are able to redefine their goals to adopt new procedures and improve upon different adaptation strategies (Agrawal & Perrin, 2008).

Again, institutions are described to exist in two forms: formal and informal (Uphoff & Buck, 2006; Agrawal & Perrin, 2008; Agrawal *et al*., 2010). In the process of adaptation, informal institutions have been identified to be the initiators of adaptation actions in human societies (Dixit *et al.*, 2009), while, formal institutions are noted to develop strategies and improve upon the response strategies established by informal institutions so as to make interventions sustainable and reduce maladaptation (Agrawal, 2010). This is demonstrated in the findings of Nadeem *et al*. (2010) who studied the role of local governance in strengthening the adaptive capacity of water governance systems and flood mitigation infrastructure in Nepal and India.

Institutions involved in climate change adaptation have been recognized to exist in a hierarchy ranging from the local level, national to international level (Agrawal, 2010; Agrawal & Perrin, 2008; Moser & Ekstrom, 2010; IPCC, 2014). Thus, Ziervogel and Ericksen (2010) call for the analysis of institutional response to adaptation at the different levels of governance during adaptation studies. National governments, for instance, have been identified to lead in the adaptation agenda by deciding on the funding priorities and

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trade-offs, promoting institutional structures, and providing policy direction to the lower levels of governance to guide adaptation (IPCC, 2014).

Though the contribution of institutions on each level cannot be ruled out, institutions at the local level have been identified to be the most important in adaptation as the most important influence institutions have on adaptation is seen and felt at the local level (Agrawal & Perrin, 2008). Apart from controlling human behaviour, institutions at the local level control the ability of households and individuals to adapt by incorporating old and new processes and policies into the system to facilitate adaptation. (Hall *et al.*, 2006; Agrawal & Perrin, 2008). The influence of local institutions is felt through practices such as risk sharing, shaping the nature of responses by individuals or households to community level adaptation through the organisation of an incentive structure and by mediating and shaping external interventions into the local context (Agrawal & Perrin, 2008). Institutions involved in adaptation at the local level have also been found to have the ability of strengthening existing coping strategies and make them more sustainable and in some cases introduce new adaptation strategies that meet the adaptation needs of households and communities they serve (Agrawal, 2010). Again, institutions in rural areas have been noted to help in integrating smallholder farmers into the national economic system by applying innovative methods that will make the smallholder farmer more competitive to receive better prices and have access to investment resources. Similarly, Agrawal *et al*., (2010) observed that, for adaptation to be effective, local institutions must bear characteristics of responsiveness, flexibility, and ability to adapt to the uncertainties that surround climate change.

Agrawal (2010), Agrawal *et al*., (2010) and Tiwari and Joshi (2014) in discussing the effectiveness of institutions in adaptation mentioned that, the interaction between the

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different types of institutions determine the efficiency of adaptation. Institutions interact with each other in either horizontal or vertical relationship and in some cases both (IPCC, 2014; Tiwari & Joshi, 2014).

Vertical relations describe how the various institutions involved in adaptation on different levels--international, regional, national and local--link and interact with each other (Gehring & Oberthü, 2008, while horizontal relations refer to the interconnections between the different types of institutions on the same level (*ibid*). Therefore, in studying the role of institutions in adaptation at the local level, Agrawal *et al*. (2010) suggest that, one has to pay attention to the nature and goals of institutions, how they facilitate particular interventions, and how institutions link up with each other and the rural households. This is because, individuals have been documented to adapt through complex multidirectional interactions between institutions and all actors within the system at different scales (Rodima-Taylor *et al*., 2012). This was demonstrated in the study by Eriksen and Selboe (2012) who studied the social organisation of adaptation to climate variability in Norway, and realised that farmers strategies for managing climate change depended on collaborative exchanges relied on their relationship with informal social networks that depend on trust as well as formal institutions and regulations. The process of facilitating adaptation at the local level involves important actions and decisions that need to be taken by the higher levels of governance (Harmeling *et al*., 2010). These processes include collection of climate change adaptation information and making it available, provision of human, financial and technical resources to support adaptation at the local level, providing social protection for the vulnerable and creation of policies that will enhance bottom-up feedback processes in the horizontal relations of institutions (*ibid*). This therefore creates a situation where local innovations and adaptations are interlinked with those from the

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global scene, thus becoming an integral component of adaptation between institutions and actors (Rodima-Taylor *et al*., 2011).

From the discourse above, one can invariably conclude that all institutions involved in the adaptation process are interdependent and equally important in the adaptation process. Nonetheless, though power relations exist between and within institutions at all levels, individuals and communities must not be left out as they are the beneficiaries of adaptation (Eriksen & Selboe, 2012).

Atazona (2013), shows that the adaptation process in Ghana involves all forms of institutions within the vertical column of institutions--international, national and local. International institutions have been recognized to offer funding for implementation of climate change projects, sometimes while working together with government or with locally based NGO's (Stanturf *et al*., 2014). However, Yaro *et al.* (2014) reported that, national institutions are not directly involved in adaptation though through policies and service provision they ensure that conditions are met for adaptation and sometimes run adaptation driven projects. NGOs, on the other hand, have been identified to spearhead adaptation by building the capacities of people through education, provision of livelihood choices and introduction of new opportunities (Yaro *et al*., 2014; Stanturf *et al.*, 2011). Yaro *et al*. (2014) report that even though private institutions were engaged in adaptation, their activities are usually limited to areas with good road networks.

Many studies conducted on institutions and adaptation in Ghana are centred on the natural resource sector, with focus on forest management (For example, Kalame *et al.*, 2011; Kalame *et al*., 2009; Mayers *et al*., 1996; Koku & Gustafssen, 2003).

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2.7.1 NGOs and Climate Change Adaptation: Procedural or Due Diligence?

Over the years, NGOs have effectively positioned themselves as credible organisations for assisting small farmers who lack resources (Lewis & Kanji, 2009). NGOs are crucial in developing farmers' capacities to adapt to climate change (Yaro et al., 2015). This suggests that NGOs are instrumental in climate change adaptation but they also require systematic enquiry to ascertain how this actually occurs.

NGOs encounter as well as pose some challenges in the process of executing their adaptation interventions. Yaro et al. (2015) explain that many NGOs with their myriad adaptation interventions, churned out to the same farmers at the same time, can be problematic. These challenges can be hard to overcome because of endogenous, self-reinforcing organisational processes despite the increasing rhetoric, evidence in the emerging literature on adaptation strategies underscores the importance of inter-elite power relations *vis-à-vis* institutional arrangements, as well as the role of NGOs (notably patron-client relations) in shaping broader development processes and outcomes of climate change adaptation interventions (Abdulai, 2014).

The impact of the interventions by NGOs towards how these farmers adapt and consequent implications on their livelihoods largely remains underexplored. Against such backdrop, this study assessed the case of two districts thus the Savelugu Municipal Assembly and the West Mamprusi District in the Northern and North East regions of Ghana whose smallholder farmers have witnessed the interventions of many NGOs.

2.7.2 Climate Change Interventions in Northern Ghana

Northern Ghana is classified as the most vulnerable part of the country to climate change due to poverty, harsh environmental factors, dependence on the natural resource sector,

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and low opportunities for livelihood options (Stanturf *et al*., 2014). Studies also show that popular coping strategies such as charcoal burning and tree cutting, which have been adopted, damage the environment and create further stress upon people's livelihoods. Preferred diversification options lie chiefly in the areas of migration, wage labour exchange and the development of on-farm strategies which incorporate climate smart techniques (Yaro *et al*., 2014; Stanturf *et al*., 2014). The importance of institutions in promoting adaptation have been recognized in studies undertaken in the northern part of Ghana (For example, Stanturf *et al*., 2014; Darko & Atazona, 2013; Yaro *et al*., 2014; Belden, 2010).

Yaro *et al*., (2014) and Belden (2010) found that all forms of institutions (formal and informal) are involved in adaptation in northern Ghana. While Yaro *et al*. (2014) posit that formal and informal institutions play complementary roles in adaptation, Belden (2010) discovers that, the relationship and interaction between formal and informal institutions maybe non-interactive, complementary, conflicting or collusive depending on the kinds of resources, incentives and rules in place. These factors may promote or inhibit adaptation and development in a local area (Yaro *et al*., 2014, Belden, 2010). Institutions involved in adaptation have been recognized to perform specific functions. While state institutions involved in adaptation have with the exception of the Ministry of Agriculture have been identified to offer direct adaptation services (Yaro *et al*., 2014), NGO, on the other hand, have been reported to offer both direct and indirect services to adaptation (Yaro *et al*., 2014).

2.8 Effects of Climate Change Interventions on Farmers' Livelihood

Sithole et al. (2014) employed a propensity score matching to determine the effect of farmers' participation in smallholder irrigation schemes of Ntfonjeni Rural Development

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Area (RDA) in Swaziland on household income. The results of the Average Treatment Effect indicated access to irrigation water improved the households' monthly income of participating households by SZL 244 (USD24.40). It is showed that access to reliable irrigation enables farmers to adopt technologies and intensify cultivation, leading to increase in productivity, high production and greater returns from farming (p8).

Ingram et al. (2017) investigated the impacts of cocoa sustainability initiatives in West Africa cocoa farmers, using the case of UTZ certification program from Ghana and Ivory Coast. Quantitative data was collected from certified and non-certified farmers from both countries using questionnaires, and the researchers also collected qualitative data through interviews, community focus group discussions, interviews with teachers, cooperatives executives, certifying organisation representatives, cocoa traders, financing organisation and the COCOBOD. Fifteen environmental, economic and social indicators were developed as proxy to measure the impact of the UTZ certification program by comparing the computed indicators of certified farmers to non-certified farmers using t – test and propensity score matching techniques. The results revealed that the UTZ certification program provided modest benefits to cocoa farmers.

Avea *et al*., (2016) applied stochastic frontier analysis to assess the effects of NGOs support on the technical efficiency of 349 smallholder soybean farmers in northern Ghana. The results revealed a potential growth of 11.5 percent in the mean technical efficiency of soybean production of 0.885. It was further reported that land area, agro-chemicals, and seeds contributed to production growth while labour is over used. Avea et al., (2016) further found that NGO facilitation as well as group membership influences technical efficiency and farmers facilitated by NGOs and development agencies recorded 4.4 percent more efficient than non-facilitated farmers.

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2.9 Factors influencing Farmers' Participation in Climate Change Interventions

Existing research has identified a number of factors that determine the involvement of the local farmers in climate change interventions by NGO's. Mutoko (2014), examined the benefits, incentives, and barriers to adopting of climate smart agricultural practices implemented at the Mitigation of Climate Change in Agriculture (MICCA) pilot site in Kenya. Questionnaires were used to collect household level data from 150 farmers who participated in the project and interviews administered with key informants which was supplemented by focus group discussions. Thematic analysis was used to analyse qualitative responses while descriptive statistics were used to analyse quantitative data. It was revealed that male-headed households, households with larger holding and secured land ownership, and membership with farmer-based groups were the important determinants of households' participation in the MICCA project.

Sithole et al., (2014) determined the factors influencing farmers' participation in smallholder irrigation schemes in Swaziland, using the case of Northern Rural Development Area (NRDA). Data was sought from 96 households that participated in the local irrigation scheme and non-participant households using household questionnaire. Data was analysed using descriptive statistics and Probit regression model. The study revealed that distance to the irrigation site, and membership of other groups had significant negative effect on households' participation in local irrigation schemes. On the other hand, age of household head, occupation average farm size and access to credit had significant positive influence on households' participation in local smallholder irrigation scheme. According to Gujarati (2008), both Probit and Logit regression models can be used alternatively based on the decision of the researcher. This study adopted the binary Logit regression model to examine the factors influencing farming households' participation in

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climate change interventions because the coefficients estimate is easy to interpret relative to the Probit model.

2.10 NGOs Climate Change Adaptation Interventions: Any Challenges?

Within the determinants of involvement in Climate Change interventions, there are some conditions and factors that constrain the achievement of set goals. The constraints militating against the achievement of NGOs' goals on climate change related interventions can be viewed from two dimensions: challenges faced by households in accessing support from institutions, and challenges NGOs faced in providing support to farming households to adapt to climate change.

2.10.1 Challenges in Accessing Support from Institutions: Farmers Perspective

Smallholder farmers and institutions (NGOs) need to work together to bring about a successful adaptation process. However, it has been realized that, there is sometimes a disconnect between support providing organisations and the smallholder farmers. Studies reviewed around this topic suggest that, in most cases, smallholder farmers lacked the necessary information to help them cope with the changes that are being experienced within the sector and especially climate change (Bawakyillenuo et al., 2016; Wossen et al., 2014). This arises from the low numbers of extension officers considering the function they play in the productivity of smallholder farmers. Extension officers introduce new modern farming methods to farmers, better yielding crop and animal varieties and also link farmers to markets and credit. Most smallholders are cut-off from extension support as they are found in areas that are far and difficult to reach. Research has also shown that even when extension support is available, gender, age and status is also a determinant of a farmer being considered for adaptation support (World Bank, 2013; Etwire *et al*., 2013;

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Laube et al. 2012). In the bid to NGOs assisting communities and individual households adapt successfully to climate variation, individuals or communities to benefit from interventions may oppose the adaptation project which might hinder adaption effort (Jantarassami *et al*., 2010).

Research conducted on challenges that inhibit smallholder farmers' access to institutional support in Ghana outlined age, wealth, location and gender to be major factors that affected institutional access. Other factors which were less frequently cited in literature as factors which affected smallholder farmer access include weak farm management which is expressed in lack of book keeping and land tenure security. Yaro *et al.* (2014) and Fosu-Mensah *et al.* (2012) identified finance, limited spacio-temporal reach, lack of human resources and information as issues that challenged the effectiveness of institutional support amongst smallholder farmers. Apart from informational barriers which might result from both institutions and smallholder farmers, all the barriers identified by Yaro *et al.* (2014) and Fosu-Mensah *et al.* (2012) may be described as purely institutional barriers as termed by Moser and Ekstrom (2010).

Bondinuba (2012) argued that another factor that may result in challenges of smallholder farmers accessing support especially from financial institutions is the lack of book keeping by smallholder farmers. This especially creates problems for smallholder farmers when they seek support to adapt from institutions which require collateral agreements as they usually have nothing to show as evidence for their ability to pay back the loans (Sonne, 2010). The security of the land tenure system being practiced in an area has been identified as another factor which may affect smallholder farmers' decision to access institutional support (Hisali *et al*., 2010). As land pressure on land continues to rise due to population growth and market development (Cotula & Chauveau, 2007). As a result, smallholder

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farmers' sharecropping contract with their land owners may be reviewed arbitrarily by land owners for various reasons which eventually leads to their eviction from the land (Du Plessis, 2005; Cotula *et al.*, 2008). This therefore makes it difficult for women and migrant farmers, especially, who face the worst forms of land tenure agreement, to access institutional support to adapt to climate change.

2.10.2 Challenges in Providing Support: Insights from NGOs

Institutions, in trying to fulfil their obligations to aid individuals adapt to climate change sometimes, face certain challenges. Some of these hindrances might come from two sources: the institutions themselves, or from the people whom the institutions seek to help. In this section, the discussion is going to be centred on obstacles that arise from the institutions themselves hindering their ability to provide support to farmers.

Various studies looking at institutions in adaptation agree that, the implementation of adaptation projects is affected by hindrances resulting from insufficient finance and staff which in some studies is referred to as resources (Jantarassami *et al*., 2010; Measham *et al*., 2011; Rajalahti, 2012). This problem usually stems from the fact that, most institutions at the local level depend on institutions at the higher levels and therefore lack the autonomy to make and take decisions without prior approval of their managers (Jantarassami *et al*., 2010; Measham *et al*., 2011; Crabbe & Robin, 2006; Mukheibir & Ziervogel, 2007). This institutional barrier tends to affect the quality and scope of adaptation projects as institutions will be forced to offer short-term technical adaptation rather than a long-term adaptation approach which will involve integrated approaches with other institutions (Crabbe & Robin, 2006). In a quest to finding a solution to inadequate finance, Rajalahti (2012) suggested that, all stakeholders must contribute effectively with their financial and political capitals to ensure the continuity of adaptation projects implemented by

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institutions. However, Spielman *et al*., (2008) submits that, doing this will only go on to further worsen the poverty situation of marginalized households as they have few resources to contribute to the innovation network**.** Eriksen and Selboe, (2012) demonstrated in their study on how power dimensions at the local level affected policy interventions. They found out that, when formal institutions lead the way in adaptation without giving regard to local institutions, the actors to which adaptation is directed will end up being disempowered thus leading to inaction rather than adaptation (Eriksen & Selboe, 2012).

Similarly, in a study by Jantarasami *et al*., (2010), purposive sampling was used to select and interview 32 managers and resource specialists, based on their job duty schedules at the natural resource division, parks or forest units in the Parks and Forests of the US. This criterion only presents constraints to implementing climate change projects from the implementing institutions' point of view without revealing the challenges faced by beneficiaries, which is vital to successful implementation of projects. In assessing the institutional barriers to the implementation of climate change adaptation projects in the U. S. National Parks and Forest, Jantarasami *et al*., (2010) employed a qualitative approach by transcribing interview responses using inductive coding methods and analysed into themes and patterns. The perceived challenges to implementing adaptation projects in the forest and parks in the US were categorized into input constraints (insufficient information on climate risk at local level for effective climate change adaptation, inadequate financial and human resources, and perceived opposition by the public or stakeholder groups to adaptation interventions by way of lawsuit, etc.); informal institutional barriers (internal inertia to change and partners' inertia to change); and formal institutional barriers (internal operating procedures, external environment laws, ownership mosaic).

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Measham *et al*. (2011) used a case study approach to explore the constraints on planning for climate adaptation in three of the revered climate distressed governing councils in Sydney of Australia as a result of their politicised local planning process. The study reported that the personal interest of authorities in leadership, competing priorities among local communities, land related constraints, lack of credible and relevant information about the nature of climate risk, institutional manipulation by government, and absence of policies on climate change adaptation, were the main constraints militating against the effective adaptation to climate change through municipal planning in three councils of Sydney and Australia.

Insufficient information on the impacts of climate change at the local level has been identified by empirical studies as a barrier that affects the implementation of adaptation projects by institutions at the local level (Crabbe & Robin, 2006; Mukheibir & Ziervogel, 2007; Jantarassami *et al*., 2010; Moser & Ekstrom 2010; Deressa *et al*., 2009). This barrier will in most cases result in a partial understanding of climate change impacts on the part of institutions thus, creating uncertainties about the opportunities and benefits that will be accrued to both the institution and society as a result of adaptation (Hummil & Tanner, 2011). This barrier in many instances results from lack of and (or) unavailability of reliable climate information at a scale that is relevant to the local level and thus, making adaptation planning difficult (Deressa *et al*., 2009; Jantarassami *et al.*, 2010).

Another barrier which has been identified to have a great impact on the ability of institutions to offer certain kinds of adaptation support within particular socio-cultural settings is the culture of the people (Moser & Ekstrom, 2010). Empirical evidence from adaptation projects shows that, there have been cases where farmers rejected a particular intervention, because it went against their culture (Nielson & Reenberg, 2010).

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Pradhan *et al*., (2012) identified that the involvement of different kinds of institutions in the adaptation process could create a situation where institutions pursue different adaptation strategies that may complement each other or be competitive. This can sometimes make their work in adaptation unsuccessful. Agrawal (2010) also identified that, institutions in the social sphere enjoy certain levels of comparative advantages in their effort to deliver adaptation. Pradhan *et al*., (2012) therefore suggested that, owing to the differences in goals, operation and comparative advantage, the specific roles each institution can play in adaptation must be laid out and the accepted mode of communication and interaction within and between organisations must be clarified. This point is further stressed upon by Agrawal (2010), who also calls for a strict observation of what he calls the three factors in the assessment of institutions in adaptation. These three factors include the nature and goals of institutions, their methods in facilitating adaptation strategies and the linkages institutions have with each other and the households which they serve. These factors will not only aid in the assessment of adaptation, but also in the process of planning and implementation of adaptation projects.

Although these studies support interaction between the different types and levels of institutions, findings of Upton (2005) disclose that, when institutions have weak linkages between themselves, especially those on different levels, partnerships become difficult and tend not to succeed causing the intervention to fail. Agrawal *et al.*, (2010) in contributing to this debate, posited that, the responsiveness of local institutions to climate change adaptation is affected by weak technical and managerial skills, poor linkages of local institution with others on the higher levels, poor information gathering and dissemination systems together with unclear missions and conflicting priorities between levels and agencies of government. These constraints have serious implications in the adaptability of the poorest and vulnerable groups who are mostly impacted by climatic stress (Agrawal *et*

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al., 2010). This was further illustrated by Adger *et al.*, (1997) whose study on adaptation in Bangladesh showed that during disasters, when institutional supplies directed at food security, human settlements and health were inadequate to meet the needs of the people; the plight of the people to whom this support is directed tend to be increased. Other scholars such as Smit and Pilfisova, (2001) in their contribution to the institutions and adaptation discourse found that, when NGOs are developed and evolved to meet the task of aiding adaptation, they tend to create an enabling environment for the management of trending climate risks. In such a situation, institutions are equipped to provide the capacity needed to attend to future risks posed by climate change.

2.11 Empirical Review

2.11.1 Factor influencing farmers' participation in climate change interventions

Mutoko (2014) examined the benefits, incentives, and barriers to adopting of climate smart agricultural practices implemented at the Mitigation of Climate Change in Agriculture (MICCA) pilot site in Kenya. Questionnaire were used to collect household level data from 150 farmers who participated in the project and interviews administered with key informants which were supplemented by focus group discussions. Theme analysis was used to analyse qualitative responses while descriptive statistics were used to analyse quantitative data. It was revealed that male-headed households, households with larger holding and secured land ownership, and membership with farmer-based groups were the important determinants of households' participation in the MICCA project.

Sithole et al., (2014) established the reasons manipulating farmers' involvement in smallholder irrigation systems in Swaziland, using the case of Ntfonjeni Rural Development Area (RDA). Data was sought from 96 households that participated in the local irrigation scheme and non-participant households using household questionnaire.

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Data was analysed using descriptive statistics and Probit regression model. It was revealed that distance to the irrigation site, and membership of other groups had significant negative effect on households' participation in local irrigation schemes. On the other hand, age of household head, occupation average farm size and access to credit had significant positive influence on households' participation in local smallholder irrigation scheme. According to Gujarati (2008), both Probit and Logit regression models can be used alternatively based on the decision of the researcher. This study adopted the binary Logit regression model to examine the factors influencing farming households' participation in climate change interventions because the coefficients estimate is easy to interpret relative to the Probit model.

2.11.2 Effects of Climate Change Interventions on Farmers' Livelihood

Sithole et al., (2014) employed a propensity score matching to determine the effect of farmers' participation in smallholder irrigation schemes of Ntfonjeni Rural Development Area (RDA) in Swaziland on household income. The results of the Average Treatment Effect indicated access to irrigation water enhanced the farmers regular income of participating households by SZL 244 (USD24.40). It is showed that "access to reliable irrigation enables farmers to adopt technologies and intensify cultivation, leading to increase in productivity, high production and greater returns from farming" (p8).

Ingram *et al*., (2017) investigated the impacts of cocoa sustainability initiatives in West Africa cocoa farmers using case of UTZ certification program from Ghana and Ivory Coast. Quantitative data was collected from certified and non-certified farmers from both countries using questionnaire while qualitative data sought through community focus group discussions, interviews with teachers, cooperatives executives, certifying organisation representatives, cocoa traders, financing organisation and the COCOBOD.

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Fifteen environmental, economic and social indicators were developed as proxy to measure the impact of the UTZ Certified certification program by comparing the computed indicators of certified farmers who participated in the certification program to non-certified farmers who did not participate in the certification program using t – test and propensity score matching techniques. The results revealed that the UTZ Certified certification program had subtle change in power of cocoa farmers for market participating, with increase in technical information and dissemination of good agricultural practices by strengthening the capacity of members of farmer-based cooperatives.

Avea *et al*., (2016) applied stochastic frontier analysis to assess the effects of NGOs support on the technical efficiency of 349 smallholder soybean farmers in northern Ghana. The results revealed a potential growth of 11.5 percent in the mean technical efficiency of soybean production of 0.885, It was further reported that land area, agro-chemicals and seeds contributed to production growth while labour is over used. Avea et al. (2016) further found that NGO facilitation as well as group membership influences technical efficiency and farmers facilitated by NGOs and development agencies recorded 4.4 percent more efficient than non-facilitated farmers.

2.11.3 Challenges to climate change intervention

The Purposive sampling technique was used by Jantarasami *et al*. (2010) to select and interview 32 managers and resource specialists, based on their job duty schedules at the natural resource division, parks or forest units in the Parks and Forests of the US. This criterion only presents constraints to implementing climate change projects from the implementing institutions' point of view without revealing the challenges faced by beneficiaries, which is vital to successful implementation of projects. In assessing the institutional barriers to the implementation of climate change adaptation projects in the U.

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S. National Parks and Forest, Jantarasami *et al*., (2010) employed a qualitative approach by transcribing interview responses using inductive coding methods and analysed into themes and patterns. The perceived challenges to implementing adaptation projects in the forest and parks in the US were categorized into input constraints (insufficient information on climate risk at local level for effective climate change adaptation, inadequate financial and human resources, and perceived opposition by the public or stakeholder groups to adaptation interventions by way of lawsuit, etc.); informal institutional barriers (internal inertia to change and partners' inertia to change); and formal institutional barriers (internal operating procedures, external environment laws, ownership mosaic).

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2.12 In Pursue of Theoretical Framework

The study is underpinned by two main theories; the stakeholder theory and programme impact theory. The stakeholder theory contends that individuals and groups whose lives are or likely to be influenced by an organization's actions and programs should be managed prudently because they constitute the 'stakeholders' of the organization. The theory has widely been applied in the business field to explain relations between organisations and their

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stakeholders. Due to its significance and vast popularity among the academics and practice, extensive research works (Clement, 2005) have been conducted on this theory. In his popular book, *"Strategic Management: A Stakeholder Approach", Freeman (1984) popularized the idea of stakeholders, and* discussed the relevance of the individual and groups beyond the organisation's stakeholders. The theory explains the behaviour of organisations and their relationship with the external environment and society.

A key postulation of the stakeholder theory has been to enable managers understand stakeholders and strategically provide for them appropriately (Freeman, 1999). More clearly, the stakeholder theory suggests two main questions: what is the purpose of the firm, and what are the responsibilities of the management to the stakeholders? (Freeman et al, 2004). Freeman (1984, p.46) finds that, "stakeholders are any group or individual who can affect or is affected by the achievement of an organization's objectives". There are inside stakeholders, owners or shareholders, managers, employees, or those having a direct claim on organisation's resources, and outside stakeholders such as customers, suppliers, unions, communities, government and public, (Jones, 1995), who do not have direct claim.

Stakeholder management describes the satisfaction of stakeholders which suggests that at least the prime stakeholders should be satisfied, and it is the moral obligation of the organisations to strike a balance between the interests of the stakeholders and directing the strategies of the organisations (Buchholz & Rosenthal, 2005). Applying the stakeholder theory to NGO climate change adaptation, it suggests that small holder farmers are external stakeholders of NGOs and are required to be catered for by the NGOs. In that regard, it is important for NGOs to demonstrate much interest in the outcomes of their interventions on smallholder farmers' livelihoods which requires prudent monitoring and evaluation mechanisms.

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The stakeholder theory is applicable to NGOs' climate change adaptation interventions within the context of the Northern Region. NGOs have three vital stakeholders, namely, the NGOs themselves, their donors, and the beneficiaries, thus, small holder farmers whose livelihoods are influenced by activities of NGOs. Applying the theory to this study makes it possible to highlight the obligations and responsibilities that these NGOs have towards their beneficiaries, and examine the extent to which these NGOs conceptualise and approach livelihoods of their stakeholders. NGOs may be put into the community stakeholders' group where communities, regulators, pressure groups, the media and communities are the stakeholders. NGOs are accountable to their employees, donors and those individuals who are targets or beneficiaries of the NGOs.

The second theory guiding this study is the theory on programme impact which contends that the assessment of the effect of an intervention establishes whether or not an intervention had achieved its objectives or not (African Impact Evaluation Initiative (AIEI), 2010). Two approaches exist for the assessment of impact in the literature. These approaches are the "before and after" and the "with and without" approaches. The "before and after" approach assesses the impact of interventions by comparing the performance of key variables during and after the intervention with those before the execution of the intervention. This is done by using the statistical methods to assess whether or not there is significant change in some key variables over time. This usually produces biased estimates because it does not take into account the effect of confounding factors on the change.

The "with and without", on the other hand, assesses the impact of interventions by comparing the behaviour of essential variables in a sample of participating beneficiaries of a project with their behaviour in a non-participating group. The experiences of the non-

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participating group known as the comparison group are used as a proxy for what would have happened in the participating group.

Statistical and econometric models are mainly used in impact evaluations. Three main kinds of impact evaluation designs exist, namely experiential, quasi-experimental and non-experimental. Impact evaluation assesses the impact a project has on beneficiaries by comparing outcomes between participants and control groups (AIEI, 2010). This theory is relevant to this study because it evaluated the effects of NGOs' climate change interventions on the livelihood of farmers by soliciting data from both beneficiary and non-beneficiary farmers.

Selection into the treatment and control groups is random in randomized control design. On the other hand, quasi-experimental or non-experimental design methods are used to carry out an assessment when it is not possible to construct treatment and control groups in experimental design. Through econometric methodologies such as difference in difference methods, instrumental variables and matching methods these techniques create comparison groups that resemble the treatment group (Baker, 2000). Therefore, to determine the effect of NGOs' interventions on the livelihood of farming households, the "with and without" evaluation method, specifically the matching method was employed.

2.13 Sustainable Livelihood Framework: A Framework for Analysis

This study hinges on the influx of climate change, climate change interventions of NGOs and the livelihoods of farming households. This makes it imperative to conceptualise the effects of these NGOs interventions on households' livelihoods based on the Sustainable Livelihood Framework. Hence, in conceptualizing the framework for the study, a review of the various sustainable livelihood frameworks is necessary.

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The Department for International Development (DFID) Sustainability Livelihood Framework (SLF) views people operating in a context of vulnerability. The adoption of a livelihood approach within DFID resulted from the publication of the 1997 United Kingdom (UK) Government White Paper on International Development. One of the three specific objectives, designed to achieve this aim, is a commitment to policies and actions which support sustainable livelihoods (Carney *et al*., 1999 cited in Frantz, 2001). The objective of DFID's sustainable livelihood approach (See Figure 2.2) is to increase the agency's effectiveness in poverty reduction by seeking to mainstream a set of core principles and a holistic perspective in the programming of support activities to ensure that these correspond to issues or areas of direct relevance for improving poor people's livelihoods. The framework is not intended to be an exact model of reality, but to provide an analytical structure to facilitate a broad and systematic understanding of the various factors that constrain or enhance livelihood opportunities, and to show how they relate to each other. In this study, the interest is to link climate change projects components to the various livelihood assets of households including social, financial, physical, natural and human resources.

The sustainable livelihood framework is built around five principal categories of livelihood assets. An important part of the analysis is thus to find out people's access to different types of assets (such as physical, human, financial, natural, and social) and their ability to put these to productive use. The framework offers a way of assessing how organisations, policies, institutions and cultural norms shape livelihoods, both by determining who gains access to which type of asset, and defining what range of livelihood strategies are open and attractive to people (Carney, 1998). NGOs often have a criterion for selecting beneficiary households for their interventions and hence, determine the type and amount of livelihood sources available to households.

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The DFID framework inspires the researcher to take a broader and systematic assessment of what issues constitute and cause poverty. Whether these issues constitute shockwaves that adversely affect livelihoods of farmers, whether it constitutes the policy failure or institutional malfunctioning, whether the system lacks resources to examine the relations between them. Even though the framework takes no accounts of the sectorial assessment of property, nonetheless, it tries to reconcile the contribution made by all the sectors to building up the stocks of assets upon which people draw to sustain their livelihoods (Carney et al., 1999). For DFID, the idea is that if people have better access to assets, they will have more ability to influence structures and processes so that these become more responsive to their needs (Carney *et al.*, 1999). Livelihood strategies are the ways in which people combine and use assets in pursuit of beneficial livelihood outcomes that meet their own livelihood objectives are also influenced by this environment (Carney *et al.*, 1999). The possibility and effectiveness of livelihood strategies are dependent upon the accessibility of assets, services and opportunities which can be positively enhanced or negatively undermined by ecological factors, social structures or institutional processes. This accessibility is seen in the context of smallholder access to land before and after the inception of intervention programs of governmental and non-governmental organization. The framework is also able to handle the complexities of local realities, livelihood strategies and poverty outcomes, and the dynamic interrelations between them (DFID, 1999).

The vulnerability context frames the external environment in which people exist. People's livelihoods and the wider availability of assets are fundamentally affected by critical trends as well as by shocks and seasonality over which they have limited or no control. The phenomena of NGOs climate change adaptation interventions are seen to constitute the external environment of the smallholder farmers. Hence, this study adopts the Sustainable

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Livelihood Framework to determine how NGOs' climate change adaptation interventions impact livelihood of beneficiary farmers (see Fig2.1).

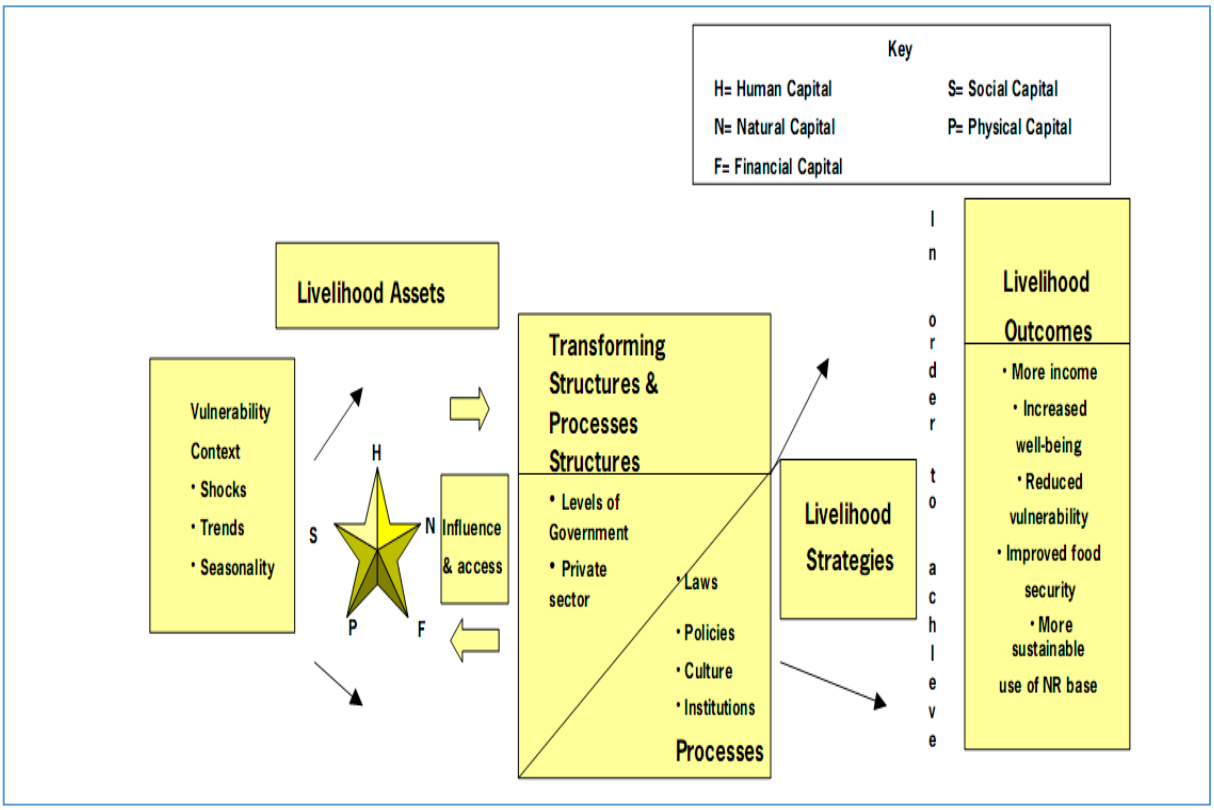

Figure 2.1: UNDP Sustainability Livelihood Framework

Source: DFID, 1999

In this study, livelihood is conceptualised and comprises the skills, resources (including both material and social resources) and actions essential for a means of living. A livelihood is sustainable when it can cope with and recover from stresses and shocks and manage to enhance its capabilities and assets both now and in the future, while not undermining the natural resource base (Chambers & Conway 1991 p8).

Sustainable Livelihood Analysis denotes a 'multiple capitals' approach which views sustainable livelihoods along five key indicators: available capital (natural, human, social, physical and financial) and an examination of the vulnerability context (trends, shocks and stresses) in which these capitals (or assets) exist. Attempts have been made to link these

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livelihood capitals to a measure of poverty and vulnerability (Erenstein, 2011). The approach divides people's assets into five categories. Human assets refer to the skills, knowledge, good health and ability to work which cumulatively enable individuals undertake different livelihood strategies. Social assets (or social capital) refer to the social resources which people can draw on including informal relationships of trust, reciprocity and exchange with families, friends and neighbours as well as more formalised groupings (e.g., community and faith groups). Physical assets refer to the tools and equipment that people need to be productive along with the basic infrastructure needed to function. Examples are affordable transport and energy, decent housing and access to information. Financial assets include earned income, pensions, savings, credit facilities, state (welfare) benefits, child maintenance, among others. Finally, public assets refer to public services, including libraries, local organisations and regeneration groups as well as people's general engagement within their community beyond the immediate circle of friends and family.

From the above, this study adopts the Sustainable Livelihood Framework to determine how NGOs' climate change interventions impact livelihood of beneficiary farmers in the Northern Region of Ghana. The SLF suits this study in that it presents the transforming structures of institutions including the private sector, which this study sought to identify and review in the context of the Ghana National Climate Change Adaptation Strategy; access to these transforming structures which is the second objective of the study; and how access to these transforming structures influence livelihood assets of households, which is the third objective of the study.

2.14 Gaps in the Literature

Most studies on climate change interventions only identified the interventions, without situating their project objectives into how they are contributing to achieving Ghana's goal

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on climate change enshrined in the National Climate Change Adaptation Strategy which was drafted in 2013 to guide all climate change projects in the country. For instance, START (2012) identified the climate change projects implemented in northern Ghana with donors, project duration and activities. START (2012) only profiled climate change projects in Northern Ghana without reviewing such projects in the national context to assess the effectiveness of such projects in achieving national goals on climate change.

In the literature, studies that have attempted explaining the effects of farmers' participation in climate change interventions on their livelihoods failed to highlight the role NGOs. The few studies that have attempted explaining the effects of farmers' participation in NGOs' climate change interventions on their livelihoods do so in passive and others have either employed only qualitative approaches (example Jantarasami *et al*., 2010) which lacks the inferences for generalisation; or use only quantitative methodology such as treatment models and regressions (example Avea *et al*., 2016; Sithole *et al*., 2014) which is quite cumbersome to understand by audience without quantitative background. In the research so far, only a few studies employ the mixed method in determining the effects of NGOs climate change interventions on farmer households' livelihoods in northern Ghana.

Yet, the limited studies on effects of farmers' participation in NGOs' climate change interventions on livelihood used case studies where single intervention is studied using either qualitative, quantitative or mixed methods. These gaps identified in the literature are filled by the current study as it employed a mixed method to explore farmers participation in multiply climate change interventions implemented in Northern Ghana by NGOs and its effects on their livelihood.

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2.15 Conclusion

This chapter presented the literature in which the study is positioned. Key concepts used in the study were defined, after which the theoretical and empirical literature were reviewed. Major themes discussed are climate change and its consequences, farming households' vulnerability to climate change, and adaptation strategies and sustainable livelihood and institutions and climate change. Other relevant theories were reviewed to build a theoretical framework for the study. Finally, the stakeholder and programme impact theories were presented as the frameworks to guide data collection and analysis.

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CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter presents the research process that was followed in conducting the study. The chapter begins with a brief overview of the philosophical foundations of social research, and proceeds to discuss the adoption and suitability of the pragmatic paradigm for the study. There are discussions on the research approach, design, and the data collection regimes adopted. The data analysis procedures and other ethical considerations made in the study are also discussed at the end of the chapter. The chapter provides a detailed account of the research process from its conception and design and provides justifications for the adoption of the mixed method approach and the case study design as well as other choices made in the study.

3.2 The Study Area

This study is conducted in the Savelugu Municipal and the West Mamprusi Districts in the Northern Region of Ghana. The specific communities from the Savelugu Municipality were Chaalam, Zosali, Dipale and Nakpanzo while the communities in the West Mamprusi District include Nambari, Nayawko, Takorayiri and Janga. The Northern Region is bounded to the north by the Upper West and Upper East Regions, to the east by the Black and White Volta Rivers and Volta region, to the south by Brong Ahafo Region and to the west by Upper West Region and Burkina Faso. The region has a land area of 70,384 square kilometre (31% of Ghana's land area) with a population of 2,479461, 10.1% of the national population (GSS, 2012).

The region vegetation is mainly "grassland, interspersed with Guinea and Sudan savannah woodland characterised by such drought-resistant trees as the baobab, shea nut, acacia,

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dawadawa, mango and neem" (GSS, 2012 p50). The region experiences two seasons: the dry season (between November to April) and the wet season (between May and October) with an average annual rainfall of 750mm – 1050mm (GSS, 2014). The agricultural sector employs 73.11% of the region's population of 15 years and above, with 43.06% being female. The main crops cultivated in the region include, among others, maize, rice, yam, cassava, soya beans, millet, and sorghum. (GSS, 2012).

The region experiences the effects of climate variability in the form of shifting rainfall patterns and more frequent and extreme floods and droughts. The impacts on rice production in the region are negative since agriculture in the region is principally rain-fed (Yengoh, *et al*., 2010). West Mamprusi District is the third largest district in the region with a total population of 168,011 of which 50.06% are female, whilst Savelugu Municipality is the fourth largest district in the Northern Region with a population of 139,285 of which 51.51% are females.

The study considered two regions of Ghana i.e., Northern and North East Regions, which were purposely selected. Again, the researcher selected two districts (one in each region) based on the reasons below. The Savelugu Municipality in the Northern region and West-Mamprusi District in the North-East region were therefore selected. However, until the recent creation of the new regions, both were in the Northern Region.

There are four-major parameters that underpinned the selection of the two regions and the districts. The first reason is the ecological zone of the area; the second reason is the nature of farming activities; the third reason is the presence of NGOs and the last reason is ease of access to the communities by the researcher. Both study areas' ecological zones are Sudan savanna, which observes about 1000mm/year of rainfall with only 150-160 days of the growing season for crops. The nature of farming is mainly on a smallholder basis.

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There are very few commercial farmers who are found in the main cities of the area. Presence of NGOs: In relation to NGOs, there are a good number of both local and international NGOs in the study area, working to improve the livelihood of vulnerable people through agriculture, health, education and governance. Ease of access to the researcher: The study sites are both located on the main Tamale-Bolgatanga road, making it easier and cost-effective for me to carry out the research while still achieving the study's purpose.

Other consideration for the selection of this study area is its mix of urban and rural population who are predominantly smallholder farmers and contributes greatly to the regional crop output. The area has an influx of many non-governmental organisations who have facilitated variously in the activities of these farmers. Such unique characteristics enabled the researcher to evaluate the NGO interventions that are related to climate change adaptation and more importantly their impact on livelihoods of recipients.

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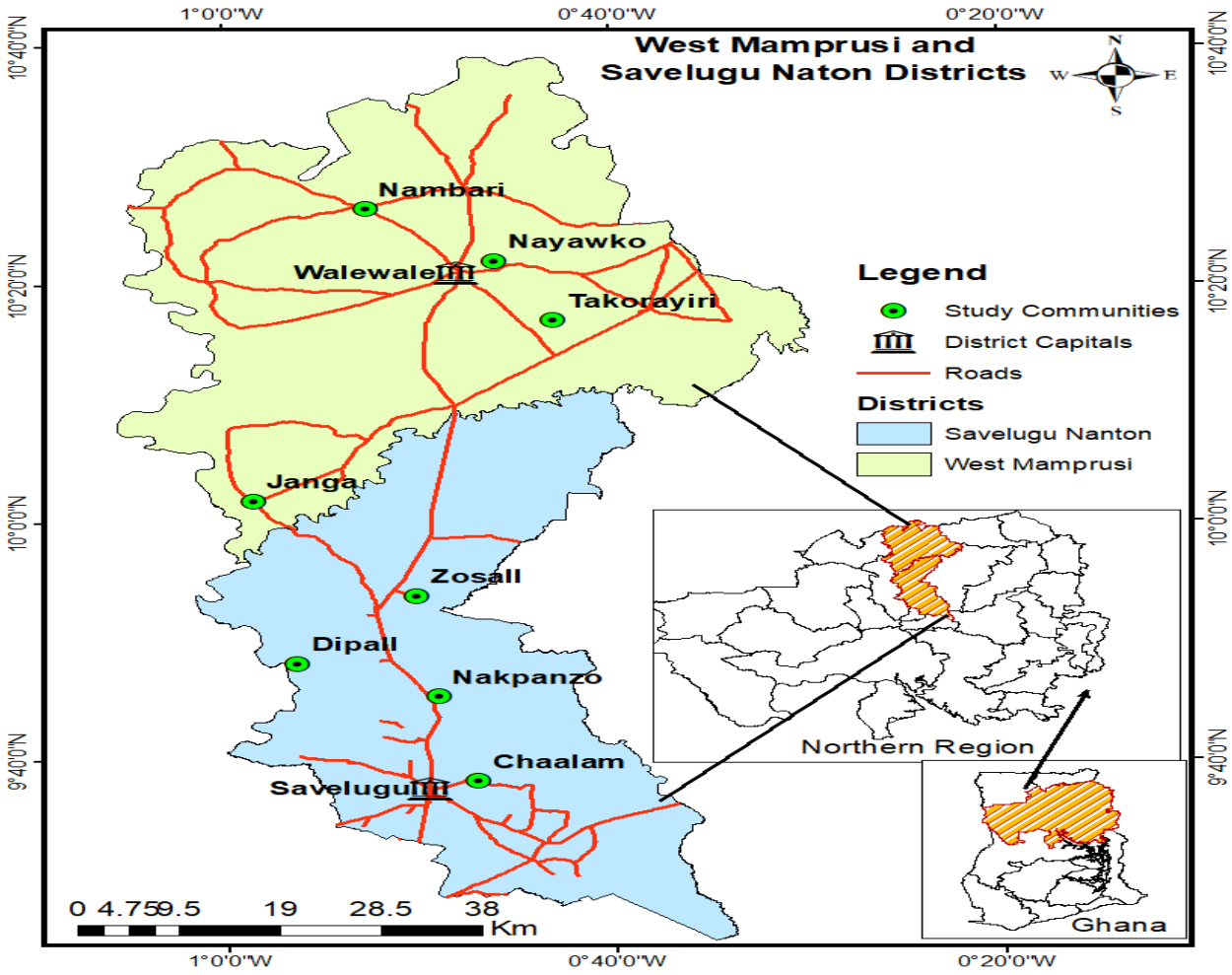

Figure 3.1: Map of Savelugu Municipality and West Mamprusi District Showing Study Communities
Source: Department of Geography and Resource Development, University of Ghana, (2019)

3.3 Walking Through the Philosophical Foundations of Social Research

Social Science research is rooted in some basic philosophical assumptions. These assumptions do not only provide an intellectual framework that specify a discipline's proper domain, appropriate research questions, and rules of inference, but also serve as the basic construction of a researcher's view of reality (Morgan, 1980). These philosophical assumptions are expressed in four basic paradigms: ontology, epistemology, methodology and axiology.

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Whereas ontology borders on the nature of reality (what is out there to know), epistemology is about what we can know and how we can know about it. Scholars are divided along the objectivist and subjectivist continuum in terms of ontology with a consequent adoption of the positivist and interpretive epistemology. Methodology concerns the science and study of methods and assumptions about how knowledge is produced and focuses on investigating the potentialities and limitations of particular techniques or procedures (Grix, 2000; Lincoln & Guba, 2000; Creswell, 2013). While some scholars adopt the quantitative approach, others use qualitative strategies. The last dimension, axiology, concerns the role of values in research, with a distinction made between separating facts from the values of the knower (inquirer) and knowing object and, the contention that conducting research without the imposition of values is impossible and axiology (value free and value laden) (Guba & Lincoln, 1994). The latter admit the value-laden nature of research, and actively report their values and biases, as well as the value nature of information gathered in the field (Lincoln & Guba, 2000; Burrell & Morgan, 1979).

These paradigms are important to all studies, including this one because assumptions made by the researcher have consequences for the strategies and tools adopted (methodology) as well as judgements made about values (axiology) in the entire research process (Blaikie, 2007; Creswell 2009). The researcher is, however, of the view that although these classifications come with their own strengths and weaknesses, it is not just trumpeting the strengths of one paradigm over the other that is important, but rather, the awareness that having fundamentally different assumptions lead to different strategies, and the possibility of producing different research outcomes.

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3.4 The Choice and Appropriateness of the Pragmatic Paradigm

Considering the nature of the study and underlying research objectives, the study was situated within the pragmatic research paradigm. The paradigm, hinges on the assumption that although there is a single "real world", individuals have their own unique interpretations of that world. Proponents of this paradigm emphasise effectiveness as the most important consideration or criterion for judging a particular research approach and the value of research (Maxcy, 2003). Effectiveness is when a chosen approach works to explain or answer a specific research problem.

The pragmatist paradigm is relevant for this study in several respects. First, the paradigm gave the researcher the methodological freedom to use any approach that works, be it qualitative or quantitative strategies, to explore the CC livelihood impacts from the different idiosyncrasies of respondents. By covering and detailing the experiences of a good number of officials and beneficiaries of NGO led CC interventions, the researcher had a more comprehensive and yet detailed understanding of the issues.

Second, the paradigm was relevant because NGO adaptation strategies on CC are quite complex and therefore necessitated the engagement of different research strategies. This complexity is reflected in the nature of the research questions which are exploratory. Situating the study in the pragmatist paradigm made it possible to understand the complexities of CC interventions and its consequent impacts on livelihoods.

Third, situating the study in a pragmatist ambience allowed the researcher to take advantage of both quantitative and qualitative strategies in order to develop a thorough understanding of the impacts of CC interventions by NGOs on farmers. The pragmatic paradigm allowed the combination of both inductive and deductive logics, with the study beginning with a conceptual framework developed from theoretical literature to find out

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how climate change adaptation interventions impact on the livelihoods of smallholder farmers through interviews and surveys (Creswell, 2014; Teddie & Tashakkori, 2009).

Lastly, with regards to generalising the research findings, pragmatists take into consideration questions of "external validity and the transferability of results" (Creswell, 2014). In turn, quantitatively, the results can be generalised statistically through large sample size and qualitatively, the findings can be transferred from one explicit situation to another. However, pragmatists believe in the concept of causality, which is associated with the quantitative domain or notion of internal credibility and quantitative idea of internal validity. These two concepts of validity (rationality or legitimacy) and credibility otherwise known as reliability are central to pragmatists for the purposes of upholding firmly on their findings.

3.5 Research approach

Following from the study's positioning in the pragmatist paradigm, the mixed method approach was used. The approach combined elements of both qualitative and quantitative techniques in a single study and was relevant for a number of reasons.

First, it made it possible for a comprehensive and yet detailed assessment of the intricate issues on farming households' livelihoods and the constraints to NGO-led climate change adaptation interventions. The deployment of qualitative tools enabled the researcher to detail the experiences of beneficiaries and officials from their own perspectives and settings, while the quantitative tools allowed the sampling of a cross section of farmers whose responses helped ascertain the relationship between NGO interventions and farmer livelihoods (Creswell, 2013; Sullivan, 2002).

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As pointed out by Creswell (2013), the qualitative approach is appropriate in answering 'how' and 'why', questions. The researcher was able to engage in detailed interactions with selected participants through in-depth interviews and focus group discussions, the researcher got a deeper understanding of the implications of NGO-led CC adaptation interventions on smallholder livelihoods. This helped to achieve the explanatory aspect of the research objectives. On the other hand, the quantitative elements which involved administering questionnaires to a cross section of beneficiary smallholder farmers of NGO interventions and those who have not benefited, by the use of simple correlation tests and regression analysis were used to ascertain adaptation interventions impact on the lives of smallholder farmers. In this way, the descriptive aspects of the study objectives were achieved.

The mixed approach also facilitated triangulation and aided in getting a more comprehensive view of the cases in such a manner that a single method could not achieve. It ensured validity through the use of multiple sources of gathering evidence. In this study, in-depth interviews were combined with questionnaires and document reviews and that helped in establishing a chain of evidence. These are consistent with Johnson and Onwuegbuzie's (2004, p. 21) observation that the approach "provides stronger evidence for a conclusion through convergence and collaboration of findings". While the quantitative aspect ensured a more detached measuring of definitive statements made by respondents and helped to determine the effects of NGOs climate related adaptation interventions, the qualitative technique helped to understand the interventions and challenges of NGOs and the indigenous adaptation strategies of farming households, from their own perspectives. These helped the researcher to have an in-depth understanding of the meanings and context-specific experiences of farmers in the selected communities.

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3.6 The Case Study Design

For mixed method approach, several designs can be used. The choice of a particular design, however, depends on a study's objectives and associated research questions (Braun & Clarke, 2006). This study used the case study design, which best suited the objective of seeking to understand in-depth NGO interventions on climate change adaptation and its implication on farmers' livelihoods.

The design enabled the coverage of a precise area, in this case, the Savelugu Municipality and the West Mamprusi District, giving respondents the opportunity to share both personal and professional views and experiences pertaining to the locality (Yin, 2009). The case study design enabled the researcher adequately gather enough data to respond to or achieve the research objectives.

In addition, the case study was appropriate to describe the context and characteristics of the study areas, organisations and deep-seated motives and experiences of farmers and officials. The technique allowed interaction between the researcher and the researched in their natural setting and in a manner that enhanced deeper understanding of the NGO interventions and the response of farmers. Finally, designing the study as a case study enabled the researcher adopt and combine different data collection instruments. In this study, in-depth interviews, focus group discussions and questionnaires were combined to enhance triangulation and validity of the data (Creswell, 2014; Yin, 2009).

3.7 Concurrent Mixed Method Design

The study adopted a concurrent mixed method design. The concurrent mixed method allows for both quantitative and qualitative data to be collected during the same stage, although one form of data can be given more weight over the other (Terrell, 2012; Creswell

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et al., 2003). Concurrent mixed method gave the researcher the opportunity to converge or merge quantitative and qualitative data in order to provide a comprehensive analysis of the research problem (Seah *et al.*, 2018; Mayoh & Onwuegbuzie, 2015). The researcher may embed one smaller form of data within another larger data collection in order to analyse different types of the questions (Creswell & Clark, 2017). The purpose for adopting the concurrent mixed approach was to use both qualitative and quantitative data more accurately and appropriately and to define relationships among variables of interest. As concurrent mixed method is theoretically driven, the theoretical underpinnings of this study are thus, the stakeholder theory (Freeman, 1984) and the theory on programme impact (African Impact Evaluation Initiative, 2010) which initiate social change and advocacy.

Data was gathered from the Savelugu Municipality and the West Mamprusi District over a three (3) months period. This was done by the researcher and four (4) well trained field assistants. The Savelugu Municipality was the first study location where the data collection started. During the process, the director of agriculture, social development and planning officer, chiefs and assembly were first interviewed. This gave an exploratory background of the phenomenon of study. Subsequently, questionnaires were administered to smallholder farmers through and interview approach and two focus groups organised, thus, one (1) male group and one (1) female group. The interview approach was used to solicit information from farmers through questionnaires. It was observed that a majority of the farmers could not read and write english due to lack of formal education hence the need to interpret and document their responses.

At the West Mamprusi District, the procedure was similar; however, the quantitative data was collected before the qualitative. The process started with the administering of

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questionnaires to farmers. Households were accidently selected and farmers available were asked to voluntarily respond to questions. Farm level questionnaire administration was also done with farmers who are not available at the household. Caution was taken to avoid repetition and/or double interviews. Interviews were then conducted with other stakeholders including the director of agriculture, National Disaster Management Organisation (NADMO) officer, agriculture extension officers and social and development planning officer.

Appropriate data management was done for both sets of data. The quantitative data was carefully edited to remove all outliers that can have adverse impact on the outcome of results. The data was subsequently coded and inputted into SPSS for analysis. Analysis and presentation were done according to the study objectives. Management of qualitative data was more complex and involving as it involved the transcription of data from the stakeholders as well as the FGDs. To ensure data quality, the researcher and an expert interpreter took time to carefully transcribe the information collated in a radio recorder. The transcribed information was used to present results of the objectives of the study and part of the information integrated into the quantitative study. The concurrent approach enabled the researcher to gain deeper understanding of the phenomenon of study and present empirical findings that are representative of the study. For instance, combining both the quantitative and qualitative data collection at the same time helped the researcher to adjust the research instruments to suit the new emerged field ideas. The challenges of the quantitative were also addressed by the qualitative and vice-versa.

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3.7.1 Steps in conducting mixed research method

This section presents what Creswell (2009) called the steps to follow in conducting mixed method. According to Creswell, there are four factors to consider in conducting mixed method research. These four factors are; timing, weighting, mixing and theorizing.

3.7.1.1 Timing: Concurrent, Sequential or Convergent

Timing has been considered as vital when conducting mixed method research. According to Creswell (2009), the researcher must take into consideration the timing of both qualitative and quantitative data collection. The researcher needs to be mindful of the stages of the mixed method data collection (Sequential and Concurrent). In gathering data, either of the methods (quantitative or qualitative) can be utilized first or simultaneously. On the one hand, when the researcher gathered qualitative data before quantitative, the researcher anticipates to explore the issue with the participants at on one side. The researcher then increases the understanding of the issue in the second phase through the use of large numbers (respondents) usually from the sample of a population. On the other hand, the concurrent phase allows the researcher to gather both qualitative and quantitative data simultaneously or at the same time. In turn, under this study, data was therefore gathered concurrently. Thus, in each community visited by the research team, a focus group discussion was first held and followed by the households' survey.

3.7.1.2 Weighting or Priority: Equal or Unequal

This is the second to consider in conducting mixed method research. This is the stage the researcher gives priority to either of the methods (quantitative or qualitative). The researcher prioritised whether the weight should be placed on the qualitative research or the quantitative research. Creswell (2009) recognised that, conventionally, it is possible to

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place the weight on both methods (qualitative and quantitative). Under this stage, sometimes, depending upon the objectives of the study or the interest of the researcher or the type and nature of the respondents, the weight could be the same or invariably emphasised one over the other. Under mixed method, the standard procedure is for the researcher to unequivocally indicate the weight of the study. Consequently, this study complements each of the methods in line of concurrent case study design.

3.7.1.3 Mixing or integrating: Separating, Transforming or Connecting

This is the stage where the researcher triangulates the research findings. This stage is regarded as the critical phase because it presents issues in two-fold: at what stage the researcher mix the results in mixed method study and how should the mixing be done? The symbolism of mixing is where the researcher does the following: first, merging the qualitative data at one end of the results continuum; secondly, keeping the data separate at the end of the finding's continuum; lastly, combining the two data sets at the or between the two extremes. Consequently, this study instantaneously made use of both the qualitative and quantitative data sets albeit separated but linked. The mixing was done through linking data analysis of the two phases thus, the quantitative and the qualitative phases.

3.7.1.4 Theorising or Theoretical Lens: Implicit or Explicit

This is the final stage of the four steps to follow in conducting mixed method espoused by Creswell (2009). Theorising is considered as important stage in mixed method because it juxtaposes the theoretical perspective underpinning the study. Creswell (2009) concludes that in conducting mixed method study, theory informs the nature and purpose of the research and could shape it from the lens at the beginning in proposing the type of

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questions to ask, the people to consider for the study and the date to commence the data collection, which would eventually proffer suggestions and solutions for policy and practice.

These four steps (timing, weight, mixing and theorising) were adequately followed to enhance the data collection process and procedures in line with mixed method study.

3.8 Sampling Procedure

A number of sampling procedures were combined to select respondents for the study. First, the purposive sampling technique was used to select communities of unique location and characteristics relevant for the qualitative data. As has already been hinted, the two regions, namely Northern Region and North East Region, were purposively selected because of the climatic conditions, and the fact that they have the highest percentage of smallholder farmers, the food basket of the nation, as well as a good presence of NGOs. Within the regions, the purposive sampling strategy was also used to select officials best positioned to offer useful information that answered the study's research questions as well as maximise the possibility of making valid inferences (Creswell, 2013).

The technique was used to select key actors from the Savelugu Municipal Assembly and West Mamprusi District including directors of agriculture, social development and planning officers, Chiefs, opinion leaders, and other stakeholders in the agricultural sector. According to Newman (2007), purposive sampling technique is largely used to select unique cases that are very informative and a 'difficult-to-reach' population. These respondents were selected because they were instrumental in the activities of smallholder farmers, as well as the livelihood improvement of smallholder farmers and at the same time operate with the NGOs in their programs. In that regard, they are deemed to possess

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expert information to actively facilitate the research process. Additionally, the same technique was used to select NGOs and their key officials. These NGOs are operating in the Savelugu Municipal and the West Mamprusi District whose scope of activities cover programs related to climate change adaptation in the smallholder farming space.

The selection of West Mamprusi District and Savelugu Municipality was based on the fact that these two districts have received the highest NGO interventions, and have been randomly chosen among other districts in the Northern Region based on population and land size. Four communities each were randomly selected from West Mamprusi District and the Savelugu Municipality. Simple random sampling was used to proportionately select the required number of farmers who have benefited from an NGO climate change intervention and those who have never benefited from such projects. According to Krejcie and Morgan (1970), for a population of between 20, 000 and 40, 000, using a confident interval of 95%, a sample size of 241 is statistically sufficient for a study. Given that some farmers selected may not be able to participate in the study, a total of 260 respondents (80 beneficial households and 180 non-beneficiary) farming households were selected for the study using stratified and simple random sampling techniques. Table 3.1 presents the sample size distribution by community and district.

For the quantitative data, the simple random sampling was used to proportionately select the required number of farmers who have benefited from an NGO climate change intervention and those who have never benefited from such projects. In all, 260 respondents (80 beneficial households and 180 non-beneficiary) farming households were selected for the study using stratified and simple random sampling techniques. Two control community were selected from each district (Chaalam and Nakpanzoo in Savelugu

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Municipality and Takorayiri and Janga in the West Mamprusi District). Table 3.1 presents the sample size distribution by community and district.

Table 3.1: Sample Size Distribution by Communities and Districts

District	Community Name	Beneficiaries		Non-beneficiaries		Total Respondents	
		Males	Females	Males	Females	Males	Females
Savelugu	Dipale	9	10	10	10	19	20
	Zoosali	11	10	11	13	22	23
	Chaalam	0	0	10	11	10	11
	Nakpanzoo	0	0	14	11	14	11
	Sub -Total (Savelugu)	20	20	45	45	65	65
West Mamprusi	Nambari	9	11	10	10	19	21
	Nayawko	12	8	12	14	24	22
	Takorayiri	0	0	11	13	11	13
	Janga	0	0	12	8	12	8
	Sub -Total (West Mamprusi)	21	19	45	45	66	64
Key informants						13	
Total Sample Size		**80**		**180**		**273**	

3.9 Sources of Data

Data for the study was collected from both primary and secondary sources. The primary data was collected from key administrative officials of the Savelugu Municipal Assembly (SMA) and West Mamprusi District (WDA), officials of the selected NGOs, chiefs,

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opinion leaders, social development and planning officers, MoFA and smallholder farmers.

The secondary data was collected from published and unpublished materials relevant to the study. Reports from the selected NGOs, Ministry of Food and Agriculture (MoFA), Ministry of Gender, Children and Social protection were perused as the study bothers on livelihoods of poor farmers. Other information was also gleaned from journal sources, scholarly books and internet sources. The use of both primary and secondary sources of data enhanced the validation of data from different sources and reliability of research findings.

3.10 Data Collection Instruments

Primary data for the study was collected through face-to-face interviews, focus group discussions (FGD) and structured questionnaires. The study relied heavily on semi-structured interview approach, FDGs guides and structured questionnaires with modified questions to suit the abilities of the key respondents and farmer households. These instruments enabled the researcher to have a detailed discussion with key informants who have the required information sought for by the researcher. In-depth interviews enable researchers to interact with key informants with the aid of an interview guide. Again, researchers have the chance of asking further probing and follow-up questions, to seek further clarifications on the information sought (Creswell, 2013). This instrument was used to elicit information from NGO officials, key respondents from the two districts as well the MoFA officials, and opinion leaders in the study districts. In all, thirteen (13) key informants at the municipal assembly and other relevant departments as well as the NGOs were selected for the interviews: three officials from Ministry of Food and Agriculture (MoFA) (regional director and two district directors in the two study districts); eight from

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NGOs; two from the two districts (social development and planning officers). The study combines these different categories of respondents, to ensure triangulation and verification of information, and to ascertain the veracity of comments by officials.

Additionally, structured questionnaires were distributed to farmers to provide their experiences with the NGOs. The structured questionnaire contained close-ended questions, which were designed based on some key indicators to determine the effectiveness of NGO intervention on livelihood of farmers. It also entailed open-ended questions which gave respondents the freedom to provide their thoughts and share experiences without restrictions.

This was complemented with focus group discussions (FDGs) which helped to cover several participants within shortest possible time. The FGDs helped to generate insights into group meanings and shared experiences from different perspectives of the subject under study due to its ability to assemble people of different background (Creswell, 2007, 2013). Overall, four (4) FGD sessions were held in the selected districts. These FDGs were organised in each of the eight communities. Each focus group discussion consisted of between seven to ten members comprising of a community development chairman, representative of the chief of the community, representatives of male and female groups, at least one beneficiary and non-beneficiary household members. For the three research team members, one asked the questions, the other recorded responses, while the third person took pictures. Each FGD lasted for a period of between two (2) to three (3) hours.

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Table 3.2: Research matrix of research objectives, data collection instruments and analysis.

Objective	Method	Technique/ Instruments	Analysis
Identify the various NGO interventions on climate change in the context of the Ghana Policy on Climate Change Adaptation Strategy	Qualitative	Key Informant Interview FGDs	Thematic analysis
Determine factors influencing farmers participation in NGO-led climate change interventions	Mixed	Household questionnaire & FGDs	Binary logic regression
Examine the effects of NGO interventions on livelihoods of smallholder farmers	Mixed	Questionnaire, Interviews & FGDs	Livelihood Index and Propensity Score Matching
Assess the key constraints to the implementation of NGO-led climate change adaptation interventions	Mixed	Questionnaires, Key Informant Interview FGDs	Descriptive Statistics, Kendall Coefficient of Concordance and thematic analysis

Source: Author's Construct, 2019

3.11 Validity and Reliability of Instruments

Validity in research refers to the extent to which an empirical measure adequately reflects the real meaning of a concept under consideration; thus, the degree to which a study measures the variable it claims to measure (Babbie, 2005, p.148; Gravetter & Forzano, 2006, p.68). To ensure validity in the study, a number of steps were taken. First the research instruments were carefully developed based on the stated objectives of the study.

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The researcher also consulted with experienced researchers to review the instruments to ensure that subjects who possessed the characteristics of the research objectives are covered to reflect the real outcome of the findings.

On the other hand, reliability is an issue of whether a particular technique applied repeatedly to the same objects, yields the same results each time (Babbie, 2005, p.145). To ensure reliability of data collection instruments of this study, all the instruments were made simple for participants understanding, pre-tested to ensure suitability before data collection exercise and revised for ease of administration. The researcher's supervisors who have firm knowledge in the area of the investigation vetted and approved the instruments before the data collection. Besides, triangulation of methods was used to ensure the accuracy of the data collected from the respondents to guarantee that the views expressed are accurately reported in this study.

3.12 Data Management and Analysis

For the qualitative method, all audio-recorded interviews and focus group discussions were transcribed and sorted out into themes reflecting the key objectives of the study. The similarities and variations in responses were analysed and the necessary inferences drawn from key respondents' answers. The emerging trend in the respondents' answers were cross examined with the secondary data and the necessary conclusions drawn. In the course of data analysis, the researcher used direct quotations by respondents to emphasise some of the points being made.

On the other hand, the quantitative data (questionnaires) were coded, and entered unto the Statistical Package for Social Sciences (SPSS). Frequency distributions and charts were generated to ascertain the trends of responses; this was followed by carrying inferential

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statistics such as regression analysis to ascertain the relationships between NGO climate change adaptation interventions and impact on livelihoods of smallholder farmers.

3.12.1 Climate Change Interventions Implemented by NGOs

The climate change interventions implemented in the Northern Region of Ghana were solicited through interviews with staff of selected NGOs. These responses were analysed qualitatively using thematic analysis by discussing the objectives and projects activities of all NGOs under the various objectives of the Ghana National Climate Change Adaptation Strategy (GNCCAS). This was to situate the objectives of all the NGOs' interventions under Ghana NCCAS, which provides a guideline and policy framework based on the nation's priority areas.

3.12.2 Effects of NGOs Interventions on Livelihoods of Smallholder Farming Households

The Livelihood Index (LI) espoused by Downing *et al.,* (2001) was employed to measure the livelihoods of smallholder farmers in the Northern Region. This was computed for farming households who benefited from NGOs-led climate change adaptation programs. The Livelihood Indicator is commonly used in assessing effect of a project or risk on the livelihood of a system. The advantage of the LI is that, it provides a framework that makes it possible to analyse both the essential indicators of livelihood and the contextual factors influencing these indicators. The Livelihood Index assumes equal weights for all major and sub-components.

The degree of smallholder farmers' livelihoods has been examined based on the Sustainable Livelihood Framework. The five livelihood indicators used by Downing *et al.,* (2001) are human, social, financial, physical, and natural capitals. Each of the indicators

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is composed of several sub-indicators (see Table 3.2) which are measured on different scales. The sub-indicators are first standardised to a common scale using equation (1).

$$Index_S = \frac{S_s - S_{Min}}{S_{Max} - S_{Min}} \quad (1)$$

Where Index's is the sub-indicators of Livelihood Index, S_s' is the observed value for sub-indicator s, S_{Min} and S_{Max} are the minimum and maximum values of the sub-indicator in the combined data.

After standardizing the sub-indicators for each of the indicators of the Livelihood Index, the index for each of the indicators was then calculated by averaging the indices of the sub-indicators as given in equation (2)

$$C_i = \frac{\sum_{i=1}^{N} Index_i}{N} \quad (2)$$

Where C_i is one of the five capital indicators of LI, N is the number of sub-indicators constituting the capital indicator. The livelihood index for a beneficiary (or non-beneficiary household) was then calculated using equation (3).

$$LI = \frac{\sum_{i=1}^{5} W_i C_i}{W_i} \quad (3)$$

Where LI denotes the Livelihood Index, C_i is the value capital indicator *i*, W_i is the weight of each capital indicator, determined by the number of sub-indicators which comprised of, the LI scaled from 0 (worst livelihood) to 1 (best livelihood). Table 3.3 presents the main and sub-indicators of livelihood considered in the study.

To assess the effect of the adoption of NERICA on market participation (measured as the proportions of sale) and income of rice producing households, all observable characteristics have to be the same between the adopters (treatment) and non-adopters

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(control). Therefore, the expected treatment effect of the adoption of NERICA or the Average Treatment Effect on the Treated (ATT) is the difference between the actual proportions of sale (or actual income in the case of assessing income) and the proportions of sale (or income) if they did not adopt NERICA. This is given as;

$$ATT = E(Y_i^A - Y_i^N | D_i) \quad (4)$$

Where Y_i^A denotes proportion of sale (or income) when *i-th* household adopts NERICA, Y_i^N is the proportion of sale (or income) of the *i-th* household when they do not adopt NERICA and D_i represents adoption of NERICA (D_i = 1 for adoption and 0 otherwise). The difference (F) between observable and control is written as;

$$A = E(Y^A | D_i = 1) - E(Y^N | D_i = 0) = ATT + \varepsilon \quad (5)$$

Where ε is the bias and is given by

$$\varepsilon = E(Y^N | D_i = 1) - E(Y^N | D_i = 0) \quad (6)$$

The ATT true parameter is only identified if the outcome of treatment and control under the absence of adoption are the same. This is given as:

$$E(Y^N | D_i = 1) = E(Y^N | D_i = 0) \quad (7)$$

The propensity score matching addresses the problem bias by assuming (i) conditional independence which states that for a given set of covariates, participation is independent of potential outcomes (Becceril & Abdulai, 2009) and (ii) a sizeable common support or overlap in the propensity scores across treated and untreated groups to allow for possible matching of the treated members to closely related untreated group members. Once these conditions are met and the biases are corrected, then, the effect of participation in the intervention on the outcome variable can be estimated.

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Table 3.3: Measurement of main and sub-indicators of livelihood

Major Indicator	Sub-Indicator	Measurement	Expected effect on livelihood
Human capital	% of HHs reporting improvement in their nutrition	Percent	+
	% of HHs that have safe HH member from injury or new diseases	Percent	+
	Average age of HHs	Years	-/+
	% of HHs reporting reduced effect of climate change on their health	Percent	+
	Average food sufficient months	Months	+
	Number of crops cultivated by HH (crops diversification)	Number	+
	Average yield of main crops cultivated (kg)	Kg	+
	Average HHs livelihood sources (Livelihood diversification)	Number	+
	Farming experience of HH (years)	Years	+
	Highest educational level of HHH (years)	Years	+
	% of HH with access to training on agronomic practices	Percent	+
	% of HHs where a family member has had vocational training	Percent	+
Natural capital	Average farm lands lost due to climate change (acres)	Acres	-
	Average distance to farm land	Km	-
	% of HHs using only forest-based energy for cooking purpose	Percent	-
	% of HHs reporting depletion in their forest product due to climate change	Percent	-
	% of HHs that collect water directly from natural sources (river, stream, pond)	Percent	-
	% of HHs with consistent water supply	Percent	+
	% of HHs reporting depletion in their natural water sources	Percent	-
Major Indicator	Sub-Indicator	Measurement	Expected effect on livelihood
Social capital	HHs average stay in community (years)	Years	+
	% of HHs belonging to FBO	Percent	+
	% of HHs headed by males	Percent	+
	% of HH that have not engaged in land related conflict in the past 12 months	Percent	+

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	% of HHs that have sought for assistance from their local assemblies within the past 12 months	Percent	+
	% of HH participating in climate change adaptation decisions at community level	Percent	+
	% of HHs reporting not to have loss house or property due to climate change	Percent	+
	% of HHs that have access to financial credit	Percent	+
	% of HHs with a member working in a relatively more developed community/town	Percent	+
Financial capital	% of HH who received remittance during the year	Percent	+
	% of HHs reporting some financial freedom	Percent	+
	Average HH income	Ghana Cedis	+
	% of HHs attributing reduced income to climate change	Percent	-
	% of HHs reporting improved road network to farms	Percent	+
	% of HHs with access to farm inputs	Percent	+
	Number of agricultural diversifications	Number	+
Physical capital	Average HH farm size (acres)	Acres	+
	% of HH with access to farm assets (tractors, harrow, planters, etc.)	Percent	+
	% of HH that save crops for sale during off-farming season	Percent	+
	% of HH that save seeds for next season	Percent	+

Source: Author's contruct, 2019

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To determine the effect of NGO-led climate change interventions on farming households' livelihood, the Propensity Score Matching (PSM) was employed to test for significant difference in the LIs of beneficiary and non-beneficiary farming households. As indicated in the theoretical framework, the "before and after" approach often gives biased results because it does not take into account the effect of confounding factors on the change (Wanaina *et al.*, 2012). The "with and without" approach on the other hand compares the behaviour in the essential variables in the sample of project beneficiaries with their behaviour in non-programme group. Matching techniques, one of the "with and without approaches, have been widely used in impact evaluations in recent times (Ali & Abdulai, 2010). Ideally, an individual from a control group is usually matched with one in the treatment group and the difference in the outcome variable of interest is calculated (Caliendo & Kopeinig, 2005). Propensity Score Matching (PSM) is the matching type that is widely used. Therefore, in applying the PSM, the control group is matched to the treatment group using the propensity scores. The predicted probability of participation in an intervention given observable characteristics is referred to as the propensity scores.

By definition, Propensity Score Matching is a non-experimental method used for estimating the average effect of social programmes (Rosenbaum & Rubin, 1983). In PSM, average outcomes of participants and non-participants are compared conditional on the propensity score value. It is usually said that a better match occurs if the propensity scores for the treatment and control groups are closer. Propensity score matching has become a popular evaluation method and as such its application in the evaluation of agricultural projects has been increasing in recent years (Becceril & Abdulai, 2010; Ali & Abdulai, 2010). This is because it can be applied in any situation where there is a group of treated and untreated individuals. Thus, matching is considered the best available method for selecting a matched control group which resembles the treatment group (Barbara, 2009;

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Becceril & Abdulai, 2010; Ali & Abdulai, 2010). The Propensity Score Matching (PSM) is also able to solve the problem of selection bias.

The effect of NGOs' interventions on farming households' livelihoods (measured as the LI) is determined if all observable characteristics of beneficiary (treated) and non-beneficiary households (control) are the same. Therefore, the expected treatment effect of participating in NGO intervention program or the Average Treatment Effect on the Treated (ATT) is the difference between the actual livelihood of the beneficiary household and the livelihood if they did not participate in an intervention of any NGO (LI of non-participating household).

3.12.3 Factors Influencing Farmers' Participation in NGOs Climate Change Interventions

Most studies that investigate the participation in a project employ dichotomous choice data models (participated or not participated). According to Greene (2003), both logit and probit models could be used to assess the functional relationship between the probability of participation and its determinants. Many studies used binary models to specifically analyse farmers' decisions to participate in a single programme (Gujarati, 2008). This is considered the most suitable approach, as it provides more detailed information on the characteristics of farmers who would participate in a specific programme. For this specific study, the researcher used the binary logit model to investigate the factors influencing the farmers' participation in climate change interventions by NGOs, as the participation process itself is logistic in nature and is consistent. The general form of the binary logit regression model is specified in equation (8).

$$Y_i = \beta_i X_i + \mu_i \qquad (8)$$

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Where Y_i denotes farmer *i* participation decision (Y_i is 1 if a farmer participates and 0 for otherwise), X_i denotes the combined effect of the independent variables, β_i are parameters to be estimated from the regression, and μ_i denotes the error term.

The empirical model is given by equation (9).

$$y_i(P=1) = \beta_0 + \beta_1 Age + \beta_2 Gender + \beta_3 Edu + \beta_4 Decision + \beta_5 ComStay + \beta_6 FBO + \beta_7 Income + \beta_8 HHSize + \beta_9 Farmsize + \varepsilon_i \quad (9)$$

3.12.4 Constraints of NGO Climate Change Adaptation Interventions

The constraints militating against effective interventions of NGOs were identified from past research works and pretested through focus group discussions and key informant interviews. The constraints were then revised and presented to respondents for ranking from the most pressing constraint to the least pressing one using a numeric scale 1, 2, 3….6. The total rank score of each constraint was calculated and the constraint with the least score ranked the most pressing one while the constraint with the highest score was ranked the least.

The Kendall's Coefficient of Concordance (W) was used to determine the level or degree of agreement among respondents on the rankings of challenges to effective solid waste collection using the rank scores (Legendre, 2005). The Kendall's coefficient of concordance (W) is a positive value ranging between zero (0) and one (1). A Kendall's concordance coefficient of one suggests maximum agreement among rankers while zero coefficient means maximum disagreements among rankers on the rankings of the challenges.

Given that T = the sum of ranks of each constraint being ranked, the variance of the sum is given by equation (10);

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$$Var_T = \frac{\sum T^2 - (\sum T^2)/n}{n} \quad (10)$$

And the maximum variance of T is then given by equation (11).

$$\frac{m^2(n^2-1)}{12} \quad (11)$$

Where, m denotes Number of sets of ranking by the respondents and n denotes the number of specific challenges being ranked.

The Kendall's coefficient of concordance (W) is therefore given as,

$$W = \frac{[\sum T^2 - (\sum T^2)/n]/n}{m^2(n^2-1)/12} \quad (12)$$

Equation (4) is further simplified to the computational formula as;

$$W = \frac{12[\sum T^2 - (\sum T^2)/n]/n}{nm^2(n^2-1)} \quad (13)$$

The null(H_o) and the alternative (H_a) hypotheses are stated as follows:

H_o: There is no agreement among the respondents on the rankings of challenges

H_a: There is agreement among respondents on the rankings of challenges

The coefficient of concordance (W) may be tested for significance using the F-statistic. This is given by equation (14),

$$F = \frac{[(m-1)w_c]}{(1-w_c)} \quad (14)$$

The F-statistics has $V_i = \frac{(n-1)-2}{m}$ Degree of freedom for the numerator

$V_2 = (m-1)[(n-1) - 2/m]$Degree of freedom for the denominator.

Decision rule: If $F_{cal} > F_{cri}$ from Fisher's F-statistics distribution, the null hypothesis is rejected; otherwise, it is not rejected.

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3.13 Ethical Considerations

In keeping to the ethics of social science research generally and the ethical standards of the University of Ghana in particular, a number of ethical principles were adhered to. These were to ensure that the confidentiality, anonymity, interest and safety of all respondents and organisations involved in the study were protected.

1. **No Harm to Participants:** Throughout the study period, the researchers did not engage in any act that adversely affected the physical, psychological and emotional characteristics of participants of the study. Questions were framed basically according to the status of respondents of the study. Thus, no respondent was compelled to answer any question that did not conform or relate to him or her.

2. **Voluntary Participation:** No single respondent in this exercise was coerced in any form to take part in the study. Participation in this study was completely voluntary, with no direct benefit or incentive tied to participation. Respondents had the right to participate or not, based on their own consent.

Anonymity and Confidentiality: The analysis of the responses given by the respondents were proceeded in aggregate without mentioning individual names and as collectively discussed, without linking any particular information to a particular individual or group of individuals and their respective communities.

3. **Deception:** the researchers did not use any deceptive tactics to lure respondents to respond to question desired from them. Instead, the respondents answered the questions willingly based on their understanding.

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3.14 Conclusion

This chapter presented the methodology adopted for the study. It discussed the philosophical positioning of the study and the justifications for employing a mixed method approach. The mixed method approach was used, and primary and secondary data were utilized. The study was situated within the pragmatic research paradigm.

Additionally, the chapter presented the case study as the research design for the study. It comprises two selected assemblies (Savelugu Municipal and West Mamprusi District) in the Northern and North East regions all in the northern part of the country. Based on the research objective, the chapter outlined the primary data collection methods and the instruments therein for the study, including semi-structured interviews, questionnaire administration, focus group discussions, observations and documentary reviews.

The chapter also presented how the data was analysed and the ethical considerations made in the study. The chapter was relevant, not only in providing a philosophical basis for the study, but also in providing justifications for the methodological choices made. The ensuing chapters present the empirical chapters of the study.

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CHAPTER FOUR

NGOs' CLIMATE CHANGE INTERVENTIONS IMPLEMENTED IN NORTHERN GHANA

4.1 Introduction

This chapter presents the socio-demographic profile of household interviewed for the study and the climate change interventions implemented in northern Ghana by NGOs. The chapter presents the results of data analysis and discusses the findings simultaneously.

4.2 Socio-demographic Characteristics of Respondents

This section of the chapter presents the preliminary aspect of the results and discussions. Thus, it presents the socio-demographic characteristics of households interviewed for the study. The subsequent chapters on results and discussions are chronologically presented in order of the study objectives. This includes the climate change adaptation interventions implemented by NGOs in northern Ghana, factors influencing households' participation in climate change intervention of NGOs, the effects of NGO's climate change interventions on farmers' livelihood, and the constraints militating against the implementation of NGOs' climate change adaptation interventions.

The results showed that about 69.6% of households were male headed. This is lower than the regional household male headship of 85% (GSS, 2012). The difference could be attributed to the deliberate selection of more female-headed households as beneficiaries of NGOs' climate change interventions. Majority (80%) of respondents were Muslims and 90% of them married. Northern region is a Muslim dominated region, thereby accounting for the majority of respondents being Muslims.

Citizens dominated the study area accounting for (88.5%) with about 48.1% and 33.5% belonging to the native ethnic groups of Dagomba and Mamprusi, respectively. Majoirty

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(85%) of household heads had no formal educations and only 4.2% had primary education. According to the GSS (2012), about 56.5% of persons of 11 years and older have never attended school with about 62.5% of the population of the Northern Region being illiterates in all local and international languages. Literacy is crucial in climate change adaptation because some adopters need to read instructions on labels of technology packs and effectively communicate with climate change implementation staff during workshops and trainings.

On the issue of climate change awareness, about 85.5% of respondents reported to be aware of climate change, and 77.7% reported to have observed changes in the climatic conditions of their communities. The climatic changes observed by respondents included rising temperatures, delay in the onset of rainfall, and increase incidence of storm. The effect of the changes in climate have increased plant and animal pests and diseases, caused low crop yield, loss of vegetation covers due to floods, loss of soil fertility due to erosion, and loss of crops as a result of intense sunshine and perennial floods and droughts, as shown in Table 4.1. These findings are consistent with a study by Alhassan (2016) who found that women who were smallholder rice farmers in the Savelugu Municipality and West Mamprusi District observed changed climate in the form of delayed start of rains, erratic rainfalls, and increased temperatures which have resulted in drying up of planted crops, low yield, outbreak of pest and diseases for human and plants, drought, floods and wild fires. Table 4.1 presents descriptive statistics of respondents' socio-demographic characteristics.

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Table 4.1: Descriptive Statistics of respondents' socio-demographic characteristics

Variable		No. of Households	% of Households
Household head gender: Female		79	30.4
	Males	181	69.6
Religion:	Christianity	47	18.1
	Islam	208	80.0
	African Traditional	5	1.9
Marital status:	Married	234	90
	Single	7	2.7
	Widow	4	1.5
	Divorce/Separated	15	5.8
Ethnicity:	Dagomba	125	48.1
	Mamprusi	87	33.5
	Frafra	4	1.5
	Moshe	4	1.5
	Others	40	15.4
Place of origin:	Native	230	88.5
	Settlers	30	11.5
Educational level:	None	221	85
	Primary	11	4.2
	Middle/JSS/JHS	17	6.5
	A' level/SSS/SHS	9	3.5
	Tertiary	2	0.8
Climate change awareness:	Aware	223	85.8
	Not aware	37	14.2
Change in climate observed by household			
	Observed	202	77.7
	Not observed	58	32.3
Effect of climate change on farming activities			
	Affected	221	85.0
	Not affected	39	15.0
Farmer-based organisation membership			
	Member	80	30.8
	Not a member	180	69.2
Participation in NGO climate change project			
	Benefited	80	30.7
	Not benefited	180	69.3
Type of land ownership: Own		233	89.6
	Others	27	10.4

Source: Field Survey, 2019

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Belonging to a social group or a farmer-based organisation influences farmer ability to adapt to climate change, and also participate in climate change interventions. About 85% of respondents for this study belonged to a farmer-based organisation in their communities. About 80 households, representing 30.8% participated in NGOs' climate change interventions. It was revealed during the focus group discussions that most of the farmer-based organisations (FBO) were formed by organisations (NGOs and governmental organisations) who have implemented a project in the community. Other groups were also formed by community members for self-help activities and sharing of farming experience. According to Alhassan *et al*., (2019), membership with FBO was a major source of information on farming to farmers, a platform for sharing farming experience among farmers, access to institutional credit and extension services, as well as source of market and bargaining power to farmers which are needed for effective climate change adaptation among women rice farmers in northern Ghana. About 89.6% of respondents reported owning their farm lands compared to 10.4% who rented their farm lands for their farming activities.

The mean age of household heads was 40.02 years, with the youngest and oldest household heads being 23 years and 76 years, respectively. Climate change is experienced over a long time, and the age of respondents indicate that they are elderly enough to have given accurate responses for the study. The average farming experience for respondents was 24.45 years with the maximum being 60 years. Most households reported to be indigenes of their communities and the mean years of households' stay in their communities was 30.77 years. Households stay in a community is crucial for households' to be acquainted with the climatic condition of the community for effective adaptation. The average household size was 11.01 persons with 16 persons being the maximum household size. This is higher than the Northern Region's average household size of 7.7 (GSS, 2012).

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Average household farm size was 4.23 acres, and implies that most of the households of the study are small-scale. The computed livelihood index showed that the mean index is 0.51 with a minimum and maximum values been 0.23 and 0.87, respectively. This suggests that most of the households interviewed had a livelihood above average. These are presented in Table 4.2.

Table 4.2: Descriptive statistics of continuous variables

Variable	Mean	Std. Dev.	Minimum	Maximum
Age	40.02	14.49	23	76
Farming experience	24.45	12.04	3	60
Years of stay in community	30.77	8.81	5	57
Household size	11.01	4.55	2	16
Farm size	4.23	2.31	1	10
Livelihood index	0.51	0.24	0.23	0.87

Source: Field Survey, 2019

The results showed that 94.2% of households cultivate maize. This confirms GSS (2014) report that maize is the staple for households in northern Ghana and is widely grown in the region. Most other households reported cultivating groundnuts (78.5%), rice (69.2%), millet (65%), and soya beans (40.4%). These crops are the most affected by climate change in terms of yield (Amikuzuno & Donkoh, 2012) and are the widely cultivated crops in northern Ghana (GSS, 2014) as seen in Figure 4.1.

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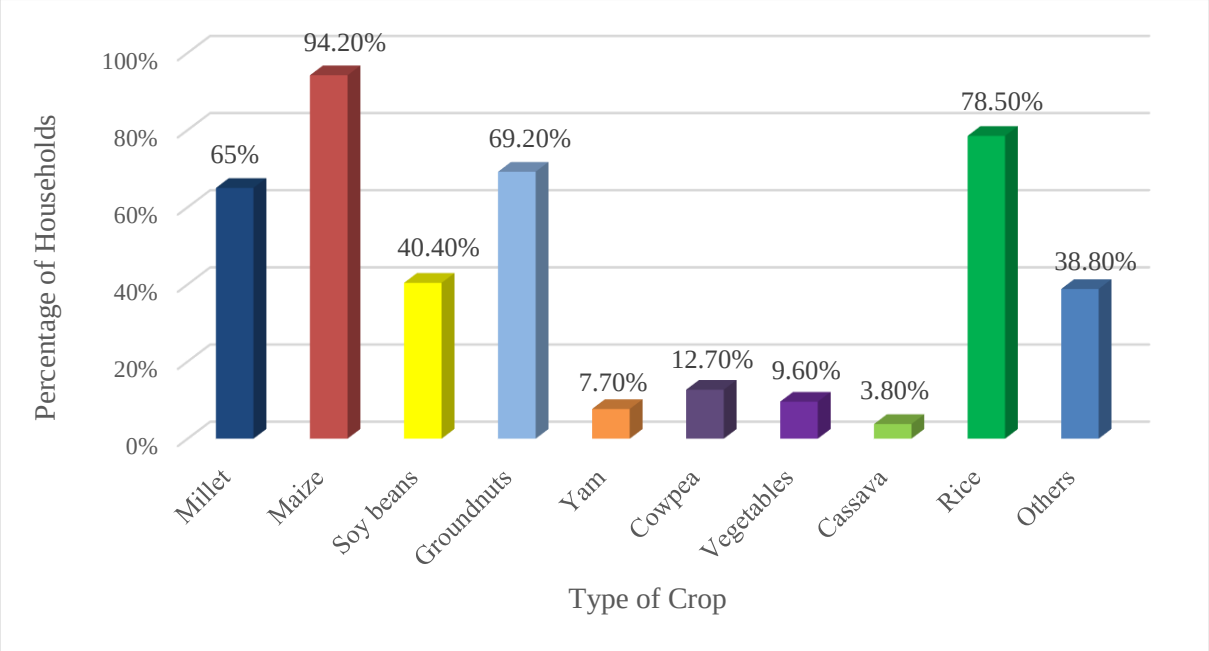

Figure 4.1: Main crops grown by households in study area
Source: Field survey, 2019

4.3 NGOs' Climate Change Interventions

This section of the chapter presents and discusses the climate change interventions implemented in northern Ghana by NGOs. It gives an overview and detailed climate change interventions implemented in northern Ghana, highlighting the interventions by NGOs in the context of the Ghana National Climate Change Adaptation Strategy. The section also analyses and discusses NGOs' mechanisms for implementing and managing climate change interventions.

4.3.1 NGOs Climate Change Interventions Implemented in Northern Ghana

The field work revealed that many of the climate variation interrelated initiatives have been implemented in Northern Region of Ghana, which have been identified. Most of these adaptation interventions come in two fold: those who sponsor the adaptation interventions and those who implemented the interventions. Indeed, some of these interventions have been sponsored by international NGOs (development partners) and implemented by same,

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other interventions have been sponsored by development partners (international NGOs) but implemented by local NGOs, governmental organisations and civil society organisations. The execution period of these projects and the setbacks encountered throughout the implementation are presented in Table 4.3.

The Bill and Melinda Gates Foundation has supported the International Maize and Wheat Improvement Centre (CIMMYT) and the International Institute for Tropical Agriculture (IITA) with the partnership of the Savannah Agricultural Research Institute (SARI) under the auspices of Council for Scientific and Industrial Research (CSIR) to advance the development of drought tolerance maize varieties (DTMA I & II) to deal with the drought situation in northern Ghana somewhere in 2006 to 2011. These organisations consulted and involved the local farmers (smallholder farmers) in all the stages of the product development in the five regions of northern Ghana. The aim was to help the smallholder farmers adapt to climate variability and change through the use of the developed drought tolerance maize varieties. However, it was revealed that not many of the smallholder farmers adopted these drought tolerance maize varieties. As a result, the developed varieties are unpopular among the farmers in the study areas. The challenges of the implementation of the product were in twofold: the developers concentrated solely on the development rather than the dissemination of the product to the farmers and the cost of the product was higher than the local farmers could afford. The implementing agencies for these varities were Seed producers, MoFA and smallholder farmers.

The International Crops Research for the Semi-Arid Tropics (ICRISAT)" in collaboration with "SARI" developed and promoted a high yielding drought tolerance millet variety called the "Pearl Millet and Sorghum (PROMIS II) varieties. It was aimed at ensuring that the variety withstands all climate variations and variability. The key partner for the implementation of the PROMISO II was MoFA and the implementation period lasted ten

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(10) months. It was revealed that the product could not succeed because the implementing agencies failed to ensure the availability of the certified seeds in the market. Therefore, smallholder farmers experienced a lot of challenges obtaining the seeds.

The Environmental Protection Agency (EPA) secured a funding from the Canadian International Development Agency (CIDA) to implement the Ghana Environmental Management Project (GEMP). The main aim was to embark upon a comprehensive reforestation triggered by desertification and land degradation which is caused by climate variability and change specifically in Northern Ghana and Ghana. The implementing agency EPA embarked on nationwide sensitisation on the effects of land degradation and desertification. EPA also championed tree planting in the implementing strategies. The key setback confronted the project was dry season bush fires especially in northern Ghana.

Between 2007 and 2011, Care International in collaboration with CSIR-SARI, implemented the Conservation Agriculture (CAP) and the Community Land Use Responses to Climate Change (CLURCC). During the implementation period, the implementing agencies encouraged smallholder farmers to adopt the following farming methods: reduce to use of external inputs, land rotation, cover cropping and minimum tillage. The implementing agencies took into consideration the topography and the soil type of the area. The components of the community land use responses to climate change comprised, tree planting and soil fertilization. Land ownership especially among women and the low adoption because farmers were anticipating immediate returns especially the ‘conservation agricultural practices.

One of the community-based organisations in the West Mamprusi District in the North East Region, Zagsilari Ecological Farms implemented the Natural Resource and Environmental Governance (NREG) project. The project was aimed at ensuring the

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sustainable utilisation of natural resources without conceding the environment in the wake up to climate variation and change. The project actions were largely on capacity building, support and advocacy at the community level on righteous agrarian and environmental practices. The key setbacks confronted by the project was extensive bush fires in project communities during the dry season.

The Zoomlion Oil Ghana LTD (ZOIL) implemented the National Forest Plantation Development Programme (NFPDP) between 2009 and 2013. The key actions undertaken included promotion of tree planting and discouraging of indiscriminate felling of trees in order to contribute to carbon sinks replenishment and minimise the effects of climate change and variability. The project was hit by recurrent drought, which adversely affected the development of the trees planted. According to a community member, the project objectives was:

> "We were given trees to plant in our farms to replace what we have been cutting for firewood. We were also educated on the dangers of cutting trees including the erratic rainfall, high storms which often removes the roofs of our buildings and high scorching sun."

The Climate Seed Knowledge (CSK) was implemented by RAINS (Regional Advisory and Innovative Network Systems) between 2010 and 2012 in the Savelugu Municipality with funding from CIDA. The objective of the project was to promote the use of indigenous seeds towards climate change adaptation. The CSK project supported farming communities financially to cultivate indigenous seeds which were deemed to be early maturing, drought tolerance and more importantly meet the dietary needs of communities. Therefore, the CSK project was an attempt to support communities to revive the indigenous seeds and the indigenous farming practices. These are practices that are also sustainable to the environment. For example, minimum tillage is not hazardous to the environment. The main challenge of the project was limited project duration or period.

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Farmers at Zoosali community in the Savelugu municipality in describing the CSK project by RAINS said that:

> "All along, we have been wondering whether we are not endangering our own survival by abandoning these indigenous seed varieties for the so-called improved seeds. RAINS assisted us cultivate our own seeds and they are nutritious, and demand fewer external inputs".

A key informant in the same community had this to say during an interview:

> "In recent times, we are getting less and less from shea nut harvest. I am happy that we have been offered the opportunity to diversify our livelihood sources".

During a focus group discussion at Dipale in the Savelugu Municipality, a farmer had the following to say about the CSK project:

> "The NGO came and made us to plant what we are used to planting. The seeds were cheap, familiar, and above all, high yielding which benefitted us."

RAINS also implemented a three-year project on climate change named Climate Change Adaptation in Northern Ghana Enhanced between 2013 and 2016. The donor organisation for the project was DIFADE Canada. The objective of the project was to increase the adaptive capacities of smallholder farmers. The project activities were mainly farmers' training on agronomic practices, planting of improved crop varieties, harvesting, post-harvest management and storage of farm produce. The current climate change project under implementation by RAINS is the SEWOH which started in the latter part of 2017 and is expected to end in late 2019. SEWOH is a German acronym which means a world without hunger. The funding organisation is the African Biodiversity Network with the project objective being to assist communities to become food sovereign through increased production. The project activities were mainly on farmers' education, food security and livelihood diversification.

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Finally, the Agro-Ecosytems to Climate Change (AAECC) was a project implemented by the German Agency for International Cooperation, in partnership with the Ministry of Food and Agriculture (MoFA) between 2012 and 2017. The AAECC project was a component of the Market-oriented Agriculture Program of the German Society for International Development (GIZ) with the objective of reducing climate-related yield losses for farmers in the Savannah and transitional zones in Ghana and to incorporate the results of the measures into the agricultural sector policy on adapting land-use systems to climate change. The projects collaborated with farmer-based organisations to provide soil and water management and improved indigenous seeds systems through experts training, and award of subsidies.

Speaking about the AAECC project, an officer with the GIZ during an interview mentioned that:

> "The AAECC project collaborated effectively with farmer-based organisation at the community level whose staff were trained on integrated soil fertility management and water conservation technologies to further provide step-down training to farmers in their communities".

On the part of project beneficiaries, a farmer at Nayawko during a focus group discussion said that:

> "We were trained on how to maximize our yield using our own local seed varieties. The officers also trained us how to maintain fertile soil, conserve water in our farms for cultivation even when rains are erratic, and also ploughed our farms and sold fertilizer to us at reduced prices."

Overall, it was observed that even though several climate-related initiatives have been implemented in northern Ghana, there appears to be little or no coordination among these projects both at the implementation and donor levels. In the words of a MoFA staff during an interview he opined that:

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> "As the crop officer of the region, I have assisted many NGOs in implementing their interventions. In my opinion, I have observed that most of the climate change intervention by NGOs are targeted at improving adaptive capacity of vulnerable farmers, assisting farmers to diversify their livelihoods and enhancing farmers' indigenous knowledge on agronomic practices for effective adaptation to climate change. What I have noticed over the years therefore, is that, there is no coordination among the NGOs, which normally occasioned duplication or project overlaped".

From the discussions above, it is evident that all the interventions identified were found to be implementing activities that were geared towards enhancing food security and boosting income levels of project beneficiaries. The implementation approach however differed from project to project. Capacity building in the form of demonstration of technologies and trainings were cross-cutting approaches among different projects. This confirms an earlier study conducted by START (2012) which conducted a survey of climate change adaptation technologies introduced to farmers in northern Ghana by research institutions.

The involvement of several institutions in the adaptation process could create a situation where organisations pursue different adaptation strategies that may complement each other or be competitive (Pradhan *et al*., 2012) and in some cases could result to maladaptation (START, 2012). This can sometimes make their work in adaptation unsuccessful. Henceforth, as suggested by Pradhan *et al*., (2012), owing to the differences in goals, operation and comparative advantage, the specific roles of each institution in adaptation must be laid out and the accepted mode of communication and interaction within and between organisations clarified for success adaptation through interventions. All the interventions by NGOs identified had a monitoring and evaluation system of some sort although these systems were not well structured. Generally, the duration for project implementation was found not to be adequate. Nonetheless, specific projects that required extension of duration were most of the time granted or given a second phase.

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Table 4.3: Selected Climate Change Interventions Implemented by NGOs in Northern Region

Name of Intervention	Objective of intervention	Donor/Implementation organisation	Duration	Activities implemented
Land Conservation & Smallholder Rehabilitation Project	Halt and reverse land Degradation	IFAD, GoG	2000-2006	- Demonstration of improved varieties, irrigation development and maintenance
Livestock Development Project	Increase food security and protein intake	GoG, AfDB	2000-2010	– Improved animal health and housing, Supplied of improved breeds, cultivation of fodder banks, animal health focused on prevention
Drought Tolerant Maize for Africa I & II	Develop & disseminate drought tolerant maize varieties	Bill and Belinda Gates Foundation	2006-2011	- Participatory testing and selection of drought tolerant maize varieties Introduction of drought tolerant varieties
Promotion of pearl Millet and Sorghum II	Increase food security through promotion of sorghum and millet production	WECARD/ CORAF	2010-2011	- Demonstration of early maturing Varieties
Ghana Environmental Management Project	Reverse desertification and land degradation	CIDA		Promotion of tree planting
Name of Intervention	Objective of intervention	Donor/Implementation organisation	Duration	Activities implemented
Conservation Agriculture Project	Promote minimum use of external inputs	Care International	2007-2011	- Promotion of conservation Agriculture
Community Land use Responses to Climate change	Improve soil fertility and reclaiming of Marginal lands	Care International	2007-2011	- Tree planting Compost making

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Participatory Integrated Climate Service for Agriculture (PICSA)	Improved access to climate information for effective adaptation	AGRA	2016-2017	-	Training on effects of climate change and diversification Information on seasonal forecast and season calendar
Climate Seed and Knowledge (CSK)	Promote the use of indigenous seeds towards climate change adaptation	RAINS and CIDA	2010-2012	-	Support farmers with financial credit to cultivate indigenous seeds
Climate Change Adaptation in Northern Ghana Enhanced	Increase the adaptive capacities of smallholder farmers	RAINS and DIFADE Canada	2013-2016	-	Training on agronomic practices, planting of improved crop varieties, harvesting, post-harvest management and storage of farm produce
A world without hunger (SEWOH)	Assist communities to become food sovereign through increased production	RAINS and African Biodiversity Network	2017-2019	-	Education, food security and livelihood diversification
Name of Intervention	Objective of intervention	Donor/Implementation organisation	Duration		Activities implemented
Adaptation of Agro-Ecosystem to Climate Change (AAECC)	Reduce climate-related yield losses for farmers and to incorporate the results of the measures into the agricultural sector policy on adapting land-use systems to climate change	GIZ/MoFA	2012-2017	–	Strategy and technology development with farming communities; training of local service providers; and supporting national decision-makers in policy and strategy development

Source: Field Survey, 2019

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4.4 The Nexus between NGOs Interventions and the National Climate Change Adaptation Strategy

The main goal of the Ghana National Climate Change Adaptation Strategy is to enhance Ghana's current and future development to climate change impact, by strengthening its adaptive capacity and building resilience of the society and ecosystems. To achieve this goal, all climate change interventions must be geared towards five main specific objectives, including improving societal awareness and preparedness for future climate change: enhancing the mainstreaming of climate change into national development to reduce climate change risks; increasing the robustness of infrastructure development and long-term investments; enhancing the adaptability of vulnerable ecological and social systems by increasing the flexibility and resilience of these systems; and fostering competitiveness and promoting technological innovation (Ghana National Climate Change Adaptation Strategy, 2013).

NGOs play a vital role in development assistance provisioning. The objectives of NGOs projects are in close proximity to the goals of Ghana's National Climate Change Adaptation Strategy. The complexity of NGO activities coupled with the vagaries of climate change adaptation and the shades posed by climate change necessitated situating the activities of these NGOs in the contest of Ghana's National Climate Change Adaptation Strategy. The foundation is to ascertain to what extent these projects project the national consensus and the debates surrounding climate change adaptation interventions. There are that tendencies and suggestions that NGOs activities can be detrimental or at variance with the wishes and fads of the beneficiaries of their interventions. Smallholder farmers are not immune or exceptional to these variances. One major problem of NGO development interventions relates to the transitory basis the interventions are framed.

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Consequently, after several years of pursuing adaptation strategies, this study investigated how these interventions impact farmers' livelihoods. Again, there is an obvious need to ensure well-targeted interventions to build climate resilience that do not have contradictory or unintended outcomes, such as maladaptation. Therefore, this study usher in understanding adaptation interventions by NGOs and provides an evidence base that informs policymakers in their quest to design effective adaptation policy documents. As growing evidence suggests, there are pressures both nationally and internationally for donors and governments to demonstrate the effectiveness and efficiency of the resources allocated to climate change adaptation. Investments are increasingly going towards mainstreaming and scaling up rather than pilot interventions.

It was established that the objectives of most of the climate change interventions by NGOs implemented in northern Ghana appeared to be in consonance with three of the objectives outlined in the Ghana's National Climate Change Adaptation Strategy. Thus, the objectives of most climate change interventions implemented by NGOs in northern Ghana aimed at building and strengthening the capacity of local farmers towards increased agricultural productivity and awareness of climate issues; enhancing living standards of vulnerable groups through livelihood diversification; and promoting existing indigenous knowledge and best practices. Going by the preceding analyses, one could argue that the skills and knowledge provided by these NGO's enable people respond adequately to climate stressors, the financial resources they offer are key to building livelihood capitals and mitigating the impacts of climate change. For example, RAINS which has the CHANGE project that seeks to assist smallholder farmers especially women in Northern Ghana to understand the causes and effects of climate variability and climate change and to embrace innovative adaptive measures to ensure sustainable, household food security and livelihoods. The Adaptation of Agro-Ecosystems to Climate Change is a component

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of the Market-Oriented Agricultural Program by GIZ with the aim of reducing climate-related yield losses for farmers and to incorporate the results of the measures into the agricultural sector policy on adapting land-use systems to climate change.

Bill and Belinda Gates Foundation developed Drought Tolerant Maize for Africa I & II. The aim was to develop and disseminate the drought tolerant maize varieties to smallholder farmers across Africa. Activities during the implementation stage was participatory testing and selection of drought tolerant maize varieties. The introduction of these varieties of drought tolerant varieties. AGRA in 2016-2017 engaged smallholder farmers in the area with Participatory Integrated Climate Service for Agriculture (PICSA). The objective of this project is to improved access to climate information for effective adaptation. Smallholder farmers were trained on effects of climate change and diversification Information on seasonal forecast and season calendar. The main aim was to enhance the awareness and understanding of farmers through accurate information about climate change and its effect on agriculture.

RAINS and CIDA in 2010-2012 introduced Climate Seed and Knowledge (CSK)to promote the use of indigenous seeds towards climate change adaptation. They supported farmers with financial credit to cultivate indigenous seeds. Again, the project seeks to address the urgent need of women and men smallholder farmers in Northern Ghana to understand the causes and effects of climate variability and climate change to embrace innovative adaptive measures to ensure sustainable, household food security and livelihoods. The farmers have reported the benefit of the weather information to other income generated activities like sheanut picking and processing, drying of farm produce and rice parboiling. A world without hunger (SEWOH) was introduced by RAINS and African Biodiversity Network between 2017 to 2019 to assist communities to become food sovereign through increased production. Activities implemented included; education, food

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security and livelihood diversification. These measures are consistent with and enshrined in the national climate change adaptation strategy document. AGRA introduced Participatory Integrated Climate Service for Agriculture (PICSA) between 2017-2017 with the objective of improved access to climate information for effective adaptation. The main activity was the training of smallholder farmers on the effects of climate change as well as income diversification Information on seasonal forecast and season calendar. This development led to a greater awareness among smallholder farmers in the lead up to climate stressors.

In turn, to ensure sustainability and consolidation of gains made, exit strategies were put in place by most NGOs interventions before project wrap up. The challenges faced by the various interventions during implementation, however, had negative consequences on the overall success and impacts of the projects. Achievements in soil fertility and vegetative growths were easily eroded by wild fires and intermittent droughts. Bush fire is a major concern not only to developmental projects but also to smallholder farmers. Low credit recovery rates negatively affected the sustainability of innovative credit systems introduced. Low promotional activities also limited the impacts of projects to only project beneficiaries. Enhancing the benefit of vulnerable ecological and social systems by increasing the flexibility and resilience of these systems; and fostering the competitiveness and promoting technological innovations.

In an interview with one of the staff of the NGOs, he stated the following:

> "Most of our interventions are aimed at reducing climate risks and increasing the adaptive capacity of farmers by improving secure and sustainable non-agricultural income-generation options as well as training and capacity building activities. Most of our interventions target women who are often the most vulnerable with the least adaptive capacity".

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Similar view was shared by another staff of an NGO during an interview who stated that:

> "Most of our climate change projects implemented so far are aimed at creating farmers' awareness on climate issues and improving their adaptive capacity towards increased agricultural productivity and enhanced living standards of vulnerable groups through livelihood diversification and indigenous practices".

This study argues that government efforts alone might not be enough to arrest the fast-growing climate change vagaries. Private sector and civil society organisations have a solid responsibility to influence climate action and commit more resources for climate change adaptation. NGOs were effective in helping the capacities of farmers to climate change adaptation through on-farm and off-farm adaptation interventions such as the preparation and application of compost manure, use of drought-tolerant crops, provision of climate information and other livelihood activities.

The adoption of NGO-led adaptation interventions manifested in the livelihoods of farmers' especially promoting higher productivity, improving soil fertility, empowerment of women and reducing the cost of production for farmers. Farmers raised additional incomes to support their families, specifically, paying children school fees and health. Farmers were also able to provide better general livelihood conditions for their families. These are the dictates of the Ghana National Climate Change Adaptation Strategy.

4.5 Conclusion

The socio-demographic profile of respondents considered in the study included gender, religion, marital status, ethnicity, place of origin, educational level, climate change awareness, observed change in climate, effects of climate change on farming activities, farmer-based organisation membership, participation in NGOs' climate change interventions, type of land ownership, age, farming experience, years of stay in community, household size, farm size, livelihood index and type of crop cultivated by

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households. It is conclusive from the results that majority of sampled households are headed by males and are Muslims households. Almost all respondents were married. Also, almost half of respondents were Dagombas and Mamprusis, and most respondents were natives of their communities. Regarding education, the majority of respondents had no formal education, but most respondents were aware of climate change, and observed climate change. About 85% of households reported that their farming activities were affected by climate change. The study also revealed that only a third of respondents participated in NGOs climate change interventions and most respondents owned their farmlands. The average age and farming experience of respondents were 40.02 years and 24.45 years respectively. The average household size was 11.01 and the average years of stay in community was 30.77 years. The main crops cultivated by farmers included maize, rice, millet, and groundnuts.

The climate change interventions implemented by NGOs in the northern region of Ghana are land conservation and smallholder rehabilitation project, livestock development project, drought tolerant maize for Africa, promotion of pearl millet and sorghum II, Ghana Environmental Management project, conservation agriculture project, community land use response to climate change, participatory integrated climate service for agriculture, climate seed and knowledge, climate change adaptation in northern Ghana enhanced, and a world without hunger (SEWOH). However, it is clear that there appears to be little coordination among NGOs on the type of interventions implemented in the region. This is confirmed by the skewed nature of initiatives implemented by NGOs in the region, which are all aimed at “building and firming the capacity of local farmers” towards increased agricultural productivity and awareness of climate issues, enhancing the living standards of vulnerable groups through livelihood diversification, and promoting existing indigenous knowledge and best practices.

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CHAPTER FIVE

IMPLICATIONS OF NGOs' CLIMATE CHANGE INTERVENTIONS ON FARMERS' LIVELIHOODS

5.1 Introduction

The second objective of the study was to understand and appreciate how NGO-led climate change adaptation practices enhance the adaptive capacity of smallholder farmers for livelihood improvements. In achieving the objective, this chapter presents and discusses results on five themes (human, social, physical, financial and natural resources) that encapsulate the adaptive capacity using the Livelihood Index (LI). The chapter presents and discusses results on the implications of NGOs' climate change interventions on the five livelihood resources of households (human, physical, financial, social and natural). The computed livelihood effect indices for each of these livelihood resources are also presented and discussed.

5.2 Implications of NGO's Climate Change Interventions on Farmers' Livelihood

The effects of NGOs' climate change interventions on the livelihood of smallholder farming households were analysed using the Livelihood Index (LI). The sub-indicators and major indicators indices, as well as the LI for each community was computed and have been discussed. Summary of descriptive statistics of the livelihood sub-indicators are presented in Table 5.1.

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Table 5.1: Computed Sub – Indicators of Livelihood by District

Major Indicator	Sub-Indicator	Savelugu		West Mamprusi		Combined data	
		Beneficiary	Non-beneficiary	Beneficiary	Non-beneficiary	Beneficiary	Non-beneficiary
Human capital	% of HHs reporting improvement in their nutrition	88	80	84	76	86	78
	% of HHs that have safe HH member from injury or new diseases	96	20	100	30	98	25
	Average age of HHs	42.7	46.62	35.44	34.92	39.07	40.77
	% of HHs reporting reduced effect of climate change on their health	28.0	20.0	24.0	20.0	26.0	20.0
	Average food sufficient months	8.8	8.0	6.7	7.5	7.75	7.75
	Number of crops cultivated by HH (crops diversification)	4.4	3.51	3.91	3.47	4.155	3.49
	Average yield of main crops cultivated (kg)	5308.07	4298.04	1825.00	1760.94	3566.54	3029.49
	Average HHs livelihood sources (Livelihood diversification)	3.23	2.12	2.91	1.84	3.07	1.98
	Farming experience of HH (years)	21.49	26.63	26.03	23.69	23.76	25.16
	Highest educational level of HHH (years)	2.02	0.92	1.93	1.09	1.98	1.01
	% of HH with access to training on agronomic practices	91.23	38.46	75.00	36.46	83.12	37.46
	% of HHs where a family member has had vocational training	46	20	41	22	43.5	21

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Livelihood Main Indicator	Livelihood Sub-Indicator	Savelugu Municipality		West Mamprusi District		Combined data	
		Beneficiary	Non-beneficiary	Beneficiary	Non-beneficiary	Beneficiary	Non-beneficiary
Natural capital	Average farm lands lost due to climate change (acres)	3.32	5.6	4.2	4.72	3.76	5.16
	Average distance to farm land	10.5	6.4	8	9.2	9.25	7.8
	% of HHs using only forest-based energy for cooking purpose	80	100	96	88	88	94
	% of HHs reporting depletion in their forest product due to climate change	100	100	76	24	88	62
	% of HHs that collect water directly from natural sources (river, stream, pond)	90	100	85	90	87.5	95
	% of HHs with consistent water supply	60	50	80	70	70	60
	% of HHs reporting depletion in their natural water sources	84	96	88	92	86	94
Social capital	HHs average stay in community (years)	34.76	31.82	48.56	39.65	41.66	35.73
	% of HHs belonging to FBO	64	40	56	52	60	46
	% of HHs headed by males	68	88	76	60	72	74
	% of HH that have not engaged in land related conflict in the past 12 months	100	89.48	81.25	79.2	90.63	84.34
	% of HHs that have sought for assistance from their local assemblies within the past 12 months	40	5	28	9	34	7
	% of HH participating in climate change adaptation decisions at community level	59.65	15.38	37.5	25	48.58	20.19
Livelihood Main Indicator	**Livelihood Sub-Indicator**	**Savelugu Municipality**		**West Mamprusi District**		**Combined data**	
		Beneficiary	**Non-beneficiary**	**Beneficiary**	**Non-beneficiary**	**Beneficiary**	**Non-beneficiary**

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Financial capital	% of HHs reporting not to have loss house or property due to climate change	52	44	40	38	46	41
	% of HHs that have access to financial credit	100	90	85	100	92.5	95
	% of HHs with a member working in a relatively more developed community/town	80	92	80	84	80	88
	% of HH who received remittance during the year	54.39	63.46	25	18.75	39.70	41.11
	% of HHs reporting some financial freedom	100	80	95	85	97.5	82.5
	Average HH income	1660.84	1670.84	1870.4	1610.24	1770.12	1640.54
	% of HHs attributing reduced income to climate change	96	100	80	56	88	78
	% of HHs reporting improved road network to farms	46.15	3.51	53.13	18.75	49.64	11.13
Physical capital	% of HHs with access to farm inputs	52	68	58	50	55	59
	Number of agricultural diversifications	2.92	2.85	3.33	2.5	3.13	2.68
	Average HH farm size (acres)	6.01	5.52	5.84	6.16	5.84	5.92
	% of HH with access to farm assets (tractors, harrow, planters, etc.)	63.16	38.46	77.08	53.13	70.12	45.80
	% of HH that save crops for sale during off-farming season	63.16	38.46	50	46.88	56.58	42.67
	% of HH that save seeds for next season	94.4	92.48	93.75	89.58	94.075	91.03

Source: Field survey, 2019

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5.2.1 NGOs' Climate Change Interventions: Implication on Human Resources of Farmers

The first indicator of the livelihood index considered in this study is the human capital. The human resources of households are critical in farming households' bid to adapt to climate change, given that a healthy household is a wealthy household. Changes in climate weakens the human capital of farming households, given that high temperatures inflict varying diseases on household members, resulting in adverse effects on the labour force of farming households. The human resource indicator borders on the effect of NGOs' climate change interventions on the health, food and skills of farmers, which affect the overall human capacity of the household. The human capital indicator consists of twelve sub-indicators, which were computed for both beneficiary and non-beneficiary households in both districts as presented in Table 5.1

The results showed that about 88%, 84%, and 86% of beneficiary households in Savelugu Municipality, West Mamprusi District and the combined data (combination of statistics of SMA and WMD), respectively, reported improved nutrition relative to 80%, 76% and 78% for non-beneficiary households in Savelugu Municipality, West Mamprusi District and the combined data, respectively (refer to Table 5.1). Good nutrition is required for a healthy human resource, which is crucial in ensuring a better livelihood for households. In the Savelugu Municipality, 96% of households who participated in NGOs' climate change interventions reported to have saved a household member from injury or new disease compared to 20% of households who did not participate in climate change interventions spearheaded by NGOs.

In West Mamprusi District, all beneficiary households reported saving a household member from injury or disease, relative to 30% of non-beneficiary households who reported saving a member from an injury or disease. In the combine data, 98% of

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beneficiary households saved a household member from injury or disease relative to 25 percent of non-beneficiary households who reported saving household members from injury or disease. Injury and outbreak of diseases weaken the human resources of farming households, and retards their livelihoods. Age of respondents showed that beneficiary households in Savelugu Municipality (42.7 years) are more youthful than non-beneficiary households (46.6 years). This was not the case in West Mamprusi District as the average age of beneficiary household heads (35.4 years) is slightly higher than non-beneficiary households' heads (34.9 years). In the combined data, the average age of beneficiary households (39.07 years) is almost the same for non-beneficiary household heads (40.77 years). Some climate change adaptation technologies such as bunds, dibbling, line planting, among others require more strength and can be effectively implemented by the younger households than the older households. According to a farmer at Nakpanzoo community in the Savelugu Municipality,

> "The farming today requires more physical strength and money. Due to my old age, I now cultivate only one acre of land because I have nobody to assist me. I have heard of agro-chemicals and fertilizer assistance from government and NGOs, but, I have not received any of such assistance".

Certain illness is attributable to changes in weather, and a reduction in the effect of such illness on the health of households' impact positively on households' livelihood. In the words of a farmer during a focused group discussion at the Janga community in the West Mamprusi District:

> "The scorching temperature often cause our sickness. Sometime, you may want to finish your farm activities and the sun is also just shining with so much heat. You have to continue to work under the sun and before you realize, you are experiencing headache and may have to absent yourself from farming activities for days. This reduces our labour days because the rain will not wait for you to recover".

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In the Savelugu Municipality, more beneficiary households (28%) reported reduced effects of climate change on their health, than non-beneficiary households (20%). In the West Mamprusi District, (24%) of beneficiary households reported decreased effects of climate change on their health relative to (20%) of non-beneficiary households. In the combined data, more beneficiary households (26%) reported reduced effects of climate change on their health, than non-beneficiary households (20%). The average food sufficiency months for households in Savelugu Municipality (8.8 months) who participated in climate change interventions organised by NGOs were higher than households (8 months) that did not participate in climate change interventions led by NGOs.

However, in West Mamprusi District, households that have never participated in NGO-led climate change interventions have more food sufficient (7.5 months) than households that participated in climate change interventions led by NGOs (6.7 months). This is unusual or unanticipated, which is contrary to Begum et al. (2016) who found that farmers in the Faridpur District of Bangladesh who received on-farm training from NGOs Trainer of Trainers increased their food production, and hence were more food-secured than farmers who never participated in the training. In an interview with one of the officers of an NGO that assisted farmers in the West Mamprusi District during the 2018 farming season, it was revealed that most of the farmers who benefitted from the NGO's assistance by way of free ploughing and indigenous seeds, were delayed due to the large number of farmers who participated. In the end, most farmers had their farms ploughed late, a time when rains had set in for long, and stopping abruptly when their cultivars still needed more water, thereby resulting in poor crop yields. In buttressing the points above, an NGO official said the following:

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> "The reason that accounted for the loss was as a result a delayed ploughing and the resultant delayed planting. Remember the farmers were many but we had fewer tractors. By the time we finished ploughing for all the farmers, it was in the middle of the rains hence, some of them couldn't get the much-needed rains. Maybe what we have to do next time is to start the ploughing period earlier to make for the numbers. The numbers were overwhelming. But we have fewer tractors".

In the combined data, there was no difference in the number of food sufficiency months for households that participated in NGO-led climate change interventions, and those who have not. Households with prolonged and severe hunger have low livelihoods, compared to households that are food sufficient.

The number of crops cultivated by households who participated in climate change interventions led by NGOs in both Savelugu Municipality (4.4) and West Mamprusi District (3.91) are higher than the number of crops cultivated by households who had not participated in NGOs climate change interventions. In the combined data, the number of crops cultivated by households who participated in NGO-led climate change interventions (4.16) was higher than the number of crops cultivated by households who have never participated in climate change interventions organised by NGOs (3.49). Different crops respond differently to climate change, and households which cultivate many crops are likely to be negatively affected in times of adverse climatic conditions, than households who cultivate few crops. Speaking to a MoFA member of staff in an interview, it was revealed that:

> "Because different crops require different amount of water, the higher the number of crops cultivated by a farmer, the lesser the chance of total crop failure. The reason is that too much rain will favour crops such as rice and lesser rains will also favour some crops such as maize and groundnuts".

It was observed that farmers who participated in NGOs climate change interventions were educated on the need for multiple cropping, to avert the effect of climate change. This

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placed beneficiary farmers at a higher advantage in adapting to climate change, than non-beneficiary farmers.

The average crop yield of households who participated in climate change interventions organised by NGOs in the Savelugu Municipality (5,308.07kg) is higher than households which had not participated in NGOs' climate change interventions (4,298.04kg). Similar results were obtained for climate change intervention beneficiary households (1,825.00kg) and non-beneficiary households (1,760.94kg) in the West Mamprusi District. In the combined data, the average yield of major crops cultivated was (3,566.54kg) and (3,029.49kg) for households that benefited from NGOs climate change interventions, and those who do not participate, respectively. The main crops cultivated by farmers include maize, rice, yam, and cowpea. These are the staple food for people in the Northern Region. Higher crop yield ensures food sufficiency and higher income for farming households, hence, better livelihood.

The average number of livelihood sources was higher for households who participated in climate change interventions led by NGOs in Savelugu Municipality (3.23), West Mamprusi (2.91) and in the combined data (3.07) than households that have not participated in climate change interventions organised by NGOs. It was revealed during a focused group discussion at Nambari community in the West Mamprusi District that:

> "Those who benefitted from NGOs' interventions were trained on soap making, soya drink processing and others given animals to rear and/or money to be used for petty trading. These beneficiaries do not suffer much when the rain fails us compared to those who have nothing doing aside farming".

Thus, livelihood diversification was found to be higher among households that participated in NGOs' climate change interventions than households that have not participated in climate change interventions led by NGOs. Livelihood diversification plays a major role in farming households' livelihood. Given that most farmers in northern Ghana depend on

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rain-fed agriculture as a livelihood source which in most cases suffer the adverse weather condition due to erratic rainfall and high temperatures, engaging in other sources of livelihood cushions farming households' livelihoods in cases of agricultural failure due to unfavourable weather. In the MoFA (2016) agricultural sector progress report, it was revealed that livelihood and incomes of rural poor in northern Ghana were achieved through new employment opportunities such craft works (baskets and hat weaving and pottery), dawadawa, shea, rice parboiling, pito brewing, petty trading and groundnut processing to provide additional income to farming households that participated in the livelihood interventions of both governmental and non-governmental organisations.

The average farming experience of non-participatory households in Savelugu Municipality (26.63 years) was higher than households that participated in climate change interventions led by NGOs (21.49 years). This was not the same in West Mamprusi as the average farming experience of participatory households (26.03 years) was greater than that for non-participatory households (23.69 years). Farming households with higher experience have higher capacity to adapt to climate change and hence, better livelihood. The average years of household head education for participatory households for Savelugu Municipality (2.02), West Mamprusi (1.93) and the combined data (1.98) were higher than households that did not participate in NGO-led climate change interventions with years of education of (0.92 years), (1.09 years) and (1.01 years), respectively. Literate households can read label or instructions on climate change technologies, participate in climate change training or workshops which language of instruction is different from the local dialect.

In Savelugu Municipality, NGOs climate change project beneficiary households had more access to training on agronomic practices (91.23%) than non-beneficiary households (38.46%). In West Mamprusi District, the result was not different from that of the Savelugu Municipality as (75%) of beneficiary households reported having access to

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training on agronomic practices with only (36.46%) for non-beneficiary households. In the combined data, (83.12%) and (37.46%) of beneficiary households and non-beneficiary households, respectively reported having access to training on agronomic practices. The knowledge of farming households on agronomic practice is enhanced when they have access to training on the right agronomic practices, and the capacity of such households to adapt to climate change is more enhanced than households that have not been trained. This finding echoes Begum et al. (2016) who reported that the five years on-farm training provided by NGOs to farmers through the Training of Trainer model significantly improved the livelihoods of poor farmers in Faridpur District in Bangladesh.

Vocational training could be additional skills acquired such as carpentry, masonry work, seamstress, catering, which adds to a household's vocation. Households with members with vocational training have higher livelihood diversification than households without members with vocational training (Tahiru et al., 2019). The results revealed that in the combined data, more households that participated in climate change interventions organised by NGOs (43.5%) reported to have had its' members with vocational training than households that did not participate in any NGO-led climate change intervention (21%). In Savelugu Municipality, (46%) of households who participated in NGOs' climate change interventions reported that their households' members had vocational training relative to (20%) of households that had not participated in climate change interventions led by NGOs. In West Mamprusi District, households that participated in NGOs climate change interventions had more households with vocational training (41%) than households that had not participated in climate change interventions led by NGOs (22%). Notwithstanding these interventions by NGOs, a participant in a focus group discussion at Dipale said that:

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> In most cases, what we received from NGOs is far below what we were promised by the same people. Two years ago, one NGO promised to train our women on soya drink processing and assist them financially to engage in the production of the drink. In the end, only sixteen women were trained for just two days and given GHS200.00 each. What can they do with this money?

A staff member of one of the NGOs revealed the following during an interview:

> In most of the NGOs' interventions in the district for which I represented MoFA, beneficial farmers were trained on climate smart agricultural practices, educated on crop rotation, assisted to engage in other livelihood activities such as animal rearing and agro-processing. These often improved the adaptive capacity of participating farmers relative to non-participating farmers.

In an interview with the district MoFA officer at Savelugu, his response to the effect of NGOs' climate change interventions on farmers' human capital was quite a mixed feeling, as contained in his statement:

> In most cases, the expectation of farmers on the assistance from NGOs often far exceed what they receive. I think farmers expectations need to be managed to appreciate the interventions of organisations in ameliorating their human resources. NGOs have done appreciable work to avert the effect of climate change on farmers' livelihoods. However, the activities of some NGOs staff need to be monitored.

Interacting with all stakeholders, one thing that was obvious was that NGOs have played a major role in improving the livelihoods of farmers in the region, in spite of the changing climate. Farmers were trained on modern climate smart agricultural practices, assisted with capital to diversify their sources of livelihoods, and often linked to sources of weather information which aids planning of their cropping season.

5.2.2 NGOs' Climate Change Interventions: Implications on Natural Resources of Farmers

The second indicator of the Livelihood Index is the natural capital. The natural capital indicator included water, land, and forest resources which contribute to the livelihood of farming households. The natural capital indicator consists of seven sub-indicators. The

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results showed that households that did not participate in NGOs' climate change interventions lost more land (5.6 acres) in the last 12 months due to climate change than households that participated in climate change interventions spearheaded by NGOs (3.32 acres) in the Savelugu Municipality. In the West Mamprusi district, the average acres of land lost by non-participatory households due to climate change (4.72 acres) was higher than the land lost by households who participated in climate change interventions led by NGOs (4.2). In the combined data, the average land size lost to climate change is high among household that did not participate in climate change interventions led by NGOs (5.16 acres) than households who participated in NGOs' climate change interventions (3.76 acres). Excessive rain leading to prolonged intense erosion carries away the top soil thereby making such farm lands uncultivatable by households. The UNDP (2011) in its' human development report assessed the resource endowment, investment opportunities and attainment of the MDGs in the West and East Mamprusi districts and concluded that institutions can provide alternative means of access to land and other resources and determine the type and quantity of resources with which a household is endowed and exploits. Thus, participation in NGOs' climate change interventions not only affects households' access to resources, but also access to resources affects participation in institutions projects (UNDP, 2011).

In the Savelugu municipality, the average distance to farm land was high among households that participated in climate change interventions organised by NGOs (10.5 km) than those who did not participate (6.4 km). whereas in West Mamprusi District, the average distance to the farm is farther among non-participatory households (9.2 km) than participatory households' farm lands (8 km). However, in the combined data, average distance to farm land was 9.25 km and 7.8 km for households that participated in NGOs climate change interventions and those who did not participate, respectively. Fields that

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are closer to the residence of farmers are well monitored through regular visit than field located farther from farmers' residence. On the other hand, farms that are closer to community are more exposed to destructions by domestic animals then farms located far from the community, especially when they are not fenced. In an interview with one NGO staff, she revealed that:

> "Our projects were such that we promoted organic farming. Hence, we preferred farmers to select farm sites that were far from the community, especially virgin land. These lands do not require any inorganic fertilizer to achieve high yield".

This is why the farms of farmers who participated in NGO projects were located at more distant than farmers who did not participate in NGOs' climate change projects.

All households who did not participate in climate change interventions implemented by NGOs in the Savelugu Municipality reported using forest-based energy for cooking compared to 80 percent of households who participated in climate change interventions led by NGOs. Contrary, in the West Mamprusi District, more households who participated in the NGOs' climate change interventions (96%) depend on forest-based energy for cooking than households. However, in the combined data, 88 percent and 94 percent of households that participated and that did not participate in NGOs' climate change interventions, respectively, depend on forest resources as a source of energy for cooking purposes. Meanwhile, all households in Savelugu Municipality reported depletion in their forest resources due to climate change. Whereas, in the West Mamprusi District, households reporting depletion in forest resources were more for NGOs climate change participatory households (76%) than non-participatory households (24%). However, in the combined data, many households who participated in NGOs' climate change interventions (88%) reported depletion in their forest products due to climate change compared to 62 percent of households who did not participate in climate change interventions spearheaded by NGOs. A study conducted in selected Indian villages by Usmani *et al.* (2018) showed

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that while NGO intervention in selected villages did not significantly change the use and pattern of daily-collection of fuelwood fuel, there was a significant reduction in the time spent in collecting fuelwood for households use among treated villages than the non-treated villages.

In Savelugu Municipality, all non-beneficiary households source water directly from natural sources compared to 90 percent of beneficiary households who source water directly from natural sources. Whereas in West Mamprusi District, more beneficiary households (90%) source water from natural sources than beneficiary households (85%). However, in the combined data, 95 percent of non-beneficiary households' source water from natural sources compared to 87.5 percent for beneficiary households. Households that source water from nature such as river, streams, rain, and lagoons. Most of the natural water sources are often dried up due to erratic rainfalls and high temperatures, rendering households that depend mainly on natural water sources vulnerable to clean water. Yet, more non-beneficiary households in Savelugu Municipality (96%), West Mamprusi District (92%) and in the combined data (94%) reported depletion in their natural water sources. On access to consistent water supply, more beneficiary households in Savelugu (60%), West Mamprusi (80%) and in the combined data (70%) reported having access to consistent water supply than non-beneficiary households.

During a focus group discussion at Nambari in the West Mamprusi District, when participants were asked of the effect of NGOs' climate change intervention on the natural resources, the response was as follows:

> "Our participation in the NGOs' interventions have been very beneficial to us. The NGOs gave us trees to plant in our farms; some created bunds for us to conserve water at our farms, and others have expanded our streams for us for dry season farming".

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At Chalaam in the Savelugu Municipality, a male participant in the focus group discussion opined that:

> "The NGOs have helped us in many ways: they provided alternative sources of livelihood especially to our women who were engaged in charcoal burning, thereby helping to preserve our environment"

Women in the same Chalaam community on their part were of the view that:

> "These NGOs have stopped us from cutting trees for our charcoal activities which we rely on for livelihood, but, have failed to adequately resource us to venture into other sources of livelihood".

The researcher observed that NGOs have helped to conserve the natural environment either by assisting communities to enforce by-laws on forest reserve and water bodies' preservation and/or assisting community members to engage in other environmentally friendly livelihood activities that do not pose any danger to the environment.

5.2.3 NGOs' Climate Change Interventions: Implication on Social Resources of Farmers

The third indicator of the Livelihood Index is social capital which refers to the demographic characteristics and network or relations of farming households. Six sub-indicators constitute the social capital indicator. These include households' years of stay in community, membership of farm-based organisations, male-headed households, land related conflict, seeking for assistance from local major stakeholder, and participation in community's decision making. Beneficiary households have stayed longer than non-beneficiary communities in both Savelugu Municipality and West Mamprusi District. However, in the combined data, average years of stay in community for beneficiary and non-beneficiary households are 41.66 years and 35.73 years, respectively. Households that have stayed in their communities for long have more knowledge on the climatic condition

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for effective adaptation. More beneficiary households in Savelugu Municipality (64%) and West Mamprusi District (56%) reported belonging to farm-based organisation than non-beneficiary households. However, in the combined data, 60 percent of households that benefitted from NGOs' interventions (60%) belonged to farmer-based organisation than households that did not participate in NGOs interventions (46%). Farmer-based organisations provide the necessary assistance to its members by way of training, market access, access to inputs, and access to credit.

In the Northern Region, the cultural practices marginalize female-headed households relative to male-headed households. While the results revealed that in the Savelugu Municipality, 88 percent of non-beneficiary households were headed by males compared to 68 percent of beneficiary households headed by males. For the West Mamprusi District, 76 percent of beneficiary households were headed by males while 60 percent of non-beneficiary households were headed by males. Accordingly, about 74 percent of non-beneficiary households in the combined data were headed by males relative to 72 percent of beneficiary households that were headed by males. The situation in northern Ghana is similar to Bangladesh as reported by Begum et al., (2016) that women in Bangladesh have less control over household resources and information than men, constraining their day-to-day farming activities and also restrict their livelihood options. In view of these, Practical Action Bangladesh, an NGO based in Bangladesh provided skill training on affordable technologies aimed at increasing income of women and empowering them to participate in decision making processes at all levels (Begum et al., 2016). The NGOs working in the study area have similar target as opined by a staff of one of the NGOs during an interview:

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> "… in this part of the country, women are often marginalized in all aspect of life: they are not allowed in decision making, lack resources, have their rights trumped upon, and above all, subjected to high inhuman acts by men. Bearing these in mind, our interventions are targeted at women with the aim of strengthening their capacity to participate in decision making at the community and higher levels and also liberate them from financial dependence……".

The results showed that most households in both districts reported engaging in land related conflict within the last 12 months. In the combined data, 90.63 percent of beneficiary households and 84.34 percent of non-beneficiary households reported been engaged in land related conflict in the last 12 months. Conflict is a social destructive tool, and households engaging in conflicts with other households have low social relations which influence livelihood negatively.

The percentage of households that have sought for assistance from their local assemblies or local authorities was low. However, 40 percent and 28 percent of beneficiary households in Savelugu Municipality and West Mamprusi District respectively reported seeking for assistance from their local authorities in the last 12 months compared to less than 10 percent of non-beneficiary households who sought for assistance from their local assemblies. In the combined data, 34 percent of beneficiary households had sought for assistance from their local assemblies relative to only 7 percent for non-beneficiary households. In terms of decision making, more beneficiary households in Savelugu Municipality (59.65%) and West Mamprusi District (37.5%) reported participating in decision making at the community level than non-beneficiary households. However, in the combined data, 48.58 percent of households that participated in NGOs' interventions reported participating in decision making in their communities than non-beneficiary households (20.19%). A similar finding was reported by UNDP (2011) which found that although most people knew their district chief executives and members of parliament in the West and East Mamprusi districts, their interactions with such political leaders were

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minimal. People's participation in community development programmes depends, among others, on the effectiveness of the political leadership at the local level and interactions of communities with their leaders (UNDP, 2011). During a focused group discussion at Takorayiri in the West Mamprusi District, a farmer made an interesting revelation:

> "We were always afraid of our MPs and DCEs. The assembly was like hell fire to us. No one wanted to go near it, not to talk of sending your complaints to them. …..., But later when ActionAid Ghana came to educate us on the need to hold our leaders accountable, we have always been going to the assembly to tell them our demands and also inquire on certain developmental projects embarked upon by the assembly. Now, we those with the courage to visit the leaders often have our communities assisted then when we were seated aloof".

Households that have a stake in their communities' response to climate change, have higher adaptive capacity than households that do not participate in decisions on climate change adaptation at the community level.

5.2.4 NGOs' Climate Change Interventions: Implication on Financial Resources of Farmers

Financial capital is the fourth indicator of the Livelihood Index, and refers to the assets' ownership and financial capacities of households. The financial indicator consists of eight sub-indicators: loss of property due to climate change, access to financial credit, household members working in a relatively developed community/town, access to remittance, financial freedom of households, average income, climate change induced reduction in income, and road network to farms. The results indicate that more beneficiary households in both Savelugu Municipality and West Mamprusi District reported not losing any property as a result of climate change, than non-beneficiary households. In the combined data, 46 percent of beneficiary households reported not to have lost any property due to climate change compared to 41 percent of non-beneficiary households. In Savelugu Municipality, all beneficiary households reported having access to financial credit while

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90 percent of non-beneficiary households reported having access to financial credit. In the West Mamprusi District, all non-beneficiary households had access to financial credit relative to 85 percent of beneficiary households. In the combined data, more non-beneficiary households (95%) reported access to financial credit than beneficiary households (92.5%). Access to financial credit boost production of farming households and assist them to diversify their sources of livelihood. This finding is similar to IFAD (2006) which evaluated the land conservation and smallholder rehabilitation project in the Upper East Region of Ghana and reported that all the beneficiaries acknowledged that the project has enhanced their food security through access to credit to generate income and cash earned during the project period.

More non-beneficiary households in both districts had household members working in a relatively developed communities or towns than beneficiary households. In the combined data, 88 percent of non-beneficiary households reported having a member(s) working in a relatively developed community or town relative to 80 percent of beneficiary households. It was revealed during focus group discussions that most household members who worked in developed towns usually work as cleaners, head-porter, and other lowly paid jobs in Tamale, Kumasi, Accra and other developed cities. According to a staff member of one of the NGOs sampled for the study, he stated that:

> "There is high prevalence of rural-urban migration among these communities. Most young girls abandon their education and leave to the cities for 'kayayo'. Our target has been to reduce this outmigration of the youth, especially the girls, by training them on handy-works that can engage them for livelihood in the off-farming season."

It was observed at the communities visited that households that have not benefited from any livelihood diversification interventions and have no non-farm job tend to have most of their youth travelling to the cities in search for greener pastures. This explains why households who have not benefited from NGOs' interventions reported a higher number

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of household members working in other communities or towns, than households that have benefited from NGOs interventions.

More non-beneficiary households (63.46%) in Savelugu Municipality had more households receiving remittance than beneficiary households. In the West Mamprusi District, 25 percent of households who participated in NGOs' interventions reported to have received remittance in the past 12 months relative to 18.75 percent for non-beneficiary households. In the combined data, 41.11 percent of non-beneficiary households received remittance within the past 12 months compared to 39.7 percent of beneficiary households. It is obvious that since non-beneficiary households have more household members working in other towns than beneficiary households, they (non-beneficiary households) will have more of their households' members sending them money from their towns of work, than beneficiary households. Remittance cushions households in periods of financial distress and hence, improves livelihoods.

A majority of beneficiary households in the study reported financial freedom, as compared to non-beneficiary households. In the combined data, the results showed that 97.5 percent of households that benefited from NGOs climate change intervention had financial freedom, compared to 82.5 percent of non-beneficiary household. Households that are financially independent have higher livelihoods than those that are financially dependent. A female farmer at Dipale community in the Savelugu Municipality had the following to say at a focused group discussion:

> "Those who participated in the NGOs soy drink training were given GHS200.00 each as capital. This has increased their income earnings and made them financially independent from their husbands than we those we did not participate in the intervention".

In Savelugu Municipality, the average income of non-beneficiary households (GHS1, 670.84) was higher than the average income of beneficiary households (GHS1, 660.84).

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whereas, in the West Mamprusi District, the average income of beneficiary households was GHS1, 870.84 compared to GHS1, 610.24 for non-beneficiary households. However, in the combined data, the average income of beneficiary households (GHS1, 770.12) was higher than non-beneficiary households (GHS1, 640.54). Whereas more non-beneficiary households in Savelugu Municipality attribute low incomes to climate change than beneficiary households, more beneficiary households attribute low income to climate change than non-beneficiary households in the West Mamprusi District. However, the combined data revealed that 88 percent of households that benefited from NGOs' climate change interventions attributed low income to climate change compared to 76 percent of non-beneficiary households. Households attributing reduced income to climate change are more hit by climate change. Few households that did not participate in climate change interventions implemented by NGOs reported improved road network to their farms compared to households that participated in NGOs' climate change interventions. For the combined data, almost half of beneficiary households interviewed reported improved road network relative to only almost 11 percent of non-beneficiary households.

In an interview with a staff of RAINS, one of the NGOs under study, his response to a questions on the effect of their interventions on the livelihood of beneficial farmers was unambiguous:

> "In most cases, we assist female farmers to venture into petty trading and shea processing as alternative sources of livelihood to farmers. When the project ended, most farmers have been calling and sharing their success stories with us and asking for more similar assistance.

When farmers were asked of the effect of NGOs' climate change interventions on their livelihood at a community focus group discussion at Dipale in the Savelugu Municipality, one female participant said that:

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> "The NGOs assist us financially to invest into our farming or engage in other livelihood activities like shea butter processing. Also, we are linked to companies who pay higher for our farm produce than those who are not part of the NGO group".

In all communities visited, it was observed that farmers who have participated in NGO-led interventions had alternative livelihood sources other than farming. Most farmers in northern Ghana depend on rain-fed agriculture as their mainstay. Farmers who were fortunate to have benefited from NGOs' interventions were assisted financially to liberate them from financial dependence.

5.2.5 NGOs Climate Change Interventions: Implication on Physical Resources of Farmers

The fifth indicator of the Livelihood Index is the physical capital and includes households' basic needs and access to basic physical amenities. Six sub-indicators comprise the physical capital indicator – access to farm inputs, number of agricultural diversifications, average household farm size, access to farm assets, saving of crops for sales during off-season and saving of seeds for planting in subsequent season. The empirical results showed that in Savelugu Municipality, 68 percent of non-beneficiary households had access to farm inputs compared to 52 percent of beneficiary households in the municipality. Whereas in the West Mamprusi District, more beneficiary households (58%) reported having access to farm inputs than non-beneficiary households (50%). However, the combined data showed that about 59 percent of non-beneficiary households reported having access to farm inputs compared to 55 percent of beneficiary households. Timely access to farm inputs such as improved seeds, fertilizer, inoculants, agro-chemicals, among others are vital in ensuring high yield of farm produce.

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On agricultural diversification, the average number of agricultural activities engaged by beneficiary holds in Savelugu Municipality, West Mamprusi District and in the combined data were respectively 2.92, 3.33 and 3.13 compared to 2.85, 2.5 and 2.68 for non-beneficiary households in the Savelugu Municipality, West Mamprusi District and in the combined data, respectively. Agricultural diversification increases farming households' resilience to climatic stimuli. The results further revealed that in Savelugu Municipality, the average household farm size for beneficiary households (6.01 acres) was more than non-beneficiary households (5.2 acres). In the West Mamprusi District, non-beneficiary households cultivate on slightly larger farm size (6.16 acres) than beneficiary households (5.84 acres). In the combined data, the average farm size for beneficiary and non-beneficiary households were 5.84 acres and 5.92 acres, respectively.

More beneficiary households in Savelugu (63.16%), West Mamprusi (77.08%), and in the combined data (70.12%) had access to farm assets than non-beneficiary households (38.46%, 53.13% and 45.80%, respectively). Access to farm assets such as tractor, harrow, planters, harvesters, threshers, among others stimulate farming activities positively. About 63.16 percent and 50 percent of beneficiary households in Savelugu Municipality and West Mamprusi District, respectively, reported saving crops to sell during off-farming season relative to 38.46 percent and 46.88 percent of non-beneficiary households, respectively. In the combined data, more beneficiary households (56.58%) reported saving crops in order to sell during off-farming season than non-beneficiary households (42.67%). Farming households that are able to save farm produce in order to sell at the lean season earn higher income than households that do not. In term of saving seeds, in Savelugu Municipality, more beneficiary households (94.4%) reported saving seeds for subsequent season than non-beneficiary households (92.48%). In West Mamprusi District, 93.58 percent of beneficiary households and 89.58 percent of non-beneficiary households

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reported saving seeds for subsequent season. In the combined data, more beneficiary households (94.08%) saved seeds for subsequent season than non-beneficiary households (91.03%). Households that are able to save seeds have high access to seeds for sowing in subsequent farming season thereby easing their difficulty in search for seeds. A representative of GIZ in an interview said the following:

> "We built the capacity of farmers in our operational communities to construct silos for food crop storage, assisted farmers with improved seeds in the first year and educated them on how to save seeds for use in subsequent planting season and how to market their farm produce for higher income".

Members in a focus group discussion at Nakpanzoo community in the Savelugu Municipality who benefited from NGOs' climate change interventions summarized the physical resource benefits of participating in NGO-led climate change interventions as follows:

> "For we those who are members of NGO groups, the NGOs have facilitated our access to tractors, seeds, and even combine harvesters which we never got as it still pertains to farmers who are not members of these NGO groups, …… we were also provided with silos for safe storage of our farm produce and trained on how to save our seeds for planting in subsequent seasons."

A non-beneficiary in the same focus group discussion explained that:

> "Unlike our colleague farmers who were supported by NGOs, we do not have access to tractors to plough our farms immediately the rain starts. Also, we lose most of our crops during harvesting, especially rice because we are unable to get harvesting equipment in time. The worst is at the start of farming season when we those who have not been part of NGOs projects have to go round begging for seeds to sow in our farms from other farmers who were trained on how to save seeds and have proper storage facilities"

5.3 Computed Indices for Main Livelihood Indicators

The indices for the main indicators of the Livelihood Index were computed by normalising and averaging the sub-indicators indices constituting each of the indicators. This is presented in Table 5.2.

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Table 5.2: Computed Main – indicator and Livelihood Indicator Indices

Main livelihood indicator	Savelugu		West Mamprusi		Combined Data	
	Beneficiary	Non-beneficiary	Beneficiary	Non-beneficiary	Beneficiary	Non-beneficiary
Human	0.61	0.43	0.53	0.38	0.57	0.40
Natural	0.71	0.77	0.72	0.66	0.72	0.71
Social	0.65	0.38	0.6	0.49	0.63	0.43
Financial	0.68	0.67	0.6	0.56	0.64	0.62
Physical	0.22	0.18	0.24	0.18	0.23	0.18
Livelihood Index	0.57	0.48	0.54	0.45	0.56	0.47

Source: Author's Computation, 2019

The computed main livelihood indicator indices of 0.61 and 0.40 for households in Savelugu Municipality who participated in NGO-led climate change interventions and those who did not participate in NGO-led climate change interventions, respectively showed that households that participated in climate change interventions spearheaded by NGOs have higher human resources than those who did not. Similarly, the computed human resource index of 0.53 and 0.38 for beneficiary and non-beneficiary households, respectively in the West Mamprusi District suggest that households that benefited from NGO-led climate change intervention have better human resources that non-beneficiary households. In the combined data, households that participated in climate change interventions led by NGOs (0.57) have higher human resources than households who have never participated in NGOs' climate change interventions (0.40). The implication is that households that participate in NGOs' climate change interventions have higher health, food, knowledge and skills than households who have not benefited from NGOs' climate change interventions. This finding is consistent with Begum et al. (2016) who reported

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that skill-based training on the use and maintenance of agricultural farming and process machinery for farmers in Bangladesh by Practical Action Bangladesh improved the livelihoods of small entrepreneurs, the marginalized and vulnerable farmers through increased incomes, employment, food security, health and nutrition.

Non-beneficiaries' households in Savelugu municipality have more access to natural resources (0.77) than beneficiary households (0.71). For the West Mamprusi District, however, NGOs' climate change intervention beneficiary households had better livelihood in terms of natural resource livelihood indicator than non-beneficiary households. However, the combined data revealed access to natural resources for beneficiary households (0.72) and non-beneficiary households (0.71) are almost the same. Households that participated in NGOs' climate change interventions are capable of improving their land, forest and water resources than household that did not. This result is not different from the findings of Adiita and Natia (2015) who reported that the high rate of deforestation among farming communities in the Savannah and transitional zone of Ghana due to households' dependence on firewood and charcoal for household fuel was significantly reduced by the interventions by GIZ/MoFA to assist farmers establish woodlots which had positive implications on the environment and eco-system.

The computed indices for the social capital main livelihood indicator showed that in Savelugu Municipality, beneficiary households have higher social capital (0.65) than non-beneficiary households. Also, in the West Mamprusi District, household that participated in NGOs' climate change interventions have more social resources (0.60) than households that did not participate in NGOs' interventions (0.49). In the combined data, the computed indices of 0.63 and 0.43 for beneficiary and non-beneficiary households suggest that households that participated in NGOs' climate change interventions have more social

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capital than households that did not participate in such interventions. Thus, households that participated in NGOs' climate change interventions have more social networks and relations than households that have not participated in NGOs' interventions on climate change.

In a focus group discussion, a woman participant had this to say:

> "Most of our women in this community were engaged in tree cutting for firewood and charcoal burning. But, when this NGO came, they educated us on the negative effects of tree cutting and supported training on soap making to serve as alternative sources of livelihood".

The financial resources indices showed a negligible difference in the financial resources of beneficiary households (0.68) and non-beneficiary households (0.67) in the Savelugu Municipality. However, in West Mamprusi District, beneficiary households had higher financial resources (0.60) than non-beneficiary households (0.56). The computed financial resources indices for the combined data also showed that beneficiary households had slightly higher financial resources (0.64) than non-beneficiary households (0.62).

Though beneficiary households in Savelugu, West Mamprusi and in the combined data have more physical resources than non-beneficiary households, the computed indices revealed that the level of physical resources for both beneficiary and non-beneficiary households have been low to warrant any significant effect on the livelihood of farming households. This means that farming households have low access to farm assets, farm lands, farm inputs and physical seeds and crops.

The computed livelihood indices revealed that households that benefited from NGOs' climate change intervention in the Savelugu Municipality have higher livelihood (0.57) than non-beneficiary households (0.48). In the West Mamprusi District, the livelihood indices of 0.54 for beneficiary households and 0.45 for non-beneficiary households

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indicate that household who participated in climate change interventions spearheaded by NGOs have higher livelihood than households that have not participated in NGOs' climate change interventions. Combining data from the two districts, the livelihood indices showed that beneficiary households with livelihood index of 0.56 have higher livelihood than non-beneficiary households (0.47). This means that households that participated in NGO-led climate change interventions have higher natural, social, physical, human and financial resources than households that have not participated in NGOs' climate change interventions. The radar diagram (Figure 5.1) shows higher livelihoods for households that participated in climate change interventions organised by NGOs than households that did not participate in NGOs' climate change interventions in terms of human and social resources. Although households that participated in NGOs' climate change interventions had higher physical, financial and natural resources than households that have not participated, the differences are marginal than the human and social resources.

In an interview with an official of the northern regional MoFA, it was revealed that:

> "Most of the NGOs that intervene in climate change adaptation in the Northern Region usually form farmer-based groups with whom they work. Members of such groups are usually trained, linked to other organisations for inputs, credit, weather information and good markets. This networks strengthens the social capital of member farmers relative to non-member farmers. Also, participating farmers received skills and training on climate smart agricultural practices which enhance their human resource to adapt to climate change and variability more than farmers who did not participate in such interventions"

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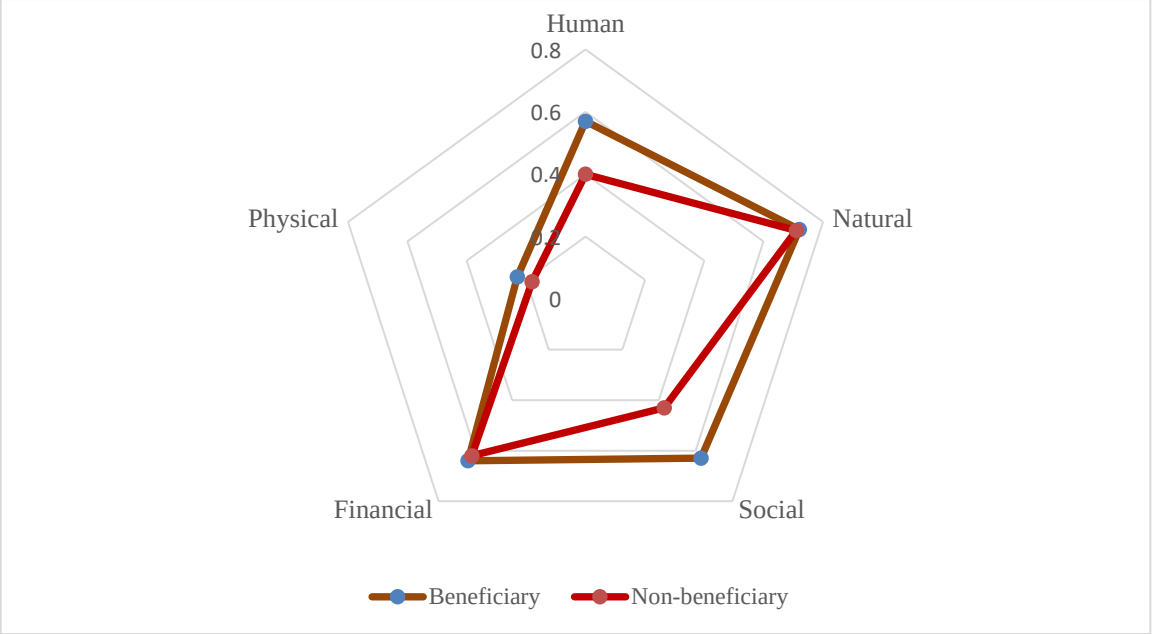

Figure 5.1: Radar diagram showing the main livelihood indicators for farming households

Source: Field survey, 2019

5.4 Propensity Score Matching Results of the Effects of Farmers' Participation on Livelihood

Livelihood of farmers in this study was measured as a ration based on the sustainable livelihood framework, and scaled between zero and one. The Propensity Score Matching technique was employed to estimate the effect of farmers' participation in NGOs' climate change interventions on farmers' livelihoods. This involved identifying the propensity scores using the binary logit regression model, matching analysis with the propensity scores and then identifying the treatment effect on livelihood of farmers (outcome variables) in the Northern Region.

The goodness of fit test used was the likelihood ratio test which indicates that the model fits the data well (P value = 0.042). The findings reveal that most of the variables used were significant in determining farmers' participation in climate change intervention through the Logit model which used the maximum likelihood estimation method. There is

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usually the possibility of selection bias when participation is not randomly assigned. The propensity score matching technique is therefore employed to account for selection bias.

This study estimated the propensity scores for all the 260 respondents. This included 80 participants (as the treated group) and the 180 non-participants (as the control group). The observed distribution of covariates across the participants and non-participants was balanced using the propensity scores. This suggests that estimating the propensity score balances the treated (participants) and untreated (non-participants) groups.

Furthermore, the propensity scores and covariate balance are presented in Appendix B. This represents the covariate balancing test which tests the hypothesis that both groups have the same distribution in covariates after matching. The table in Appendix B depicts the percentage bias before and after matching, covariates' means and their t-test of difference in means. It shows the matched sample means as well as the unmatched sample means. The results show that the matched sample means for the covariates listed are similar for both the participants (treatment group) and non-participants (control group) in climate change interventions which was not the same prior to matching. The covariate balancing outcome depicts that those covariates whose differences were statistically significant prior to matching have been balanced in a way that after the matching they are no longer statistically significant. Hence, the covariates are made comparable by balancing them through matching. Through this process the selection bias is reduced.

The results were used to estimate the effect of climate change interventions on the livelihoods of farmers among farmer groups having similar features. The matching algorithm employed was the Nearest Neighbour matching algorithm. The effect of the participation in NGOs' climate change interventions on farmers' livelihood was estimated using the Average Treatment Effect on the Treated (ATT). The estimation results provide

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a supportive evidence of statistically significant difference between participants and non-participants in terms of the proportions of livelihood among farmers in the Northern Region of Ghana. The results of the average treatment effect are presented in Table 5.3.

Table 5.3: Results of Propensity Score Matching on the Effect of farmers' participation in climate change interventions on their livelihood

Sample	Participants	Non-participants	Difference	Std. Error	t- statistic
Unmatched	0.8105	0.4495	0.3610	0.1417	2.54
ATT	0.8105	0.4495	0.3610***	0.1318	2.58
ATU	0.4495	0.8218	0.3723	0.1007	3.68
ATE			0.3602	0.1105	3.25

***Notes:* ATE, ATT and ATU indicate average treatment effects, average treatment effects for the treated and untreated respectively.**
***** implies statistically significant at 1%.**

This finding is consistent with Avea *et al*., (2016) who assessed the contribution of NGOs and development agencies to the sustainability of smallholder soybean farmers in northern Ghana and found that NGOs' facilitation had a significant influence on the technical efficiency of soybean production as indicated by the significant high production efficiency of farmers facilitated by NGOs than non-facilitated farmers. Just as Avea *et al*., (2016) concluded that production and efficiency of soybean farmers could be improved through more services to farmer groups and sustainable interventions from NGOs and other social programs. The findings of this study also imply that farmers livelihoods can be improved through increased farmers participation in NGOs-led climate change interventions which boost farmers adaptive capacity and overall resilience to climate change and variability. Findings from this study is also supported by Igram et al., (2017) who showed that UTZ certification program had subtle changes in the power of cocoa farmers for market

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participation, through increase in technical information and dissemination of good agricultural practices, in order to strengthen the capacity of members of farmer-based cooperatives in Ghana and Ivory Coast.

5.5 Conclusion

NGO-led climate change interventions implemented in the Northern Region of Ghana has a significant positive effect on the human, social, and physical resources of participatory households. Thus, the overall livelihood of households that participated in the interventions of NGOs improved as a result of their participation in the climate change interventions. However, natural resources of both beneficial and non-beneficial households are the most affected by climate change interventions spearheaded by NGOs in the Northern Region of Ghana.

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CHAPTER SIX

DETERMINANTS OF HOUSEHOLDS PARTICIPATION AND CHALLENGES IN NGOs' CLIMATE CHANGE INTERVENTIONS

6.1 Introduction

This chapter presents the results and discussions on what informs smallholder farmers participating in climate change interventions implemented by NGOs in the study area. Three sections constitute this chapter. Section 6.2 presents the results and discussions on drivers of households' participation in NGOs' climate change interventions, while Section 6.3 presents the challenges in implementing climate change interventions. Section 6.4 presents the conclusion of the chapter.

6.2 Determinants of Households' Participation in Climate Change Interventions

Results of the binary logit regression model showed that the Wald Chi^2 of 38.07 is significant at 5 percent. This justifies the suitability of the binary logit model in determining the factors influencing farmers' participation in climate change interventions in the Savelugu Municipality and West Mamprusi District of the Northern Region and the North East Region of Ghana by NGOs. The binary logit regression revealed that age and educational level of household head, years of household stay in community, and household size has no significant influence on farming households' participation in climate change projects of NGOs in the study areas. This finding resonates with the finding of Etwire *et al*., (2013) who reported that age of household head and household size had no significant effect on households' participation in Agricultural Value Chain Mentorship project in the Northern Region of Ghana. The findings also support Muema et al. (2018) who found that education of farmers had no significant effect on access to seasonal climate information among smallholder farmers in Makueni County of Kenya. On the other hand, household

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heads' participation in decision making at community level, and membership of a farmer-based organisation had significant positive influence on farming households' participation in climate change interventions, while gender of households' head, households' income and farm size had significant negative influence on households' participation in climate change intervention implemented by NGOs. This is presented in Table 6.1. This study discusses only factors which significantly influences households' participation in climate change interventions implemented by NGOs in the Northern Region of Ghana.

Table 6.1: Results of binary Logit regression on factors influencing households' participation in climate change interventions of NGOs

Independent Variable	Coefficient	Std. Error	P – Value
Age of household head	-0.020	0.017	0.242
Gender of household head	-0.264**	0.403	0.032
Education level of household head	0.465	0.363	0.403
Participation in decision making at community level	1.442***	0.379	0.000
Years of stay in community	0.341	3.563	0.426
Membership of farmer-based organisation	0.414*	0.365	0.057
Household income	-0.814***	2.653	0.000
Household size	0.163	0.162	0.514
Farm size	-0.400***	1.634	0.005
Constant	0.813	2.080	0.296
Regression Diagnosis			
Number of observations		258	
Wald Chi^2		38.07**	
Prob > Chi^2		0.042	
Pseudo R^2		0.130	
Log Pseudo likelihood		-278.5187	

Source: Field Survey, 2019

*****, ** and * denote statitistically significant at 1%, 5% and !0% respectively**

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Contrary to Etwire *et al*., (2013) who found that sex of household head had no significant effect on households' participation in agricultural projects in northern Ghana, the empirical results of this study showed that gender of household is significant at 5 percent and negatively influence households' participation in climate change interventions led by NGOs. This result suggests that male headed households are less likely to participate in climate change interventions implemented by NGOs than female headed households. Given that most women are marginalised in northern Ghana due to socio-cultural factors, most organisation into climate change and food security intervention tend to target women farmers as a way of bridging the gender gap in climate change adaptation. A staff of one of the NGOs had the following to say during an interview:

> "Women are more vulnerable to climate change in northern Ghana and have the least adaptive capacity relative to men. To bridge this gender disparity in adaptive capacity, most climate change projects come with specification to include more women as beneficiary and we do just that."

Generally, there was unanimity among households across the study communities that most climate change interventions by NGOs gave more priority to women than men. During a focus group discussion, a participant said that:

> "The NGO officials like our wives more than us. When they come, they want to involve women in our meetings and even give them opportunity to leadership positions which we previously did not allow in this community. …….. in some cases, they come wanting only women to assist without recourse to men (leaving we the men to our fate)."

The results imply that women are given more priority for participation in NGOs' climate change interventions than men. This finding contradicts the reports of the Asian Development Bank (2013) which found that women and girls in Asian and the Pacific regions face many inequities and constraints, often embedded in norms and practices and encoded in legal provisions such as those laws governing access to land, including inequitable and exclusionary provisions, thus institutionalizing discrimination. Where

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such legislative measures are not in place, customary rules and practices often have restrictive consequences for women limiting their access to key resources such as land and credit, and affecting household food security and nutrition. Thus, these factors constrain women access to education and employment opportunities and curtails their economic autonomy and weakened their participation in the gender equality and food security program which was implemented by the Asian Development Bank. Similarly, Nabikolo *et al*., (2012) reported that male–headed households had more access to household assets, more influential in community decisions than female–headed households adapted more effectively to climate change through participation in both governmental and non-governmental interventions in Uganda then female–headed households. The differences in the findings of this study and the earlier studies could be attributed to the differences in the objectives of the interventions.

Household heads' participation in decision making at the community level was significant at 1 percent, and had a positive effect on households' participation in climate change interventions led by NGOs. Thus, a household which has its' head participating in community decision making are more likely to participate in climate change adaptation projects implemented by NGOs relative to households whose heads' do not participate in community decision making.

This is inconsonant with Tahiru et al. (2019) finding suggests that household heads who have a stake in decision regarding the entire community have their households more likely to participate in climate change interventions than households whose heads do not participate in community level decision making. What this means is that participation in decision making at the community level by household heads has a significant positive influence of participating in NGO-led climate change interventions. NGOs staff usually contact community leaders at the community entry stage of their project implementation

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who are the main stakeholders in the communities. They are sometimes involved in selecting and identifying beneficiaries for all projects in their communities. An official of an NGO had this to say:

> "When we go to a community, we need to visit the elders and all those who matter in the community. In selecting the beneficiary, it is only proper that we include some of these stakeholders so that they can assist in maintaining the group activities especially after the project is over."

Another officer supports the stands thus:

> It is easier to contact decision makers in the communities. Such people are easy to locate and they exert some kind of influence over community members. When they accept you and your organisation, then you are on your way to implement your programs without any difficulties.

Households' membership of farmer-based organisations was significant at 10 percent and had a positive effect on the households' chances of participating in NGOs' climate change interventions. Thus, when household members belong to a farmer-based organisation, it increases the likelihood of the household participation in NGO-led climate change interventions than households which do not belong to any farmer-based organisation. For effective control and judicious use of limited resources, most organisations prefer to work with groups at the community level rather than individual farmers or households. According to a participant of one of the focus group discussions:

> Any organisation that come into this community either work with existing groups or form their own groups and work with them.

Another participant contributed in support of the earlier view espoused by another participation during the focus group discussion;

> For example, in this community, many a times, organisations that come prefer to work with the groups that are there already. Any organisation that forms its own groups do so only when there are no existing groups.

In support of the above renditions, an NGO staff member asserted that;

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> It lessens our work when you visit a community and they already have existing farmer-based groups. The existing groups already have leadership and lay down rules hence, it serves you from the hustle of putting them together and forming leadership amongst them.

NGOs prefer farmer-based organisations because it is an easier way to manage beneficiaries and members also serve as watch-dogs to each other which ensures realisation of project objectives. This confirms an earlier finding by Agrawal et al. (2009) who reported that participation in the Local Management Project in the Bam region of Burkina Faso was based on villagers who were able to organise themselves into groups with acceptable social goals aligned to project objectives and willing to compromise to protect the forest and convert bushlands to farmlands. Another studies by IFAD (2018) supported this argument and reported that smallholder farmers' participation in the Agricultural Value Development Project in Siere Leone over the six-year period was based by farmers' membership with registered farmer institutions such agribusiness centres, farmer-based organisations and cooperatives. Also, this finding is supported by Muema *et al*. (2018) who found that smallholder farmers who belonged to farmer-based organisation were more likely to access seasonal climate information services in Makueni County of Kenya.

The results also showed that household income was significant at 1 percent and negatively influence farming households' participation in climate change interventions implemented by NGOs. This result indicates that as farming households' income increases, the likelihood of the household participating in climate change interventions organised by NGOs decreases. The study revealed that NGOs support households with lower income levels so as to reduce their financial insecurity and empower them to be financially independent. In the words of a staff of one of the NGOs during an interview, he revealed the following:

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> "Our intervention policy is that we do a cursory survey of all communities to identify the most vulnerable and climate distressed communities. In each community, not all households have the same capacity to adapt to climate change. So, we conduct mini-census and based on households' income, human resource strength, and other factors; we are able to select the needy households to benefit from the intervention since resource constraint will not permit us to assist every person."

Another respondent drives home the point more forcefully;

> We normally embark upon what is called means-testing and targeting. These strategies help to identify the susceptible households who are but willing and ready to work with us especially with regards to issues of adaptation. Remember we are dealing with groups but the groups are, made up of individuals with different adaptive capacities. Therefore, our programs take into consideration the individual needs in the various groups.

This finding is supported by IFAD (2018) which reported that the Agricultural Value Development Project implemented in sixteen districts in Siere Leone targeted low-income communities and households. Also, the finding is consistent with Muema *et al*. (2018) who found that monthly income of households had significant positive effect on smallholder farmers' access to seasonal climate information or forecast in their farm management decisions against climate risks in Makueni County of Kenya due to the financial resource constraint.

This study revealed that farm size was also significant at 1 percent and had a significant negative influence on households' likelihood of participating in NGO-led climate change interventions. The interpretation of this result is that as a household farm size increases, the likelihood of it participating in climate change interventions organised by NGOs decreases. This means that small-scale farming households are more likely to be selected to participate in NGO-led climate change interventions than large-scale farming households. Small-scale farmers are mostly women, subsistent farmers, and lack the capacity to expand production or respond to climate change and are the hardest hit in cases of unfavourable weather. These make small-scale farmers the main target of NGOs'

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climate change interventions in the Northern Region and North East Region of Ghana. Though Muema *et al*., (2018) earlier found that total farmland of households significantly influences smallholder farmers' participation in climate change adaptation interventions, it was revealed that expanding farm size increases farmers' access to climate change information services from institutions.

6.3 Challenges of NGOs' Implementation of Climate Change Interventions

This section presents the challenges militating against the implementation of climate change interventions by NGOs in the study area. The challenges militating against the implementation of climate change interventions were identified during the recognisance survey, through key informant interviews with major stakeholders. The identified challenges were validated by community members during focus group discussions at community level, and were also supported by existing studies through literature review. The constraints hindering the implementation of climate change interventions were analysed on two perspectives: beneficiary households and staff of implementing organisations.

Households were asked to tick all constraints which in their view were militating against the effective execution of NGOs projects on climate change. This is presented in Figure 6.1. The results revealed that all seven constraints (households' misconceptions of NGO work, absence of support from other institutions, difference in households' needs, land shortage, socio-cultural and religious barriers, perceived corrupt NGOs' staff and high illiteracy among households) were militating against the effective implementation of climate change projects by NGOs, but at different intensities. High illiteracy among households was the most popular constraints reported by households (83.8%). This was reported more by households in Savelugu Municipality (89.8%) than households in West

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Mamprusi District (78.2%). High illiteracy rates among households impedes the ease of project implementation because some components of adaptation projects are in the form of written material for beneficiary households to read and understand the concept. It is also difficult for illiterate household heads to be sent for climate change adaptation workshops outside their location, especially when the medium of communication is different from their local dialect. During an interview with a staff of one of the NGOs, it was revealed that *in instances where the officer in charge of the project is unable to speak the local dialect of the project implementing community, a translator is usually hired and this comes at an additional cost to the organisation mostly outside their budget.*

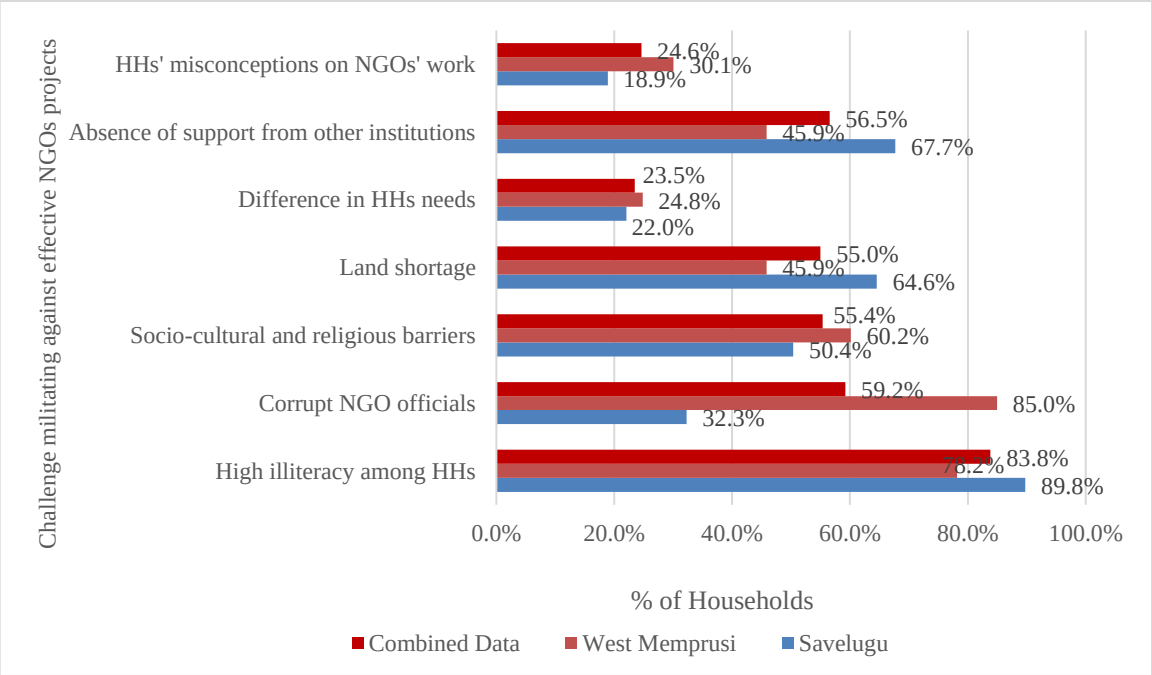

Figure 6.1: Households' views on constraints in implementing NGOs' climate change interventions

The constraints militating against the effective implementation of climate change interventions by NGOs were ranked by households by assigning 1 to the most pressing constraint up to 7 for the least pressing constraint. The constraint with the least mean was ranked as the most serious constraints towards NGO climate change interventions. Results of ranked constraints by respondents revealed that though there are slight disparities in the

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order of pressing constraints between the two districts, overall, the five most serious constraints hindering the effective implementation of NGOs' climate change interventions, in the view of respondents, are corrupt NGOs staff, high illiteracy among household, land shortage, socio-cultural and religious barriers, and differences in farming households' needs. Table 6.2 presents the results of households ranked constraints and the Kendalls' Coefficient of Concordance.

Table 6.2: Ranked constraint in the implementation of NGOs' climate change interventions

Constraint	Combined Data		Savelugu		West Mamprusi	
	Mean Rank	Rank	Mean Rank	Rank	Mean Rank	Rank
Corrupt NGOs' officials	1.92	1st	1.92	1st	1.93	1st
High illiteracy among households	3.37	2nd	3.71	4th	2.79	2nd
Land shortage	3.47	3rd	2.75	2nd	4.71	5th
Socio-cultural and religious barriers	3.66	4th	3.92	5th	3.21	3rd
Difference in farming households' needs	4.05	5th	3.29	3rd	5.36	6th
Absence of support from other institutions	5.71	6th	5.42	6th	6.21	7th
Misconception of NGOs work by households	5.82	7th	7.00	7th	3.79	4th
Kendall's Test Statistics						
N	260		125		135	
Kendall's W[a]	0.412***		0.631***		0.503***	
Chi-Square	46.923		45.414		21.118	
Df	6		6		6	
Asymptotic. Significance.	0.000		0.000		0.002	

Source: Field Survey, 2019

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The results revealed that the most pressing constraint militating against the effective implementation of NGO-led climate change interventions in the opinion of respondents in both districts was corrupt NGO staff with a mean rank of 1.92 for the combined data. Most respondents (59.2%) were of the view that NGO staff do not give them the full benefit package as specified in the projects. During a focus group discussion, a participant said that:

> "We are still poor because when the white men donate huge gifts to be given to us, staff of the intermediary organisations usually give us meagre and retain a chunk of it to themselves. Just last year, one organisation came and gave us two sheep each and later, we heard we were supposed to be given five sheep."

Another respondent in a different community complained about corrupt staff of NGOs and said that:

> "Some of the NGO worker are thieves. They were supposed to give us GHS500.00 each as start-up capitals after a two days training on how to make soap using local material. But, in the end, each participant was given only GHS200.00. How can this money be used as capital to help us diversify our livelihood as an adaptation strategy to climate change?"

When staff of NGOs were contacted during interview, they responded that beneficiaries hold this prejudice as a result of misconception of NGOs work and high expectation from NGOs by households. However, NGO staff did not debunk this issue of corruption among NGO workers entirely but, were of the view that it is not as much as been expressed by households. This finding confirms Khair (2015 p6) who revealed NGOs, that were contracted to benefit from the BCCTF funded project to install "bio-gas plant for producing organic fertilizer from hyacinth and afforestation in the Hill district council" in Bangladesh, were later accused of allegation of embezzlements and fake beneficiary lists.

The second most pressing constraint hindering the effective implementation of NGOs' climate change projects is high illiteracy among households. This was revealed by the mean rank value of 3.37 for the combined data. It was however ranked as the 4th pressing

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constrain among households in the Savelugu Municipality. Household respondents revealed that they are unable to communicate well with some staff of NGOs due to language barrier. Also, there are some training which could have assisted household in adapting to climate change, but households are unable to attain because the mode of instructions for such training and workshops is usually English, and requires beneficiaries to be literate. A staff member had the following to say during an interview:

> "In many cases, reading materials on climate change adaptation are unhelpful in our operational areas due to the high illiterate households we deal with. So, we always prefer practical and material adaptation measures."

In confirming the above statement, another member avers that:

> I'm wondering why the authorities can't write in the local dialect for easy understanding of us. We didn't go school because our fathers didn't send us to school. As a result, we can't speak, read and write. So, whenever the officials come and can't speak our local language, it possesses a lot of challenges and for that matter not helping us get the concepts well.

It was confirmed by households during focus group discussions that most households are unable to read labels on climate change adaptation technologies, attain workshops on climate change adaptation and also communicate effectively with climate change experts.

The mean rank of 3.47, for the combined data, indicates that land shortage is the third most pressing constraint militating against the effective implementation of climate change interventions by NGOs. Land is most important resource to farming households in the Northern Region of Ghana which are vested in chiefs. Where NGOs require land to set up demonstration fields for effective training of farmers to adapt to climate change, they are often faced with the problem of no idle land and have to rely on few parcels/plots of land sacrificed by some households. Improved crops varieties require that it is cultivated on virgin lands which are not close to any cultivated land to be used as seeds in the subsequent farming season. Unfortunately, most of the lands are under cultivation and the few uncultivated lands are owned by few stakeholders. An NGO official observed that:

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> We are always challenged with demonstration farms largely because of unavailable virgin lands or idle lands to be used as such. A demonstration farm should not be far from the people and should not also be a used land. It should be new land entrusted unto us to be used for such purposes. But often times, we don't get such lands easily. In some cases, we have to locate lands far from home and water bodies which is problematic in the sense that the farmers have to travel long distances to access the demonstration farms.

Women in particular have peculiar problem with access to land and have to rely on their husbands or other family members for land to implement new technologies introduced by NGOs to adapt to climate change. According to Ampaire et al. (2017), communal land lease and reduced land holding among households, especially women, was the main challenge faced by institutions implementing climate change adaptation intervention in Uganda.

Socio-cultural and religious barriers was ranked as the 4th most pressing constraint to effective implementation of NGOs' climate change interventions. Thus, believes and practices of a community have serious implication on the success of NGOs' climate change projects. It was revealed that a project on livelihood diversification earmarked for rearing of pigs to support farmers increase their income as a measure to enable them adapt to climate change, which was uprightly rejected by beneficiaries. The reason is that the study area is an Islamic dominated community which abhor the rearing of pigs and consumption of pork. In a similar way, the cultural practices in northern Ghana place women as second-class citizens and any projects targeted at women must involve men to succeed. In a focused group discussion at Nakpanzoo in the Savelugu Municipality, a male farmer said that:

> "NGOs that come to this community to support our women must first seek for our approval and support before they can be allowed to work. In the household, what a man says is final and no woman or child dare challenge it"

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In supporting the above assertion, a female respondent avers that:

> Most at times, when they (NGOs) come, they (NGOs) want to deal with us directly, which is not acceptable in this area. They (NGOs) must first of all create the indulgence of our husbands and seek their concerns before dealing with us. For example, our husbands have to approve our relationship with the organisations before we could deal with them. The organisations sometimes find it difficult to understand us in this regard. Our activities are guided by societal norms hence a woman can't just take such decisions; either to participate or not to participate without the concern of the husband.

This finding is consistent with Nielsen and Reenberg (2010) who found that the major barrier to adopting technologies introduced through climate change adaptation projects among four main ethnic groups in northern Burkina Faso was farmers adherence to the traditional concepts of personal integrity, worthiness, and shame which frowns on livelihood diversification options of labour migration, gardening, and working for development projects. Also, Quaye (2014) revealed that climate change adaptation projects in northern Ghana focusing on tree planting do not succeed, due to their traditions and norms, namely, that all trees are owned by the chiefs irrespective of who planted and grew them.

The fifth most pressing constraint to the effective implementation of NGOs' climate change interventions is difference in households needs in adapting to climate change. The different households across the region have diverse needs to improve their adaptive capacity. Staff of NGOs revealed during interviews that when identifying communities' needs during mini-census, it is some time cumbersome to arrive at what sort of assistance will be acceptable to all households. The only way of arriving at consensus is to rank the needs of households and select the one (s) which are more pressing and afflict most households' adaptive capacity. Ampaire et al. (2017) reported that market, socio-economic and environmental factors were the major institutional constraints contributing

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significantly to the differences in what is required by men and women for effective adoption of technologies aimed at climate change adaptation in Uganda.

Results of the Kendall's Coefficient of Concordance test revealed significant agreements among households in both districts and in the combined data on the ranking of the constraints hindering against the effective implementation of climate change interventions by NGOs. These are showed by the Chi – Square values of 46.923, 45.414 and 21.118 for Savelugu, West Mamprusi and the combined data, respectively. These values were significant at 1 percent. The Kendall Coefficient of Concordance values of 0.412, 0.631 and 0.503 means that there is 41.2 percent, 63.1 and 50.3 significant agreements among households in Savelugu Municipality, West Mamprusi District and the combined data on the ranking of constraints hindering NGOs climate change interventions.

The analysis of the field data further showed that two key constraints were mentioned by staff of NGOs to be hindering the realisation of their aims for climate change interventions in the Northern Region of Ghana. First, it was clear that climate change interventions span from one year to five years, with most projects ending after the second year. This time frame, in their view, is too short for farmers to adopt technologies introduced by the interventions for effective adaptation to climate change. In the words of an NGO respondents,

> "Most of the projects on climate change do not exceed two years, with majority being one-year trial. Unfortunately, these periods are donors' specification and we have nothing to do about it, though we continually persuade them to increase the duration, they remain adamant due to resource limitations."

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Another official had to say:

> Your organisation source of funding is from another organisation. You are on the ground working with the community people. You are vividly aware of the timing or during challenges of some of the interventions. Yet, you are directed by the donors not to temper with the project duration so invariably, you are incapacitated. The donors need to listen to us the implementing agencies sometimes. I'm pretty sure if that is the case, we will definitely have a successful adaptation.

It was obvious from households that most farmers wish to still be on NGOs' climate change projects, which have been beneficial in their view, but, ended abruptly. According to farmers, they need more time to learn and adopt technologies introduced by climate change interventions spearheaded by NGOs. According to Alabi (2018), the focus of short–term goal by political institutions strongly hindered the effectiveness of climate change policies and programmes in the Osun State in Nigeria. Thus, the climate change policies and programmes require longer time to achieve its objectives but, the stakeholders tend to prefer short-term results which are not effective in improving farmers' adaptive capacity to be more resilient to climate change and variability. This confirms an earlier finding by Measham *et al*., (2011) who reported that one of the main barriers to implementing climate change adaptation projects by local municipalities in New South Wales, Australia was short limited time horizon of plans based on funding organisations' specifications and based on the degree of impact of previous projects. To avert this problem, Measham *et al*., (2011) revealed that local implementing agencies had to lobby for institutional change and extension of project durations to achieve greater impacts on climate change adaptation.

The second constraint militating against the effective execution of interventions on climate change in the view of staff of NGOs have been erratic rainfalls and unfavourable weather. Almost all farmers in the Northern Region depend on rain-fed agriculture. In most cases, technologies such as improved seeds, fertilizer, inoculants, bunds, among other introduced

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to and applied on field by farmers are rendered ineffective when the rains fail to fall at the right time, and when temperatures are high. There have been instances where farmers sow improved seeds and apply fertilizer given them by NGOs which either fail to germinate and remain buried in the soil to rot due to high temperatures or are carried away by running water due to floods from excessive rains. As identified by some scholars (Mukheibir & Ziervogel 2007; Jantarassami *et al*., 2010; Moser & Ekstrom 2010; Deressa *et al*., 2009), insufficient information on the impacts of climate change at the local level is a major barrier that affects the implementation of adaptation projects by institutions at the local level. This barrier in many instances results from lack of and (or) unavailability of reliable information on climate change at a scale, which is appropriate to the local community and thus, making adaptation planning difficult (Deressa *et al*., 2009; Jantarassami *et al.*, 2010). A participant of a focus group discussion in Janga community within the West Mamprusi District said that:

> "When we are given improved seeds and educated on appropriate farming practices, the rain is often our problem because we do not own it. You will plant but, the rain may disappoint you".

Another participant observed that:

> These days you can't predict the weather. When we were children, our parents could predict the weather and tell when the first rain will set in. but now, our generation are unable to tell the story because the weather vacillates. This is a problem. Again, the June-July normal rains have moved further to sometimes either August-September or September-October. The signs don't come as expected or better still you may notice the signs and alas, the rain will deceive you.

It was observed during the data collection that erratic rainfall pattern is a general challenge faced by both project beneficiaries and project implementers. Northern Ghana has a single rainfall, and anything that shifts the start of rain within a farming season affects the majority of the people who depend on rain-fed agriculture for their livelihoods.

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6.4 Conclusion

The study revealed that male-headed households, income of farming-household, and the average farm size of the households have a significant negative influence on farming-households' participation in climate change interventions implemented by NGOs, while households' participation in decision making at the community level and membership of farmer-based organisation, significantly increases the likelihood of households' participation in interventions on climate change implemented in Northern Ghana.

In the view of the households, corrupt NGOs staff, high illiteracy among households, land shortage, socio-cultural and religious barriers, difference in farming households' needs and absence of support from other institutions are the major constraints militating against the effective implementation of climate change interventions implemented by NGOs. On the other hand, staff of NGOs opined that brief time lines of climate change projects and unpredictability of rainfalls and unfavourable weather conditions in the region were the most serious challenges hindering the realisation of climate change interventions' objectives.

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CHAPTER SEVEN

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

7.1 Introduction

This study set out to investigate NGO climate change adaptation interventions and their implications for farmers' livelihoods in two districts in the northern region. It also examined the policy, institutional and regulatory framework within which these interventions occur. This broad objective was formulated into four research questions to guide the study. These research questions were intended to respond to a number of limitations that were identified in the literature. Having analysed and discussed the study's findings in the previous chapter, this final chapter presents the summary, conclusions and recommendations from the study. The first part of the chapter presents summary of findings based on the objectives of the study, while the second part covers the conclusion and recommendations derived from the results.

7.2 Socio-Demographic Characteristics of Respondents

The socio-demographic profile of respondents considered in the study included gender, religion, age, marital status, ethnicity, place of origin, educational level, climate change awareness, observed change in climate, effects of climate change on farming activities, farmer-based organisation membership, participation in NGOs' climate change intervention interventions, type of land ownership, age, farming experience, years of stay in community, household size, farm size, livelihood index and types of crop cultivated by households. It was established that almost 70 percent of households sampled are headed by males and about 80 percent of household heads were Muslims. The majority of respondents were married, and about 48 percent of household heads were Dagombas. Close to 90 percent of households were natives of their communities with over 80 percent

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of respondents having no formal education. The average age of farming-household heads was 40.02 years with an average farming experience of 24.45 years. The average household size was 11.01 persons, and the average years of households' stay in community was 30.77 years. The majority of farming households interviewed cultivated maize, rice, groundnuts, millet and soya beans

It was established that most respondents were aware of climate change, and acknowledged observing changes in climate over the years. About 85 percent of households reported that their farming activities had been affected by climate change. It was however found that only a third of respondents participated in NGOs' climate change interventions, although most of them owned their farmlands.

7.3 Summary of Key Findings

The study examined the impact of climate change adaptation interventions of NGOs on smallholder farmers in two districts in Northern Ghana. The study is pertinent, given that areas which rely heavily on rain-fed and subsistence agriculture are noted for their high climate-sensitive agricultural systems, and are more susceptible to climate variation. In Ghana, the Northern parts of the country have been the hub of several international and local NGOs with interventions to bridge the North–South development gap. These NGOs have been instrumental in climate change adaptation programmes in many facades, such as exerting pressure on policy makers to adopt climate adaptation related interventions; embarking on outreach programs, and campaigns to educate smallholder farmers, as well as the development of resilience measures aimed at reducing vulnerability of smallholder farmers to the impact of climate change.

The study yielded a number of interesting findings and insights. The study highlights the role played by both government institutions and NGOs in adaptation interventions towards

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the improvement of wellbeing and food security among smallholder farmers. It was established that climate change interventions implemented by NGOs in the study areas are land conservation and smallholder rehabilitation, livestock development, promotion of the planting of drought tolerant maize, pearl millet and sorghum II, Ghana Environmental Management, conservation agriculture, community land use, response to climate change, participatory integrated climate service for agriculture, climate seed and knowledge, climate change adaptation in northern Ghana enhanced, and a world without hunger (SEWOH). These interventions were geared towards the attainment of three objectives outlined in Ghana's National Climate Change Adaptation Strategy. These objectives include building and strengthening the capacity of local farmers towards increased agricultural productivity and awareness of climate issues, enhancing living standards of vulnerable groups through livelihood diversification, and promotion of existing indigenous knowledge and best practices. However, it was observed that there appears to be no or little coordination among the various organisations (both donors and implementing agencies) involved in the implementation and support in the interventions on climate change.

In terms of human capital, it was established that households that participated in NGO-led climate change interventions reported improved nutrition, saved household members from injury, reduced effect of climate change on their health, diversified crops, increased average yield of major crops, diversified livelihood, had more years of education, had training on agronomic practices and vocational training of household members, than households which did not participate in any NGO climate change intervention.

In relation to social capital, the study showed that relative to households that did not participate in climate change interventions implemented by NGOs, more households that participated in NGO-led climate change interventions reported higher stay in their

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communities, belonged to farm-based organisation (FBOs), engaged in land related conflict, sought for assistance from their local assemblies, and participated in climate change decisions at community levels.

The study found enhancement of the financial resource of the smallholder farmers as more households that participated in NGO-led climate change interventions reported improvement of their financial freedom, average household income and improved road networks than household that did not participate in climate change intervention implemented by NGOs.

There has also been some improvement in the physical capital of farmers. Comparatively, more households that participated in NGO-led climate change interventions reported higher agricultural diversification, access to farm assets, saved crop and seeds, than households that did not participate in any NGO climate change intervention.

Drivers of households' participation in NGOs' climate change interventions were determined using the binary logit regression model. The results justify the suitability of the binary logit regression model with a Chi^2 value of 38.07 being significant at 5 percent. It emerged that age and farming household head educational level, years of family stay in community, and household size has no significant influence on farming households' participation in climate change projects of NGOs. The results further revealed that household heads' household involvement in community level decision-making and belonging to a farmer-based association had significant positive influence on the farming households' likelihood of participation in climate change interventions implemented by NGOs. On the other hand, gender of households' head, households' income and farm size had significant adverse impact on household livelihoods at the same time participation in intervention on climate change by NGOs.

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The study established that several factors hinder the successful implementation of climate change interventions in the communities. Key among them is, high illiteracy among households and corruption by NGOs staff. Majority of farming households also reported socio-cultural and religious factors, land shortage and absence of support from other institutions as challenges to the implementation of climate change interventions by NGOs. The Kendall Coefficient of Concordance results showed that farmers ranked corrupt NGO staff as first, high illiteracy among households as second, land shortage as third, socio-cultural and religious barriers as fourth, difference in households needs as fifth and absence of support from other institutions were ranked by farmers as the sixth most pressing constraints militating against the effective implementation and achievement of interventions on climate change by NGOs in the North East and the Northern Region of Ghana.

In the view of NGO staff, two major constraints hinder the realisation of climate change interventions objectives in the two regions of Northern Ghana. The first is the short span and timing of donor funded climate change interventions. This was found to be from one to five years, with most projects ending after the second year. The second is erratic rainfall and unfavourable weather which hampers NGOs in their quest to assist farmers who depend on rain-fed agriculture to adapt to climate change.

Finally, the computed main indicator indices showed that households which participated in NGO-led climate change interventions had higher human, natural, social, financial, and physical resources as well as the overall livelihood than households that did not participate in NGO-led climate change interventions. Results of the propensity score matching also revealed that the livelihoods of households that participated in NGO-led climate change interventions were higher as a result of their participation.

As outlined and discussed in the empirical chapters, a number of important findings emerged from this study. These are summarised in the table below.

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Table 7.1: Summary of key findings Religious

Research Question	**Key findings**
Implication of NGO climate change intervention on livelihood	**Human resources (Households)** Enhanced climate awareness Enhanced adaptive capacity Reported improved nutrition-for a healthy living Improved health and reduce illness Decrease climate change effects on their health Food sufficiency (increase food production)-reduced hunger Enhanced knowledge on agronomy practices Livelihoods diversification-more livelihood sources Employment **Natural resources (Households)** Alternative means of access to land Improved method of cooking Creation of bunds for water conservation Planting of more trees in the farms Reduction in trees felling **Social Capital or Social resources (Households)** Belonged to farmer-based groups Enhanced social networks Enhanced Communal pooling (Kpariba) Women have access to lands-NGOs acquired lands for them Women participating in decision making Amicable resolution of land related conflicts Formation of farmer-based groups Increase community life **Financial resources (Households)** Access to credit Employment creation Access to remittances Financial freedom Acquisition of properties Improvement in financial status Children education Access to good health Increased in family income Reduction of rural-urban migration Reduction of head-porter (kayaaye) Livelihood diversification **Physical resources (Households)** Access to farm inputs Increase in farm size Improved storage facilities-silos for food crop storage

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	Improved seeds Access to farm assets ie tractors, planters, harvesters etc Livelihood diversification
Drivers of household participation in climate change interventions	**Significance positive determinants (Household heads)** • Participation in decision making at community level • Membership of farmer-based organisations **Significant negative determinants (Household heads)** • Gender • Income • Farm size **No significant determinants (Household head)** • Age • Education level • Years of stay in community • Household size
Challenges to the implementation of NGO led climate change interventions	**Corruption** (corrupt NGO staff)- It was found that NGO staff do not give the full package to beneficiaries. **High illiteracy**- most households are unable to read labels on adaptation to climate change technologies, attend workshops on climate change adaptation and also communicate effectively with climate change experts. **Land shortage** (especially among non-natives and women) Where NGOs require land to set up demonstration fields for effective training of farmers to adapt to climate change, they are often faced with the problem of no idle land. Women in particular have peculiar problems with access to land. **Socio-Cultural and Religious Beliefs**- the cultural practices in northern Ghana place women as second-class citizens and any projects targeted at women must involve men to succeed. Rearing of pigs has been rejected in the area due to religious beliefs.

Author's Construct, 2019

7.4 Conclusions

Overall, a number of conclusions can be distilled from the study's findings. In the first place, it is evident from the study that the climate change interventions implemented by

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NGOs in the Northern Ghana are Land Conservation and Smallholder Rehabilitation Projects, livestock development projects, drought tolerant maize for Africa, Promotion of Pearl Millet and Sorghum II, Ghana Environmental Management Project, Conservation Agriculture project, Community Land use Response to Climate Change, Participatory Integrated Climate Service for Agriculture, Climate Seed and Knowledge, Climate Change Adaptation in Northern Ghana Enhanced, and a World Without Hunger (SEWOH).

It was also observed that many of the interventions implemented by NGOs in the Northern Region of Ghana, are in consonance with only three objectives of the Ghana National Climate Change Adaptation Strategy. As previously noted, this policy is aimed at building and strengthening the capacity of local farmers towards increased agricultural productivity and awareness of climate issues, enhancing the living standards of vulnerable groups through livelihood diversification, and promoting existing indigenous knowledge and best practices.

Furthermore, NGOs' interventions on climate change implemented in both regions, has a significant positive effect on the livelihoods of participating households. Thus, the livelihoods of households which participated in the interventions of NGOs, improved overall.

However, human and social capital was regarded as the most affected livelihood asset by NGOs' climate change interventions, with households participating in these interventions having improved livelihoods in terms of human and social resources, as compared to non-participating households.

The study further revealed that households' participation in NGOs' climate change interventions, is negatively influenced by male-headed households, household income, and average household farm size. Similarly, households' involvement in community

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decision-making activities and being a part of farmer-based associations, significantly increases the likelihood of households' participation in adaptation interventions implemented in Northern Ghana.

Finally, the study established that corrupt NGOs' staff, high illiteracy among households, land shortage, socio-cultural and religious barriers, difference in farming households' needs, and absence of support from other institutions, are the major constraints militating against the effective implementation of climate change interventions by NGOs. On the other hand, staff of NGOs opined that the short duration of climate change projects, unpredictability of rainfalls and unfavourable weather conditions in the region, were the most serious challenges hindering the realisation of the objectives of NGOs' climate change interventions.

Generally, the study argues that government efforts alone might not be enough to arrest the fast-growing climate change vagaries. Private sector and civil society organisations have a solid responsibility to influence climate action and commit more resources for climate change adaptation. NGOs were effective in helping the capacities of farmers to climate change adaptation through on-farm and off-farm adaptation interventions such as the preparation and application of compost manure, use of drought-tolerant crops, provision of climate information and other livelihood activities.

The adoption of NGO-led adaptation interventions manifested in the livelihoods of farmers' especially promoting higher productivity, improving soil fertility, empowerment of women and reducing the cost of production for farmers. Farmers raised additional incomes to support their families, specifically, paying children school fees and health. Farmers were also able to provide better general livelihood conditions for their families.

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7.5 Recommendations

- **Coordination among organisations**

  The study recommends that both government institutions and the NGOs implementing 'climate change' interventions should build synergies toward linking up and coordinating climate change interventions implemented in the regions, to avoid duplication of resources in some aspects. This will ensure a full realisation of the objectives of the "Ghana National Climate Change Adaptation Strategy" and hence, the Sustainable Development Goals.

- **Collaboration with other state agencies**

  Given the study's finding on the unpredictability of rainfall and its implications on the climate change adaptation interventions implemented in the Northern Regions, NGOs should collaborate with the Ghana Meteorological Service Department to inform farmers about expected start and end times of rains. This will enable farmers to be acquainted with the weather forecast for their area, in order to adjust their seasonal farming calendar to fully realize the objectives of climate change interventions.

- **Extension of projects duration**

  As was found in the study, climate change adaptation requires a longer period of time. It is therefore recommended that donor organisations extend the duration of climate change adaptation projects to at least five years, to enable farmers adopt technologies introduced through interventions for effective adaptation.

- **Establishment of Farmer-based groups**

  It is further recommended that farming households in the various communities' form groups to enhance their participation in climate change interventions. This can be done through MoFA and other agriculture-based NGOs (e.g., Marker for

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Development - MADE) to link up to the appropriate market, credit sources, and skill upgrading opportunities on modern agronomic practices. This is to enable farmers minimise their vulnerability to climate variability and improve their livelihood.

- **Introduction of Night School System/Adult Education**

  The study recommends the introduction of an adult education system to address the high illiteracy rate among farmers in the country. The 'Night School System' initiated by School for Life, an NGO based in northern Ghana should be reintroduced, and replicated by other NGOs to improve adult literacy among smallholder to facilitate their participation in climate change interventions. This will strengthen the adaptive capacities of the farmers and hence, reduce their vulnerability to climatic stressors.

7.6 Contribution to Knowledge

This study has provided new insights on climate change adaptation interventions by NGOs, and enhances knowledge on the phenomenon. Through its findings and the analysis made, the study makes a number of useful contributions to knowledge.

First, the study contributes to the general literature on climate change adaptation, and its impact on farmers. This is against the backdrop that prior studies did not focus on farmers' livelihood interventions. This study disaggregated the effects of NGOs' climate change intervention on livelihoods, and their effects on livelihoods, and unearthed the high disparity in the social and human resources of farmer households. The study shows that climate change interventions need to be broadened to strengthen the human and social networks of farmer households for better livelihoods. By this, the study has added to what

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was already known (Phillips & Pugh, 2010) about Climate Change impacts on farmers livelihood and has therefore contributed to knowledge.

Secondly, the study is novel given that it is the first to have investigated the role of NGOs in climate change adaptation by using a mixed method approach. While acknowledging that some previous studies assessed the effects of climate change interventions on the livelihood of farmer households, these studies employed either qualitative approaches only (example Jantarasami *et al*., 2010) which lacks the inferences for generalisation; or only quantitative methodology (see Avea *et al*., 2016; Sithole *et al*., 2014) which tend to lack the critical in-depth lived experience of the beneficiaries. By combining both approaches in this study, methodological rigour was enhanced through data and method triangulation, ultimately strengthening the findings and analysis that was presented (Phillips & Pugh, 2010).

Finally, the study contributes policy relevant knowledge on Climate Change. The findings are useful to governmental institutions such as the Food and Agriculture Ministry, Environmental Protection Agency, the District Assemblies, and other NGOs, signaling to them the appropriate areas of adaptation to be targeted to ensure that Ghana achieves the objectives enshrined in the National Climate Change Adaptation Strategy.

7.6 Suggestions for future research

This thesis has provided insights on NGOs-led climate change interventions, and their implications on livelihood adaptation among farmers in the two regions (Northern region and North East region) of Northern Ghana. In conducting the study, some issues were identified which offer opportunities for further studies to elucidate the specific topic, as well as related ones. In the main, it is expected that the findings and analysis made in the

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study will trigger further research interest in studies on climate change interventions, for a more comprehensive understanding of the issue.

Firstly, given that this study was limited in scope to only climate change interventions implemented by NGOs in the two Northern Regions of Ghana, it is suggested that future studies be conducted, to include governmental organisations' interventions on climate change. Furthermore, these studies must extend in coverage to other districts and communities, for deeper and wider understanding of the effects of climate change interventions on livelihoods.

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APPENDICES

Appendix A: Household Questionnaire

This questionnaire is a research instrument to carry out a study on ***"Non-Governmental Organisations Interventions on Climate Change Adaptations and Implications on Livelihoods of Guinea Savannah Farmers in Ghana"*** in partial fulfilment of the requirements for a Doctor of Philosophy (Ph.D) Degree in Social Policy Studies. The data elicited from participants shall be used solely for academic purposes and respondents are assured of the strictest confidentiality.

Your selection has been random. However, you reserve the right **TO** or **NOT TO** participate in this survey since participation is voluntary rather than mandatory. Your participation in this survey will only require your time, but no cost. Conversely, there is no direct benefit accruable to respondents for participation. I would appreciate your time for participation in this survey.

The expected duration for this survey is about 30 minutes and will solicit responses on personal characteristics, farming activities, climate variability, access to credit and extension services, and other institutional and environmental issues pertinent to the survey.

Reports of findings emanating from this survey would be treated confidential and analysis of responses would be based on aggregates of all responses, without mentioning names of individual respondents.

To show your approval to participate in this survey without any condition, kindly sign or thumb print the respondent section of this consent form.

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Thank you in advance.

....

Name of respondent Signature/Thumb print

....

Name of enumerator Signature/Thumb print

Contact Details:

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University of Ghana, Legon

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Section A: Demographic Characteristics of Respondents

Name of Respondents…… Serial Number…….

Mobile Number…… Date of Interview …./…./2018

Name of Town/Village…….. Name of Municipality……

A. Demographic Information

1. Age of respondent: …….

2. Gender of respondent: 0. Male 1. Female

3. Education of respondent: 1. None 2. Primary Education 3. Middle/JSS 4. SSS/Tech/Voc 5. Training College f. Tertiary

4. Marital Status: 0. Single 1. Married 2. Divorced/Separated 3. Widowed

5. Religion: 1. Traditional religion 2. Christian 3. Islam 4. Other, specify……

6. Ethnicity: 1. Dagomba 2. Mamprusi 3. Nanumba 4. Frafra 5. Moshe 6. Akan 7. Other, specify……

7. Place of Origin of respondent: 1. Native 2. Settler/Migrant 3. Other, specify…….

8. How often do you stay/reside in the community/village: 1. Stay during the farming season 2. Stay throughout the year.

9. Years of farming experience of respondent: ……

10. Are you the head of your household? 0. No 1. Yes

11. If no, provide name of household head: ……..

12. Sex of Household Head: 0. Male 1. Female

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13. Age of Household Head: ……

14. Household Size: ……

15. Type of land ownership: 1. Own land (purchased/Inherited) 2. Rented 3. Shared holding

16. Do you belong to a Farmer Based Organisations (FBOs) or any Cooperative: 0. No 1. Yes

17. If yes to question 16, name the organization/cooperative……

Occupational information

18. What crops do you grow? *Please tick as many as applies to you*

a. Millet [ ] b. Maize [ ] c. Soya Beans [ ] d. Groundnuts [ ] e. Yam [ ] f. Cowpea [ ] g. Vegetables [ ] h. Cassava [ ] i. Yam [ ] j. Cotton [ ] Others please specify ……

19. Can you please state the size of your farm? [ ]

20. For what purposes do you farm?

a. As a major occupation [ ] b. For income [ ] c. To provide the family with food [ ] d. As a hobby [ ] Others please specify……

21. Please tick as much as is applicable to you the major tools and implements you use in undertaking your activities? a. Hoe [ ] b. Cutlass [ ] c. Plough [ ] d. Water Cans [ ] e. Water hose [ ] Others please specify……

22. Do you rear animals? a. Yes [ ] b. NO [ ]

23. What animals do you rear? a. Goats [ ] b. Sheep [ ] c. Cattle [ ] d. Chicken [ ] e. Guinea fowl [ ] f. Pigs [ ] Others please specify ……

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24. Do your family members help you in your farming activities? a. Yes [ ] b. NO [ ]

25. Do you use hired labour on your farm? a. Yes [ ] b. NO [ ]

26. If yes, to Q8, how many days per season? [ ]

B. Awareness and Understanding of Climate Change

27. Have you observed any changes in the climatic conditions of this community in recent years?

a. Yes [ ] b. NO [ ]

28. If yes, kindly describe some of the changes you have observed.

a. Increasing temperatures [ ] b. Rains coming when they are not expected [ ]

c. Increased incidence of storms [ ] d. Loss of vegetation cover [ ]

e. Loss of soil fertility [ ] f. ***Others please specify*** ……

29. Has these changes affected your farming activities? Please tick as many as are applicable.

a. Low yields [ ] b. Plant pests and diseases [ ] c. Animal diseases [ ]

d. Animal mortality [ ] e. Loss of crops as a result of intense sunshine or high rainfall

f. ***Others please specify*** ……

30. How many years have you observed these changes?

a. For about 5 years [ ] b. Between 6-10 years [ ] c. Between 10-15 years [ ]

d.15- 20 years [ ] e. more than 20 years [ ]

31. What do you think is the cause of these changes? a. God/gods b. Deforestation c. Bush burning d. Increased population e. Others (specify)……

32. Have you taken any steps to adjust to the changes? a. Yes [ ] b. NO [ ]

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33. If yes, can you describe some of the measures you have put in place to cope with the situation?……

……

……

34. Are the measures effective to deal with the changes? a. Yes [ ] b. NO [ ]

Please explain …….

……

……

35. What are members of your community doing collectively to address the changes in the environment?

……

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……

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Section B: NGO interventions that have implications on climate change adaptations

36. Do you receive any form of support from any institution to help you adapt to climate change? a. Yes [ ] b. NO [ ]

If no, please skip to question 39

37. If yes to Q36, which of the following climate change adaptation interventions by NGOs do you practice (in the last 1 or 2 crops growing season)? Tick all applicable.

S/No.	Name of Climate-Smart Agricultural Practice	NGO intervention (yes=1, No = 0)	Farmer adoption (yes=1, No = 0)
1.	Fire belt to control wild fires		
2.	Control of indiscriminate tree cutting		
3.	Ploughing across slopes		
4.	Stone bunding		
5.	Composting		
6.	Intercropping with leguminous crops eg. Mucona, Soya bean		
7.	Planting early maturing crop varieties		
8.	Planting drought/flood resistant crop varieties		
9.	Tie ridging/Contour Farming		
10.	Tree Planting		
11.	Use of Climate information		
12.	Use of market information (e.g Pricing)		
13.	Crop residue management for animal feed production		
14.	Ploughing back of crop residue after harvesting		
15.	Harrowing		
16.	Dibbling		
17.	Mixed farming		
18.	Mixed cropping		

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19.	Irrigation		
20.	Creating drainage channels in farms		
21.	Mulching		
22.	Livelihood diversification		

38. Can you mention the names of institutions that offer you support?

……

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Section C: Livelihoods of Smallholder farming Households

39. Please respond to the following livelihood indicators with Yes/No or writing the appropriate response where applicable.

Livelihood Indicator	**Yes**	**No**
Human Capital		
Has your household nutrition improved for the past one year		
Has this Household safe a member, or escape any injury or new diseases?		
The adverse effect of climate change on the health of my HH has reduced for the last 5 years		
HH average food sufficiency months		
Number of crops cultivated by HHs (crops diversification)		
HHs average crop yield of major crops		
Livelihood diversification		
HH member(s) have had vocational training to acquire skills on other livelihoods		
Highest educational level of HHH (years)		
Average age of Household Head (HHH)		
Access to training on agronomic practices		
Farming experience		
Natural Resources		
HHs has regained eroded and degraded farm lands		
I have been empowered to participate in decisions on climate change adaptation in my community		
Average distance to farm land		
Do you HH depend only on the forest for its source of energy for cooking?		
Do you think there is a reduction in the depletion of forest products?		
HHs that collect water directly from natural sources (river, stream, pond)		
There is consistent water supply to my household		
Depletion of natural water sources has reduced		
Social Resources		
Has your HH engaged in any land related conflicts with another HH?		

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Has HHs sought for assistance from the local assemblies/chiefs		
HH years of stay in community		
Participation in decision making on community adaptation to climate change		
Financial Resources		
HH has been assisted by an NGO to engage in non-agricultural livelihood source		
HH access to remittance		
HHs access to financial credit		
Do your HH experience financial crisis		
Average HHs farm incomes		
Average non-farm income		
Physical Resources		
Road network in my community has improved		
HH has access to farm inputs (fertilizer, agro-chemical, etc) by HHs		
Agricultural livelihood diversification		
Access to farm assets (eg tractor, harrow, planter, etc)		
Average HH farm size		
Do HH save crops for sales during off-season		
Do HH save seeds for next season		

Section D: Local mechanisms for evaluating outcomes of climate change adaptation interventions

40. How easy is it for you to approach institutions for adaptation support? a. Very easy [] b. Easy [ ] c. Indifferent [ ]

b. Difficult [ ] e. Very difficult [ ]

41. Have you personally approached an institution for support in climate change adaptation? a. Yes [ ] b. NO [ ]

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42. If yes, can you tell me your experiences?

a. Frustration b. successful c. slow but successful d. not successful e. chased away

43. If no, tell me the experience of those you know who tried.

……

…….

36. Can a farmer group approach an institution for aid in adaptation to climate change?

a. Yes [ ] b. NO [ ]

37. If no, please explain why

……

……

38. Are there any selection criteria for farmers to satisfy before they are given support by any institution? a. Yes [ ] b. NO [ ]

39. If yes, please explain the selection criteria …….

……

40. How best do you think your livelihood can be improved in the face of climate change? Tick all applicable:

a. Training on livelihood diversification b. Access to credit c. training on climate smart agricultural practices d. access to market. e. access to climatic information f. policy enactment by government

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Section E: Constraints that affect NGO climate change adaptation interventions.

Tick all constraints militating against the effective implementation of NGOs intervention activities in assisting farming household adapt to climate change. Rank these constraints in order of pressing using the 1,2, … and 7, with 1 denoting the most pressing constraint.

Constraint	Tick (√)	Rank
High illiteracy among farming households		
Corrupt NGO officials		
Socio-cultural and religious barriers		
Land tenure issues		
Difference in farming households' needs		
Absence of support from other institutions such as community leaders, governmental organisations and other corporative		
Misconception of NGOs activities by households		

41. What gaps are there in current adaptive strategies or interventions you provide for groundnut farmers?

42. Explain how local participation (within different social groups) is included in the formulation of your interventions and adaptation programs.

……

……

……

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43. Sources of Income (Please complete the table below)

Source of Income	**Amount in GHS (2017/18 farming season)**
1. Farming (sales from last harvest)	
2. Off-farm activities (e.g. labourer)	
a. Wage	
b. kind (estimate in monetary terms)	
3. Petty trading	
4. Formal Occupation (e.g. teacher, nurse etc.)	
5. Remittances	
6. Pension / government transfers	
7. Other, specify	

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Appendix B

Interview Guide for NGOs Staff

The interview guide is a research instrument to facilitate a semi-structured interview to carry out a study on ***"Non-Governmental Organisations Interventions on Climate Change Adaptations and Implications on Livelihoods of Guinea Savannah Farmers in Ghana"*** in partial fulfilment of the requirements for a Doctor of Philosophy Degree (Ph.D) in Social Policy Studies. The data elicited from participants shall be used solely for academic purposes and respondents are assured of the strictest confidentiality.

Section A: Demographic Characteristics of Respondents

1. Organisation of respondent ……
2. Gender…….....
3. Job Position.....
4. Number of years you have been in your present position.....

Section B: NGO interventions that have implications on climate change adaptations

1. What projects of your NGO aim at improving farmers adaptation to climate change?
2. How often does your organisation engage in each of these activities?
3. What specific activities do your organisation embarks on to help farmers adapt to climate change?

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4. Climate Change Interventions implemented by NGO since 2000

Name of Project	Duration of project	Project objectives	Activities	Beneficiary Communities

Section C: Implications of NGO interventions on livelihoods of small holder farmers

1. In helping out farmers, how exactly do you identify your beneficiaries?
2. Do you think the interventions you give to farmers have implication on their livelihoods? Please explain your answer
3. Explain at least four (4) main ways in which the assistance you give to farmers has improved upon their livelihoods.
4. Do you receive success stories from your interventions? Could you tell at least three or four?
5. What do you think would have become of these farmers without the interventions NGOs offer them?
6. How do your interventions influence the following measures of livelihood?
    i. Farmers' access to *Physical assets such as* tools and equipment for adaptation
    ii. Access to financial resources
    iii. Human assets including providing them with skills, knowledge and adaptation techniques
    iv. Provision of public assets to enhance adaptation

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Section D: Mechanisms for evaluating outcomes of climate change adaptation interventions

1. How do you monitor the progress of your interventions you offer to smallholder farmers?
2. What mechanisms do you use evaluate the outcomes or aftermaths of your interventions?
3. How do you know your interventions have been successful or not?

Section E: constraints that affect NGO climate change adaptation interventions.

1. What main challenges constrain your efforts in improving farmers adaptation to climate change?
2. How do you think the interventions for climate change adaptation could be enhanced
3. Any recommendation?

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Appendix C

Check List for Community Focus Group Discussion

Section A: Local mechanisms for evaluating outcomes of climate change adaptation interventions

1. How do you monitor the progress of NGOs interventions on smallholder farmers?
2. What mechanisms do you use evaluate the outcomes or aftermaths of your interventions?
3. How do you know your interventions have been successful or not?
4. What do you think is the cause of these changes? a. God/gods b. Deforestation c. Bush burning d. Increased population e. Others (specify)……
5. Have you taken any steps to adjust to the changes? a. Yes [ ] b. NO [ ]
6. If yes, can you describe some of the measures you have put in place to cope with the situation?……..…

   ……

   ……
7. Are the measures effective to deal with the changes? a. Yes [ ] b. NO [ ]

Please explain …….

……

……

8. What are members of your community doing collectively to address the changes in the environment?

……

……

……

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Section B: NGO interventions that have implications on climate change adaptations

9. Do you receive any form of support from any institution to help you adapt to climate change? a. Yes [ ] b. NO [ ] ***If no, please skip to question 11***

10. If yes to Q9, which of the following climate change adaptation interventions by NGOs do you practice (in the last 1 or 2 crop growing season)? Tick all applicable.

S/No.	Name of Climate-Smart Agricultural Practice	NGO intervention (yes=1, No = 0)	% of Farmers adopting strategy
1.	Fire belt to control wild fires		
2.	Control of indiscriminate tree cutting		
3.	Ploughing across slopes		
4.	Stone bunding		
5.	Composting		
6.	Intercropping with leguminous crops eg. Mucona, Soya bean		
7.	Planting early maturing crop varieties		
8.	Planting drought/flood resistant crop varieties		
9.	Tie ridging/Contour Farming		
10.	Tree Planting		
11.	Use of Climate information		
12.	Use of market information (e.g Pricing)		
13.	Crop residue management for animal feed production		
14.	Ploughing back of crop residue after harvesting		
15.	Harrowing		
16.	Dibbling		
17.	Mixed farming		

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18.	Mixed cropping		
19.	Irrigation		
20.	Creating drainage channels in farms		
21.	Mulching		
22.	Livelihood diversification		

11. Are the measures effective to deal with the changes? a. Yes [ ] b. NO [ ]

Please explain

…….

……

……

12. What are members of your community doing collectively to address the changes in the environment?

……

……

……

13. Can you mention the names of NGOs and the project that offer you support?

Name of Project	Implementing NGO	Start date	End date	Project aim and activities

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RESPONSE MEMO

Candidate Name: Abdallah Tahiru

Index Number: 10240040

Thesis Title: **CLIMATE CHANGE ADAPTATION INTERVENTIONS BY NON-GOVERNMENTAL ORGANISATIONS IN SAVELUGU MUNICIPALITY AND WEST-MAMPRUSI DISTRICT IN NORTHERN GHANA: IMPLICATIONS FOR LIVELIHOODS OF SMALLHOLDER FARMERS**

Comments and Corrections/Responses to comments

No.	Comment	Students' Response to comments
Examiner One (1)		
1	The thesis title should have the two districts	Revision has been effected.
2	Justification for the selection of two districts inadequate	The study considered two regions of Ghana i.e., Northern and North East Regions, which were purposely selected. Again, the researcher selected two districts (one in each region) based on the reasons below. The Savelugu Municipality in the Northern region and West-Mamprusi District in the North-East region were therefore selected. However, until the recent creation of the new regions, both were in the Northern Region. There are four-major parameters that underpinned the selection of the two regions and the districts. The first reason is the ecological zone of the area; the second reason is the nature of farming activities;

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		the third reason is the presence of NGOs and the last reason is ease of access to the communities by the researcher. Both study areas' ecological zones are Sudan savanna, which observes about 1000mm/year of rainfall with only 150-160 days of the growing season for crops. The nature of farming is mainly on a smallholder basis. Even though, there are very few commercial farmers who are found in the main cities of the area. In relation to NGOs, there are a good number of both local and international NGOs in the study area, working to improve the livelihoods of vulnerable people through agriculture, health, education and governance. The study sites are both located on the main Tamale-Bolgatanga road, making it easier and cost-effective for the researcher to carry out the research while still achieving the study's purpose. Other consideration for the selection of this study area is its mix of urban and rural population who are predominantly smallholder farmers and contribute greatly to the regional crop output. The area has an influx of many NGOs who have facilitated the activities of these farmers in diverse ways. Such unique characteristics enabled the researcher to evaluate the NGOs' interventions that are related to climate change adaptation and more importantly their impact on livelihoods of recipients. (Page 57)
	One of the research questions was to ascertain the extent to which NGOs adaptation interventions are consistent with the National Climate Change Adaptation Strategy.	In the main work, on page 102, I juxtaposed the consistency or otherwise of the aims and objectives of those interventions and how

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3		they relate to the national climate change goal. The content is as captured below: "The main goal of the Ghana National Climate Change Adaptation Strategy is to enhance Ghana's current and future development to climate change impact, by strengthening its adaptive capacity and building resilience of the society and ecosystems. To achieve this goal, all climate change interventions must be geared towards five main specific objectives, including improving societal awareness and preparedness for future climate change: enhancing the mainstreaming of climate change into national development to reduce climate change risks; increasing the robustness of infrastructure development and long-term investments; enhancing the adaptability of vulnerable ecological and social systems by increasing the flexibility and resilience of these systems; and fostering competitiveness and promoting technological innovation (Ghana National Climate Change Adaptation Strategy, 2013). It was also observed that many of the interventions implemented by NGOs in the Northern Region of Ghana, are in consonance with only three objectives of the Ghana National Climate Change Adaptation Strategy. As previously noted, this policy is aimed at building and strengthening the capacity of local farmers towards increased agricultural productivity and awareness of climate issues, enhancing the living standards of vulnerable groups through livelihood diversification, and promoting existing indigenous knowledge and best practices.

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		For example, RAINS which has the CHANGE project that seeks to assist smallholder farmers especially women in Northern Ghana to understand the causes and effects of climate variability and climate change and to embrace innovative adaptive measures to ensure sustainable, household food security and livelihoods. The Adaptation of Agro-Ecosystems to Climate Change is a component of the Market-Oriented Agricultural Program by GIZ with the aim of reducing climate-related yield losses for farmers and to incorporate the results of the measures into the agricultural sector policy on adapting land-use systems to climate change" (Page 102).
4	What shows beneficiaries show better outcomes as a result of adaptation interventions by NGOs?	The findings of the work have pointed to the following outcomes of those interventions: Furthermore, NGOs' interventions on climate change implemented in both regions, have a significant positive effect on the livelihoods of participating households. Thus, the livelihoods of households which participated in the interventions of NGOs, improved overall. However, human and social capital was regarded as the most affected livelihood asset by NGOs' climate change interventions, with households participating in these interventions having improved livelihoods in terms of human and social resources, as compared to non-participating households. **The overall livelihood effect index** indicates a **higher livelihood index of 0.56** for those participated than those who didn't. The results indicate that **the average treatment effect of the treated (ATT)** the **difference is significant 1%** indicating their

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		participation in NGOs Interventions **leads to 0.3610 increased in their livelihood index** for those who benefited. Pages 133 --136
5	Why not limit the study to selected projects instead of all the interventions implemented by NGOs in the two districts? Table 4.3 should show all the climate change interventions implemented and not selected ones.	The novelty; unlike other works which concentrated on individual projects. This particular thesis employed more than one project. Thus, multiple projects were studied and adopted for this study. These projects were looked at in relation to how consistent there are with the Ghana national climate change adaptation strategy document. This has been captured at the introduction stage of the work. I have explained at the introductory stage of the thesis that, this particular study focused on only interventions implemented by NGOs excluding governmental organisations. This is found in page 1. For example, it was apparent that not all the interventions were implemented by NGOs. Some of the projects were implemented by governmental agencies such as MoFA and EPA. Therefore, this study concentrated on only projects implemented by NGOs.
6	What is the social dimension of this study?	The social dimension of this work relates to unraveling the extent to which NGO interventions inure to the benefits of the ordinary citizens. This will inform donors to redirect their social support towards Climate Change Intervention. In other words, the findings reveal that these NGOs work has significant impacts on the livelihood of the beneficiaries. Which simply means that going forward, the government of Ghana's current call for *Ghana beyond Aid* could be strengthened through the support of these NGOs. The

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	What is the social policy in this work?	study also reveals that, NGOs play a crucial role in terms of the livelihood improvement of people. Government should be able to set up state institutions that will be able to take up the role of the NGOs so that this institution could use most of this donor funding that are normally channeled to NGOs to embark on their activities. This study is about livelihood improvements of smallholder and how NGO interventions on climate change adaptation enhances the livelihoods of this vulnerable groups.
7	Missing references in the text and the references in the list that are not cited in the text.	I have perused the thesis document severally and ensured that all sources cited are captured under the references section.
8	Proof reading	The work has been proofread by experts at the University of Ghana-Carnegie Writing Centre. Therefore, grammatical errors have been eliminated.

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CANDIDATE

23/04/2021

ABDALLAH TAHIRU **DATE**

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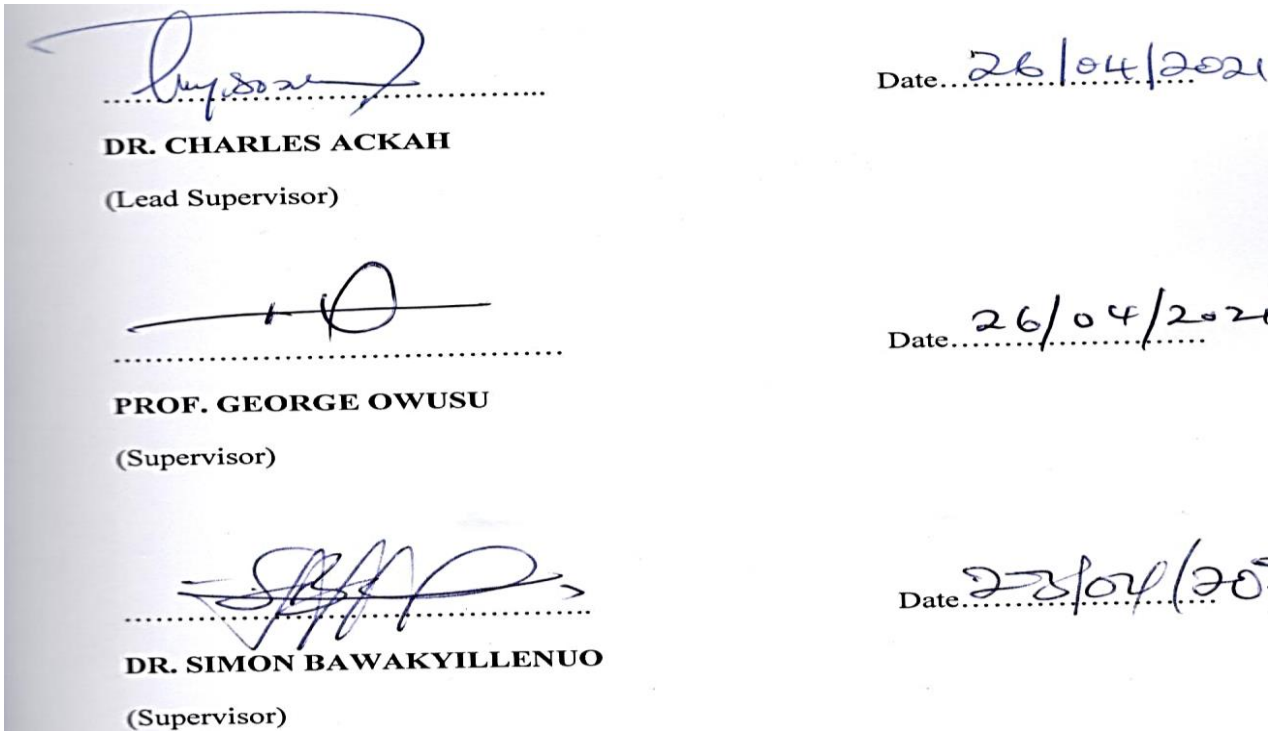

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