UNIVERSITY FOR DEVELOPMENT STUDIES

THE EFFECTS OF BUSHFIRES ON FOOD SECURITY IN THE SISSALA EAST DISTRICT

BY

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DECLARATIONS

STUDENT

I, Gilbert BaliniaAdda hereby declare that this dissertation is the result of my own original work and that no part of it has been presented for another degree in this University or elsewhere and other authors used as reference have been duly acknowledged.

Candidate's Signature……..

Date……

SUPERVISOR

I, Emilia Guo hereby declare that the preparation and presentation of the dissertation was supervised in accordance with the guidelines on supervision of dissertation laid down by the University for Development Studies.

Principal Supervisor Signature……

Date……

ABSTRACT

This study was conducted on the effects of bushfires on food security in the Sissala East District of Ghana. The sample size was two hundred and ninety one(291) respondents out of which two hundred and eighty six (286) respondents responded to the instrument forming a response rate of 95 percent using a simple random sampling technique to select the respondents for the study. The objectives of the study were; to assess the factors that cause bushfires, to find out the effects of bushfires on production levels of farmers, assess the effects of bushfires on food security in the Sissala East District, to find out earlier interventions to minimize bushfires in the study area and finally to find out the constraints to bushfires prevention as well as measures that can be adopted to reduce the menace in the Sissala East District. The study revealed that there were several factors that cause bushfires in the Sissala East District which majority of them stated Fulani herdsmen and the activities of hunters as the major causes and others such as unattended fires from adjoining communities, charcoal burners, indiscriminate disposal of cigarette butts and arsonists who at times set fire on farms. The study revealed that bushfires affects food production levels of farmers resulting in transitory food insecurity in the Sisaala East District since many of the affected people could only have food for four to five months after harvest, and that some interventions such as community bushfire volunteers squads, creating of fire belts around farms, and regular bushfire sensitization could minimize the occurrence of bushfires and the enactment and enforcement of bye-laws could also reduce the constraints of bushfires prevention in the SissalaEast District. The study recommended that the District Assembly and the Traditional Authority should enact bye laws to regulate the activities ofFulani herdsmen, hunters slash and burn agriculture as well as charcoal burners and severe sanctions to culprits of bushfires.

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DEDICATION

I dedicate this work to my dear Wife Gloria and Son Kelvin for their fervent prayers, support, advice and encouragement during my studies.

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ACRONYMS AND ABBREVIATIONS

AU	African Union
DCE	District Chief Executive
EPA	Environmental Protection Agency
FAO	Food and Agricultural Organization of the United Nations
FSC	Forestry Service Commission
GDP	Gross Domestic Product
GEMP	Ghana Environmental Management Project
GLSS	Ghana Living Standard Survey
GNFS	Ghana National Fire Service
GSS	Ghana Statistical Service
GFMC	Global Fire Monitoring Center
HND	Higher National Diploma
ICEIR	Institute for Continuing Education and Interdisciplinary Research
IFFN	International Forestry Fire News
JHS	Junior High School
MMDA'S	Metropolitan/Municipal/District Assemblies
MoFA	Ministry of Food and Agriculture
NEAP	National Environmental Action Plan
NWMP	National Wildfire Management Policy
PHC	Population and Housing Census
PNDC	Provisional National Defense Council
SADA	Savanna Accelerated Development Authority
SEDA	Sissala East District Assembly

SHS	Senior High School
SPSS	Statistical Package for Social Sciences
UDS	University for Development Studies
UN	United Nations
UNDP	United Nations Development Programme
UNEF	United Nations Environment Fund
UNEP	United Nations Environment Programme

CHAPTER ONE

INTRODUCTION

1.1Background of the Study

Throughout historical epochs, the human race has been instrumental in ensuring that all people have access to sufficient good quality food to live active and healthy lives. Despite efforts in the past decades, indicators of the twenty first century clearly demonstrate that providing sufficient food to all people remains an urgent problem situated at the nexus of nature, society, technology and ensuring that people have sufficient access to food has been and remains a core challenge to the security and stability of communities, states and the international system (Bryan 2011).

The Food and Agriculture Organization estimated that 12 percent of the world' populations (842 million people) are undernourished in terms of energy intake, thevast majority of hungry people 827 million of them- live in developing regions, wherethe prevalent of undernourishment is estimated at 14.3 percent. An estimated26 percent of the world's children are stunted and 2 billion people suffer from one or more micronutrient deficiencies (FAO 2013).

In Sub-Saharan Africa, it is argued that over 70 percent of the food insecure people live in rural areas. Ironically these smallholder farmers produce ninety percent of the continent food supply, however the majority of these poor rural folk rather experience food unsecured conditions (Heidhue,2004).

In Ghana, the former Food and Agricultural Minister, HonorableKwesiAhwoi stated that recent statistics shows that a total of 1.2 million Ghanaians are food unsecured throughout the year, while 2 million were becoming food insecure during the lean season or at the onset of a natural or man- made disaster(the Chronicle News Paper

March 11, 2012). According to the former Minister these figures are 5 to 10 percent of the total population but the majority of people at risk of food insecurity are concentrated in the three Northern regions(Northern, Upper east and Upper west). Events such as the severe floods of 2007, coupled with bushfires, climate change, chieftaincy conflicts, rise in global food and fuel prices have cumulatively heightened the already existing vulnerabilities among people and communities in these regions in the former Minister view.

Mohiuddin and Poonam (1991), articulate that many factors militate against a state where global food security could be reached notable among them are migration of farmers to cities to find other work as prices of farm produce keep on deteriorating, inadequate water supply (erratic rainfall), environmental degradation, population growth, cash crop production, natural disasters and conflicts. Adequate food supply poses two challenges namely; to provide enough food to meet the needs of the earth's expanding population, without destroying natural resources needed to continue producing food. The second is to ensure food security – that is to make sure all people have access to enough food to live active, healthy lives (Anderson, 2009) .

John and Katharine, (2008) indicates that the natural environment does not only provide sources of material inputs for the economic system, but also provide life support services in the form of a breathable atmosphere and livable climate and a variety of amenity services, including recreation and wildlife observation. From the above discourse man and his environment are intrinsically inseparable.

Man has continued to use resources at his disposal without recognizing the harmony that these elements create in order to sustain themselves (John and Katharine,2008). Ghana's interest on the need for environment sustainability grew in the 1960's as a

result of the emergence of varied serious problems facing the environment (Nsiah-Gyabaah,1996);this sentiment was further echoed by the Global Fire Monitoring Center (GFMC, 2004).The colonial legacy pertaining to bushfire changed in the early 1970's as a consequence of the Sahelian drought "crisis" and associated economic difficulties

In the light of these varied challenges facing the environment, the international community through United Nations (UN) formed various agencies to reverse this trend, these include; United Nations Development Programme (UNDP), United Nations Environment Programme (UNEP) and the United Nations Environmental Fund(UNEF).At the continental and sub-continental level the African Union (AU) and theEconomic Community of West African States (ECOWAS)had both established commissions for the environment, to formulate policies to be fitted into the global environmental policy(UNEP,2006).

At the national front the Environmental Protection Agency (EPA), the Provisional National Defense Council (PNDC) law 229 1990 (control and prevention of bushfires) and the (National Wildfire Management Policy, 2006). The Forestry Commission and other environmental legislations were initiated to ensure environmental security and sustainability.

Although these enactments and policies were established to ensure environmental quality, the environment is being abused by anthropogenic activities such as bushfires, indiscriminate disposal of waste, bad farming practices among others (Nsiah-Gyabaah, 1996).The incidence of the perennial bushfires is so pronounced in many communities and its resultant effects of food insecurity, wildlife migration and extinction, loss of human lives, destruction of medicinal plants and more pronounced

of this phenomena is visibly exhibited in the three Northern Regions during the harmattan season spanning to the rest of the dry season, and indeed it is not an exaggeration to say that it is uncommon to find an acre with vegetation cover all year round inthese regions (Nsiah-Gyabaah, 1996). This has become a source of worry to government; however, the immediate pain receivers of this multiplicity of negative impacts of the perennial bushfires are the rural dwellers whose livelihoods are intrinsically a nexus to the environment.

The Sissala East District in the Upper West Region is currently challenged with the incidence of perennial bushfires which seems to have impacted negatively on food security in the district. Many factors contribute to this state of affairs but poverty seems to be in the center of affairs that causes the perennial bushfires in the Sissala East District, (Sissala East District Assembly, 2011). The effects of poverty ripples into many other aspects of economic activities such as using fire for hunting wild animals, fire for constructing fire belts, fire for clearing bush and fire for honey extraction among others. This is further buttressed with the Ghana Living Standard Survey, Sixth round GLSS 6 (GSS, 2012) which described the Upper West Region as the poorest region in the country where nine out of every ten people is poor.

The poverty syndrome is widely accepted as the basis for environmental degradation. The Brundtland Commission, (1987) concluded that poverty is a major cause for environmental degradation. The report therefore concluded that drastic reduction of poverty is a necessary and central condition for ensuring environmental quality. Mohiudin and Poonam, (1991) admitted that “environmental preservation has to be joined with the task of poverty alleviation so as to break the vicious cycle between poverty and environmental degradation”. Widespread poverty, food insecurity and environmental degradation cause severe human suffering and threaten to

destabilizeglobal, regional and national economic and ecologicalconditions. If these trends continue, the world will not be a pleasant place to live for most of humanity (Penstrup-Andersen and Pandaya-Lorch,1998).

The aim of this work is therefore to identify the interconnections of bushfires and food security and to contribute knowledge on the causes, prevention and effects of bushfires on food security in the Sissala East Districtthat could be of importance to policy makers at the local and national level as well as other organizations that are into environmental sustenance and food security.

1.2 Problem Statement

Among the numerous constraints faced by the people within the "fragile savannah ecology" (Nsiah-Gyabaah,1996) is the issue of bushfires. The bushfire in the savannah ecology over the years has been identified as one of the major socio-economic problem stifling the economic progress of the savannah ecology which vegetation and food crops are consumed perennially by these bushfires. Throughout the Sissala East District year on year basis it is not common to find an acre with vegetation cover all year round. This threatening phenomenon does not only affect the biodiversity in the Sissala East District but also lowers the productivity of the soil, burn food crops and lower the overall agricultural output thereby exposing the district to food insecurity. Protecting the natural fragile savannah ecology of the Sissala East District is eminent since most of the people livelihoods are intrinsically inseparable from the natural environment.

It is against this background that government has increased its efforts through relevant institutions such as the Environmental Protection AuthorityGhana and the Savannah

Accelerated Development Authority (SADA) and other international bodies to reduce if not to eliminate totally the perennial bushfire menace and other environmental ills.

It however, appears that these efforts are not yielding the desired results as expected by government. It is in line with this that the researcher worked on the causes, preventions and how bushfires affect food security in the Sissala East District as well as the constraints in bushfire preventions and suggestions for bushfire prevention.

1.3 Research Question

The main question guiding the study is; how do bushfires affect food security in the Sissala East District?

1.3.1Specific research questions

1. What arethegeneral factors that cause bushfires in the Sissala East District?
2. What are the effects of bushfires on the production levels of farmers in the Sissala East District?
3. What are the effects of bushfires on food security in the Sissala East District?
4. What interventionhas been put in place to minimize or prevent bushfires in the Sissala East District?
5. What are the constraints to bushfires prevention in the Sissala East District?
6. What measures can be adopted to minimize the occurrence of bushfires in the Sissala East District?

1.4 Objectives of the Study

The study broadly examines the effects of bushfires on food security in the District.

1.4.1 Specific Objectives

1. To ascertain the general factors that causesbushfires in the Sissala East District.

2. To find out the effects of bushfires on production levels of farmers in the Sissala East District.

3. To find out the effects of bushfires on food security in the Sissala East District.

4. To find out what interventions have been put in place to minimize or prevent bushfires in the Sissala East District.

5. To find out the constraints to bushfire prevention in the Sissala East District.

6. To find out what measures can be adopted to minimize the occurrence of bushfires in the Sissala East District.

1.5 Justification

According (John and Katharine 2008) the environment and its resources form the basis for economic transformation in a locality particularly in rural communities. The overwhelming effects of bushfires on the local economy and food security in the Sissala East District (SEDA 2011) coupled with the fact that the 2010 population and housing census indicated that a higher proportion of the population are occupationally engaged in farming speaks volumes for urgent efforts to reduce the menace to avoid possible communal conflicts on land use.

Though there have been earlier efforts to reverse the trend of events the desired results are far-fetched, therefore this piece of work hasevaluated the earlier efforts and made some recommendations that could be useful to policy makers at the local and national levels as well as other organizations that are into environmental sustenance and food security.

1.6 Scope of Research

The study was confined to Sissala East District with Tumu as the district capital. The study mainly looked at the causes of bushfires, the effects of bushfires on production levels of farmers, the effects of bushfires on food security in the district, interventions to reduce bushfires, constraints to bushfire prevention and finally measures that may be adopted to reduce the bushfire menace.

1.7Suggestions for Further Research

For future research, it is recommended that, the scope and sample size of the study should be broadened to capture more data thus broadening the number of communities, sample size and if possible cover all communities in the Sissala East District which could provide grounds for generalization.

1.8 The Organization of the Study Report

The study report is organised into five chapters. Chapter one presents the general introduction, background of the study, problem statement, research questions, and objectives of the study, justification, definition of key concepts, key variables, scope and organization of the study are contained in this chapter.

Chapter two is the review of literature related to the effects of bushfires on food security. In it is introduction, record of wildfires in Ghana, bushfires in the savannah region, causes of bushfires and effects of bushfires. Also contained in this chapter are wildfire legislations in Ghana, anti-bushfires law, PNDCL 46 (1983) control of bushfire law, PNDC law 229 (1990) control and prevention of bushfire law, the Ghana national fire service Act, 1997 (Act 537), past policies and initiatives in bushfire management, and the National Wildfire Management Policy (NWMP, 2006). In addition, this chapter also explore productivity and bushfires and food security.

Chapter three presents the methodology of the study and description of the study area. The methodology contains; the research design, choice of sample size, training, pre-testing, data editing and data analysis. The description of the study area contains the location and size, vegetation, climate, natural environment and the district map. Chapter four presents' data analyses as well as discussion on the data collected from the field. Chapter five presents the summary of findings of the study, conclusion and recommendations.

1.9.Definition of Key Concepts

1.9.1 Food Security

The concept, food security has multiple definitions and dimensions making it a popular concept on global issues. According to(FAO, 2009) food security is the idea that all people at all times have access (including physical, social and economic) to sufficient, safe, and nutritious food necessary to lead active and healthy lives.

In Ghana, The Ministry of Food and Agriculture (2003) defined food security to be good quality nutritious food hygienically packaged, attractively presented, available in sufficient quantities all year round and located at the right place at affordable prices.

1.9.2Food Security Dimensions

Food security could be categorized into chronic and transitory modes, chronic food insecurity occurs when people are unable to meet their minimum food requirements over a sustained period of time. Were as transitory food insecurity occurs when there is a sudden drop in the ability to produce or access enough food to maintain a healthy life(World Food Summit,1996).

1.9.3 Indicators of food security

1. Food Availability; refers to the physical presence of food which may come from own production, purchases from internal market or imports from overseas.

2. Food Accessibility; household food access is the ability to obtain sufficient food of guaranteed quality and quantity to meet nutritional requirements of all household members.

3. Food Utilization; this refers to ingestion and digestion of adequate and quality food for maintenance of good health.

4. Stability of food supplies; this refers to the continuous supply of adequate food all year round without shortages(World Food Summit, 1996).

1.9.4 Bushfires

Abushfire is a term applied to any uncontrolled fire in the natural vegetation andcultivated lands (Barnes et al, 2004).

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

Ghana's forest cover stood at 8.2 million hectares in 1900 and dwindled terribly to some 800,000 hectares in 2001 (NWMP, 2006).According (NWMP, 2006) the period between 1983 and 1984 saw Ghana going through a horrifying experience when prolonged drought led to raging bushfires, which caused massive destruction to the environment andin fact, forests which served as buffer zone between the savannah and the forest regions were affected.

The literature review was confined to the record of bushfires in Ghana, causes of bushfires, bushfires and agricultural productivity, food security, laws to prevent bushfires in Ghana and constraints to bushfire prevention,

2.2 Record of Bushfires in Ghana

There are few records on bushfires in Ghana. Data on anthropogenic caused fires dating back to the pre-independence era are also lacking, however, records of wildfires in Ghana can be traced to the frequency of drought periods because most drought years are accompanied with widespread wildfires. Droughts have obviously been occurring since the beginning of the 19th century (Nsiah-Gyabaah, 1996). He however, agued further that, it was only after 1970 that the problem of drought and associated wildfires came into the forefront of national concern for the environment

Available records accordingNsiah-Gyabaah (1996) shows that during the 1982-83 harmattanseasons, about 35 per cent of crops were destroyed by wildfire. In 1984-85, about 145 wildfires were reported in the northern savannah zone alone. The crops

most affected were rice and maize. The average size of farms affected was 50 hectares, with the largest covering about 100 hectares.

Ghana experienced serious wildfires during the catastrophic Sahelian drought (1973-74) and again in the period 1984-1985. Available data on the 1984-85 wildfires in all the country's ecological zones show clearly that the Guinea and Sudan savannah areas suffered the most impact with loss of vegetation, standing crops, farms, wildlife, habitat, human lives and property (Nsiah-Gyabaah, 1996).

Table 2.1 Incidence of Bushfires in Ghana (1984-85)

Number	Region	Main Vegetation	Main crop	Number of fires 1984-85	Percent of total 1984-85	Rank
1	Northern	Savannah	Rice, Millet Guinea corn	145	14.5	1
2	Upper East	Savannah	Sorghum Millet	125	12.4	2
3	Upper East	Savannah	Sorghum Millet	112	11.1	3
4	Brong Ahafo	Transitional zone	Cocoa Timber Maize	110	10.9	4
5	Volta	Semi deciduous forest	Cocoa Root crop	107	10.6	5
6	Ashanti	Semi deciduous forest	Cocoa Timber Cocoyam Plantain	104	10.3	6
7	Eastern	Semi deciduous forest	Cocoa Oil palm	96	9.6	7
8	Central	Coastal savannah	Maize Cassava	92	9.1	8
9	Greater Accra	Coastal savannah	Maize Cassava	68	6.9	9
10	Western	Semi deciduous forest	Timber Cocoa Cocoyam	46	4.6	10

Source: Environmental Protection Council (1989)

2.3 Causes of Bushfire

In the Savannah region, soil and vegetation deterioration is caused by human activities especially bushfires. At the beginning of the dry season, herders often start fires to stimulate the growth of young shoots. According to herders, the regrowth or young offshoots are more palatable and contain more nutrients. Burning improves ranges because grazing animals frequently are found concentrated on burned areas where the herbage is more accessible, palatable and nutritious (Nsiah-Gyabaah,1996).

Burning of bush and grass in the savannah occurs mostly or often by man for agricultural purposes (e.g., to facilitate the growth of new grass for livestock) and for hunting. Bushfires are more extensive in the savannah where a number of factors are responsible for the frequency and extensiveness of the fires. The grasslands, by their geographic locations, have a prolonged dry period which extends from October-April which results in a more thorough drying up of vegetation and soils. The intensity of the sun is generally felt with sparse vegetation. Wind speed is generally high. The importance of grazing is particularly significant in this region. Therefore the need for fresh green grass leads to the tendency of herders to burn off dry and undesirable vegetation (grasses) and to promote the growth of pasture (Nsiah-Gyabaah, 1996).

Hunting is also an important economic activity in the savannah ecosystem, and most hunters set fires to drive out game in hunting. In the forest ecosystem, indiscriminate bush burning has been one of the major factors in the change of forest to woodland, woodland into savannah and savannah to shrub land. The Sudan and Guinea grasslands are anthropogenic climax communities maintained by grazing, bush burning and crop cultivation and they will revert to shrub and then woodland and forest if these controlling factors are removed (Nsiah-Gyabaah, 1996).

In Ghana, bushfires have become a major cause of forest cover loss and decline in agricultural crop production since the 1983 wildfires that ravaged the semi-deciduous forest zone (Hawthorne, 1994 and Nsiah-Gyabaah, 1996). The uses of fire in slash and burn in agriculture has been seriously criticized and blamed for the high incidence of wildfires(Goldammer, 1998). Hence, many people with diverse professional backgrounds and interests blame fire use in agriculture for the rapid vegetation and soil degradation in the tropics (Greenland, 1975 and Korem, 1985). Although the criticisms on the use of fire in agriculture has been persistent, fire usage in agriculture appears to exacerbate. Regrettably, alternative methods to the use of fire have not benefited much from research and scientific innovations. Jansen (1995) argues that scientists' views on burning are inconsistent. Jansen further indicated that, while burning is often condemned in peasant farming systems, experiments are being conducted into the use of fire as a new technique for clearing weeds and pests from fields, and stimulating plant growth in the United States of America. Hence, the problems involved in burning relate to the conditions under which it is used, the cultural practices and rationality of its use and not the actual technology of burning or not burning.

In most cases it has been assumed that farmers have limited knowledge in fire management or are not making any effort to curb the incidence of wildfires (Korem, 1985). Consequently, it has been suggested that farmers should be made to understand the value of organic matter in the soil and taught how to replace wasteful shifting cultivation with permanent cultivation so that they could be weaned off from the use of fire, (Korem, 1985). However, the fact that farming is dynamic and is constantly fed by farmers' knowledge and perceptions, suggests that farmers might have

developed some appreciable level of fire-related knowledge to enable them cope with increasing incidences of wildfires in the agricultural landscape.

Notwithstanding the fact that slash and burn has contributed immensely to the bushfire menace in the savannah ecological zone as emphasize above, it is also a fact that hunting for game and honey extraction in this fragile ecological zone has also exacerbated the bushfire menace(Nsiah-Gyabaah, 1996). Equally a contributor of this menace is indiscriminate disposal of cigarette butts.

The District Chief Executive (DCE) for BremanAsikuma said the effect of bushfires on human life and property is very severe and could lead to poverty and mortalities. The DCE also added that "the slash and burn method of farming is the most common in the Central Region and appeal to farmers to ensure that fire belts were created when undertaking farming activities (Ghana News Agency, 22-01 2012).

According to Amissah and Agyeman(2010), bushfires are a common occurrence in the savannah ecological zone of Ghana. The savannah and grassland environments produce fine fuels that dry out rapidly at the end of the rainy season resulting in some of the most frequent fire-return intervals on Earth.

2.4 Productivity and Bushfires

The impact of bushfires on productivity varies according to geographic area, species, stand composition, tree age, soils (in particular water holding capacity), effects of carbon dioxide (CO_2) and nitrogen fertilization and interactions between any of these factors (Girardinet al, 2008). Some of the changes may be temporal, reverting once saturation levels have been reached. This is projected to be the case for water availability, where reduction of water generally reduces plant growth but in areas of water surplus may initially increase growth when water logging is being reduced.

Similar reactions have been noted for CO_2(Ollingeret al., 2008 and Clark et al, 2003) and nitrogen fertilization (LeBauer and Treseder,2008) as well as temperature increases (Reich and Oleksyn,2008).

Some studies have also registered decreasing growth rates in tropical forests (Feeleyetal, 2007 and Clark et al, 2003). Water deficits over extended periods have also been shown to decrease productivity (Malhiet al, 2008) and may be the cause for the declined productivity recorded by the studies above. Some authors argue that based on paleontological evidence this may not result in the forest dieback often mentioned in connection to expected changes in the Amazon region(Mayle and Power,2008).

2.5 Effects of Bushfires

Review by Fischlinet al, (2009) on detected impacts, vulnerability and projected impacts of bushfires on forests found that impacts varied across the continents with some forest types being more vulnerable than others. Impacts included increased growth, increased frequency and intensity of fires, pests and diseases and a potential increase in the severity of extreme weather events(e.g. droughts, rainstorms and wind) and food insecurity. Human activities, including forest conservation, protection and management practices, interact with wildfires and often make it difficult to distinguish between the causes of changes observed and projected. Deforestation and fires in the Amazon region, for example, form a vicious circle with wildfires (Aragãoet al., 2008 and Nepstadet al.,2008), with the potential to degrade up to 55 percent of the Amazon rain forests (Nepstad, 2008 and Nepstadet al, 2008).

2.6Food Security and Bushfires

While the world is far from approaching the biophysical limits to food production(Penning de Vries et al,1995), there are warning signs that growth in food production has begun to lag; for instance, food production did not keep pace with population growth in more than 50 developing countries in the 1980s and early 1990s, (FAO, 1995 and Chakraborty et al,2008).Africa may be able to feed just 25 percent of its population by 2025 if environmental and soil degradation on the continent continues at its current pace(United Nations University,2013).

Small-scale poor farmers clearing land for agriculture to meet food needs accounted for roughly two-thirds of the 15.4 million hectares of tropical forests worldwide converted to other uses every year during the 1980's(Sharma, 1992), such forest conversions driven by food insecurity is likely to continue particularly in Africa, unless farmers have alternative ways of meeting food needs and these needs will accelerate with population growth in rural areas (Per Pinstrup-Andersen and Pandya-Lorch,1997).

According to NWMP (2006) statistics at the forestry sector reveals that the annual loss of revenue from merchantable timber to wildfires is about US$ 24 million. The cumulative effect of wildfires is an annual loss of 3percent of Gross Domestic Product (GDP) estimated at about US$210 million. Although the devastating effects of wildfires are felt by all, it is the poor who are particularly at risk because they depend directly on land for their livelihood and often live in fragile ecosystems.

2.7 Bushfire Legislations in Ghana

The initial efforts at controlling wildfires did not place any emphasis on management. The first official attempt to manage wildfires was seen in the Savannah Woodland

Policy of 1934. This policy however only sought to persuade (not coerce) local communities to embrace fire management as a tool for savannah woodland management. The policy advocated for the prevention of burning farmlands and grasslands and encouraged wildfire awareness campaigns. The policy implementation was ineffective because the strategies proposed were at variance with the cultural practices of the people, which included slash and burn as an agricultural practice, (Nsiah-Gyabaah, 1996).

The National Environmental Policy recognizes past qualitative and quantitative deterioration in land cover (forest and savannah) and wildlife resources due to frequent and uncontrolled burning of bush. In recognition of the beneficial effects of fire as a management tool, especially in the traditional farming systems and the detrimental impacts which often accompany its abuse or misuse, legislative controls were introduced in 1983. In 1988, the National Environmental Action Plan (NEAP) was initiated to put environmental issues on the priority agenda. The EPA also designed policy actions to prevent and control bushfires that cause significant or irreparable damage to habitat, flora, fauna and ecological balance (Nsiah-Gyabaah, 1996).

2.7.1 Control and Prevention of Bushfires

In 1983 an anti-wildfire law (PNDC Law 46), was promulgated to prohibit the setting of fires except for certain agricultural, forestry and game management purposes. The purpose of the law is to protect land cover, wildlife and habitat.This law was enacted to control wildfires in the country. However, the law failed to make provision for implementation arrangements in terms of responsibilities for governmental agencies and roles for communities and Traditional Authorities. In addition, fines and penalties

prescribed under the law were not deterrent enough; hence the law did not achieve the desired results.

In 1990PNDC Law 229 -control and prevention of bushfire was decreed to replace P.N.D.C.L 46, which was an improvement over the 1983 law in assigning functions to the District Assemblies and making provision for the establishment of Village Fire Volunteer Squads. Even though the law advocated for the establishment of community based fire volunteers, it was silent on how logistics could be provided to assist their operations (Nsiah-Gyabaah, 1996). Again, it did not provide a comprehensive framework for addressing the wildfire menace in the country(National Wildfire Management Policy, 2006).

2.7.2 National Wildlife Policy

This policy aimed at conservation and sustainable development of the nation's forest and wildlife resources for maintenance of environmental quality and perpetual flow of optimum benefits to all segments of society. However, the policy did not consider wildfire as a major issue in forest management and therefore did not place wildfire management high on the national agenda.

The situation became uncontrollable in 1983 when the country lost most of its natural forests thus marking a turning point towards the adoption of a comprehensive fire management effort in the country. These efforts culminated in the implementation of several donor-funded projects on wildfires, the formation of inter-agency working groups to plan and manage wildfires in the country and the enactment of various policies and legislative instruments to deal with the problem of wildfires, (NWMP, 2006).

2.7.3*The Ghana National Fire Service Act, 1997 (Act 537)*

This is an Act that re-established the National Fire Service to provide for the management of undesired fires and related matters. However, the Act was flawed in respect to wildfire management as it was highly skewed towards industrial and domestic fire management. In addition, the Act did not go far enough with respect to empowering local communities and groups to deal with wildfire management issues.

2.7.4 National Wildfire Management Policy (2006)

The national wildfire management policy is based on some principles that are listed below:

- Land and its resources provide the direct source of livelihoods for majority of rural population and that poverty reduction and wealth creation in the country are dependent upon effective management of wildfire for sustainable management of natural resources.
- Different ecological zones and natural resource management systems exist in the country which requires different wildfire management systems.
- Fire would continue to be used as a tool for rural land management but this must be done in a controllable and an environmentally friendly way.
- Wildfire management requires multi-sectorial approach and gender sensitive collaboration among stakeholders including the vulnerable.
- District Assemblies (DAs), Traditional Authorities (TAs), opinion leaders and local community groups including women and youth groups are important actors in wildfire management.
- Wildfire management activities at all levels will be carried out based on effective and efficient planning and networking.

- A nationally coordinated early warning systems and well formulated public education programmes are essential for sustainable wildfire management.
- Sustainable incentives, rewards and benefit-sharing system are indispensable in successful wildfire management.
- Capacity of communities and community structures will be developed in wildfire management and this will be sustained through the provision of adequate and appropriate logistic and technical support by taking into consideration their indigenous knowledge.
- International best-practiced systems and indigenous knowledge are important ingredients in evolving sustainable wildfire management practices.
- Adequate research needs to be encouraged and promoted in collaboration with local and international bodies and sustained to provide the basis for developing best practices in wildfire management.
- Past experience has demonstrated that wildfires cannot be controlled through legislations, bye-laws and annual launching of wildfire control educational campaigns at the central level. The country needs to move away from piece-meal approach to wildfire management to a more comprehensive and sustainable community-based approach (Ministry of Lands Forestry and Minds, 2006).

2.8 Constraints to Bushfire Prevention

Despite the several legislations and policies that had been put in place to eradicate the perennial bushfires there exist constraints which inhibit the exclusion of the perennial bushfires in Ghana especially in the Savannah ecological zone. According to GFMC (2004) during the colonial era repeated and unsuccessful efforts to systematically exclude bushfires were abandoned in favour of accepting early burning as a necessary

"evil". The lack of biophysical information on the fire load is frequently the main reason why "early burn" fires end up in practice behaving more like late fires which ironically the former are intended to prevent.

According to GFMC (2004) while unwanted and uncontrolled burning may greatly have an effect at the community level, it may not yet be sufficiently important to warrant the concern of policy makers, and that perception must be challenged as a first step towards more deliberate, controlled and responsible use of fire in Africa. This assertion of GFMC (2004) explains vividly the rational of most governments in Africa not using remote sensing in addressing the menace,couple with the fact that there are not enough qualified human resource in the fire industry to manned this remote sensing equipment and gadgets.

Inadequate budgetary allocation to deal with the menace by the appropriate agencies is thebane of the perennial bushfires (Korem, 1985), these sentiments were further echoed by GFMC (2004) that the perennial bushfire menace despite the inadequate budgetary allocation is further compounded by excessive sectoralism in many governments, leading to uncoordinated policy development, conflicting policies and duplication of efforts and resources.

2.9 Conceptual Framework

Figure 2.1 illustrate the conceptual framework that serve as a roadmap for achieving the main objective of the study in assessing the effect of bushfires on food security in the Sissala East District.

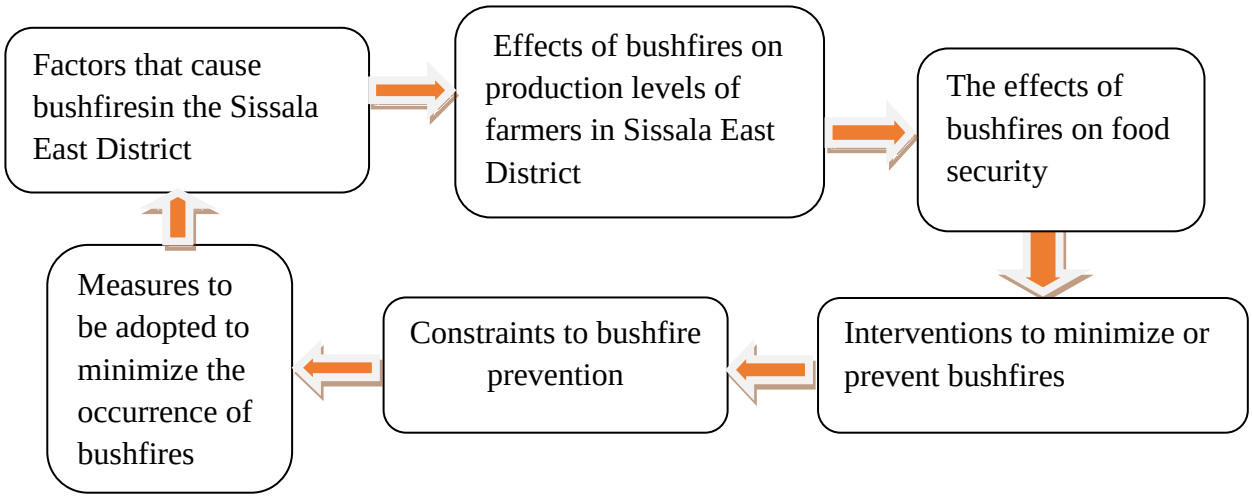

Figure 2.1: Conceptual framework on the effects of bushfires on food securityin the Sissala East District

Source: Authors Construct, 2013

The conceptual framework which served as a roadmap for achieving the main objective of the study was centered onthe objectives of the study. The framework demonstratethat, there is a link between bushfires and food security in a cyclical flow,the factors that cause bushfires in the study area could lead to low agricultural productivity thereby exposing the district to food insecurity and that the earlier interventions to minimize the bushfire menace in the district was constrained by certain factors and therefore new measures must be adopted to prevent the factors that cause bushfires in the district.

2.10 Conclusion

The chapter reviewed literature on the following; record of bushfires in Ghana, bushfires in the Savannah Region, causes of bushfires, laws to prevent bushfires in Ghana, bushfires and agricultural productivity and food security which serves as a guide to the study and finally present a conceptual framework which set the tone for the study.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

This chapter presents, the methodology adopted in conducting the study including the research design, study area profile,sampling procedures, data collection techniques, sample frame, choice of sample size, training, pre-testing, data editing and analysis.

3.2 Research Design

The design of the work is survey research a component of quantitativeresearch. This was chosen over other quantitative research techniques the fact that survey research measures two or more variables and also tests multiple hypotheses to determine the relationship among the variables. Theoutline of the work was survey planning, development of questionnaire, sampling techniques, choice of method to administer the questionnaire, editing, analysis and presentation of the report.

3.3Profile of the Study Area

Theprofile presents the location and size, the vegetation cover, the climate, the natural environment and the map of Sissala East District.

3.3.1 Location and Size

The Sissala East District is located in the North- Eastern part of the Upper West Region of Ghana with a population of 56,528 with male population of 27,503 (49%) and female constituting 29,025 (51%), Ghana Statistical Service(GSS) Population and Housing Census (PHC) 2010 (GSS,2012).

The Sissala East District falls between Longitude 1.30^0 W and 2.30 E and Latitude 10.00^0 N and 11.00^0 S with a total land size of 4,744 sq km – representing 26 percent of the total landmass of the Upper West Region (SEDA, 2011). The District shares

boundary on the North with Burikina Faso, on the East with KassenaNankana West and Builsa Districts, to the South East with West Mamprusi District, South West with Wa East and Nadowli Districts and to the West by Sissala West District (SEDA, 2011).

3.3.2 Vegetation

The Sissala East District falls within the Guinea savannah vegetation belt (SEDA, 2011). The vegetation consists of grasses with scattered fire resistant trees such as the shea nut, the baobab and dawadawa trees. Acacia is also a common tree of this vegetation belt. The heterogeneous collection of these trees meets domestic requirements for firewood and charcoal, construction of houses, cattle kraals and fencing of gardens.

3.3.3 Climate

The climate of the SissalaEast District is tropical continental as experienced in the northern regions of Ghana. Throughout the year, temperatures are high with a minimum of 23ºC at night and a maximum of 42ºC during the day.

The mean monthly temperature ranges between 21ºC and 32ºC. The highest monthly maximum temperature rises up to 42ºC before the rainy season in May with lowest minimum temperature falling to about 12ºC in December when the harmattan winds from the Sahara dries up the vegetation.

3.3.4 Natural Environment

The Sissala East District is mainly covered by guinea savannah vegetation with few savannah supported trees. However, human activities such as farming and bush fires, shifting cultivation, felling of trees for firewood and charcoal production and

overgrazing by animals contribute greatly to deforestation and soil erosion in this natural environment.

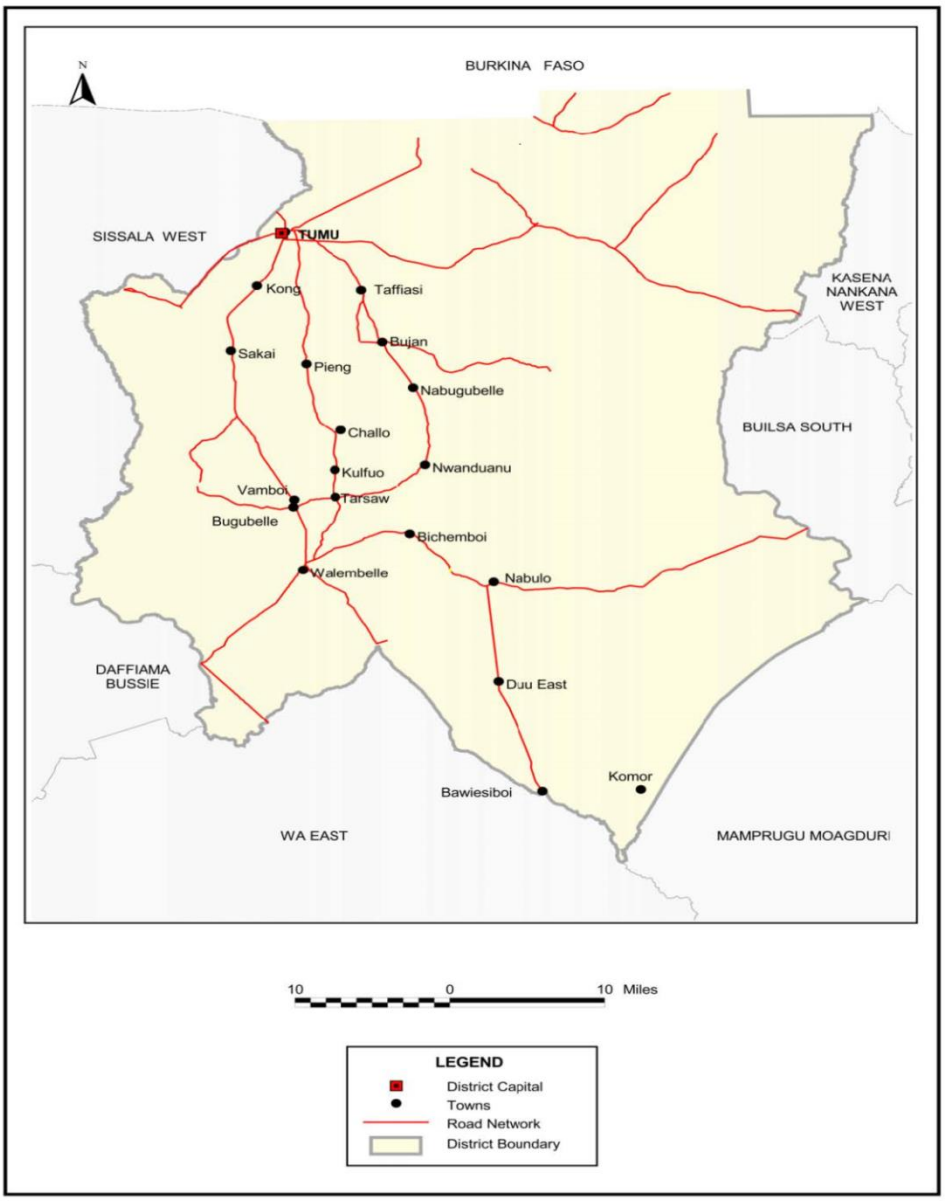

Figure 3.1: A sketch map of Sissala East District

Source: Sissala East District Assembly (2011)

3.5. Sampling Procedures

This is required for any valid survey, since it is often not economically feasible to cover every unit of the population (Anaman, 2003).The most widely used sampling technique in survey research is the probability sampling, the advantage lies on the fact that every subject has an equal chance of being selected(Opoku,2005 and Anaman,2003).To ensure that each of the phenomenal affected respondents were given equal chance of being selected for the survey a probability sampling technique (systematic sampling) was used to select respondents for the interview. A non-probability sampling technique of purposive sampling was used to select respondents for the key informant interviews and the focus group discussion. This technique involves selecting a sample on the basis of knowledge of the population and the objectives of the research (Anaman,2003).

Five communities were sampled randomly by using the lottery method and the farmers in those communities were enumerated as a target for the administration of the instrument. With a sample frame of 1263 farmers, the K^{th} term formula was used to determine the interval range for selecting the respondents for the instrument administration in the sampled communities, below is the formula

$$K^{th} = \frac{SF}{SS}$$

Where;

K^{th} = Interval range

SF = sample frame

SS = sample size

Thus, with a sample frame of 1263 and sample size of 291, by substituting the values into the formula;

$$K^{th} = \frac{1263}{291}$$

$$K^{th} = 4$$

Thereforeat an interval range of four (4), the instrument was administered in proportion to the number of farmers in the selected communities.

Table 3.1: Number of farmers in the sampled communities

Community	Number of farmers	Number of farmers interviewed
Bugubelle	342	79
Challou	280	65
Bujan	201	46
Kassana	230	53
Pina	210	48
Total	1263	291

Source: Researcher's construct, April, 2013

Non-probability technique of purposive sampling was adopted during the key informant interviews with representatives of some selected organizations that were directly involved with the prevention of bushfires in the study area such as; Ghana National Fire Service, Environmental Protection Agency, Ministry of Food and Agriculture, Game and Wildlife Department, Forestry Commission, National Disaster Management Organization, Sissala East District Assembly, Chiefs and Assembly members of the selected communities. Whereas the focus group discussion was held with bushfire volunteer squads from the selected communities.

3.6 Sample Frame

The sample frame is the individuals and organizations that the data would be generated from (Anaman, 2003). Target groups that the research focused on were

famers who were administered with the instrument and the bushfire volunteer squads discuss the focus discussion guide with the researcher, representatives of Ghana national fire service,Environmental protection authority,Ministry of food and agriculture, Forestry commission, Game and wildlife,Sissala East District Assembly as well asChiefs, Opinion leaders, and Assembly members were administered with the key informant guide.

A field survey was conducted in five (5) sampled communities to enumerate the number of farmers in these communities for the research and the findings revealed that they were 1263 farmers in these communities which was then used as a sample frame for the study.

3.7 Choice of Sample Size

The sample size was calculated scientifically through the use of a sample size determination table developed by Krejcie and Morgans (1970). At 95% confidence level and 5% margin of error, sample size of 291 was established for the study.

3.7 Data Collection Techniques and Tools

There are various methods of conducting survey research. These include interviews (structured and unstructured questionnaire) and focus group discussions (Tagoe, 2009). The questionnaire however is perhaps the most powerful and useful tool for conducting survey research in the social sciences (Opoku,2005).Semi-structured interviews, key informants interviews and focus group discussions were used to generate data for this study.

Anaman (2003) indicated that in the data collection exercise tools are needed to carry out the work. In the light of this; questionnaires, and focused group discussion guides were provided for the exercise.

3.8 Pre – Testing

Neuman (2003) and Opoku (2005) identified reliability and validity as critical to all measures. The survey instrument (interview schedule) was pre – tested at Bakwala community to identify potential problem areas of the instrument. The questions that were found not to be addressing the issue were either modified or deleted and new befitting questions added.

3.9 Training ofResearch Assistants

Golashani (2003) Neuman (2003) and Opoku (2005) identified the need to recruit research assistants to assist in the data collection exercise and must be trained so as to achieve standardization. Three research assistants were recruited and trained in the under listed areas;

1. Interview skills
2. Community entry skills
3. Definition of bushfires and food security
4. Translation of the questionnaire to Sissali and Kassim languages
5. Criteria for selection of interviewees
6. Field work and pre-testing

Some community members were also recruited to assist the research assistants in the following ways;

1. Help research assistants to familiarize themselves with the clusters they are to survey.
2. them to the clusters administrative and social authorities. Provide advice on when it would be appropriate to visit households.

However, the recruited community members were not allowed to interview or choose households for the research Assistants.

3.10 Data Analysis Techniques

Anaman (2003) observes that the data analysis process begins when the researcher has reached the final stages of the research work.Tagoe(2009) underscores the fact that qualitative data analysis is very different from that of quantitative analysis and this is further buttress by (Corbin and Straus,1990) that qualitative analysis process begins at the data collection stage.

In this regard the daily administered questionnaires were checked by the researcher to ensure accuracy on each day. The research assistants reviewed each questionnaire before leaving the household/community where it was administered. At the end of each day of fieldwork, the Researcher reviewed each questionnaire for accuracy, logical patterns and legible writing. Research assistants were asked to return to survey households if they are missing or problems on them observed by the researcher.

A debrief was held at the end of every session to examine the key informant interviews and focus group discussion activities and results. The recorded session on the tape was then transcribed to notes, processed, edited and coded to ease analysis.

Opoku (2005) andAnaman (2003) identified Statistical Package for the Social Sciences(SPSS) as the most popular software for data analysis in the social sciences. Data analysis was done by using SPSS Version 11.0. Cross tabulation of quantitative data was done in relation to the study objectives to find out associations or relationships amongst them. A summary of the various results was then tabulated and others put on approved statistical figures such as pie chart bar graph etc.

3.11 Ethical Considerations

Professional ethical issues in social research work deal with minimum professional standards of conduct of research that are considered acceptable to the general research

community and the legal authorities of the geographical entities that researchers undertake their studies (Anaman, 2003).

Circulars were sent to the district assembly and all assembly members within the clustered communities of the study area. Verbal consents were obtained from Chiefs of the clustered communities. In the same vein, circulars were sent to governmental departments before key informant interviews were held.

The researcher used research assistants who assisted in the datacollection who first explained the purpose of the study to the respondents and sought their informed consent before proceeding with the administration of the questionnaires. The farmers were given the opportunity to ask questions for clarity and decision making in relation to the survey likewise the focus group discussions and key informant interviews.

CHAPTER FOUR

RESULTS AND DISCUSSION

4.1 Introduction

This chapter presents the analysis and discussion of the empirical aspects of the study. Analysis entails the critical examination of data in order to understand its parts and relationships and to discover its trends in relation to the objective of any study. It means the separation of the data into its constituent parts (Twumasi, 2001). In this study, the analysis was conducted on empirical data from five sampledcommunities, representatives from some selected institutions, community fire volunteer squads, Chiefs, Assembly members and Opinion leaders within the Sissala East District.

With a sample frame of 1263 farmers and a sample size of 291,286 farmers were administered with the instrument representing a response rate of 95% indicating that five (5) farmers were not administered with the instrument.

4.2 Socio-demographic Information of Respondents

This section presents the findings of the field research in relation to thesocio-demographic information of respondentsof the survey. Areas of particular interest to the researcher under this section are sex differentiation, age distribution, marital status, educational status, and the occupation of participants as discussed below.

4.2.1 Sex Distribution

The sex of respondents was investigated and the results are presented in figure 4.1 below.

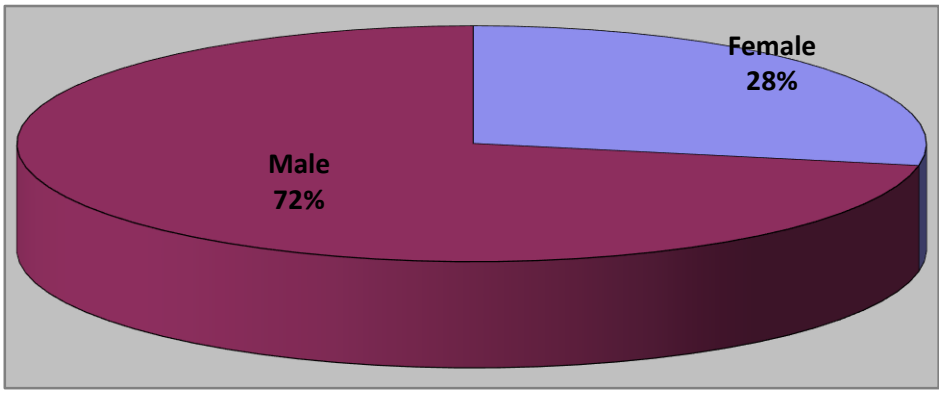

Figure 4.1: Sex distributions of respondents

Source: Field survey, November, 2014

FromFigure 4.1. Out of the 286respondents who responded to the questionnaire, 206of them (72.0%) were males, while the remaining 80 (28.0%) were females.

4.2.2Age Distribution

The age of the respondents was equally deemed important and was investigated and the findings are presented in figure 4.2.

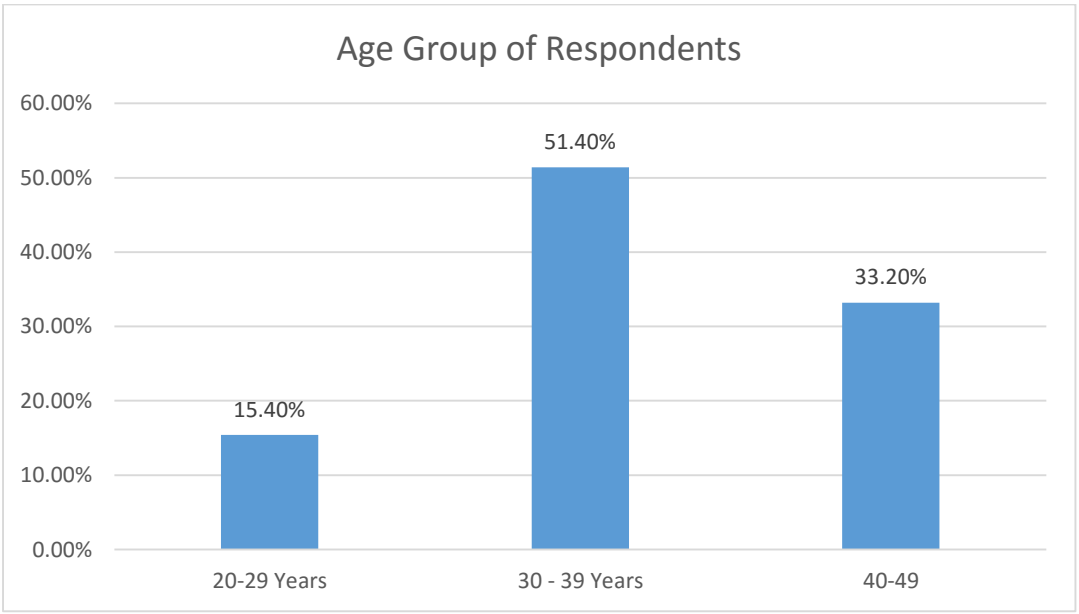

Figure 4.2: Age distribution of respondents

Source: Field survey-November, 2014

From figure 4.2, among the 286 respondents who responded to the instrument, 147 of them representing 51.4 percent were between 30-39 years, 95 respondents constituting 33.2 percent were between 40-49 years, while 44 respondents made up of 15.4 percent were between 20-29 years. The finding shows that the majority (51.4%) of the respondents were in their youthfulage between 30 to 39 years.

4.2.3 Marital Status

An important socio-demographic feature which was also investigated was the marital status of the respondents and presented in table 4.1 below.

Table 4.1: Marital status of participants

Marital status	**Frequency**	**Percent**
Married	95	33.2
Single	54	18.9
Divorced	51	17.8
Separated	72	25.2
Widowed	14	4.9
Total	**286**	**100.0**

Source: Field survey, November, 2014

On the marital status of the respondents, it was clear that out of the 286 respondents, 95 of them representing 33.2 percent indicated that they were married, 72 respondents constituting 25.2 percent stated separated, while 54 of them representing 18.9 percent were single, 51 respondents representing 17.8percent indicated divorced, and 14 of them representing 4.9 percent statedwidowed.

4.2.4 Educational Status

The educational status of the respondents was investigated and the results are presented in Figure 4.3 below.

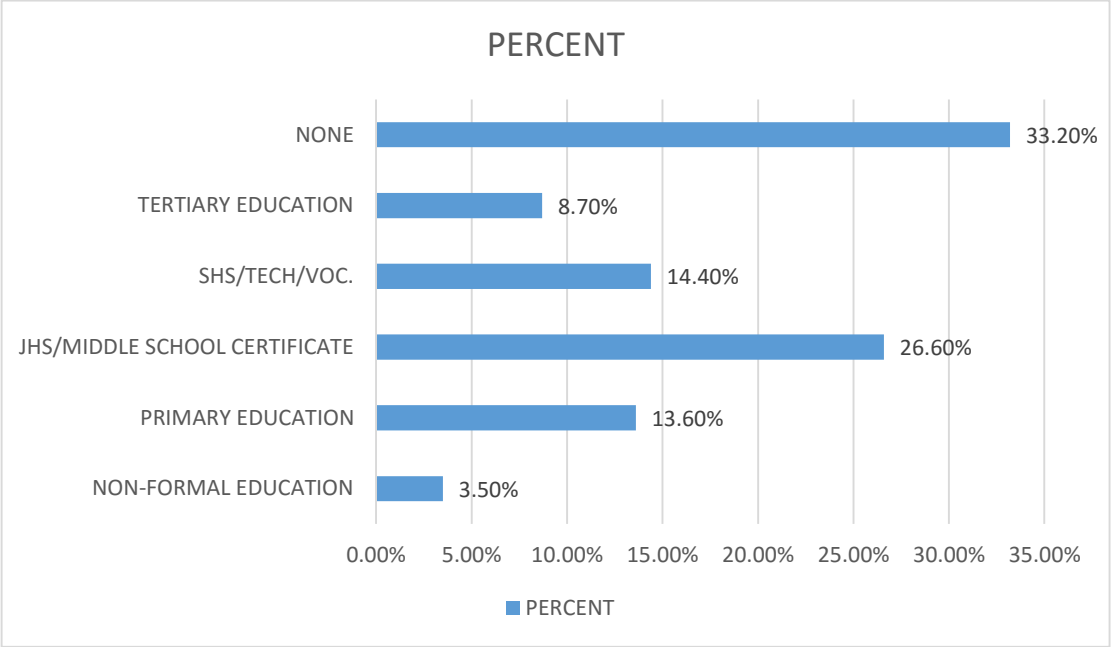

Figure 4.3 Educational Statuses of Respondents

Source: Field Survey, November, 2014

From figure 4.3 out of the 286 respondents 89 of them representing 33.2 percent indicated that they have not had any formal education, 25 respondents representing 8.70 percent stated that they have had tertiary education- thus Higher National Diploma (HND), Degree and Diploma, 76 respondents representing 26.60 percent indicated that they have had Junior High School (JHS) or Middle School Leaving certificates (MSLC), 47 respondents representing 14.40 percent stated Senior High School (SHS)/ Technical/ Vocational certificates, 39 respondents constituting 13.60 percent also indicated that they have primary education, and 10 of them representing 3.5 percent stated that they have had non-formal education.

4.2.5 Occupation of Respondents

The occupational status of respondents was also investigated and presented in Table 4.2 below.

Table 4.2: Occupation of participants

Occupation	**Frequency**	**Percent**
Trader	26	10.1
Farmer	133	46.5
Teaching	92	32.2
Others	32	11.2
Total	**286**	**100.0**

Source: Field survey, November, 2014

Table 4.2 displays the occupation of the respondent of which 133 respondents representing 46.5 percent were farmers, 92 of them made of 32.2 percent were teachers who also engaged themselves in farming, while 32 respondents representing 11.2 percent indicated others meaning that they were engaged in other works other than farming as their main occupation and 29 of the respondents made of 10.1 percent were trader.

4.3. Respondents Experience on Bushfires

This section presents the findings of the research on respondents experience on bushfires. Areas of particular interest were respondents experience on bushfires, causes of bushfires and number of farms destroyed by bushfires.

The respondent's experiences with bushfires was investigated and presented in Table 4.3 below.

Table 4.3: Respondents experience of bushfire from 2010-2014

Year	No of bushfire affected farmers	Percent
2010	62	22
2011	56	20
2012	48	17
2013	61	21
2014	59	20

Source: Field survey, November, 2014 n=286

Out of the 286 respondents who responded to the instrument as presented in Table 4.3, indicated that throughout the study period (2010-2014) bushfires had affected farms in the study area. From table 4.3 in 2010,62 (22%) farmers farms, were destroyed by bushfires, in 2011 56 (20%) farmers farms were destroyed by bushfires, in 2012 48 (17%) farmers farms were destroyed by bushfires, in 2013 61 (21%) farmers farms were destroyed by bushfires and in 2014 59 (20%) farmers were destroyed by bushfires.

The focus group discussions with the, community fire volunteer squads and the key informant interviews with Opinion leaders,Assembly members and Chiefs revealedthat from 2010-2014, their farms were burnt by bushfires and attested that food and cash crops as well as the vegetation cover of the various communities were affected. This attestation partiallyconfirm the assertion by (Nsiah-Gyabaah, 1996) that, "throughout the Savannah Ecological Zone, it is not common to find an acre of vegetation cover all year round".

The key informant interview with the GNFS revealed that from 2010 to 2011 there were about 205 reported bushfire cases in the district, 225 bush fire cases from 2011-

2012, while 190 bushfire cases were reported between 2012-2013 and 215 bushfire reported cases in the study area from 2013-2014.

The finding from the Ministry of Food and Agriculture revealed that the bushfire menace was exerting a heavy toll on agricultural production in the district annuallyand that there is no particular year that the menace did not surface and hardly could you see a vegetation cover of the District without traces of burns. The Ministry indicated from 2010 to 2011,135 farmers reported that their crops were destroyed by bushfire, from 2011-2012, 138farmers reported that bushfire destroyed their crops. In 2012-2013 farming season 29 farmers reported having had their crops destroyed by the bushfires and from 2013-2014, 87 farms got destroyed by bushfires.

The finding from Environmental Protection Authority revealed that the most challenging of the environmental menace in the region was the perennial bushfires spanning from October to March, that devour more than three quarters of the vegetation cover and not only the vegetation but food crops as well as plantations, forest and game reserves. These bushfires could burn for two to three days and get extinguished by natural means (rivers, paths and roads).

4.4 Causes of Bushfires

This section presents the findings on the causes of bushfires in the study area and it ispresented in a multiple response Table 4.4 below

Table 4.4: Causes of Bushfires

Causes	Frequency	Percent
Fulani herdsmen	104	36.0
Hunters	97	33.0
Fires from adjoining communities	59	21.0
Controlled burning getting out of hand (slash and burn)	49	17.0
Others	38	13.0

Source: Field survey, November, 2014 n=286

Table 4.4 displays the multiple responses findings on the causes of bushfires in the Sisaala East District. The findings revealed that out of the 286 respondents 104 respondents representing 30 percent indicated Fulani herdsmen, were as 97 of them representing 28 percent said the activities of hunters, 59 respondents representing 17 percent stated fires from adjoining communities, while 49 respondents representing 14 percent indicated controlled burning getting out of hand, and 38 respondents representing 11 percent stated others such ascigarette smokers, and arsonist attacks. The findings from the key informant interviews with the stakeholders and focus group discussions produce no variant results from the farmer's opinion. These findings to a large extend agrees with the assertionsNsiah-Gyabaah(1996) that herders often burn off dry and undesirable vegetation (grass) to promote the regrowth of palatable and nutritious grass for grazing .

4.5 The Effects of Bushfires on Production Levels

This section investigated the effects of bushfires on production levels of farmers. The findingscumulatively (2010-2014) revealed that 100 acres of maize, 80 acres of cotton, 50 acres of millet, 30 acres of groundnuts and 70 acres of sorghum were some of the crops that were destroyed by the bushfires for the past four years.

The effects of bushfires on production level of farmers was also investigated and presented in table 4.5 below.

Table 4.5: Quantity of crops harvested in bushfire affected farms and non-bushfire affected farms respectively.

Acreage	Crops	Bushfire affected farm	Non-bushfire affected farm
One	Maize	10 bags	18 bags
One	Millet	7 bags	13 bags
One	Groundnut	10 bags	15 bags
One	Sorghum	5 bags	14 bags
One	Yam	800 tubers	1150 tubers
One	Cotton	6 bales	11 bales

Source: Field survey, November 2014

The findings revealed that the most cultivated crops in the area were; maize cotton, groundnuts, yams, millet and sorghum. Equally revealed was the average quantity harvest after the bushfires in one hundred (100) kilograms per each crop except yam which was counted 100 tubers as one dozen. Table 4.4illustrate average harvest differences in bushfire affected farms and non-bushfire affected farms respectively; maize one acre- 10 bags, millet one acre- 7 bags, groundnuts one acre- 10 bags, sorghum- 5 bags, yams one acre- 800 tubers and cotton one acre- 5 bales. The findings further revealed that but for the bushfires averagely an acre of maize would

have harvested 16 bags, millet one acre would harvest 11 bags, groundnuts one acre would harvest 14, sorghum one acre would harvest 12 bags, cotton one acre would harvest 11 bales and yam one acre would harvest 1150 tubers.

The findings from the key informants and the focus group discussions indicated that the negative effects of bushfires on agriculture were overwhelming; the bushfires burnt crops, pastures, loss of soil fertility, creeping desertification, and the migration of wild animals to Burkina Faso forest reserve. The focus group discussions and the key informant interviews further indicated that the effect of bushfires on livestock was enormous given the fact that it led to loss of pasture, and mortality ofanimals. Thefindings partially agrees with Chakraborty et al,(2008) and Jepsen et al, (2008) that natural disturbances and bushfires often decrease forest area by the damage they cause to trees and may also decrease agricultural productivity.

4.5 The Effects of Bushfires on Food Security

This section presents the finding of the effects of bushfires on food security in the study area. The findings revealed that food availability and incomes in the past four dry seasons had adversely been affected as a result of bushfires. In 2010-2011 harmattan seasons farmers lost 203 bags (100kg) of maize, 172 bags (100kg) groundnuts, 509 tubers of yam, 105 bags (100kg) of millet, cotton 233 bales and 97 bags (100kg) of sorghum and the cumulative cost in monetary value of these food items computed at the prevailing market price per bag and a dozen of yam as Gh¢67,257.61 (Field survey, 2014).The field survey, (2014) produce the other statistics, in 2011-2012 farmers lost 181 bags of maize, 190 bags of groundnuts, 600 tubers of yam, 91 bags of millet, 300 bales of cotton and 59 bags of sorghum and this computed in monetary value as Gh¢51,518.11. In 2012-2013 farmers lost 101 bags of maize, 94 bags of groundnuts, 210 tubers of yam,51 bags of millet, 102 bales of

cotton and 67 bags of sorghum this cost in monetary terms computed as Gh¢ 42,105.12. In 2013-2014 farmers lost 139 bags of maize 107 bags of groundnuts, 239 tubers of yam 78 bags of millet 221 bales of cotton and 62 bags of sorghum and the cost in monetary value computed as Gh¢54,910.18.In 2014 farmers lost 72 bags of maize, 31 bags of groundnuts 89 tubers of yam 25 bags of millet 102 bales of cotton and 12 bags of sorghum and the cost in monetary value computed as Gh¢21,117.94.

The finding from theMoFAon the effects of bushfires on food security revealed that over the four year period, the total destruction cost to food crops and livestock were enormous there by reducing the income levels of farmers. Over this period farmers loss 480 bags of maize and cost per bag was GH¢80.00, the total cost of destruction of maize was GH¢38,400.00. 153 bales of cotton and the cost of a bail was GH¢250.00, total cost of cotton destroyed GH₵38,250.00 and 80 bags of groundnut cost per bag GH¢120.00, total cost of groundnuts destroyed GH¢9,600.00.

The above finding further revealed that, 197 respondents out of the 286 people who responded to the questionnaire representing69percent indicated that they were food insecure for the past four years as a result of bushfires in thedry season and return to food secured status the next harvesting season whilst 89 respondents representing 31 percent stated they were food secured throughout the four years. This shows that the transitory food insecurity mode existed in the Sissala East District meaning that there was a sudden drop in the availability of food, access and utilization of food to maintain a healthy life.

The finding also revealed that people have to adopt coping strategies before the next harvesting season and the severity of the food insecurity was directly related to the household size of farmers.

4.5.1 Food Insecurity Mode

Food insecurity dimensions or mode of the respondents was also investigated and presented in Table 4.5.

Table 4.6: Food insecurity mode

Number of months	**Frequency**	**Percent**
Two(2) months	84	29.0
Three(3) months	73	26.0
Five (4) months	53	19.0
Three (5) months	45	16.0
Six (6) months	31	10.0
Total	286	100.0

Source: Field survey, November, 2014

Table 4.6 displays the food insecurity mode that exists in the District. Out of the total number of 286; 84 respondents indicated that their produce only lasted for two months, 73 indicated that their produce lasted for three months, 53 indicated that their produce lasted for four months, 45 indicated that their produce lasted for five months and 31 indicated that their produce lasted six months. This trend of food insecurity as depicted above may suggest that the transitory food insecurity mode prevails in the District.

4.5.2 Coping Strategies to food insecurity

An important aspect of the investigation was the coping mechanisms adapted by the respondents to food insecurity, it was also investigated and presented in a multiple response Table 4.6.

Table 4.6: Coping strategies to food insecurity

Coping strategies	Frequency	Percent
Reduced amount of food taken	153	53.0
Sold livestock	93	32.0
Spend less on non-food item	81	28.0
Migrate to other areas to work	59	21.0
Asked for support	38	13.0

Source: Field survey, November, 2014 n=286

Table 4.6 indicates a multiple response analysis on the coping strategies to food insecurity as result of the bushfires in the district. Out of the 286 respondents, 153 intimated that they reduced the amount of food eaten. Nearly a quarter (22.0%) of the respondents said that they sold out livestock in order to feed on, 38 said they asked for support from others such as close and distant family members, 59 said some family members also migrated to other areas to work and remit the family, and 81 said that they spend less on non-food items such as clothing, bicycles, bowls etc.

4.6 Past Interventions to Minimize Bushfires

This section presents the findings on past interventions to minimize the incidence of bushfires in the study area. The findings revealed that out of the 286 respondents, 196 of them representing 68.5 percent indicated yes to the question that there were measures to minimize the outbreak of bushfires in their community, and 90 respondents representing 31.5 percent stated no to the question that they were measures to minimize the outbreak of bushfires in their communities. The findings revealed that those interventions were; anti-bushfire volunteer squads and community

bushfire sensitization, however the findings also revealed that these interventions short-lived only in the early 1990's when PNDC law 229-1990 was promulgated.

Findings from the focus group discussions revealed that there was a decline in reported cases of bushfires in 2001-2002 and it was attributed to the Plan Ghana, Ghana national fire service and the Sissala Traditional Council anti-bushfire district wide campaign collaboration from October 2001 to march 2002 which was climax with the "Pare Gbelle festival" of the people of the Sissala Traditional area**.**

The findings revealed that the GNFS has laws and policies to enforce to reduce the incidence of bushfires which were the PNDC law 229-1990 and the National Wildfire Management Policy of 2006.

It also came to light from the findings that the EPA has a programme designed to reduce the incidence of bushfires, which is The Ghana Environmental Management programme (GEMP) sponsored by Global Environmental Fund (GEF**).**

4.7 Constraints in Bushfire Prevention

This section presents the findings on the constraints in reducing bushfires in the study area. The findings revealed that out of the 286 respondents 190 of them representing 66.4 percent stated yes, indicating that there were constraints in minimizing bushfires in their communities, with 96 respondents representing 31.5 percent who stated no to the question.

The constraints to bushfire prevention was also investigated and presented in amultiple response Table 4.7.

Table: 4.7 constraints in bushfire prevention

Constraints	Frequency	Percent
Lack of community fire volunteer squad	131	46.0
Irregular sensitization	89	31.0
Fulani herdsmen	67	23.0
Fire from adjoining communities	51	18.0

Source: Field survey, November, 2014 n=286

Table 4.7 multiple response findings on the constraints of reducing bushfires revealed that out of the 286 respondents; 131 indicate that lack of community anti-bushfire volunteer squads, 89 said irregular sensitization, 67 said the activities of Fulani herdsmen and 51 indicated fires from adjoining communities.

The findings with the focus group discussions revealed that the challengeto reducing bushfire in the various communities was the issue of bushfires from adjoining communities and concluded that, if volunteers were trained in all communities in the district, well-resourced and motivated they could monitor and reduce the incidence to an appreciable level.

The findings from the GNFS and Forestry commission revealed that the major constraint to a successive reduction of bushfires in the area was inadequate/lack of funds for the implementation of laws and policies which is not in variance with GFMC (2004) assertion that inadequate budgetary allocation and sectorialism in many governments has resulted to uncoordinated policy development, conflicting and duplication of efforts and resources. They alluded to the fact that the National

Wildfire Management Policy (2006) was a well-crafted policy and if fully implemented it has the potential of reducing the incidence of bushfires to an appreciable level in the district.

The EPA intimated that the major constraint in fighting the bushfire menace was the fact that the necessary structures were not in place to ensure that projects were fully implemented to meet the desired results. The EPA indicated that at the district assembly level in all the districts in the region the bushfire sub-committee was not in place, no bye laws except Nandom District and no standing community fire volunteer squads in the region. The findings further revealed that the EPA does not have the human resource capacity to respond to the mandate of the organization in the region hence the reason for its non-existence at the district level.

The findings revealed that the GNFS could not extinguish any of the bushfires reported to the Service the fact that the fire tender was not conducive for bushfire fighting. The service could only assist farmers in creating fire belts around their farms and reserved areas. To the fire service, funding for bushfire volunteer training remains a challenge to the service hence the PNDC Law 229, Prevention and control of bushfires of 1990 must be reviewed, Act 537 that established the Ghana national fire service should be reviewed because it is skewed towards domestic and industrial fires. Chief among the challenges was the fact that the District Assembly does not see the bushfire menace as a developmental challenge and think that it is an old aged canker that cannot be stopped.

4.8Measures to Minimize the Incidence of Bushfires

This section presents the findings on measures that can be adopted to reduce the incidence of bushfires in the study area. The findings revealed that out of the 286 respondents, 228 respondents representing 78.3 percent indicated that they were

certain measures that could be adopted to minimize the incidence of bushfires in their communities and 58 respondents representing 20.7 percent indicated no to the question. The findings shows that majority of the respondents are of the view that something could be done to minimize the incidence of bushfires in their communities.

Measures to reduce the perennial occurrence of bushfires in the area was also

Investigated and presented in a multiple response Table 4.8.

Table 4.8: Measures to reduce the incidence of bushfires

Measures	**Frequency**	**Percent**
Formation of anti-bushfire volunteer squads	119	42.0
Involvement of Traditional Authority	92	32.0
Community bye laws	87	30.0
Indifferent	44	15.0

Source: Field survey, November 2014 n=286

Table 4.8 displays multiple response findings on measures to reduce the incidence of the bushfire menace, out of 286 respondents, 119 respondents said the formation of anti-bushfire volunteer squads in all the communities, 92 said the involvement of traditional authority, 87 indicated community bye laws and 44 were indifferent with the reason that the menace was an old aged canker that it would be difficult to do away with if not to eliminate.

The finding from the focus group discussions with the community fire volunteer squads and the key informant interviews with the Assembly members, Chiefs and other opinion leaders indicated that the way forward in reducing the bushfire menace was the formation of bushfire volunteer squads, community bye laws and the registration of all Fulani herdsmen in the various communities. Other stakeholders

such as the Forestry Commission, EPAand MoFA also postulated that the way forward in reducing the bushfire menace were regular sensitization, creation of fire belts, train community fire volunteer squads, community bye laws and the inauguration of the bushfire sub-committee at the assembly, community participation, package for volunteers and involvement of the traditional authorities.

Findings from the only security agency involved in the prevention of bushfires GNFS revealed that the bushfire menace was an old aged canker and needs a persistent annual sensitization and community bushfire volunteer squads back by community based bye laws administered by the traditional authorities to reduce the canker.

CHAPTER FIVE

SUMMARY OF FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.0 Introduction

Chapter five presents the summary of results of the study which entails the socio-demographic features of the respondents, respondents knowledge on bushfires, causes of bushfires, the effects of bushfires on agricultural productivity, the effects of bushfires on food security, past interventions to reduce bushfires in the area, constraints to bushfires prevention in the area and appropriate measures to prevent bushfires in the area. Finally this chapter draws conclusions and suggested recommendations on the topic investigated.

5.1 Summary of Findings

The findings of the study on the socio-demographic information of respondents revealed that among the 286 respondents who responded to the instruments, majority (72%) of themwere males while 28.0 percent were females. Most of them were within the youth age group of 30 to 39 years.

On the highest level of education attained by respondents, the result shows that out of the 286 respondents, 50.0percent have not had any formal education, followed by 26.6 percent who had JHS/MSLC education, and 13.60 percent had primary education.

On occupational distribution, 46.5percent had farming as their main occupation, followed by 32.2 percent who are teachers but engaged in farming, 21.3 percent were petty traders and peasant farmers and others.

On respondents experience of bushfires spreading into their farms in the study area, it emerged that the bushfire menace was not a new phenomenon to them, out of the 286 respondents who responded to the questionnaire, 77.3 percent indicated yes to the

question that from 2010-2014, they have experience outbreak of bushfires that spread to their farms, while 22.7 percent said no, to the question.

The findings revealed that the major cause of the menace was the activities of Fulani herdsmen who use fire as a means of pasture management for cattle grazing.Closely followed were hunters who use fire to trap their game in the natural vegetation.Slash and burn agriculture has also gain recognition in the study area as another factor that contribute significantly to the incidence of bushfires. Equally prevalent was the issue of fires from adjoining communities and others such as cigarette smokers, coking at farm, and charcoal burners.

The findings revealedthat 67.1 percent of the respondents intimated that the bushfires had affected their farms resulting in the destruction of food/cash crops such as maize, groundnuts, sorghum, yams and cotton. The key informant interview conducted with the Ghana National Fire Service indicated that there were 210 bushfire outbreaks that were reported to the service in Tumu from 2010 to 2014. The findings revealed that out of the 210 reported cases, 97 of the bushfires spread to farms destroying 17 acres of maize, 7 acres of cotton, 10 acres of aforestation projects belonging to SADA and 5 acres of forest reserve belonging to the forestry commission that cost about fifty – eight thousand Ghana cedis (GH¢ 58,000.00) only. Equally revealed was that the most affected crop by the bushfires in the Sissala East Districtwas maize followed by cotton which is in consonance with the 1983-84 national wildfire disaster as intimated by Nsiah-Gyabaah (1995) that the most affected crop was maize.

The findings from the respondentsrevealed thatFood availability and incomes over the study period had adversely been affected as a direct result of the bushfiresover the study period thereby exposing 85.7 percent of the respondents into transitory food insecurity. A quantum of 696 bags of maize,594 bags of groundnuts,1647 tubers of

yams 350 bags of millet 658 bales of cotton and 297 bags of sorghum were destroyed over the study period and income lost cumulatively over the period was estimated at Gh₵176,408.96 (Field survey, 2014).

The study revealed that68.5 percent of the respondentsindicated that they were past interventions to minimize bushfires in the district. These were the anti-bushfire volunteer concept, annual bushfire sensitization, PNDC law 229-1990, the National wildlife management policy (2006) and the Ghana environmental management project.

The findings revealed that 66.4 percentof the respondents intimated that they were certain constraints to minimizing bushfires in the district, key among these werethe nonexistence of the bushfire subcommittee at the district assembly, lack of bushfire volunteer squads, the activities of Fulani herdsmen, hunters and fires from the adjoining communities were some of the constraints to minimizing bushfires in the study area.

The study revealed that 78.3 percent of the respondents indicated that there are certain measures that can be adopted to reduce the incidence of bushfires in the district these were; the formation and motivation of bushfire volunteer squads, involvement of traditional authority, enactment of community bye laws and inauguration of the bushfire sub-committee at the district assembly.

5.2 Conclusions

Bushfires are not a new phenomenon in the study area 77.3 percent of the people indicated that they were battling with the phenomenon perennially. They are several factors that cause bushfires in the Sissala East District and chief among them was the Fulani herdsmen who use fire as a means of pasture management in ruralTumu

followed by hunters, unattended fires, slash and burn agriculture, arsonist and cigarette smokers.

The bushfires impacted negatively on the production levels of farmers in the study area the fact that 67.1 percent ofrespondent's farms were destroyed by the bushfires which adversely affect their production levels and thelocal economy as a whole. Transitory food insecurity was found to be prevalent in the Sissala East District with 85.7 percent of farmers enduring it perennially because of the bushfiresover the study period.

It was found that there were earlier interventions to reduce the bushfire menace in the area but weak coordination, lack of commitment and logistical constraints characterized the implementation of laws and policies and therefore could not yield the needed results.

The major constraint in minimizing the bushfire menace in the study area was the nonexistence of the bushfire subcommittee at the District Assembly which will serve as a mouthpiece on bushfires in the district and lack of community anti-bushfire volunteer squadswho will prevent and fight bushfires as they may occur.

The appropriate measuresto reduce the bushfires menace in the study area is the inauguration of the bushfire subcommittee at the District Assembly,the formation of community bushfire volunteer squads, enactment of community based bye laws and the registration and monitoring of the Fulani herdsmen activities throughout the District.

5.3 Recommendations

From the above findings and conclusions, the following recommendations have been made on the causes and effects of bushfires on food security in the Sissala East District.

The bushfire menace is embedded with the cultural practices of the people, it is therefore recommended that a well-coordinated sensitization programme be implemented by the stakeholders in the District to educate; Fulani herdsmen, hunters, farmers (slash and burn agriculture) and charcoal burners in the district.

As a way of mitigating the effect of bushfires on production levels in the study area, the study recommend that farmers should cultivate the habit of creating fire belts around their farms, and endeavour to harvest their crops on time to avoid farm fires.

With the effects of climate change and bushfires on food security it would be appropriate that the zonal extension officers of MoFA encourage farmers to rear animals to supplement their crop farm proceeds to reduce the effect of food insecurity in case of bushfires.

Annual bushfire consistentsensitization must be pursued vigorously by the stakeholders in environmental sustenance in collaboration with theSissala East District Assembly and the Traditional Authorities, the fact that the phenomenon is embedded with certain cultural practices and believes to demystify those believes**.**

It is sad to know that although the PNDC law 229 -1990 enjoins all MMDA'S to inaugurate the bushfire sub- committee at the Assembly, this has not been done at the Sissala East Assembly. It is therefore recommended that the district assembly should inaugurate the bushfire sub-committee as a mouthpiece in addressing the bushfire menace in the area.

A bushfire subcommittee be establish in the District Assembly to coordinate the activities of all stakeholders especially informal organized structures such as the Traditional Authorities to enact community based bye laws on bushfires and organize the anti-bushfire volunteer squads in their communities to deal with the menace.

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APPENDIX I: Interview Schedule for farmers

This questionnaire is designed to seek opinions of farmers in relation to the effects of bushfires on food security in the Sissala East District. It is worth noting that any data collected from the respondent shall be strictly treated confidential and shall be used only for this academic purpose.

A. Demographic information of respondents

1. How old are you? (1) [ ] 10 -19 (2) [ ] 20-29

[ ] 30 – 39 (4) [ ] 40 & above

2. Gender (1) [ ] Female 2) [ ] Male

3. What is your ethnicity? …….

4. Name of your community. ……..

5. Marital status (1) Married (2) Single (3) Divorced (4) Separated (5) Widowed

6. Highest level of education attained. (1) Non formal education (2) Primary JSS or MSLC (4) SSS / TECH / VOC (5) Tertiary (6) Nil

7. Occupation (1) Trader (2) Farmer (3) Extension Officer (4) Others

B. Knowledge on bushfires

8. From 2010 to 2014 did you experience any outbreak of bushfire?

(a) Yes (b) No

9. Do you know what might have caused the bushfire (a) Yes (b) No

10. If yes what was the cause?

C. The effects of bushfires on production levels

11. Did the bushfire destroy your crops? (a) Yes (b) No

12. If yes what crop got destroyed?

13. What quantity got destroyed for the past four years?

D. Effects of bushfires on food security

14. What was the effect on food and pasture?

.....

15. What was the effect on price of food commodities and livestock?

.....

16. What was the effect on your income and food crops?

.....

17. Did that create a decrease in your ability to have enough food to eat for the past four years? (a) Yes (b) No

18. If yes how long were your yields able to sustain you after the disaster?

19. How did you cope with the disaster?

E. Past interventions to minimize bushfires

20. Do you have any measure in your community to minimize the outbreak of bushfires? (a) Yes (b) No

21. If yes what are those measures?

F. Constraints in minimizing bushfires

22. Are there any constraints in minimizing bushfire in your community (a) Yes

(b) No

23. If yes what are those constraints?

G. Measures to minimize the incidence of bushfires

24. Is there anything that can be done to minimize the incidence of bushfires in your community? (a) Yes (b) No

25. If yes what can be done?

APPENDIX II: Key informant interview guide

Question guide for stakeholders (Ministry of Food and Agriculture, Environmental Protection Agency, Game and Wildlife, Forestry Commission, Ghana National Fire Service, and Community Fire Volunteer Squads) on the Effects of Bushfires on Food Security in the Sissala East District.

(A) Ministry of food and agriculture

1. What are the causes of bushfires in the district?
2. What is the effect of bushfires on agricultural production in the district?
3. In what ways do bushfires affect food security?
4. Is there any policy by MoFA to address the bushfire menace?
5. What are the constraints in minimizing the menace?
6. In what way can we reduce the frequency of bushfires in the district?

(B) Environmental protection agency, Game and wildlife, Forestry Commission, Fire volunteer squads.

7. What are causes of bushfires in the district?
8. How many bushfires were reported to your outfit this year?
9. Did they spread to any farmland?
10. What will be the estimated cost of destruction by the bushfire?
11. Is there a particular project design to reduce bushfires?
12. Are there any challenges in your quest to reduce the outbreaks?
13. How can we reduce the frequencies of the bushfire outbreaks?

(C) Ghana national fire service

14. How many bushfire outbreaks have been reported to your outfit for the past four years?

15. Have you been able to extinguish them?

16. Did they spread to farmlands to cause destruction of food crops for the past four years?

17. What is the estimated cost of destructions of food crops by bushfire for the past four years?

18. Are there any challenges you encounter in your efforts to reduce bushfires, explain if any?

19. In what ways can we reduce bushfires?

APPENDIX III: Focus group guide

A question guide for Focus group discussions with Chiefs, Assembly members, Jantiina (land owners) in all the ten selected communities.

1. In the past four years did you experience any bushfire in your community?
2. What was the effect on production levels of farmers?
3. Did it affect food security in your community?
4. Do you have any intervention that have being put in place to prevent or reduce the bushfire menace in your community?
5. What are the constraints in reducing bushfires in your community?
6. What do you think are the best measures to reduce if not to eliminate the outbreak of bushfire in your community?