

**UNIVERSITY OF NAIROBI**

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**DEPARTMENT OF SOCIOLOGY AND SOCIAL WORK**

**ADAPTATION STRATEGIES OF SMALL-SCALE FARMERS TO CLIMATE CHANGE  
AND FOOD SECURITY: THE CASE OF KIAMBAA CONSTITUENCY, KIAMBU  
COUNTY**

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## **DECLARATION**

This project is my original work and has not been presented for a degree in any other academic institution, college or university.

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This research project has been submitted with my approval as University supervisor.

**Signed** \_\_\_\_\_ **Date** \_\_\_\_\_

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**Supervisor**

## **DEDICATION**

I dedicate this project to my beloved parents Emily Jepkurui Konyaei and Bob Kennedy Ambuga Kahonga who established the groundwork for my schooling and my siblings; my late brother Evans, my sisters Brenda and Florence. I love you so much.

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## ABSTRACT

Changes in climate have affected both developed and developing nations with equal measure, affecting both the underprivileged and the privileged in both countries. This study aimed at assessing the adaptation strategies of small-scale farmers to climate change and food security in Kiambaa Constituency, Kiambu County. The objectives of this study were: to examine the perception of small-scale farmers in Kiambaa Constituency, Kiambu County on climate change, to investigate the strategies adopted by farmers as coping mechanisms to climate change and to examine household food security in Kiambaa Constituency, Kiambu County. A total of thirty (30) respondents were selected for interviews using snowball sampling approach. Both quantitative and qualitative design was used in this research study. Data collection instruments used were in-depth interviews and focus group discussions.

The study results show that farmers are aware of climate change and are aware of the various ways environmental adjustments have an effect on their livelihoods. The themes that emerged from the interviews were that climate change was perceived as increased temperature, unpredictable rainfall, and an increase in recurrence of drought consequently impacting crop production.

There are various strategies that the farmers adopted to cope with the effects of increased temperatures. These included stop cultivating some crops, shift to shorter cycle crops, shift to high yielding seeds and crop variety, mixed cropping, and reduce the size of the farm and irrigation. Despite the challenges of decreased/unreliable rainfall, the small-scale farmers are consistently making efforts to cope and adapt to the changes. Some of the strategies they have adopted include changes in planting dates, use of higher-yielding seeds and crop variety and irrigation. The adaptation strategies opted by farmers to cope with drought included the shift to drought-resistant crops, shift to higher-yielding seeds and crop variety and use of trenches. To cope with decreased production the adaptation strategies comprised of the use of pesticides, shift to higher-yielding seeds and crop varieties, diversify income, and introduction of new crop variety.

The Household Food Insecurity Access Scale (HFIAS) measurement tool revealed that food in the households was insecure due to it being insufficient quality. Generally, the adaptation techniques to climate alternate were found to have a tremendous contribution to crop production and for that reason food security to most of the small-scale farmers in the study area, regardless of low possibilities on applying by farmers.

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# CHAPTER ONE: INTRODUCTION

## 1.1. Background of the Study

Changes in climate have affected both developed and developing nations with equal measure, affecting both the underprivileged and the privileged in both countries. Developing countries and the underprivileged in these countries are, however, more susceptible to the effect of changes in climate (Adger *et al.*, 2003). According to IPCC (2007), in the face of climatic changes and variability are perhaps the most extensive environment challenge of our time posing worldwide an excessive challenge to sustainable progress. These are no longer merely potential threats but an inevitable reality. It is therefore important to give just as much attention to managing the effects of a rapidly changing climate as it is to measures how communities are adapting to these changes. The areas probable to experience the utmost have an effect on are the economic system, food security, water bodies, ecosystems, coastal areas, health and the spreading of populaces and settlements. Generally, due to the outstanding deficiency of monetary, institutional and technological capability, Africa is regarded as susceptible to changes in climate effects (Eriksen *et al.*, 2008).

Changes in climate is anticipated to disproportionately have an effect on small-scale farmers by more aggravating the threats that they face. The latest studies demonstrate that even a moderate increase in temperatures can have an adverse impact on food grains such as rice, maize, and wheat, which are the most leading cereal crops of small-scale farmers (Harvey *et al.*, 2014). Environmental alteration is furthermore anticipated to change pests and disease occurrences, increasing the recurrence and seriousness of dry seasons and downpours and spike the likelihood of depressed yields, disappointment, and eutherian mortality, among others.

Agronomy is the predominant basis of the conducive mainstream of both rural and urban families in economically evolving nations, Hence, an applicable response by way of the farming segment to the

unwanted outcomes of changes in climate is crucial if food security is to be ensured. Adaptation to local weather change is a compelling extent at the farm level, which can minimize weather susceptibility through making rural families and societies more capable to organize themselves for adjustments in climate variability. This will stall the projected damages brought about by means of detrimental climatic activities (IPCC, 2001).

According to the Kenya National Bureau of Statistics (KNBS, 2018) Economic Survey, the agricultural sector has continued to be the major contributor to Kenya's economic growth. Agriculture contributes nearly 26% of the Gross Domestic Product (GDP). The sector recorded combined overall performance in 2017 which led to a decelerated growth of 1.6 percent in contrast to a 5.1 percent increase in 2016. This reduced increase is by and large attributed to drought coupled with pests (such as the fall armyworms) and to disease which led to the general deterioration in agricultural production.

In Kenya, the agricultural sector is the central basis of employment in rural areas. The sector is dominated by the aid of small-scales who account for about 75% of the complete agricultural output. For the agricultural region to proceed to contribute considerably to the usual aim of monetary growth, capital creation, food, and sustenance security and poverty mitigation, small-scale agriculture ought to be changed (KALRO, 2017).

## **1.2. Statement of the Research Problem**

Agreeing to Nicholson, (2015), aridity has expanded significantly in Africa since the 1970s. Cultivating frameworks and sustenance of rural populations have experienced the massive outcomes of climate perturbation. This has led to changes in the highest quality increase for yields and has extended pest occurrences leading to very low agricultural yields. Crop income is anticipated to

depreciate even further given the ongoing weather changes as affected by climate change. Food security is additionally anticipated to diminish (Schlenker and Lobell, 2010). Hitherto, the agronomy segment is what nations rely on to altogether add to the decrease of destitution and accomplishment of the Sustainable Development Goals (SDGs).

Climate change manifestation brought about eccentric and discouraged harvest yields and to loss of animals, prompting enduring nourishment deficiencies and over-dependence on crisis nourishment based mediations to meet neighborhood nourishment shortfall (GOK, 2005). Cultivating practices, for example, crop, soil, land, and water the executives' innovations are key adjustment systems however usage stays low, particularly in Sub-Saharan Africa (Bryan et al., 2013). Adjustment is significant proposing to the unfavourable effects of atmosphere dangers. It is contended that nourishment security can be expanded with adjustment to the negative impacts of environmental change (Di Falco, 2014).

In Kenya, household food insecurity is alarmingly high (Gitu, 2004). Small-scale farmers through local agricultural food production continue to face more challenges in coping with erratic weather patterns, and this is despite the formulation of national food policies aimed at alleviating household food insecurity (GOK, 2008). Farming is the major agricultural activity in Kiambu County and backs 17.4 percent of the region's populace pay. In the county, changes in climate have led to the irregularity of rainfall, resulting in low food production. Be that as it may, there is no archived proof on the effect of environmental change in the county and thus the requirement for an exhaustive report so as to adjust viable techniques to address the issue (CGK, 2015).

Smit and Olga (2001) contend that there is a need to look at explicitly the adjustment of the conditions that really happens in economic and social frameworks and the ramifications of future climatic conditions. In any case, there is information scarcity on farming adjustment techniques embraced by the small-scale farmers in Kenya in most counties, and especially in Kiambu.

Adaptation decisions by farmers are directed by their impression of climate change and associated dangers. It is of worry to evaluate how small-scale farmers recognize the progressions previously occurring in their climatic locales and to further survey the methodologies they take on to adapt and adjust to these changes. The adapting and adjustment methodologies that little scale small-scale farmers adjust depend, to an enormous degree, on their recognition and information in regards to environmental change. This study, subsequently, targets at assessing how changes in climate are being perceived by small-scale farmers and to establish the adaptation procedures that these small-scale farmers have adjusted to living with the effects of environmental change. The examination will concentrate on small-scale farmers in Kiambaa Constituency, Kiambu County. The reason for choosing Kiambu County is on the grounds that it's an extraordinary agrarian potential and Nairobi County acquires a lot of its food from there. It is trusted that the outcome of this research study will prompt the improvement of appropriate strategies that will help small-scale farmers to conquer the climatic changes achieved by environmental change.

### **1.3. Research Questions**

This study was guided by the following research questions:

1. What are the perceptions of small-scale farmers with regard to climate change?
2. What strategies have farmers adopted to cope with the effects of climate change in ensuring household food security?
3. What is the status of household food security in Kiambaa Constituency, Kiambu County

## **1.4. Objectives of the Study**

The main objective of this study was to examine the perception and adaptation strategies of small-scale farmers to climate change in Kiambaa Constituency, Kiambu County.

The specific objectives of this study were:

1. To examine the perception of small-scale farmers in Kiambaa Constituency, Kiambu County on climate change;
2. To investigate the strategies adopted by farmers as coping mechanisms to climate change;
3. To examine household food security in Kiambaa Constituency, Kiambu County.

## **1.5. Justification of the Study**

Farming is the key dominating economic in the region and backs 17.4 percent of the county's people wage. More attention has been paid to environmental change framework demonstrating, environmental change effects, adjustment, and risk evaluation, anyway unfathomably little consideration has been committed to the observations and choices for adjustment of those encountering environmental change. On account of environmental change impacts on little scale agribusiness, what is evident is the opening between researchers' assessment of world environmental change and small-scale farmers' responsiveness. Notwithstanding the remarkable improvement of climate science in comprehension and managing the issue of changes in environmental and its effects on the agronomic sector at the overall level, mindfulness, and worry for the issue at neighborhood levels, explicitly between the rural small-scale farmers in Africa, stays significant. Concentrates in different pieces of the world have demonstrated that ranchers adapt to environmental change fundamentally dependent on their view of modifying the atmosphere (Li et al., 2013).

Climate change adjustment may moreover be seen as a reaction to environmental change impacts. Adjusting to atmosphere dangers is key to the reason for expanding nourishment security and improving the strength of cultivating frameworks. As per (IPCC, 2001) environmental change adjustment is the alteration in natural and financial frameworks to the correct or foreseen environmental change so as to limit the negative and improve the compelling effects of environmental change. Adjustment unmistakably changes the general public needs to make to enhance environmental change sway. Low-level on small-scale farmers' mindfulness may also antagonistically influence their strength to environmental change impacts as mindfulness is necessary for adapting to or planning for environmental change and changeability. The degree of small-scale farmers' ability of their condition should be a manual for reacting effectively to the difficulties of environmental change and upgrade efficiency.

The results of climatic shocks and over the top climate happenings cause suffering on small-scale farmers and the reality that there is climatic changed before and will keep on evolving, later on, underlines the need to capture how small-scale farmers see and adjust to environmental change effects to control imminent adapting methods to diminish the adverse effects (Hepworth and Goulden, 2008).

## **1.6. Scope of the Study**

The study focused primarily on addressing the perception and adaptation strategies of small-scale farmers to climate change examining food security in Kiambaa Constituency, Kiambu County. The findings of the study are meant to provide an in-depth understanding of climate changes among the small-scale farmers' for better adaptation strategic planning which will later improve planning schemes in agriculture and other economic sectors. The study did not examine large scale farmers, therefore, the results may only be applicable to Kiambu small scale farmers.

## 1.7. Significance of the Study

The study aimed at establishing the status of household food security and coping strategies among small scale farmers in Kiambaa Constituency, Kiambu County. Small-scale farmers' perceptions of climate change would improve current strategies and interventions to ensure successful adaptation strategies. The findings of the study will be shared and discussed in Kiambu food security stakeholder meetings. Understanding how small-scale farmers cope with and respond to climate change would enable policymakers to enhance and develop policies and strategies that could help small-scale farmers to cope and adapt to these changes.

Therefore, the findings will be shared with the Ministry of Agriculture and Livestock to provide relevant input in policymaking in the area of household food insecurity and small scale farming practices. This will help in capacity building and empowerment among the small scale farmers concerning household food insecurity and coping strategy issues.

The findings will provide relevant data to local NGOs in planning food aid support programmes. The findings will also contribute to the body of knowledge in academia and may provide insights on food security gaps for further academic research.

## 1.8. Definition of Concepts

**Adaptation:** includes a preliminary layout and measures to reduce the vulnerability of natural and human systems towards authentic or expected stresses.

**Climate change:** Long-term change in world weather patterns, associated in particular with the make bigger in temperature and rainfall activity. A change in the country of the local weather that can be identified (e.g., by means of the usage of statistical tests) with the aid of modifications in the



mean and/or the variability of its properties and that persists for an extended period, commonly many years or longer (IPCC, 2007).

**Coping strategies:** Ways of lowering impacts of a poor event once it has happened such as household food insecurity.

**Household:** A unit comprising of a group of persons dwelling together, sharing from the equal dietary pot and the identical supply of livelihood on a normal basis.

**Household food insecurity:** The incapacity of a household to have sufficient meals to furnish and sustain its members' dietary intake. Household food insecurity has three components: Unavailability, lack of getting right of entry to and non-utilization of meals.

**Small-scale farmers:** Farmers whose agricultural orientation is usually subsistence and cultivate land no longer exceeding 10 acres.

# **CHAPTER TWO: LITERATURE REVIEW AND THEORETICAL FRAMEWORK**

## **2.1. Introduction**

This section will discuss the following; Concept of climate change, Impact of climate change, perception of farmers on climate change, adaptation strategies to climate change by small-scale farmers, household food security and conceptual framework. Sources of the literature will be internet, journals, government documents, newspapers, textbooks, and visual media.

## **2.2. Concept of Climate Change**

Agreeing to IPCC (2001) any substitute in the climate after some time, paying little respect to whether as a result of regular changeability or in light of human development. This complexity from that in the Framework Convention on Climate Change, where climatic changes suggest an exchange of climate that is accredited rapidly or by suggestion to human development that adjusts the production of the overall air and that is despite trademark environment changeability saw over for all intents and purposes indistinguishable timespans. The incessant uncommon changes in climate designs watched thinking about the 1950s, have prompted a considerable accord about a changing world climatic framework (IPCC, 2013). Writing shows that the worldwide amounts of a day off-ice have decreased radically, ocean degrees have risen and the centralizations of ozone-depleting substances in the biological system have quickened fundamental to alterations in precipitation and precipitation designs, expanded in the recurrence of the dry season and tempest related occasions (Pittock, 2009).

The pattern of changes in worldwide climatic conditions is tragically happening with respect to other developmental stressors like HIV/Aids; variances in market costs of oil and mineral assets; obligation emergency; rising destitution levels; and general food insecurity in Africa (Stringer, et al., 2009). The blend of these elements further puts strains on the limit of African governments to put resources into climate change moderation and adaptation programs.

Nonetheless, the Intergovernmental Board on Climate Change (IPCC, 2007) further shows that Africa is amongst the exceptionally defenseless landmasses on the planet to changes in worldwide climatic conditions because of its low versatile limit and affectability to changes in climatic factors, especially the rural division. In spite of this disclosure, a key property of national and mainland thinks about change in climate impacts evaluation; moderation procedures; and adaptation systems in Africa is that they need idiographic subtlety (Nkomwa, et al., 2014).

### **2.3. Impact of Climate Change**

Production in agriculture is anticipated to be compromised by changes in climate, especially in small-scale structures with minimal versatile limit, as at present ordinary in numerous pieces of Africa. Understanding the particular effects of local changes in climate on food wellbeing is troublesome in light of the fact that vulnerabilities are unevenly unfurling all through the world and in this manner rely upon the limit of networks and nations to adapt to dangers. Concerning food security, limited areas of the world may trip beneficial properties under local weather change, however generating nations are perhaps to be adversely affected. Projections recommend that the number of human beings at the chance of hunger will make bigger by means of 10–20% through 2050 due to local weather change, with 65% of this population in Sub-Saharan Africa. The number of malnourished children could augment by up to 21% (24 million children), with the overwhelming part being in Africa (Nelson et al., 2009).

Changes in climate takes steps to worsen present dangers to food security and employment on account of an overall of components that include the developing recurrence and force of climate perils, lessening farming yields and diminished production in defenseless areas, rising wellbeing and sanitation dangers, expanding water shortage, and heightening clashes over rare assets, which would prompt new helpful emergencies just as expanding removal (IPCC, 2007). Africa has been perceived as one of the segments of the world most powerless to the effects of climate change (IPCC 2014). The real and possible impacts of changes in climate in Africa are monstrous and wide-extending, influencing numerous parts of individuals' everyday lives. Numerous climate models foresee the horrendous effects of climate change on farming creation and food security in monstrous pieces of Sub Saharan Africa (FAO, 2008).

Changes in climate are projected to impact most of the points of view that influence food security: availability, access, relentlessness, and use. The general openness of food is affected by the guide of changes in agrarian yields similarly to alterations in arable land. Changes in food generation, all things considered with various factors, should impact food costs, which would influence the limit of shocking families to get to sustenance exhibits and may need to confine dietary arranged assortment. Reduced water openness and quality in specific zones may need to realize revived prosperity and sanitation issues, for instance, a diarrheal affliction which, aggregately with changes in vector-borne disease plans, has the feasible to improve craving, and antagonistically impact sustenance use. Ridiculous environment results upset the unwavering nature of food supply similarly to individuals' employments. Additions in phenomenal climate, for instance, floods and droughts, as the last result of natural change, would intensify this example and should affect occupations that depend upon environment tricky activities, for instance, rain-fed agribusiness and livestock nurturing (Schmidhuber and Tubiello, 2007).

Agronomy continues to be one of the backbones of Africa's economic, social and rural advancement. About 70% of Africans and generally 80% of the landmasses poor remain in rural areas and depend essentially on agribusiness for their livelihood. The agronomic segment is the foundation of Kenya's economy which contributes legitimately to 26% of the Gross domestic product yearly, and an extra 25% indirectly. It supplies 65% of Kenya's exports and offers over 18% of formal employment. In excess of 40 million individuals live in Kenya, 80% of them live in rural areas and depend completely on farming (GOK, 2010). Kenya remains one of the high risks countries from the effects of changes in climate due to over-dependence on downpour sustained agriculture and pastoral animal rearing system. Changes in climate examples have direct negative outcomes on farming exercises in Kenya, for example, expanded temperatures and erratic precipitation that has come about to compromising food security and occupations of numerous networks Agribusiness is foreseen to undermine human wellbeing with the climate change impacts by means of influencing the reasonableness and accessibility of nutritious food (Lloyd et al. 2011).

#### **2.4. Perception of farmers on climate change**

Perceiving climate inconstancy is the initial phase in the strategy of adjusting agriculture to changes in climate. Perception and adaptation techniques are the two key components of the adaptation methodology (Maddison, 2007). Farmers first need to recognize the effect of modifications in the climate to take appropriate adaptation procedures so as to relieve their helplessness and to upgrade the general versatility of the agro-environmental system (Bryan et al., 2009).

Misdirecting perceptions will cause inadmissible adaptation measures. Farmers who become mindful of possible sizes from changes in climate are more noteworthy probably to help approaches and projects that reason to handle it (Gordon et al., 2013). A few creators' pressure that perceptions about the environment and common assets change for people considering the way that their apparent world

is emotionally created and is affected with the guide of going before involvement, kind of instruction, and distinctive financial qualities (Sudarmadi et al. 2001)

The expedient speed of climate and its foreseen enormous adverse outcomes on numerous agricultural systems propose a more extensive and critical requirement for adaptation. Many research brings up that farmers become mindful of climate change in an alternate manner and what's more display that they incline to overemphasize the adverse effects of variable climates and their misunderstanding impacts crop generation and at last adds to food insecurity because of the reality it is the condition for their introduction of adaptation rehearses (Nelson, 2009).

## **2.5. Adaptation strategies to climate change by small-scale farmers**

Sub-Saharan nations in Africa are most prone to the impact of changes in climate, and this is owing to excessive reliance on the production of agricultural and restrained adaptive capacity (Bryan *et al.*, 2013). A few investigations have been completed the world over on how small-scale farmers adjust to climatic changes and the hugeness of adjusting agriculture to changes in climate in the landmass. Every one of these studies has inferred that the majority of the farmers see that the changes in climate are switching and they are taking up a few adaptation measures to limit the effect. Agricultural adaptation to climate change includes modifications made to the agricultural system in response to current or future climate changes, which reduce vulnerability to climate change and capitalize on opportunities (Below et al., 2012).

Adaptation approaches utilized by small-scale farmers suggest that estimates that are strikingly more affordable, for example, altering planting dates and expanding crops should be utilized, while those that are costly or need more noteworthy capital, for example, water system frameworks are utilized

that are costly or need more noteworthy capital, for example, water system frameworks are utilized by not many farmers (Below et al., 2012). This implies the inclination for adaptation options is impacted by farmers' financial abilities.

Notwithstanding, IFAD (2010) stresses that adaption alone can't avoid all climate assortment impingement, a point of convergence on familiarity with changes in climate and adaptation in social club to help nearby networks in managing the infringement of changes in climate is expected to react to this hazard. Until now, there are not many improvement systems for advancing manageable agriculture. So as to save productiveness even with the above climate challenges, farmers need to react with great adaptation systems. Agronomy adaptation to changes in climate comprises alterations made to the agricultural system because of the front line or future changes in climate, which lessen defencelessness to changes in climate and benefit from circumstances (Walthall et al., 2012).

## **2.6. Theoretical Framework**

A theory is a well-defined set of interrelated principles used to describe, explain, and predict how society and its components are associated with each other. A theoretical framework comprises of interlinked thoughts and concepts anchored with the aid of theories. It is a logical set of propositions acquired from empirical arguments (Kombo & Tromp, 2006).

### Utility Theory

One of the theories this study reviewed is utility idea which is apprehensive about individuals' preferences and choices. It is involved additionally with inclinations and with decisions of idealness, worth, value, goodness or any of various comparable principles (Fishburn, 1968). Utility refers to the contentment that every preference presents to the decision-maker. Therefore, this theory assumes that

any choice is made on the foundation of the utility intensification opinion in accordance with which the satisfactory preference is the one that presents the perfect utility (contentment) to the decision-maker.

The behavior of individual consumers is frequently defined by using utility theory. In this instance, the small scale farmer performs the position of the decision-maker that ought to determine how much every one of the numerous accessible changes in climate adaptation strategies to utilize in order to verify the absolute best potential degree of aggregate utility subject to his or her accessible revenue, rates, and different aspects.

In utility theory choices are taken through a couple of criteria. The utility that the decision-maker (i.e. small-scale farmer) receives from deciding on a particular preference of changes in climate adaptation strategy is dignified by using a utility function  $U$ , which is a calculated illustration of the decision maker's (i.e. small-scale farmer) structure of inclinations such that:  $U(x_1) > U(x_2)$ , where choice of climate change adaptation  $x_1$  is favoured over choice  $x_2$  or  $U_{x_1} = U_{x_2}$ , where choice  $x_1$  is indifferent from choice  $x_2$  which means that both adoptions are similarly desired.

The climatic change adaptation strategies adopted by the small-scale farmers will be used to govern their methodological and revenue productiveness intensities in their present-day production systems in Kiambaa Constituency and those strategies that can impart policy making will be replicated to see their possessions on the adeptness levels.

### **2.6.1. The Theory of Resilience and Vulnerability**

Another theory applicable to this research study is the theory of resilience and vulnerability. This method permits the perception of farming practices shifting and shared motion amongst small-scale farmers in Kiambaa Constituency. Vulnerability refers to the degree to which a socioecological structure is uncovered to occasions that represent a challenge in some form. Resilience refers to the



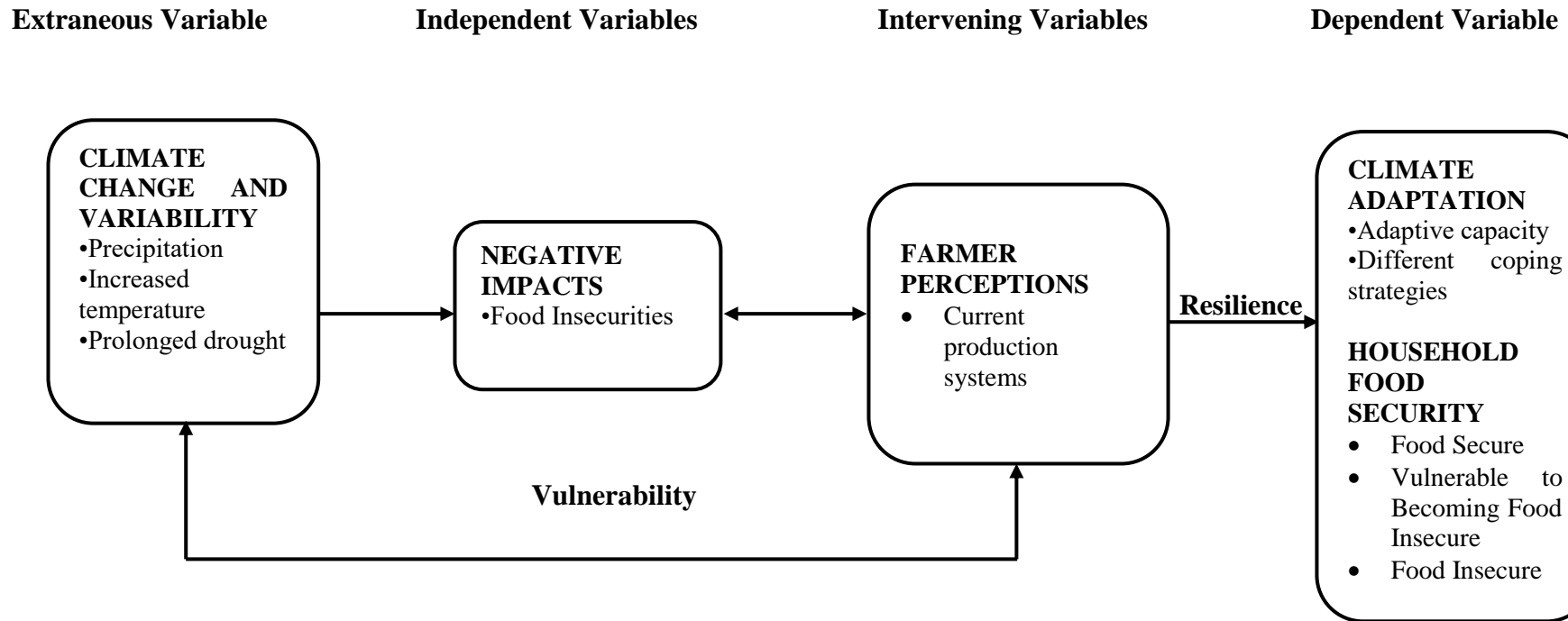
potential of a socioecological structure to ingest these difficulties without, being completely modified.

Both resilience and vulnerability encompass three interrelating factors. First is the real unsettling influences, frequently characterized stressors and can encompass climatic phenomena such as drought, floods, or non-climatic elements such as food insecurity. The second component is the influences of the stressor, whilst the third is the reaction of the socioecological structure.

The reactions can either be handling responses, which are momentary dealings both throughout the disruption or in the instantaneous outcome, whilst versatile reactions are practical and frequently long-term estimates that contain altering the situation in which handling takes place. Adaptive reactions are basically endeavors to upgrade the resilience of a socioecological structure (Berkes 2007, Adger 2006, Eriksen 2005).

## **2.7. Conceptual Framework**

Below is a diagrammatic illustration of the basic conceptual argument on the relationship between particular variables recognized in this research.



**Figure 1: Conceptual Framework**

The framework above is illustrating the interplay of various variables because of small-scale farmers' exposure to climate change and variability

Extraneous variables are those factors in the research environment that may have an effect on the dependent variables but which are not controlled. In this context, the extraneous variables comprise of climate change and variability.

Independent variables predict the amount of variation occurring in other variables. Food insecurity amongst small-scale farmers is an end result of lack of assist systems at some stage in unexpected precipitation season, increased temperatures and extended droughts.

Intervening variables link the independent variables and the dependent variables in a contributory sequence. Established in the perceptions of small-scale farmers on climate threats can solely make choices for adaptation as well as exogenous policies on changes in climate. Other non-climatic factors such as social and economic limitations additionally have an effect on their adaptation. The production system of small-scale farmers is undesirably affected by changes in climate and variability. Therefore, there is a linkage between changes in climate and variability on small-scale farmers, socially, economically and institutionally resulting in the aspects discussed under the dependent variables.

The dependent variables attempt to indicate the influence arising from the effects of the independent variables. By employing specific coping and adaptation strategies that small-scale farmer attempts to mitigate the outcomes of changes in climate. The accessibility and openness of changes in climate intercessions and sustenance systems, as well as access to climate change records (responsiveness), influences the adaptation ability and welfare of small-scale farmers to ensure household food security.

## CHAPTER THREE: RESEARCH METHODOLOGY

### 3.1. Introduction

This chapter is dealing with the methodology. It describes the study designs in terms of population, research instruments, and data collection procedures. The research aimed at enlightening the perception and adaption strategies of small-scale farmers to climate change in Kiambaa Constituency, Kiambu County.

### 3.2. Study Area

The study was carried out in one of the 47 counties in the Republic of Kenya i.e. Kiambu County, specifically Kiambaa Constituency. It is positioned in the central area and covers a whole vicinity of 2,543.5 Km<sup>2</sup> with 476.3 Km<sup>2</sup> under forest cover (KPHC, 2009). Kiambu County borders Nairobi and Kajiado Counties to the South, Machakos to the East, Murang'a to the North and North East, Nyandarua to the North West, and Nakuru to the West. According to the (KPHC, 2009), the Constituency had a population of 145,053. In 2012 the population was projected to be 157,811, by the end of 2017 the population was expected to reach 181,617. Kiambaa Constituency currently has a population density of 2 153 persons/Km<sup>2</sup>. This excessive populace can be ascribed to the closeness of the county to the capital city, Nairobi County as the greater part of the population work in Nairobi but dwell in Kiambu County.

The county has a total arable land of 1,878.4 Km<sup>2</sup> of which a total of 21,447 Ha is under food vegetation and a total of 35,367.41 Ha is under cash crops. It is the main sub-sector as far as employment, meals, security, benefits income and widespread commitment to the financial prosperity of the individuals. Most of the individuals in the County depend on the sub-sector for their employment, with 304,449 immediately or randomly utilized in the sector.

Coffee and tea are the predominant cash crops in the region. The essential food yields developed in the constituency are maize, beans, cabbages, pineapples, and irish potatoes. There has been a constant decrease in normal farm sizes with quickened population development. Presently, the normal homestead size under small scale cultivating is 0.36 Ha and 69.5 Ha under enormous scale cultivating. The territories with small landholdings are by and large found in the upper parts of Gatundu North, Gatundu South, Kiambaa, Limuru, and Kikuyu Constituency.

### **3.3. Study design**

Integrated techniques both qualitative and quantitative methods were utilized in the study. Qualitative research is practiced inside a paradigm of naturalistic inquiry (Patton, 2002). Consistent with the naturalistic approach, this study aims at examining how small-scale farmers perceive climate change and to investigate the strategies that they have adopted to cope with the effects of climate change in ensuring household food security. Qualitative research seeks an understanding of the perspective or scenario with the aid of searching at the immediate experience to furnish data that is significant (Tewksbury, 2014).

In this study, the quantitative technique was used to evaluate reactions across the contributors due to the fact all individuals were probed the same questions in the same order to permit a substantial assessment of reactions across contributors and study sites (Crossman, 2014).

### **3.4. Unit of Analysis and observation**

#### **3.4.1. Unit of Analysis**

This research was analyzing adaptation strategies of small-scale farmers to climate change and food security among farmers in Kiambaa Constituency. Cianda, Karuri, Ndenderu, Kihara and Muchatha wards being selected as the study sample locations. The distribution of respondents was spatial.

### **3.4.2. Unit of Observation**

Data sources were from the selected small-scale farmers who provided qualitative information on their adaptation strategies on farming practices to cope with climate change.

### **3.5. Target Population**

A population is the theoretically specified aggregate of the study element from which the sample was selected. This study sought to bring to subject small-scale farmers practicing rain-fed agriculture in Kiambaa Constituency as the target population. The aim was to examine the perception and adaption and coping measures put in place to mitigate themselves from the terrible outcomes of climate change.

### **3.6. Sample Size and Sampling Techniques**

#### **3.6.1. Sampling Size**

Ritchie et al. (2003), recommends that inside qualitative research the sample size is regularly little incredibly because the real wonders exclusively need to show up once to be a piece of the diagnostic guide. Sooner or later there is a point of data saturation when expanding the sample size never again adds to new proof. As indicated by Guest et al. (2006), fifteen is the littlest worthy sample, on the other hand data saturation can show inside the initial twelve meetings and after that, not many new marvels are probably going to rise. A sample of 30 respondents was chosen in this study. The sample size was chosen through saturation. Agreeing to Tuckett (2004), the decision that data saturation had been reached was facilitated through constant comparison of data.

### **3.6.2. Sampling Technique**

The study used a purposive technique of sampling. According to Bryman (2012), a purposive sampling approach has the intention to sample participants in a strategic way with the purpose of answering the research question appropriately. Purposive sampling may take the form of maximum variation approach in which the researcher identifies varied characteristics of the target population and then select sample of subjects that matched the identified characteristics. This sampling approach in this study used a clear inclusion criteria focusing only on small-scale farmers who specifically rely on rain-fed agriculture and exclusion criteria where large scale farmers, greenhouse farmers, etc. were excluded from the sample based on the research question.

Snowball sampling is considered as one of the types of purposive sampling, in which the researcher finds out from selected individuals other individuals that might be relevant to be included in the investigation. This method relies on researcher's ability to identify the variables that might affect a subject response to the questions posed and utilizing the knowledge gained from the relevant variables in selecting the sample of study. In this case, snowball sampling was used to choose the study subjects (small-scale farmers). The sample size that was selected based on purposive sampling strategy was determined in line with theoretical saturation. Theoretical saturation conveys the notion that purposive sampling has an element of process attached to it, given that, it implicitly involves a data collection process that goes hand in hand with data review and analysis and data collection terminates when new data collection yields no additional insight to the research problem being addressed.

### **3.7. Data Collection Methods**

The following methods were used in this study:

#### **3.7.1. In-depth Interview**

Interviews are an exceptional technique for program arranging and assessment. They are top relevant for procuring thorough data from the subject's viewpoint (Silverman, 2001). A wide assortment of basic attributes of interviews can be perceived comprising, open-finished inquiries, semi-organized configurations, objective looking for handle and explanation, and interviews completed in a casual, friendly style. Well-built open-finished inquiries allowed respondents to outfit notwithstanding insights concerning an offered topic rather than yes or no response. The semi-organized design allows the discourse to take the path of least resistance normally, notwithstanding a specific request, anyway alluding to the exact data outfitted by the respondent. Open-ended interviews give the chance to the interviewer to explain the announcements from the respondent to increase a more profound comprehension of the unique situation and substance material of reactions. At long last, directing the open-finished interview in a friendly style, where the interviewer basically fills in as a deliberate audience, can develop a smooth, requested and strong discussion with the respondent (Rubin and Rubin, 2004).

Kvale (1996) perceived a few methodologies for interviewers comprehensive of undivided attention whereby the interviewer tunes in and rewords the announcements of the interviewee to make certain whole comprehension of the implications being traded; perseverance which empowers the interviewee to convey unreservedly, and thorough; adaptability consequently the discourse is permitted to wander barely from the point, so craving a reordering or correction of the inquiries, and sound recording the interviews with consent as this may also be helpful for reference and



progressively attractive precision. Be that as it may, the interviewer should control the exchange to cover basic subjects. In the event that the interviewees cross away excessively far, at that point the interviewer needs to carefully step them back to the subject. Sound chronicle: sound taping of the meetings with authorization should go before this may moreover be valuable for reference and increasingly reasonable exactness.

The major instrument of data collection in this study was the in-depth interview guide. It was used to prompt data in order to acquire an all-inclusive understanding of the small-scale farmers' opinions. In-depth interviews involve probing informants' open-ended questions and probing wherever essential to gain facts deemed beneficial by the researcher. The researcher designed an in-depth interview guide for the small-scale farmers in Kiambaa Constituency. The interview guide was used as a tool to aid orientation throughout the interview and to make certain that all areas of the research are covered (Patton 2002). This guide was used to direct the researcher to obtain the small-scale farmers' views about climatic change and their perception and strategies adopted to ensuring food security. The small-scale farmer answered the questions indicating how this subject affects them. For confidentiality, codes were used instead of the small-scale farmer name this was done to enhance an element of honesty in their responses.

### **3.7.2. Focus Group Discussion**

According to (Patton, 2002) focus group discussion targets gathering high-quality data in a social environment. Focus group discussion was accustomed to secure in-depth qualitative data on small-scale farmers' perceptions concerning climatic changes help structures, interventions, and involvements regarding changes in climate. This being the case, three focus group discussions with a maximum number of ten participants in each discussion session was consequently organized in this study. Without being intimidated by the gender factor, this study involved small-scale farmers both male and female challenging each other's views as they freely expressed themselves hence forming

one focus group discussion. The FGDs was used as a method for triangulation, validation and verification of information collected through individual interviews.

The focus group discussion guide was prepared to aid the researcher to acquire data through one on one interviews that were conducted. The motive of the interview was to solicit views regarding changes in climate and small-scale farmer's perception and strategies adopted to ensuring food security. Interviews have higher adaptability and a chance to reconstitute questions (Kothari, 2004). Interview guides were utilized because of the reality they helped the researcher to stay centered all through the probing time for more profound data. This technique was helpful as it allowed members a chance to think basically on the usefulness of the practical solutions towards managing farming activities under conditions of climatic changes.

Advantages of focus group discussion include: it is relatively less convoluted to weight or direct, it licenses to investigate subjects and to produce speculations, it creates plausibility to accumulate information from the gathering collaboration, which focuses on the theme of the scientist's advantage, it has over the top "face validity" (information), it has eased in connection to different techniques, it offers speed in the outfit of the results (regarding proof of the gathering) and it allows the specialist to extend the size of the example of the subjective research (Krueger, 1994)

Some negative viewpoints incorporate: it isn't principally founded on a characteristic climate, the scientist has less power over the data that is created, the information assessment are extra testing to be done, the association of the gathering structures a social domain and the comments should be deciphered within this specific circumstance, it requests interviewers mindfully prepared, it requires exertion to unite the gatherings and the talk should be done in a situation that empowers correspondence (Patton, 2002).

### **3.8. Pilot Study**

As per [Orodho \(2009\)](#), a pilot study is practiced by subjugating the information gathering instruments to a small representative samples, indistinguishable from, any way except for the group to be overviewed. A pilot study causes the researcher to upgrade the instruments by altering the things found to be obscure, unclear, farfetched or unessential. Piloting was done to upgrade the dependability and consistency of research instruments. Piloting was done by choosing members randomly. Chosen small-scale farmers were met to test the consistency and dependability of the guide. The reactions were verified whether they are giving the necessary data. Questions that are obscure, uncertain, dicey or unseemly were adjusted or dispensed within availability for genuine information gathering.

### **3.9. Trustworthiness of Data**

In qualitative research, validity or dependability and reliability or consistency are referenced as far as the believability, transferability, constancy, and confirmability of the instrumentation and results of the examination. There should be validity so as to have reliability. The reliability of the information gathered in research is vital in confirming or approving the last research discoveries. It is subsequently incumbent upon each scientist to take practical measures in guaranteeing that the information gathered is adequately dependable. On account of this investigation, a few such actions were taken to guarantee the reliability of the exploration information.

Small-scale farmers' were guaranteed believability by utilizing reasonable strategies, for example, triangulation, expanded contact, part checks, immersion, reflexivity, and friend appraisal. There was likewise a need to build up transferability which was investigated suitably by techniques, for example, "thick portrayals", and variety in member choice. Trustworthiness was set up through review trails and triangulation. Confirmability was also settled over reflexivity or intra-or between coder reliability, where pertinent. Toward the finish of the interview sessions, interviewees were

outfitted with a duplicate of the deciphered notes from the audio recording which empowered them to audit exact interview reactions and affirm the interpretive precision. This was to increase reliability. Checking members' answers, reaction consistency, and inside technique triangulation provides a tool to test instrument reliability related to the inquiries questions. The comparability in reactions among the interviewees all through the interviews proves the exploration instrument and the precision of reactions (Stevenson and Mahmut, 2013). As a component of the reliability procedure has prescribed a persistent part checking circle.

The exactness and importance of inferences are depicted as validity, which is fundamentally founded on the study outcomes (Berg, 2009). In qualitative research, validity recommends consistency and dependability concerning exercises and happenings identified with the wonder as meant as a result of this investigation outcomes examined in the study. In qualitative research, validity, and reliability, quality enhances straightforwardness and limit conceivable outcomes to embed analyst predisposition. The study guaranteed unwavering reliability and validity depend absolutely on the ability to protect non-partisanship, and trustworthiness (Golafshani, 2003).

### **3.10. Data Sources**

The techniques of data collection employed in this study were mostly primary. Through in-depth interviews and focus group discussions, the primary data was collected directly from the field while the secondary data was collected from the print media for example books from the library, internet and the available records from the county offices.

### **3.11. Data Analysis**

Though the study was generally qualitative in nature statistics. From interviews, qualitative data were analyzed by means of themes and information presented in the narrative form. Content analysis was applied.

### **3.12. Ethical Considerations**

This document took into account several ethical issues. An introductory letter from the University of Nairobi was obtained by the researcher and used it to seek permission and clearance from all the relevant authorities.

Although the in-depth interviews entailed personal information, however, the priority of the researcher was the protection and classification of the respondents and data acquired from them. Only codes were used to differentiate respondents and interviewees.

No information was permitted into the open area without the assent of respondents other than the comprehensive report on the analysis of data.

## CHAPTER FOUR: DATA ANALYSIS AND INTERPRETATION

### 4.1. Introduction

Discussed under this section comprises four main components: the first section presents the descriptive results on household demographics and socio-economic characteristics. The second section shows climate change perceptions. Section three presents results on adaptation and coping strategies employed by farmers to deal with climatic changes. Section four presents the status of Household Food Security in Kiambaa Constituency, Kiambu County.

### 4.2. Demographic and Socio-Economic Characteristics

Table 4.1 shows the demographic information of the respondent such as sex, age, marital status, education level, and main occupation was pursued to establish the nature of the population in the study.

**Table 1: Demographic Information**

Respondents Characteristics	Category	Frequency (N) 30	Percentage (%)
Sex	Female	19	63.3
	Male	11	36.7
Age	25-29	2	6.7
	30-34	4	13.3
	35-39	5	16.7
	40-44	4	13.3
	45-49	3	10
	50 and Above	12	40
Marital Status	Single	2	6.7
	Married	20	66.7
	Divorced	3	10
	Widowed	5	16.7
Education Level	Illiterate	3	10
	Read and write	3	10
	Primary	11	36.7
	Secondary	6	20
	College	4	13.3
	University	3	10
Main Occupation	Crop cultivation	7	23.3
	Animal rearing	3	10
	Mixed farming	20	66.7

<b>Respondents Characteristics</b>	<b>Category</b>	<b>Frequency (N) 30</b>	<b>Percentage (%)</b>
<b>Family Size</b>	2	1	3.3
	3	2	6.7
	4	2	6.7
	5	5	16.7
	6	4	13.3
	7	4	13.3
	8	4	13.3
	9	3	10
	10	2	6.7
	11	1	3.3
	12	2	6.7

**Source: Field, 2018**

Both males and females are represented in this research. There were more female (63.3%) respondents than male (36.7%). The most dynamic age bunch in cultivating were aged respondents 12(40%) age 50 and above. 2(6.7%) of the respondents were aged 25-29, 4(13.3%) aged 30-34, 5(16.7%) aged 35-39, 4(13.3%) aged 40-44, 3(10%) aged 45-49. The above statistics indicate that there is minimal participation in farming from the youth and young adults as compared to older people. Consequently, from this observation, one can conclude that there is a high risk of agricultural knowledge slowly diminishing as the more seasoned age are the caretakers of information.

On the marital status, 2(6.7%) of the respondents were single. 20(66.7%) married, 3(10%) divorced and 5(16.7%) widowed. Therefore, the majority of the findings of the respondents are married.

Education level, 3(10%) of the respondent attained university level, 4(13.3%) attained college level, 6(20%) attained secondary level of education, 11(36.7%) attained primary level, 3(10%) could only read and write and 3(10%) were illiterate as they did not attain any level of education.

Majority of the respondents 20(66.7%) practice mixed farming, 7(23.3%) practice crop cultivation, and 3(10%) practice animal rearing.

Family toil is known as a transcendent wellspring of work supply in small-scale production of food crops in most parts of Africa. This encompasses the toil of all males, females, and teens in a family

unit, who make commitments to their psychological and physical endeavors to the family possessions. Most of the respondents (16.7%) clear-cut inside the family unit size of 5, succeeded by 13.3% of the respondents which clear-cut inside the family size of 6, 7 and 8.

### **4.3. Perceptions of Small-scale Farmers on Climate Change**

This section focuses on the perception and attitude that farmers brought forth in addressing the awareness of the concept of changes in climate various effects resulting from climate change. The specific thematic perceptions and attitudes will be discussed in this section. Respondents' narratives will thus be presented under these identified themes (with respect to climatic change).

#### **4.3.1. Awareness of the Concept Climate Change**

The initial phase during the time spent adjusting farming to environmental change is seeing atmosphere inconstancy (Deressa *et al.*, 2011). Most of the farmers 90% interviewed reported that they knew about the term climate change and understood what it meant, 7% had heard about it but did not know exactly what it was while 3% were not conversant with the term and did not know what it was.

As indicated by Deressa et al., (2011) farmers perceive changes in climate as dependent on their cultivating knowledge. The sightings call attention to that many of the small-scale farmers' apparent climatic changes in the course of time incited by the different ecological annihilation as a final product of human impression: A man aged 54, university education practicing mixed farming said:

We continue decreasing the trees to creating roads and constructing houses for business and residencies purpose and considered it as a natural process.

Individuals are decreasing down trees to improve infrastructures, for example, roads, build business enterprises, and houses, and so on along these lines there is quickened deforestation because of



masses development. In any case, this is interesting using what Dunn (2009) examined, he thinks about that agribusiness is furthermore legitimately in charge of changes in climate, because of the real destruction of forests happening to make increasingly agriculture land, bringing about changes in climate.

The respondents also mentioned that their source of this information was mainly from media (television, radio) 40%. A woman aged 44, of secondary education practicing mixed farming said:

I get to hear about climate change information mainly the media - TV, and radio... There is a programme I closely follow on one of our local television channels called shamba shape up. The programme is all about good farming practices.

It was additionally cited that friends 25% also performed a role. Chief barazas 5% and GoK extension officers 20% were additionally mentioned as a source of information.

Consistent with IPCC (2001) changes in climate alludes to any alternate in weather after some time, regardless of whether because of common fluctuation or as a final product of human action. The respondents related the term climate change with an array of influences on climate and the weather, consisting of increased temperatures, and extend in recurrence of drought and unpredictable rainfall. Climate change has triggered negative influences on crop production as the soil has immensely lost its productivity, there is an expansion in the incidence of pests and diseases, boreholes have dried up or a cited decline in accessible water in most cases during droughts.

#### **4.3.2. Perceptions and attitude**

The researcher asked the respondents to give their opinions as to the perceptions of climate change. The emerging themes that came out from the interviews were that climate change was perceived as an increase in temperature in the area, unpredictable or decreased annual rainfall, an increase in recurrence of droughts, and decreased productivity. We shall examine these themes now, in the aforementioned order.

#### 4.3.2.1. Increased temperatures

On the first theme (increased temperatures), the respondents gave varying sentiments. One respondent a woman aged 58, of college education practicing mixed farming, had this to say:

The word climatic change in my understanding is how the weather has become hotter and temperatures are noted as before. January and February are currently months that are very hot and dry something we have never experienced. Nowadays it's either too hot or too cold. Long-time ago we used to plan to farm with seasons, it's not possible to do that now because the weather is very unpredictable. Increased temperature has caused crop failure resulting in drying before maturity.

Another respondent a man aged 40, of secondary education involved in mixed farming, said:

From my understanding, climate change is the variation in weather. To me, this has been manifested with the change of temperatures being on the upward shove as we can experience the warmness indeed, even in months that should be cool. There is also a fast-rate increase in pests and diseases that destroys our maize, beans, potatoes, etc. This scenario might be prompted by the influence of climate change especially the intensification in temperature. We are now forced to use many pesticides and fertilizers to boost our crops as the soil has greatly lost its fertility.

A man aged 35, also of secondary education practicing mixed farming said:

Climate change is real. I have observed that because of deforestation the temperature increased. It used to be very cool and comfortable in the past, it is totally incomparable with now. These days there's an increment within the escalated of daylight to the magnitude that at nine o'clock the solar is too blistering and 'stings' resembling that of the evening.

A woman aged 38, of primary education in crop cultivation, said:

About climate change, I don't know a lot. Despite the fact that the temperature has increased gradually nowadays I sweat more than before and also food spoils faster.

Amidst the world's extremely susceptible to the effects of changes in climate in Africa (IPCC 2014).

All respondents stated that they have encountered changes in climate. This study uncovered that

most farmers were in agreement that the climate was altering and had experienced excessive weather conditions. The respondents' grasp of the insight of changes in climate in Kiambaa Constituency from individual interviews was additionally correlated with findings from FGDs. The findings indicated that there is an increased temperature in a state which was not frequent in the region. The result was that most of the respondents' perceived higher temperature concurs with the outcome of Kassahun (2009) who referenced that the majority of the respondents for his study perceived there is growth in the mean temperature at any rate for two decades

#### **4.3.2.2. Decrease in Rainfall**

The second theme was on the decrease in the quantity of rainfall acquired yearly as an indicator of climate change. Most respondents cited that currently, they have observed an increased decline in rainfall and an increase in rainfall variability, duration, and depth. A woman aged 30, of university education involved in mixed farming, said:

Nowadays rainfall has become extremely variable, occasionally it's low in quantity and sometimes higher in intensity. The seasons have routinely not been getting satisfactory precipitation to back cultivating exercises adequately. She continued, as of now, the amounts of precipitation got don't fundamentally alter the capacity of water in the waterways and watercourses. Previously, it used to rain intensely until crossing the rivers was not conceivable while in others crossing became very challenging because rivers and streams used to overflow. Now and then you may indeed be washed away in the event that you gambled crossing, it was not possible to see the extension and a couple of the huge stones along the conduit channels. The measure of precipitation we gain by and by is some of the time low and does now not, in any case, spread a portion of the waterway channel. Where it does, the progressions don't keep going for over three days to multi-week.

Another man aged 45, of collage education practicing crop cultivation said:

Rains have become so unreliable and very difficult to predict nowadays, leaving us in a dilemma. Now the rainfall is very low compared to the past. We are not sure when to start planting, hence they harvest nothing. We used to start planting around the 15<sup>th</sup> of March, but nowadays the dates have changed up to May.

A man aged 63, of primary education engaging mixed farming said:

The prolonged rains have emerged as the norm. Planting dates keep altering every year. A long-time ago we used to experience long rains from March to May and short rains from October to December. The months of June to August were primarily cool and dry. Sometimes the rains come on time however then stop beforehand than anticipated. This consequently leads to vast crop failures. It's a big challenge to us farmers and the negative impacts have also affected the growing cycle because it is shortened at times unpredictable.

Rains have become so unreliable and very difficult to predict nowadays, leaving the small-scale farmers in a problem as they don't know when to start to plant, hence they harvest nothing. The small-scale farmers used to start planting around the 15<sup>th</sup> of March, but nowadays the dates have changed up to May. This corresponds with the FGDs participants who alluded that the rains have become so unpredictable thus they have no specific season sometimes we may receive rain in January and they are not good for farmers to start growing their crops. This has caused negative impacts because the growing cycle is shortened. Changes in weather patterns have direct terrible outcomes on agricultural activities such as unpredictable rainfall that have resulted in undermining the food security and livelihoods of several populations. Agriculture is predicted to undermine human health with climate change impacts by influencing the moderateness and accessibility of nutritious food (Lloyd *et al.* 2011).

#### **4.3.2.3. Increased frequencies of drought**

The third theme was on (increased frequencies of drought), the respondents narrated the following observations; A man aged 54, of university education practicing mixed farming said:

The drought really hits hard when it is least expected and this has been an impact caused by climate change. The time we expect rain that is the time when we get hit by drought. The last 3 years which entails 2 farming seasons per year which is approximately 6 farming seasons. I'd say the drought has been rather frequent because you realize apart from last year, 2 years before we didn't harvest well courtesy of the drought if you compare to the years back then in the 90s. Drought has been increasing rapidly and it has really caused us because we are not even producing

enough for household consumption, we have to buy some food from the markets.

A woman aged 36, of secondary school education engaging in mixed farming, said:

During drought, there is neither rain nor water in the streams and boreholes. This is a major challenging impact as water becomes so scarce causing my crops to dry before reaching maturity, hence no food.

A woman aged 49, of secondary school education involved in crop farming, said:

The situation of food security is generally not good. With the drought, I got fewer harvests not much as I was expecting, but still, it was not enough for my family.

There is less and/or no rains, therefore, a shortage of water is a key impact of climate change since some of the surviving boreholes have dried up or a noted decline in available water mainly during droughts. Frequencies of drought and floods have been observed to increase in and it is possible that it will proceed as long as temperatures keep on rising globally. Recurrent droughts have additionally unfavourably influenced farming production in the area subsequently low crop yields. The farmers indicated that considering the fact that there is less rain due to extended droughts they are now more burdened and residing in fear, as they are not positive whether or not to proceed farming or not. All respondents affirmed that the predominant climatic prerequisites have had a severe impact on agricultural activities. Drought is a predominant challenge as water becomes scarce causing crops to dry before attaining maturity.

During the individual interviews and FGD, small-scale farmers revealed that they are losing hope due to prolonged droughts since when they lost almost everything it is very challenging for them to recoup from the misfortune. The small-scale farmer featured that they are precisely presented to the adverse effect of change in climate all around precipitation deficiencies (dry spell). They are aware of their vulnerability status to changes in climate. The agricultural segment is the driver of their

prosperity, therefore, the small-scale farmers' greatest concern is that the detrimental climate compromises their food security status and restricts their living alternatives.

#### **4.3.2.4. Decreased food production**

The fourth theme was (decreased food production). A man aged 60, of secondary school education in mixed farming, said:

The climate has changed. Crop diseases have increased for example maize yellow leaf diseases; these diseases were not there in the past. Leaf rust disease has also affected our coffee production, and many farmers have stopped to grow coffee due to lack of money to buy pesticides, so they have decided to grow banana trees or convert farming land to development.

A woman aged 39, of university education in crop farming, said:

Pests have really increased compared to previous years and this has vastly affected our crop production. Maize, for example, is destroyed by caterpillars which have become troublesome pests as they enter the maize cob and causing the whole maize plant to dry. These have caused a spread in pesticides and fertilizer uses over the past few years.

A woman aged 46, of secondary school education in crop farming, said:

New pests invade my crops these days compared to past years and if I don't spray pesticides I lost all of my crops. The warmth is additionally high that almost all the crops we tend to plant fail to endure for example, a few crops dry others neglect to grow.

Changes in climate are anticipated to jeopardize production of agricultural, mainly in small-scale farming with minimal versatile limit, as by and by across the board in numerous pieces of Africa (Nelson *et al.*, 2009).

The respondents were asked about their crop production and the capacity of their production. Findings indicated that most of the farmers' agricultural productions are anticipated for home consumption such as maize, beans, irish potatoes, sukuma wiki, and sweet potatoes. Agreeing with Rose (2008), household food availability is contributed by the production of staple food crops; since the chances of a family being food secure are increased when there is the availability of foodstuff in

a household. Some farmers indicated that they also produce for income generation in case there was surplus to sell so as to cater to other bare necessities. In many cases the crop production is meant for household consumption however if harvests are in excess, the farmers considered selling. Results also identified the main food crops accounting for almost 90% of all crops grown by households in Kiambaa Constituency include maize, beans, irish potatoes, bananas, sweet potatoes, sukuma wiki, and cabbages. The major cash crop grown is coffee and tea.

Pests and diseases have increased thus destroy maize, beans, potatoes, etc. This situation ought to be prompted by the impact of changes in climate especially the upsurge in temperature. As indicated by the description in IPCC (2007), the intrusion of plantation by pest and diseases remained triggered through the intensifying temperatures and precipitation alterations designs. Along these lines, temperature increase has instigated a notable loss of small-scale farmers' yield production.

#### **4.4. Strategies Adopted to Cope With the Effects of Climate Change in Ensuring Household Food Security**

This segment centers around the adaptation strategies that small-scale farmers came up with regarding the various impacts resulting from changes in climate. These strategies were a response to the specific thematic effects discussed in the previous section. Respondents' narratives will thus be presented under these identified themes (with respect to climate change).

##### **4.4.1. Strategies adopted to cope with increased temperatures**

To manage the effects of increased temperatures there are various approaches that the farmers adopted. These included stop cultivating some crops, shift to shorter cycle crops, shift to high yielding seeds and crop variety, mixed cropping, and reduce the size of the farm and irrigation

On the issue of abandoning some crops, this is how the respondents put it. A man aged 68, of primary education practicing mixed farming said:

Some crops cannot withstand these high temperatures, therefore, I have been forced to abandon them in favor of others which are more tolerable to this high temperature.

With high temperatures there is a lot of pest in the soil, therefore, this has had a toll on some of the crops. (Said a 35year old woman, of primary education practicing crop cultivation)

On adapting to crops that take a shorter time to harvest the respondents had this to say:

Currently, I cultivate improved seeds that set aside a shorter effort to develop to development. I'm nurturing improved and short maturing assortments and gradually forsaking some of their local species. (Said a 52year old woman, of primary education practicing mixed farming)

Contrasted and local seeds and other individuals purchased from the market improved seeds, thus, the season rehearsed delayed times of downpour break, as a small-scale farmer, I get shocked to determine that improved seeds endure drought conditions and ended up with some great yields. (Said a 40year old woman, of secondary education involved in mixed farming)

Another strategy that the small-scale farmers have adopted is shifting to higher-yielding seeds and new crop variety. A woman aged 56, of secondary education engaging in mixed farming, said:

In comparison to native seeds and other people purchased from the shopping centre, one is stunned to ascertain that improved seeds endure the drought conditions winding up with some great yields.

A woman aged 63, could only read and write involved in crop cultivation said:

If everybody would grow, for instance, the improved maize varieties, it'd scale back food shortages within the county that might additionally scale back the value of maize within the market.

One other strategy the farmers have adopted is the intensification of irrigation practices. A woman aged 66, of primary school education practicing mixed farming said:



With an increase in temperature, irrigation helps to improve soil moisture, so the production increases somehow. With these strategies, I get crops yields, even if less, but I can afford to have three meals per day, though other days I have to buy food, and it depends

A man aged 59, of primary school education engaging in crop cultivation, said:

I can now harvest crops though they are few even with the increased temperature. Irrigation has helped to improve my crop production, without these, you can get nothing.

On mixed cropping as a strategy the farmers had this to say:

I started active mixed cropping as a result, it helps within the dominant of insect pests. These permits produce to nurture development with the least damage from pest. I observed a number pest target explicit yields' leaves and additionally buds, the nearness of numerous elective harvests confuses them, which makes it hard for the pest to recognize the well-known yield. (Said a 50year old man, can read and write practicing mixed farming)

I don't have ample space of land to observe monoculture so farming aids in making certain that I will harvest some crops once others fail. Growing of maize and beans along help to extend soil nutrients. Also, maize provides shade to the beans. Beans cowl the soil that stops water loss, weeds, pests, and diseases. (Said a 53year old woman, of primary education practicing mixed farming)

The other strategy was on reducing the sizes of the farm (new land-use strategies). A man aged 56, of university education involved in crop cultivation, said:

I used to survive on farming income but that is not the case now increase in temperature became unfavorable for intensive agriculture activities. Hence I began incurring big losses consequently resulted in subdividing my land as an alternative to earn a living and put up rental houses. That way I'm assured of an income at the end of the month as the population is really growing fast and furious in this Constituency.

A woman aged 48, of secondary education practicing crop cultivation said:

In the past, we solely had coffee farms which are not the case now. Changes in temperature by and by now support the developing of maize and beans.

A study was done by Stigter et al. (2005) and Dankelman, (2010) dealing with the effect of intensifying (higher) temperature requirements and over the top daylight, orthodox farmers practice intercropping of warmth tolerant plant and early-developing yields (maize). The theory of resilience and vulnerability in this study allows the comprehension of movements in cultivating practices and aggregate activity among small-scale farmers in Kiambaa County. Both of resilience and vulnerability envelop three cooperating factors. First, real aggravations, much of the time named stressors and can incorporate climatic marvels, for example, dry spell, overflows, or non-climatic factors, for example, food insecurity. A subsequent angle effects of the stressor, whereas third, the reaction of the socioecological framework. Small-scale farmers recognize the particular harvest types which can be planted at the same time on a similar plot to guarantee that challenge for soil supplements, soil dampness, and sun rays are limited. A portion of these yields supply conceals for the vegetation, safeguard crops against wind results and precipitation harm, and soil improvement supplements/fruitfulness (Snelder et al., 2007; Smith, 2010). Small-scale farmers work on blending crop assortments which is indispensable explicitly for subsistence nourishment generation, because it may drag out the commencement of diseases, decline the unfurl of diseases conveying bacteria and make significantly fewer advantageous essentials by disseminating specific bacterias. For instance, maize and beans may moreover be developed in a similar field, notwithstanding, beans are planted in the focal point of the developing season and gathered sooner than the maize (Altieri and Koohafkan, 2008). The outcomes of this study agreed to the study by Patrick (2014). He established that climate change adverse impacts had influences 94.7% to shifting to shorter cycle produce, 84.4% to stop the farming of some produces, and 79.9% to intensify irrigation in three villages. As a resource, the land is important in terms of its contribution to farming and other economic activities hence it leads to the creation of employment, improved livelihood and poverty mitigation (URT 2010). According to Maharjan (2006) land is important but with the growing demands, population and the growing of

per-capital consumption within the household and region the amount of land owned by farmers do not offer a chance to farmers to produce more food and keep up.

#### **4.4.2. Strategies adopted to cope with decreased/unreliable rainfall**

Despite the challenges of decreased/unreliable rainfall, to survive and adapt to the changes in climate small-scale farmers are persistently making efforts. Some of the strategies they have adopted encompass adjustments in planting dates, use of higher-yielding seeds, crop variety, and irrigation

Respondents had exceptional views during interviews, with regard to adjustments in planting dates.

For instance, a woman aged 65, of primary school education engaging in mixed farming said:

A long time ago the principal downpour was once when an alert for the initiation of the season and we would begin preparation of the farms for planting at that time. Nowadays, I immediately start crop seeding instead of farm groundwork with the very start of the downpour.

Once in a while, I continue adjusting the planning of both farm readiness and planting dates the place I can plant some time ago or later during the season. When the soil wet planting early causes yields to proceed to exist and to endure dry season conditions till comparatively, downpours show up. (Said a 55year old woman, of primary school education practicing crop cultivation)

Some of the respondents appreciated the use of higher-yielding seeds and crop variety, such as:

I buy Hybrid or Open Pollinated Certified Seed. The seed is almost 100% pure and that over 90% of the seeds will germinate hence certified seed. This means I use less seed and be surer that I will get a crop. Using certified seed can also mean I will not get as many pests or diseases attacking your crop. (Said a 36year old woman, of primary school education involved mixed farming)

Hybrid seeds give me very good yields, but some need a lot of work, and I need to plant them exactly according to the instruction given on the packet. If I do not follow the instructions for the hybrid seed, I might not get a good yield. Crops I planted using hybrid seed do not make seed which you can plant the next season, so I am forced to buy new seed in the

next season. For example, I planted a seed I harvested from a hybrid crop, I ended up losing half of my crop. (Said a 45year old man, of secondary education practicing crop cultivation)

Irrigation as a farming strategy adopted to cope with current climatic changes is very important. The respondents mentioned:

Despite the late coming and shortage of rainfall in the area, I proceed to plant and hold the crops with the aid of the usage of our indigenous irrigation system. The machine derives water from the borehole. This supplies me with water to grow and preserve the crops. I have additionally dug furrows in the farm to forestall water loss via run-off. (Said a 29year old man, of college education involved in crop cultivation)

Irrigation helps to improve my crop production, I can now harvest crops though they are few. I have managed to do irrigation through water harvesting during rainy seasons without these you can get nothing. I am getting good harvests and good food nowadays (Said a 38year old woman, of secondary education practicing crop cultivation)

Changing rainfall patterns and rainfall variability is a strategy adopted by small-scale farmers by either preparing the farm plot in advance or they can choose to plant prior or later during the season if there experience changes planting dates (Kristjanson et al., 2012). During the focus group discussion participants affirmed that for a productive reap, planting should now be finished with the prompt beginning of the downpour. Planting ahead of schedule with variable precipitation thought inside a brief timeframe when the soil is as yet wet causes yields to endure and to endure dry season conditions until further rains show up. As per Kristjanson et al. (2012), delayed planting is contended to be a typical adjustment system embraced by a dominant part of small-scale farmers in East Africa. An exploration directed by Mendelsohn et al. (2000) indicates aside from South Africa and Cameroon, Africa adjustments uncovers that in all nations, the sowing of various assortments of a similar harvest is viewed as among the most significant adjustments. Diverse sowing periods are additionally viewed as a significant adjustment in Egypt, Kenya, and Senegal.

In spite of adapting to early planting because of the shortened produce growing season and undependable precipitation, small-scale farmers expressed that great reap was not a surety of being food secure since now and again precipitation initiated early, however, was exceptionally versatile, requiring early planted yields to get by under stressing high-temperature conditions.

A research study by Selvaraju *et al.*, (2006), points out that global changes in climate are predicted to lead to reduce fresh accessibility (surface and groundwater) and decreased soil wetness throughout the time of the year, whereas the crop water demand is predicted to extend as a result of hyperbolic evapotranspiration caused by global changes in climate and also continuous presentation of great-yielding varieties and thorough farming. These correspond with the findings in both the individual response and in the FGDs whereby small-scale farmers have now adopted to high yielding seeds and crop variety as well as also practicing irrigation to ensure that they are food secure.

#### **4.4.3. Strategies adopted to cope with drought**

The adaptation strategies opted by farmers to cope with drought included a shift to drought-resistant crops, shift to higher-yielding seeds and crop variety and use of trenches.

The study area has shifted to drought-resistant crops an adaptation strategy. A woman aged 39, of university education in crop farming, said:

Planting drought-resistant trees are the best way to stop soil erosion from destroying your farm. Terraces are often used to stop erosion, but in fact, they make the soil more unstable. I decided to plant fruit trees because they do not use a lot of water and hold the soil together. Tree roots grow deep into the soil and hold it there, stopping it from being washed away.

Napier grass is a drought-resistant crop and is good for animals. I can cut Napier in the dry season to feed to my animals, and I make silage in the rains to store for the dry season. (Said a 59year old woman, of primary education practicing animal rearing)

Shift to higher-yielding seeds and crop variety is a farming practice undertaken by farmers to cope with the effects of drought. A woman aged 36, of secondary school education engaging in mixed farming, said:

I rely on higher-yielding seeds which set aside a shorter effort to create zenith development, endure dry spell conditions and may also prompt high return. With more droughts and changing weather patterns, new seeds have been developed which mature quicker. Some of these seeds are better at resisting disease.

A woman aged 36, of secondary school education engaging in mixed farming, said:

Because of harvest disappointment encouraged through an expansion in dry spells and lacking precipitation, I currently develop all yields in all seasons to attempt my luck. Before I used to plant contingent upon seasons for instance, in the event that maize comes up short, at that point I will gather beans.

The respondents also acknowledged the use of trenches as an adaptation strategy to cope with drought. A man aged 59, of primary school education engaging in crop cultivation, said:

I use small trenches around the farm for soil water conservation have helped to improve and conserve soil moisture also to reduce soil erosion on my farm. This also helped to supply my crop with enough water resulting in increased production, and it has improved my food production.

A woman aged 39, of university education in crop farming, said:

The weather is unreliable and water is difficult to get. The use of terraces is a good way to harvest the water on my farm. This is because at the end of each terrace I did set up a trench to catch any water coming from the terrace.

Analysis of individual interviews and FGD in Kiambaa Constituency exposed that farmers have gone through changes in climate and most of them have made some changes in their farming practices as a way to adapt to changes in climate. The study found that these coping mechanisms assist farmers to cope during drought. Some of the small-scale farmers have shifted to sowing high yielding crop varieties and drought-resistant crop varieties. The utilization of drought-resistant crop assortments has been an attempt by small-scale farmers as adjustment methodologies to temperature change (Ngigi, 2009). The findings agree with Paul (1998) various adjustments measures were taken by the

affected farmers, and these embrace household-level changes additionally as supports from each formal and informal sources.

#### **4.4.4. Strategies adopted to cope with decreased production**

Adaptation strategies employed by small-scale farmers to manage production decreased comprised of the use of pesticides, shifting to higher-yielding seeds, diversify income, and the introduction of new crop variety.

Use of pesticides among smallscale farmers' in Kiambaa Constituency as one of the techniques in adjusting to altering climatic conditions. A woman aged 65, of secondary school education engaging in mixed farming, said:

I modified the utilization of ordinary plant protection products to the utilization of modern agricultural chemical products now more than in the previous years. This is because of the reality of the countless amount of fungi, the number of pests and diseases has emerged as impervious to a portion of the conventional plant protection products, and consequently, I resorted to modern agrochemicals for successful pest and disease the controlling.

The small-scale farmers considered the shift to higher-yielding seeds as one of the strategies in adjusting to evolving climatic conditions. A man aged 65, of primary school education involved in mixed farming, said:

The use of higher-yielding seeds is good only when there are rains, with no rains they produce less. But, they have helped to improve my production and I get enough food.

Diversify income is another strategy adopted by the small-scale farmers to manage the influences of changes in climate. A man aged 50, of primary school education involved in mixed farming, said:

I shifted from reliance on farming as an important source of revenue and living. I now have interaction in non-agricultural things to do such as microenterprises.

A woman aged 46, of secondary education in crop farming, said:

The growth of urbanization in this area has pushed me to take part in small enterprise and other income-generating undertakings other than farming which is continuously influenced by impacts for changes in climate.

A study by Thornton et al. (2006; 2011) most studies carried out in East Africa on adjustment of changes in climate shows that the broadening of alternatives at the family level is essential for earnings and for the family food security. The study pointed out that farmers were cultivating beyond one crop with the fundamental reason for household consumption and promoting crop surplus. Agricultural production is experiencing a lot of negative influences triggered by changes in climate. This has prompted a reduction in crop generation hence looming food security of the people. Kristjanson et al. (2012) contend that families that are progressively present-day and interact in besides cultivating and non-cultivating activities were in general in a perfect circumstance and extra food secure than those that are fundamentally less inventive and interface in less cultivation and non-cultivating endeavors. According to Fishburn, 1968 in utility theory selections are taken by using more than one criterion. The utility that the decision-maker (i.e. small-scale farmer) receives after choosing a particular preference of adaptation strategy due to changes of climate is measured by a utility function  $U$ , which is a calculated depiction of the decision maker's (i.e. small-scale farmer) system of preferences thus:  $U(x_1) > U(x_2)$ , where desire of adaptation to changes of climate  $x_1$  is desired over choice  $x_2$  or  $U_{x_1} = U_{x_2}$ , where choice  $x_1$  is detached from desire  $x_2$  which means that both alternatives are equally desired.

This is evident because in this study most farmers were not only engaged with cultivating as their major occupation but also are also diversified into doing business. Therefore small-scale farmers in Kiambu County, Kiambaa Constituency have managed to apply reliable and sound strategies to overcome this problem. The availability of food is mostly enhanced by yields obtained from their fields, but they sometimes resort to purchasing food. Due to the erratic rainfall food generation and



the ability to deliver has decreased thus in order to ascertain household food availability purchasing food has become a strong aspect.

#### 4.5. Status of Household Food Security in Kiambaa Constituency, Kiambu County

The affirmation of the levels of household food insecurity access has measured the usage of items from the Household Food Insecurity Access Scale (HFIAS) of FAO-FANTA. The HFIAS consists of 9 items particular to an experience of food insecurity. The level of household food security was set up primarily centered on a rating (sum of responses) and a grouping of the severity of food insecurity from the HFIAS scale. The rating is the amounting of the frequency-of-occurrence for the duration of the previous 12 months for the nine food insecurity-related condition. Coded with 1, 2 and 3 respectively was, the frequency-of-occurrence: rarely (once or twice in the previous 12 months), sometimes (three to ten times in the previous 12 months) and often (more than ten times in the previous 12 months).

**Table 2: Summary of the questions developed in HFIAS**

No.	Summary of the questions
1	Worry about food
2	Unable to eat preferred foods
3	Eat just a few kinds of foods
4	Eat food that they really do not want to eat
5	Eat a smaller meal
6	Eat fewer meal in a day
7	No food of any kind in the household
8	Go to sleep hungry
9	Go a whole day and night without eating

Source: [14] Coates *et al.*, 2007

**Table 3: Distribution of affirmative responses to items on the Household Food Insecurity Access Scale (HFIAS) in Kiambaa Constituency, Kiambu County**

Question	Yes	Rarely	Sometimes	Often
	%			
<b>Domain: Anxiety and Uncertainty</b> In the past twelve months, did you worry that your household would not have enough food?	(26) 86.7	(9) 34.6	(7) 26.9	(10) 38.5
<b>Domain: Insufficient Quality</b> In the past twelve months, were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources?	(25) 83.3	(4) 16.0	(6) 24.0	(15) 60.0
In the past twelve months, did you or any of your household members have to eat a limited variety of foods due to a lack of resources?	(26) 86.7	(12) 46.2	(9) 34.6	(3) 11.5
In the past twelve months, did you or any of your household members have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food?	(24) 80.0	(7) 29.2	(12) 50.0	(5) 20.8
<b>Domain: Insufficient Quantity</b> In the past twelve, did you or any of your household members have to eat a smaller meal than you felt you needed because there was not enough food?	(20) 66.7	(6) 30.0	(10) 50.0	(4) 20.0
In the past twelve months, did you or any of your household members have to eat fewer meals in a day because there was not enough food?	(23) 76.7	(12) 52.2	(8) 34.8	(3) 13.0
In the past twelve months, was there ever no food to eat of any kind in your household because of lack of resources to get food?	(10) 33.3	(6) 60.0	(3) 30.0	(1)10.0
In the past twelve months, did you or any of your household members go to sleep at night hungry because there was not enough food?	(12) 40.0	(7) 58.3	(3) 25.0	(2) 16.7
In the past twelve months, did you or any of your household members go a whole day and night without eating anything because there was not enough food?	(4) 13.3	(2) 50.0	(1) 25.0	(1)25.0

From the above table, it is evident that all households are experiencing food insecurity occurrences in all the three domains: anxiety and uncertainty, insufficient quality and insufficient quantity of food. The findings from Table 3 above demonstrate that the leading frequency was “rarely” (experiencing the occurrences once or twice a year) with a mean of 41.8 percent across the domains. 34.6 percent of the respondents infrequently stressed that their families would not have enough food in the last twelve months, 16 percent indicated that due to lack of resources they rarely were not able to eat the kind of food they preferred to eat, 46.2 percent indicated that a member of the household had to eat limited variety of food and 29.2 percent due to lack of resources ate food they did not really want. Whereas 30 percent had to eat a smaller amount of food than needed, 52.2 percent ate fewer meals in a day and 60 percent due to lack of enough food had no food to eat. Nevertheless, 58.3 percent indicated that due to lack of food they slept hungry and 50 percent ate nothing due to lack of food the whole day and night.

Then followed by “sometimes” (experiencing the occurrences once every month) which has a mean of 33.4% percent and the lowest frequency was “often” (experiencing the occurrences on a weekly basis) with a mean of 23.9% percent. These findings implied that food in the households was insecure due to it being unavailable, inaccessible and unutilized at a given time in the last twelve months. Whenever households reported that either; rarely, sometimes, or often they did not have enough food at one point they were considered food insecure. Established on the data, the average Household Food Insecurity Access Scale score was calculated as follows:

### **Sum of HFIAS Scores in the sample**

**Number of households in the sample**

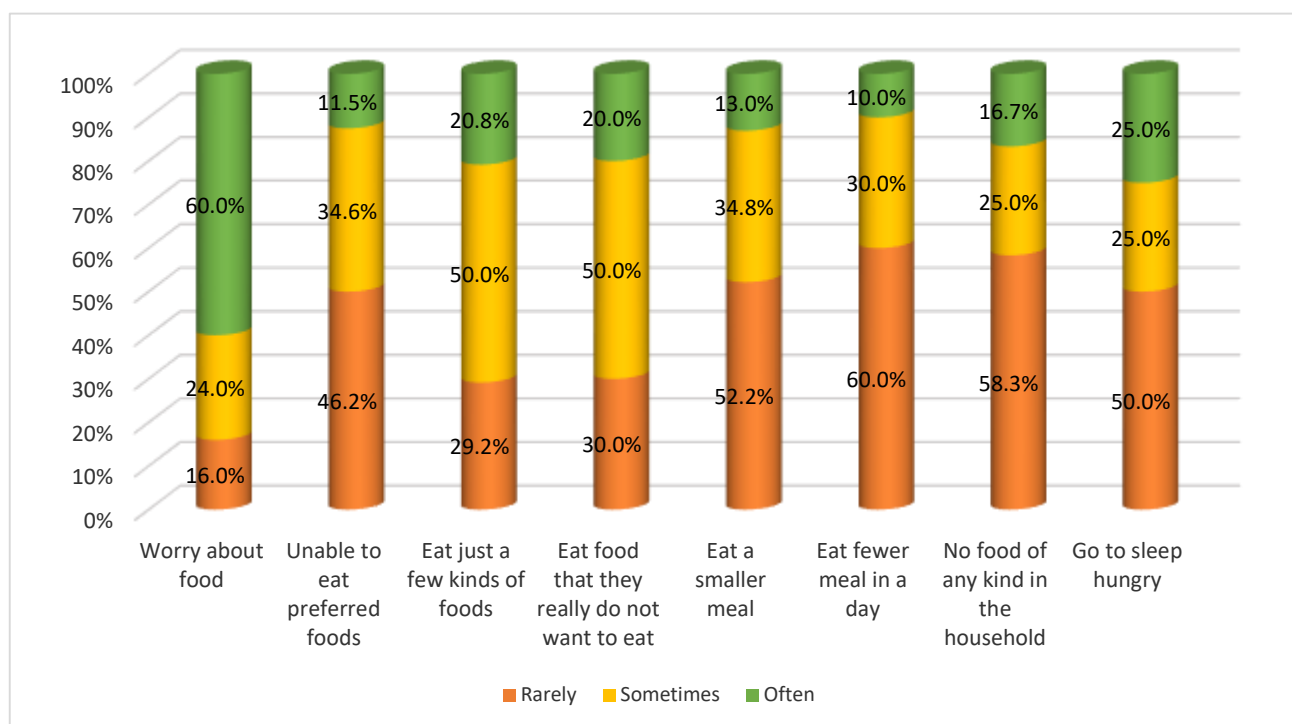
$$= \frac{170}{30}$$

**Average HFIAS = 5.67.**

According to Bickel et al's (2000) HFIAS score and categorization, households are classified into food secure, food insecure without hunger, moderately food insecure with hunger, and severely food insecure with hunger. In these scores and classification, households with a score of up to 2.32 are categorized as food secure, those with a score of up to 4.56 are classified as food insecure without hunger, a score of up to 6.53 are considered as moderately food insecure with hunger and a score of 6.54 and above are categorised as severely food insecure with hunger as indicated below.

**Table 4: HFIAS Score and Categorization**

Up to 2.32	Up to 4.56	Up to 6.53	Up to 10
Food Secure	Food Insecure		
	Food Insecure Without Hunger	Food Insecure With Hunger	
		(Less Severe) "Moderate"	(More Severe) "Severe"



**Figure 2: Showing the occurrence of food insecurity conditions at the household level**

The study results revealed an average HFIAS of 5.67 which therefore means that on average, the households in Kiambaa Constituency, Kiambu County have a score of  $5.67 \times 10/9 = 6.3$  which lies in the category of moderate food insecure with hunger. The findings indicate that the crucial factor to this condition is the reliability at the household level of the sources of food consumed. Therefore, households in Kiambaa Constituency using Bickel et al's (2000) model, can be described as those that have adopted a lifestyle of cutting back on Insufficient quality (incapable to eat favored foods, eat only a couple of sorts of foods and eat food that they truly would prefer not to eat) even as occasionally as rarely. The outcomes from the study exhibit that the adjustments in climate and natural prerequisites are taking place in the research area and are influencing farming incomes.

# **CHAPTER FIVE: SUMMARY OF FINDINGS, CONCLUSION, AND RECOMMENDATIONS**

## **5.1. Introduction**

This chapter presents a summary of the study findings, conclusions, and recommendations based on the study findings and objectives.

## **5.2. Summary of the study findings**

Discussed below is the summary of the study findings.

### **5.2.1. Perceptions of Small-scale Farmers With Regard To Climate Change**

Interviews with small-scale farmers uncovered there was a developing concern that changes in climate were a reality. Small-scale farmers in the study area pointed out that they were aware of the causes of changes in climate. They indicated that population increase and deforestation were mentioned as the main causes for this development. Outcomes showed that small-scale farmers had mostly undesirable perceptions and attitudes in explaining the climate variables most often perceived as results of climate change and causing risks. Participants perceived changes in climate influences as shortened growing seasons, changes in the length and start of the precipitation season, improved crop failures, food deficiencies and will increment in the rate of outrageous climate occasions, such as drought. In this study, the fundamental experienced impacts of changes in climate on food security were by and largely increased temperatures, decreased rainfall, accelerated frequencies of drought and hence, decreased production.

### **5.2.2. Strategies Adopted to Cope With the Effects of Climate Change in Ensuring Household Food Security**

In perspective on this research study, small-scale farmers featured various adaptation strategies used to cope with both the impacts of changes in climate on farming and food security. Noticeably there

were key modifications in the cultivating practices attempted by small-scale farmers of the study area to make certain enhanced crop production under changes of climate. The results from this research study demonstrated that farmers are trying endeavors to adjust their cultivating practices to changing climatic and natural prerequisites. The most adaptation strategies selected by small-scale farmers in Kiambaa Constituency encompassed a shift to higher-yielding crop varieties, irrigation practice, and shift to drought-resistant crop varieties. Also, mixed cropping, use of pesticides, use of trenches, reduce the size of the farm due to drought and less rainfall, were seen as diverse changes in the cultivating practices selected by farmers. Another vital inference drawn from this research is that essentially all cultivating exercises in the study area rely completely on precipitation. Consequently, there is exclusively restricted utilization of irrigation in the administration of agricultural undertakings. Farmers demonstrated that they had a few extra foods for their household when utilizing adaptation strategies than when not utilizing them. Another methodology that farmers used to keep up or enlarge harvest yields even with precipitation inconstancy was to adjust planting dates. Diversifying household income was the most used adaptation strategies to food insecurity.

### **5.2.3. Household Food Security Status in Kiambaa Constituency, Kiambu County**

On the levels of household food security in Kiambaa Constituency, the Household Food Insecurity Access Scale (HFIAS) measurement tool whenever households reported that either; sometimes, rarely or often they did not have enough food at one point they were considered food insecure. The study revealed that food in the households was insecure due to it being unavailable, inaccessibility and unutilized. The study results revealed an average HFIAS of 5.67 therefore, means that on average the households in Kiambaa Constituency, Kiambu County have a score of  $5.67 \times 10/9 = 6.3$  which lies in the category of moderate food insecure with hunger.

### **5.3. Conclusion**

The outcomes of this study revealed that the predominant source of sustenance of the small-scale farmers' in Kiambaa Constituency, Kiambu County is farming. The research study pointed out that small-scale farmers in Kiambaa Constituency are farmers who cultivated for family utilization solely and traded infrequently. There were additionally those who were farming for family utilization and selling the excess. The majority of the interrogated farmers had experienced changes in climate predominantly prolonged high temperature, unreliable precipitation and accelerated frequencies of drought. This led to diminished crop production resulting in doubtlessly and/or every so often decreased yield which in flip impacted household food security negatively through: drying of crops, crop failure, and harm as well as uncertain on sowing and planting dates. Another impact on food insecurity among households triggered by climate change was in most cases the populace increase that put pressure on useful resource use and environmental annihilation.

Most of the small-scale farmers were conscious of the changes in climate, the interventions available and reachable to them. By virtue of being excessively reliant on rain-fed farming, they have employed different adaptation strategies. It was also observed that some farmers were shifting in the direction of adaptation particularly the food producers by altering their planting dates, adopting mixed cropping, intercropping and crop diversifying. Off-farm activities contributed considerably to household income, subsequently enabling food security by supplementing their food needs.

For existence, food is a fundamental necessity and critical for sustenance. Sufficient food consumption, as far as amount and quality, is key for a healthier lifestyle. Using an effective and consistent tool, i.e. Household Food Insecurity Access Scale (HFIAS), the research looked at household-level food insecurity in Kiambaa Constituency, Kiambu County. The finding revealed that the Constituency lies in the category of moderate food insecure with hunger.



Generally, the adaptation techniques to climate alternate were found to have a tremendous contribution to agricultural output and for that reason food security to the greater part of the small-scale farmers in Kiambaa Constituency, regardless of low possibilities on applying by farmers.

#### **5.4. Recommendations**

Climate change is an actuality and is already taking its toll on agricultural activities, leaving small-scale farmers at Kiambaa Constituency, Kiambu County extraordinarily susceptible to food insecurity. Based on the findings from this study, the following recommendations are put forward that require the support of Government both at the national and county level, non-government organizations and small-scale farmers as the key stakeholders and decision-makers;

- i. Heighten sustainable adaptive strategies for reducing the impacts of climate change
- ii. To reduce climate change impacts to small-scale farmers and improve subsistence agriculture there is a need to improve farming inputs, implements, and diversification of agricultural production.

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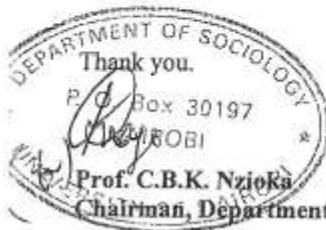
TO WHOM IT MAY CONCERN

RE: PATRICIA MARYANNE MUKARANI AMBUGA - C50/5417/2017

Through this letter, I wish to confirm that the above named is a bonafide postgraduate student at the Department of Sociology & Social Work, University of Nairobi. She has presented her project proposal entitled; "Adaption Strategies of Small Scale Farmers to Climate Change & Food Security: The Case of Kiimbaa Constituency, Kiambu County."

Patricia is required to collect data pertaining to the research problem from the selected organization to enable her complete her thesis which is a requirement of the Masters degree.

Kindly give her any assistance she may need.



Prof. C.B.K. Nzioka  
Chairman, Department of Sociology & Social Work



# IN-DEPTH INTERVIEW GUIDE

## Respondents' Informed Consent

My name is Patricia Mukarani a Master of Arts student at the University of Nairobi, Department of Sociology. I am conducting a study for my academic qualification to understand how small-scale farmers are coping and adapting to climate change to ensure food security here in Kiambaa Constituency. Information obtained from this study will help in my studies and development organizations working on Food Security Programs.

All the information provided here will be treated as **STRICTLY CONFIDENTIAL**. Data gathered by this tool shall be used solely for the purpose of this intended evaluation and nothing else. Personal details and socio-economic details of respondents shall be kept confidential and no mention of names shall be made in the final report that shall be compiled. Your participation in this study is voluntary and will be immensely appreciated. If you feel at whatever point you do not want to continue, kindly let me know. This interview will take approximately 45 minutes.

Thank you for your assistance.

## I. GENERAL INFORMATION

1.	Interview guide serial	
2.	Date of interview	
3.	Name interviewer	

## II. DEMOGRAPHIC AND SOCIO-ECONOMIC CHARACTERISTICS

### 4. Gender

0 =Male                      1 = Female

### 5. Age:

0 = ≤ 19    1= 20-24    2= 25-29    3= 30-34    4= 35-39    5= 40-44    6=45-49    7=50 and below

### 6. Marital Status

0 = Single            1 = Married    2 =Divorced    3 = Widowed    4 = Other (specify)

### 7. Education Level

0=Illiterate    1=Read and write    2=Primary    3=Secondary    4=College    5=University

### 8. Family Size (Number)\_\_\_

0 =17 years and below (Children) -----    1 =18-35 (Youth) -----    2 =36-59 (Adults) -----    3 =Above 60 (Aged) ----

### 9. Main Occupation

0 =Crop cultivation    1 =Animal rearing    2 =Mixed farming    3 =Other (specify)

## III. PERCEPTIONS OF SMALL-SCALE FARMERS WITH REGARD TO CLIMATE CHANGE

10. Have you come across the word climatic change previously?

0=Yes    1=No

11. From which source did you hear about climate change? (*Check all that apply*)

0 =Television (TV)

1 =Radio

2=Newspapers

3= Poster

4=Friends

5= Chief's baraza

6= GoK extension agents

7=Other (specify)-----

12. What do you understand by climate change?

- 13.** What is it and how does it occur?
- 14.** How does it manifest itself?
- 15.** How important is the issue of climate change to you personally?  
0 =Very important (go to question 13)  
1=Quite important (go to question 13)  
2=Not very important (go to question 14)  
3= Not at all important (go to question 14)
- 16.** Why is it important to you?
- 17.** What do you think causes climate change?
- 18.** What **impacts**, if any, do you think climate change may have?
- 19.** What crops do you mostly cultivated?
- 20.** What is the capacity of your production?
- 21.** How can you relate climate change impacts to crop production?
- 22.** How is the trend of rainfall in the past 10 years?
- 23.** How is the trend of temperature in the past 10 years?
- 24.** Which important crops have disappeared in the last 10 years?
- 25.** Do you think climate change is something that is affecting us or is going to affect you, personally?  
0 =Yes (go to question 26) 1=No (go to question 27) 2= don't know (go to question 27)
- 26.** If yes, in what way(s) is it affecting you, or is it going to affect you?
- 27.** Do you think anything can be done to tackle climate change?  
0 =Yes (go to question 28)  
1=No (go to question 29)  
2= don't know (go to question 29)
- 28.** If yes, what do you think can be done to tackle climate change?
- 29.** Who do you think should have the main responsibility for tackling climate change?  
0= International organisations (e.g. the UN)  
1= The national government  
2= County government  
3= Business and industry

- 4= Environmental organisations/ lobby groups
- 5= Individuals
- 6= Other (\_\_\_\_\_)

**IV. STRATEGIES ADOPTED TO COPE WITH THE EFFECTS OF CLIMATE CHANGE IN ENSURING HOUSEHOLD FOOD SECURITY**

30. Have you ever experience shortages of agricultural-based food items at your household?  
 0=Yes 1=No

31. If yes, what were the reasons for the food shortages?  
 0= Price increase 1= Droughts 2=Floods 3= Lack of farm inputs 4= Other\_\_\_\_\_

32. Which months did you experience shortages of agricultural-based foods the most?  
 0= Dec-Feb 1= March-May 2= June-Aug 3= Sep-Nov

33. How did you cope with these shortages?

34. Have you made any adjustment in your farming practices to climate change?  
 0=Yes 1=No

35. What adaptation measures have you used to deal with the changes in temperatures?

36. What adaptation measures have you used to deal with the changes in rainfall?

37. How do you feel about dealing with climate change challenges?

**V. STATUS OF HOUSEHOLD FOOD SECURITY IN KIAMBAA CONSTITUENCY, KIAMBU COUNTY.**

<b>Household Food Insecurity Access Scale (HFIAS)</b>			
<i>(rarely: once or twice; sometimes: 3 to 10 times; Often: more than 10X in the last 12 months)</i>			
38.	In the past 12 months, did you worry that your household would not have enough food? <i>(if answer is No, skip to Q40)</i>	1: Yes	0: No
39.	How often did this happen?	1: Rarely	2: Sometimes 3: Often
40.	In the past 12 months, were you or any household member not able to eat the kinds of foods you preferred because of a lack of resources? <i>(if answer is No, skip to Q42)</i>	1: Yes	0: No
41.	How often did this happen?	1: Rarely	2: Sometimes 3: Often
42.	In the past 12 months, did you or any household member have to eat a limited variety of foods due to a	1: Yes	0: No

	lack of resources? ( <i>if answer is No, skip to Q44</i> )		
43.	How often did this happen?	1: Rarely	2: Sometimes   3: Often
44.	In the past 12 months, did you or any household member have to eat some foods that you really did not want to eat because of a lack of resources to obtain other types of food ( <i>if answer is No, skip to Q46</i> )	1: Yes	0: No
45.	How often did this happen?	1: Rarely	2: Sometimes   3: Often
46.	In the past 12 months, did you or any household member have to eat a smaller meal than you felt you needed because there was not enough food? ( <i>if answer is No, skip to Q48</i> )	1: Yes	0: No
47.	How often did this happen?	1: Rarely	2: Sometimes   3: Often
48.	In the past 12 months, did you or any other household member have to eat fewer meals in a day because there was not enough food? ( <i>if answer is No, skip to Q50</i> )	1: Yes	0: No
49.	How often did this happen?	1: Rarely	2: Sometimes   3: Often
50.	In the past 12 months, was there ever no food to eat of any kind in your household because of lack of resources to get food? ( <i>if answer is No, skip to Q52</i> )	1: Yes	0: No
51.	How often did this happen?	1: Rarely	2: Sometimes   3: Often
52.	In the past 12 months, did you or any household member go to sleep at night hungry because there was not enough food? ( <i>if answer is No, skip to Q54</i> )	1: Yes	0: No
53.	How often did this happen?	1: Rarely	2: Sometimes   3: Often
54.	In the past 12 months, did you or any household member go a whole day and night without eating anything because there was not enough food?	1: Yes	0: No
55.	How often did this happen?	1: Rarely	2: Sometimes   3: Often

THANK YOU FOR YOUR VALUABLE TIME AND YOUR PARTICIPATION IN THIS IMPORTANT RESEARCH PROJECT.

## FOCUS GROUP DISCUSSION GUIDE

1. What do you understand by the term climate change?
2. What climate change impacts do you face in Kiambaa Constituency, Kiambu County?
3. What crops are mostly cultivated?
4. What is the capacity of farmers' production?
5. How can you relate climate change impacts to crop production?
  - How is the trend of rainfall in the past 10 years?
  - How is the trend of temperature in the past 10 years?
6. Which important crops have disappeared in the last 10 years?
7. In seasons of food shortages where do people get assistance?
8. How and where do you get information concerning climate change?
9. How do you communicate information on climate change?
10. What adaptation measures and coping strategies have you taken to combat climate change impacts?
11. Tell me about the role of various institutions/organisation that advise you about climate change support systems.
  - Mention their names
  - Climate services, interventions and support they provide
  - How important are they to you

- Describe your relationship with each provider (Using a venn diagram) also show how the identified climate interventions and support they provide
- Reliability and timeliness of receiving services/information , how do they deliver services/information
- How useful are they? (use a scale of 1-5 for them to indicate numerically while they justify why that particular rank)

12. Do you think the government is doing enough to support farmers on climate change challenges?

- What are the perceived challenges to the effective receipt and use of the climate change interventions and support systems?
- If you were to advise the government what would you suggest/ communication platforms
- What processes would you follow to ensure that farmers receive and use climate change interventions and support systems?

THANK YOU FOR YOUR VALUABLE TIME AND YOUR PARTICIPATION IN THIS IMPORTANT RESEARCH PROJECT.