

**EVOLVING COMMUNITY PARTICIPATION BASED APPROACH IN
FOREST RESOURCES MANAGEMENT IN EDU LOCAL GOVERNMENT,
KWARA STATE, NIGERIA**

BY

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ABSTRACT

This research was aimed at evolving Community participation Model in Forests Resources Management in Edu Local Government, Kwara State, Nigeria. Literatures reviewed were centered on Community Participation and Management of Forests Resources internationally, regionally and nationally. The gap was identified that none of such has been done in the study area with the appropriate methodology used. Normalized Deference Vegetation Index (NDVI) was used to detect changes in Forests Resources in the Study area between 1990 and 2018. Normalized Burn Ratios (NBR) was also used to show the rate of forests burning in the Study area. Structured questionnaires were employed to study the methods used in the past in managing Forests Resources in the Local Government for thirty (30) years and better alternative methods that could be employed to manage Forests Resources in the area. The result shows a reduction in Forests resources significantly. NDVI result shows (-0.26) which indicates a decrease in vegetation cover in the study area. The vegetation index Map of 2005 also shows there is further decrease in vegetation (0.58) (0.48) in 1990 and 2005 respectively. NDVI values of (0.35) indicated a further decline in the vegetation of the area, 2005 -2018(0.48) (0.35) respectively. Edu Local Government Forests Burn area Change detection for 1990, 2005 and 2018 shows large positive (blue) and large negative (red) which indicated changes in the study area's forests (-0.5) and (0.5) ratios. The Communal Land tenure system used to manage Forest Resources in the area have not helped in preserving the natural vegetation in the area due to loss of family values. Government's revenue generation policies had encouraged cutting down of trees. Better alternative Community participation approach as revealed in the study will help. Planting of tree crops and establishment of forests by the State Government, Edu Local Government Department of Agriculture and Natural resources in collaboration with the communities through Traditional Institutions will be helpful. Monitoring of loggers in the areas by the Communities in collaboration with the Staff of Ministry of Environment and Forestry, and Department of Agriculture and Natural Resources are needed. It is recommended that tree planting campaign should be done in all the media outfit in the State. Privatising Forests resources to individuals will help in effective Management of the Forests resources.

TABLE OF CONTENTS

Contents	Page
Cover Page	i
Title Page	ii
Declaration	iii
Certification	iv
Dedication	vi
Acknowledgments	vii
Abstract	viii
Table of Contents	ix
List of Tables	x
List of Figures	xi
 CHAPTER ONE	 1
1.0 INTRODUCTION	1
1.1 Background to the Study	1
1.2 Statement of the Research Problem	3
1.3 Justification for the Study	5
1.4 Aim and Objectives of the Research	6
1.4.1 Objectives	6
1.5 Research Questions	7
1.6 Scope and Limitation of the Study	7
1.7 Study Area	9
1.7.1 Bata Area (Fadama Area within Lafiagi District)	12
1.7.2 Forests found in Tsaragi district	12
1.7.3 Forests located within Tsonga district	12

1.7.4	Different major trees and their local names found in the Local Government	13
1.7.5	Traditional rulers found in Edu Local Government.	13
CHAPTER TWO		15
2.0	LITERATURE REVIEW	15
2.1	Review of Concepts	15
2.2.1	Community based forest resources management.	15
2.2.3	Harvesting trees	17
2.2.4	Harvesting forest recourses	18
2.2.5	Environmental degradation and community participation	21
2.2.6	Regional perspectives on forest management	21
2.2.7	Local perspectives on forest management	22
2.3	Review of related technical concepts	22
2.3.1	Normalized difference vegetation index (NDVI)	22
2.3.2	Collaborative participation	23
2.3.3	Community resource for development projects	24
2.4	Review of Related Empirical Studies	25
2.5	Summary of Literature Review	44
CHAPTER THREE		46
3.0	MATERIALS AND METHODS	46
3.1	Study Population	46
3.2	Instrumentation for Data Collection and Analysis	46
3.3	Data Collection for Objective One	47
3.3.1	NDVI analysis	47
3.4	Data Collection for Objective Two	48
3.4.1	NBR analysis	48
3.5	Data Collection for Objective Three	49

3.5.1 Sampling and Sample Size	49
3.5.2 Questionnaire data analysis	50
3.6 Data Collection for Objective Four	50
3.6.1 Questionnaire administration	51
3.7 Validity of the Instrument	51
3.8 Reliability of the Instrument	51
CHAPTER FOUR	52
4.0 RESULTS AND DISCUSSIONS	52
4.1 Finding the Level of Destructions Done to the Forestry Resources	52
4.1.1 Vegetation index map of Edu Local Government forest resources for 1990	53
4.1.2 Vegetation index map of Edu Local Government forest for 2005	55
4.1.3 Vegetation index map of Edu Local Government forest for 2018	56
4.2 Assessing the Level of Forest Burning Area in Edu Local Government between the Periods of 1990 – 2018	58
4.2.1 Burn Ratio map of Edu Local Government forest for 1990	58
4.2.2 Burn ratio map of Edu Local Government forest for 2005	59
4.2.3 Burn ratio map of Edu Local Government forest for 2018	60
4.2.4 Edu Local Government Forest Burn Value change detection during 1990, 2005 and 2015	61
4.3 Efforts Put in Place in the Past to Protect the Forest Resources in the Last three Decades in Edu Local Government	62
4.3.1 Presence of Forest in the Study Area	63
4.3.2 Seasonal Fire, Hunting and Sourcing Charcoal by Black Smiths	64
4.3.3 Urbanization and Farming and for other Purposes	65
4.3.4 Charcoal Production, Logging and for Firewood	66
4.3.5 Subsistence farming, commercial farming in the study area	67
4.3.6 Communal, family and government land tenure system	68
4.3.7 Loss of family values and cohesion caused forest clearance	69

4.4	Better Alternative Community Participation Approach that can be put in place to help to Solve this Problem	70
4.4.2:	Privatization and old method (communal land tenure system)	70
4.4.3	Local vigilantes, environmental officers and farmers	71
4.4.4	Discussion of Results	72
CHAPTER FIVE		77
5.0	CONCLUSION AND RECOMMENDATIONS	77
5.1	Summary	77
5.2	Conclusion	80
5.3	Recommendations	80
REFERENCES		84

LIST OF TABLES

Tables	Page
4.1 Respondents According to Districts	64
4.2 Respondents from Farmers, Community Leaders, Tree Loggers and Charcoal Producers	65

LIST OF FIGURES

Figures	Page
1.1 Map of Edu Local Government	10
4.1 NDVI values of Edu Local Government Forest Resource for 1990	54
4.2 NDVI values of Edu Local Government Forest Resource for 2005	55
4.3 NDVI values of Edu Local Government Forest Resource for 2018	56
4.4 NDVI differencing (2018 NDVI- 1990 NDVI)	58
4.5 NBR values of Edu Local Government Forest Resource for 1990	59
4.6 NBR values of Edu Local Government Forest Resource for 2005	60
4.7 NBR values of Edu Local Government Forest Resource for 2018	61
4.8 NBR differencing (2018 NBR- 1990 NBR)	62
4.9 Presence of Forest in the Study Area	64
4.10 Seasonal Fire, Hunting and Sourcing For Charcoal By Blacksmith	65
4.11 Urbanization, Farming and Other Purposes	66
4.12 Charcoal Production, Logging and Firewood	67
4.13 Subsistence Farming and Commercial Farming	68
4.14 Communal, family and government land tenure systems	69
4.15 Loss of family values and cohesion caused forest clearance	70
4.16 Planting of Trees and Tree crops and Orchards	71
4.17 Privatization and Old Method of managing Forest	71
4.18 Local Vigilantes, Environmental Officers and Farmers	72

CHAPTER ONE

1.0

INTRODUCTION

1.1 Background to the Study

Conservation practices all over the world are changing from traditional management approach with emphasis on managing cultural resources in a way that ensures greater flow to all stockholders especially local community, The shift in emphasis is informed by the fact that the local communities are inextricable tied to their cultural resources used as a source of food, medicine, fuel or for monitoring ecological balance (Usher, 2000).

Deforestation value in the country is about 3.5% per year, and translating to a loss of 350,000-400,000 of forest land per year (Onwubuya *et al.*, 2014). Despite the conservation predicate 14 conservations degradation of the forest reserve base still has major effects on the economy.

Justification for community participation as viewed by International Union for Conservation of Nature (International Union for Conservation of Nature (IUCN) 1990) provides that human culture must be based on respect for nature, and that the present generations have a social responsibility to conserve nature for the welfare of future generations. The view recognizes that mankind is part of nature and that all species have an inherent right to exist regardless of their material values to human. Akindele *et al.* (2021) stated that biodiversity plays a vital role in the lively hoods and survival of many Nigerians. It provides eco-system (Providing, Support Regulating and Cultural Services such as climate regulation, provisions of food and Medicine, Raw materials and aesthetic values). Ironically biodiversity is one of the most undervalued and unappreciated natural resources in Nigeria. These biodiversities are continually threatened by increasing rate of eco-system degradation and biodiversity loss (Akindele *et al.*, 2021).

Community forest Management is an evolving branch of Forestry whereby the local community plays significant role in forest management and land use decision making by themselves in the facilitating support of government as well as change agents which involves the participation and the collaboration of various stakeholders. The Federal Government of Nigeria policy goal on conservation of biodiversity is to ensure sustainable use of Forest Resources and preservation of many benefits accruing from soil, water and wildlife conservation for economic development according to United Nation Protocol. Among the current priority programs in Nigeria are the National Parks and resources and the compilation of the flora in Nigeria. The Nigeria Biodiversity Strategy and Action Plan (NBSAP) reviews the status of biodiversity conservation in Nigeria in an attempt to fill the gaps identified in the country, study programme and develop strategies and action plans to bridge the gaps in the conservation efforts.

The Government mission is that Nigeria's rich biological endowment together with the diverse ecosystem will be secured, and its conservation and management assured through appreciation and sustainable utilization by the year 2010. Nigeria will be active in the international arena while at the local level infrastructural human and institutional capabilities will be developed to enable equitable sharing of biodiversity benefits over time. The protected areas and sites programme and site of conservation interest and classified to identify area using necessary criteria. Only four States (Delta, Edo, Kogi, and Kwara) have been inventoried so far. These are lofty programme but what remain uncertain are the implementation and how the impact will trickle down to rural communities. From the above contributions of the scholars, and series of researches, community participation and management by communities is the best way to go in collaboration with other agencies of Government, as these have achieved the desired result in other places.

Most of the postulations are embraced by all stockholders. It has helped in the management of the Forestry resources in the overall interest of the community and has helped in sustaining forestry resources. Community participation and management of forestry resources is all encompassing and loaded with a lot of achievable ideas. At the level of implementation in some areas especially in Edu local Government Kwara State becomes problems as a result of different problems, such as;

Negligence on the part of staff of both Ministry of Agriculture and Environment and Forestry department; Illegal exploration of forest resources by the people; Community leaders not fully committed to the agenda; Inducement from public to prevent officials from doing their job; Unseriousness on the part of Government to protect both human and Environment, government only paying leap service; Total collapse of third tier Government.

All these and many more are responsible for the poor implementation of community participation and management of forestry resources in Edu local Government, Kwara State.

1.2 Statement of the Research Problem

Evolving Community participation and Management of Forestry Resources In Edu Local Government Kwara State is timely looking at the benefits that can be derived from it, Coupled with the rate at which the forestry resources is being tampered with through various economic activities taking place in Edu Local Government.

All these and many more pose a great danger to the environment which necessitates evolving or awakening community participation to better management of Forestry Resources in Edu Local Government for Sustainable development.

The rate at which the environment is being devastated is alarming and these include;

Climate distortion (climate change, excessive heat and drought which adversely affect the food production; Extinction of valuable forestry resources e.g. timbers; Economic trees such as locust beans, Shea butters trees, Mango trees etc are no more in abundance; Animals migrating due to distorted vegetation; Excessive erosion as a result of absence of vegetation; Vast expanse of land is infertile as a result of shifting cultivation; Medicinal trees are disappearing fast.

Our environment is our precious commodity which needs to be guarded and protected from any impending danger which Forest resources areas are part of. To this end there is need to evolve community participation and Management of Forestry Resources to guarantee our safety living and sustain the environment for future generations. Efforts to integrate rural people into biodiversity conservation through community based conservation programme is an old tradition there is a strong need to assess cultural practices traditional Laws and taboos of the people in protected areas and how they have assisted conservation in the past (Saka *et al.*, 2017). To understand how such practices could be strengthened and incorporated into natural resources management and conservation strategies.

The Worldwide campaign and enlightenment against climate change vis a vis global warming, destruction of Forestry Resources are among the contributing factors. Reforestation and effective Management of remaining forests Resources are solutions to the problems which need to be embraced by all. Our attention is all focused on what to benefit from the environment not minding the techniques and methods to be adopted to achieve these goals which impact adversely on human and environment in time too close. There is also the establishment of commercial agriculture in Kwara State located in Shonga also known as Shonga Project after the name of the town in Edu Local Government where the commercial farm is practiced. A large productive land was taken

through tripartite agreement between the State Government and the foreigners and the communities for 25 years. Another source of concern for the communities now is that large forest land was completely cleared for the commercial farming .And the envisaged crop production have been turned to dairy farming and the poultry farming .Already the Forestry resources have been removed completely.

The resurrection of Lafiagi Sugar Company by BUA Group of Company. BUA acquired arable land meant for agriculture for housing scheme for the staff and for airport. This is also not good for our forestry resources. Individual youths in the communities go to market and purchase tree cutting hand marching, go to bush and bring down the tree of all varieties without any consideration. This is done to harvest timber and is at an alarming rate. Any attempt to control them lead to crises. This is not good for the societies and the environment at large. The artificial forest established some years back around 1960s including one around Tako Gabi/kpata Lade axis and the one located around Gbadagun Gbugbu axis have been destroyed for firewood and timber purposes. This study was, therefore to attempt to evolve the community participation model in forest resources management.

1.3 Justification for the Study

Evolving community participation and Management of Forestry Resources is important now that it is a global remedy for the protection of Forestry resources. Edu Local Government is not an exception. The Communities play major roles in the destruction of Forests resources and this is done by the active members of the communities especially the youths. Since communities are homogenous societies, community policing will go a long way in checking and monitoring in and out movement of the people in the Forests areas.

The rate of which the effect of climate change and global warming is increasing such as torrential down pour, draught, flooding, sedimentation and e.tc, called for urgent interventions. Planting of trees and protecting of existing one and effective management of forest resources, changing from old methods of farming to adopting a new methods in order to protect the forest for ourselves and for future generations.

1.4 Aim and Objectives of the Research

The aim of the study is to evolve the community participation based approach in forest resources management in Edu Local Government, Kwara State, Nigeria

1.4.1 Objectives

- i. To find the level of destructions done to the forestry resources in Edu Local Governments between the periods of 1990 – 2018.
- ii. To assess the severity of forest burning in Edu local government between the periods of 1990 – 2018
- iii. To look at efforts put in place to protect forestry resources in the past and assess the level of success or otherwise in Edu Local Government.
- iv. To attempt to evolve alternative community participation approach in Edu local government.

1.5 Research Questions

To realize the stated objectives, the following questions were proposed:

- i. What is the depletion of forest like in the last two decades between 1990 – 2018?
- ii. How severe is forest burning in Edu local government?
- iii. What efforts are put in place in the past to protect the forest resources in the last two decades in Edu local Government and how effective have they been?

- iv. What better alternative community participation approach can be put in place to help to solve this problem?

1.6 Scope and Limitation of the Study

This research works scope focused mainly on evolving community participation based approach in forest resources management. The study examined the level of success of forest resources in the past and assess the level of severity of forest burning between the period of 1990-2018.

The research work covered Edu Local Government area Kwara State. The Local Government comprises three district, Lafiagi District, Shonga District and Tsaragi Districts. It has an area of 2542KM and population of 201,469 by the population census of 2006. And 2016 projection put the Population at 272,200. The local Government is bounded in the North by River Niger, Ifelodun Local Government to the South Patigi and Moro Local Government to East West with 75% land with a derived type of vegetation.

The study area is located south of river Niger in Kwara State, constant flooding and abundant rainfall which culminated into abundant vegetation hence the high concentration of agricultural activities both at subsistence and commercial level and lumbering activities. Consequently lead to clearing of natural vegetation with all its effects such as global warming and climate change or deforestation this study focus on how to evolve community participation to better manage forest resource and reduce its impact on the environment.

1990 -2018 was the target of the study to ascertain and established the level of destruction done to forests resources over time and to know trend of changes that had occurred between 1990 2005 and 2018. i.e 15 years at interval. Inability to reach the interior part of the villages as a result of the presence of rivers and mobility problem; inability of the

respondent to give out accurate information in respect of their experiences of the forest resources in their area posed greater challenge to this study.

1.7 Study Area

Edu local government is located in Kwara State. It has an area of 2542km² and a population of 201469 (National Population Census (NPC), 2006). The area is located in the Guinea savannah region. The half of the territory is occupied by a moist so called Guinea high grass savannah. Precipitation per year here is 1000-1400mm on the average. Fig 1.1 shows The area bordered banks of river Niger in the north and gallery of forest and to the South around Tsaragi area by Ifelodun Local Government .

Edu, the study area, is located between longitude 4°54'15"East and 5° 31' 00" East of the Greenwich meridian and latitude 8° 35' 38" North and 9° 15' 00" North of the Equator. It covers an area of 2,542 km². Edu is one of the sixteen Local Government Areas in Kwara State with Lafiagi as the headquarters. The Local Government Area has a population of 201,469 as reported in the 2006 population census. It has three administrative districts: Lafiagi, Tsaragi, and Shonga, (Bello and Makinde, 2007), reported that the study area has a mean annual rainfall and temperature of 300 mm and 29°C respectively. The Average Relative Humidity is about 78.6 % and this varies seasonally with the lowest reaching as low as 69.99 %. The study area is characterized by the alternate dry and wet season. The rainy season starts towards the end of March and lasts till October while dry season commences in November and ends in early March.

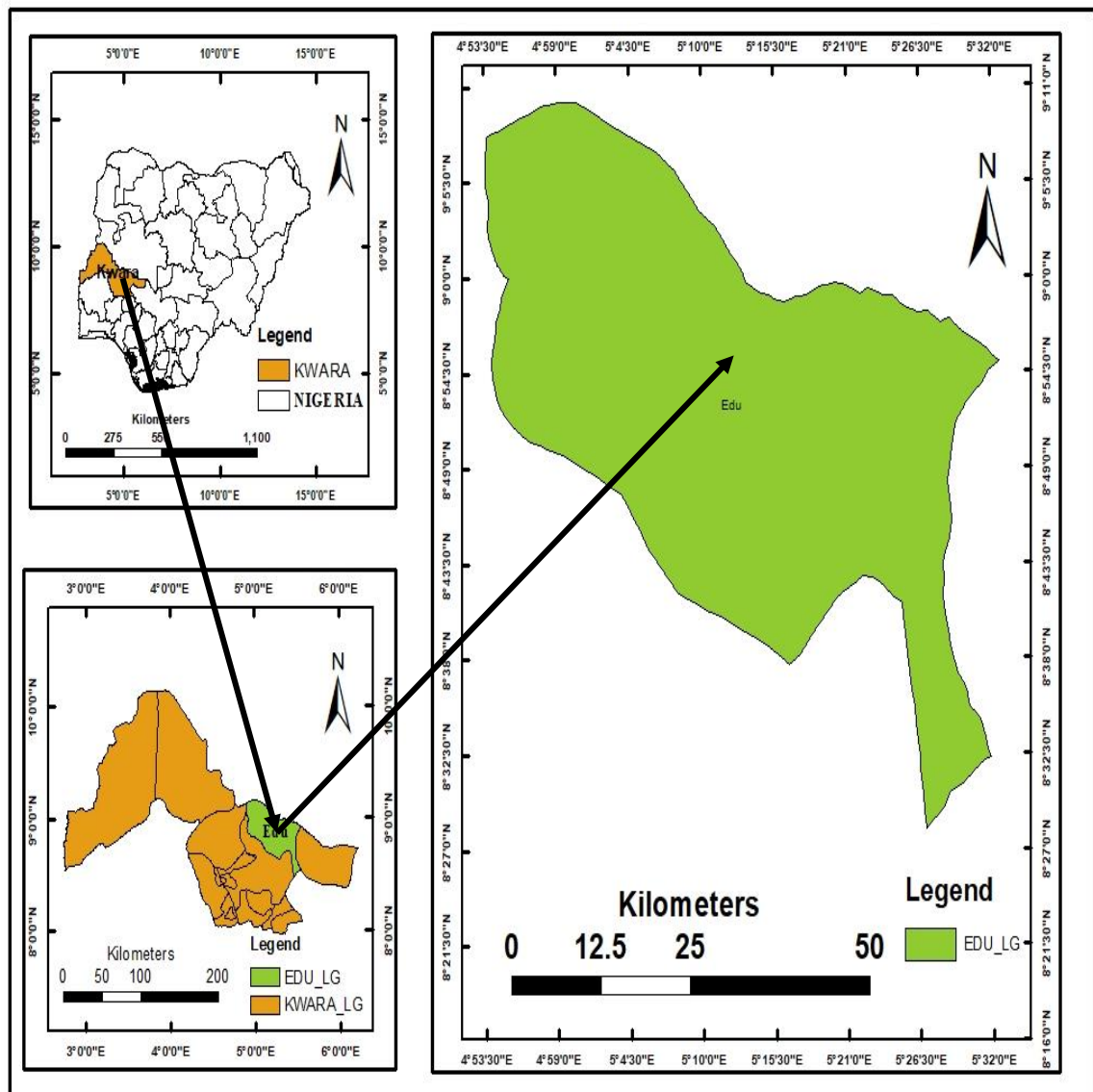


Figure 1.1: Map of Edu Local Government

Source: Author's compilation, 2019

The study area falls within the peneplain of the river Niger trough, which stretches from Jebba to Eggan on a topography that is relatively flat, lying near the River Niger and rises to the crystalline upland in the South to an elevation of less than 150 m above sea level (Bello and Makinde, 2007). Figure 1.2 shows the River Niger and its tributaries, Oyi and Oro drain the land. An overflow of the Niger and its tributaries during rain often floods the area and on recess deposits sediments on the flood plain.

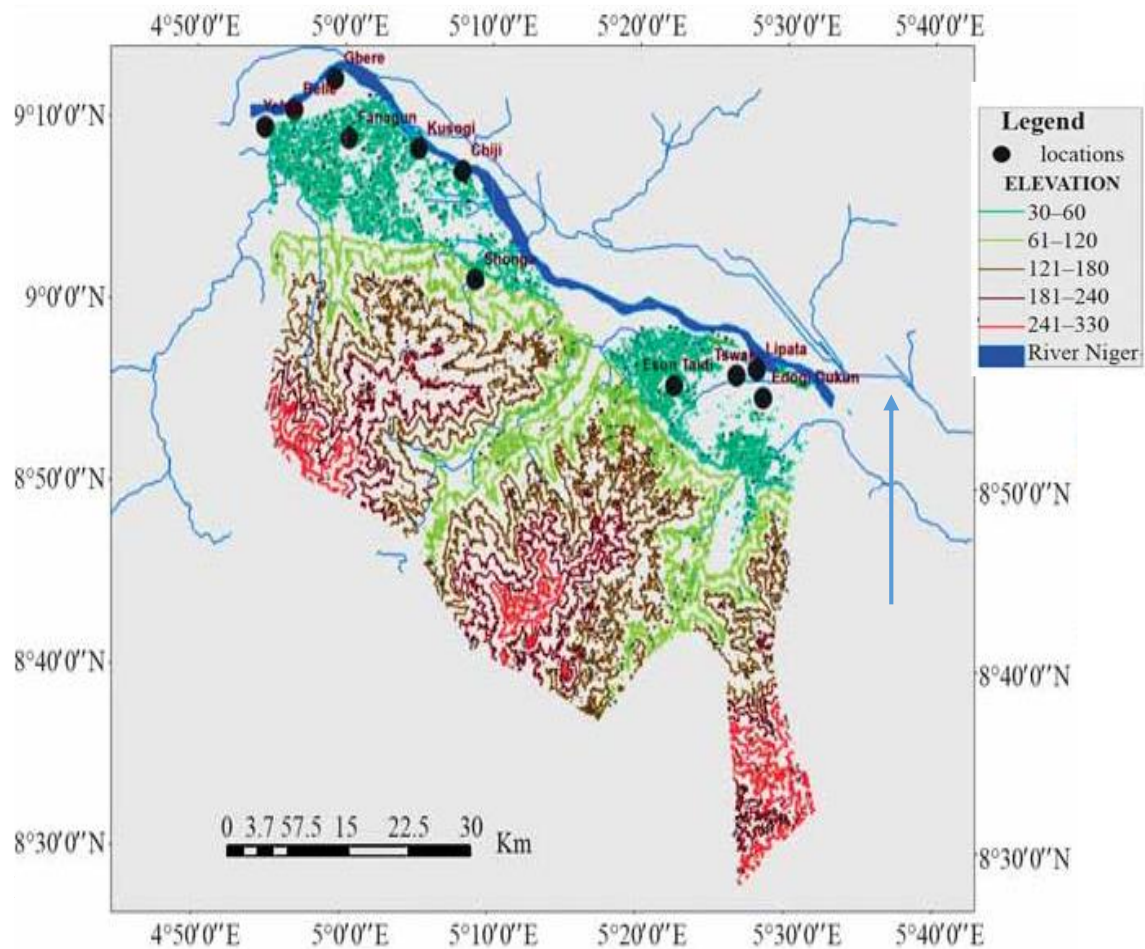


Figure 1.2: Map of Study Area

(Source: Author's work, 2019)

Edu LGA is dominated by Nupe speaking people; they live close to river banks and engage in agriculture as the major economic activity. Fish farming and rice cultivation are the two major activities of the people in the study area.

The study area comprises three districts with its different vegetation zones vis a vis forest resources. Forest located within Lafiagi district particularly, upland area are: kusoko forest, Cheko/Shaban, Woden Nuwan found within Zambufu axis. Leman forest which extend to Oke Ode area in Ifelodun Local Government, Kwara State. This forests has not been tampered with significantly due to rocky nature of the area and also repel anthropogenic activities. Patiketsan, Kusozhiko, Funti forest, Guduzduru are all found within Lafiagi area. Yipkata forest which was devastated by the Dukawa for farming

activities and Ndakodawu forest extends to Todo in Tsonga district. Luko Forest extend to Gbadagun along Gbugbu area.

1.7.1 Bata Area (Fadama Area within Lafiagi District)

Egbazhi forest around Puta area, Esun Makundunu also around Puta, Esun Twadwa very close to River Niger, Kpotsogo Puta, Kusotagi forest, Kuso Magi. Kuso Pkabugi, Kuso Gbogi Chikan Bindofu area of Lafiagi, Kuso Dungi Edo Kposhi, Gbaagi Jegba, Zuzungi, Gbako, Kaatsa, Abakwua, Sunsunuko, Baka-forest, Gbaga, Dagba, Batako and Kuso Karagi all are located within Lafiagi district. All these forests harbored wild animals in the past and have been destroyed due to increase in population and demand for space for farming.

1.7.2 Forests found in Tsaragi district

Yipkata forests in Tsaragi, Emi Npa forest, Dada forest found along Bode Saadu in Moro Local Government, Gbagunta, Esanzhi, Maako, Gbadagun, Patiko, Fanagun, Gbaduwa. Maafu all of these are found around Bacita axis. Significant part of these forests have virtually been destroyed due to various economic activities.

1.7.3 Forests located within Tsonga district

Kusozhiko within Tsonga town, Kusoyitigi, Kulanaba, KusoEdoti, Epa-Nasara BozhoZarakuta, Takunnabedagbana found in Ndakansa area, Gudu forest which extends to Ndakodawu in Lafiagi district, Kusozhanagun in Tsonga/Todo and Gudu area. Dungbe forest, Tsyata forest where Zimbabwe farms are located.

1.7.4 Different major trees and their local names found in the Local Government

The major trees found there and their local names include Wuchi, (Mahogany), *Kulanchi* or *Lonchi* (locust bee tree), *Dinchi* (black palm tree), *Gbanchi* (pig tree), *Kochi* (shea butter tree), *Pkache*. (Issa, 2015).

1.7.5 Traditional rulers found in Edu Local Government.

Emir of Lafiagi is the overall and the Chairman traditional council of Edu Local Government, Kwara State. Even though each community has its boundary, there is this collaboration in terms of community efforts. There are other traditional title holders within Lafiagi District such as Shaaba, Ndeji, Maakun, Swasun, Tsazha, Ubandawaki and Mayaki. All help in effective monitoring of the community. Ndazhitsu, EtsuYankpa, Lashan Puta and other traditional title holders help at various capacities for effective forests resources management in the local Government.

Three traditional rulers of First class staff of office are found in the local Government. Each traditional ruler is in charge of his district and domain, since farming dominate the major economic activities. Traditional rulers monitor and control the surrounding environment.

Tsaragi District, headed by the Etsu of Tsaragi with his cabinets of Shaaba, Ndazhoko, Ndamagbo and all other minor title holders are within the Town. There are other traditional and community leaders such as Etsu Yankpa and Ndazhitsu. These two traditional/Community leaders can be found in a single community or in a separate town depending on how large or otherwise of the community.

In the case of Tsonga, the Town is headed by the Emir of Tsonga with his cabinets similar to that of Lafiagi with few changes. They are Shaada, Ndeji, Maakun, Mayaki, Magajin Bindofu and Tsazha. Gudu is headed by Etsu Yankpa, Chigi and Pileagi are headed by

Gago,Tada is headed by Tsadu, Ndakansa is headed by Sonlawo. Etsu Yankpa is the village head of Kanko and Duma is for Pkafean.

At various levels these leaders are in charge of their domain which is put under their care but as a result of breakdown of the community and social cohesion and strict adherent to the roles, these have not been effective.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Review of Concepts

2.2.1 Community based forest resources management

In Nigeria human communities are found within or besides forest ecosystems, depending on those ecosystems survival. Their forests exploitation is considered a threat to conservations efforts leading to constant conflict between the Government, law enforcement agencies and the communities. The best solution is a win -win situation of particular communities based forest resources management in which the communities are regarded as stakeholders rather than threats. Management of forest with readily available markets for their timbers, employment for some of the community youths as well as community development projects. The Government should provide basic amenities for the communities as alternatives to these forest products.

Okojie (2017) noted that most of the households living within the forests community are farmers and timber workers indicating that their livelihood depends on forest from several centuries back and worse still. Their illiteracy and the poverty level are very high. According to him the clearing of forestland for farming in Nigeria account for over 80% of total forest area deforested every year.

He stated that those tresses are filtering carbon dioxide that causes harm to health of human persons. The forest ensures economic survival of million communities depending on it for livelihood and further ensures continuous supply of high quality water. It is not too late to protect and conserve some of the remaining strongholds for biodiversity and of the last lag perfectas of tropical forests it stronger financial support is made available

and all those with a stake in the outcome take actions that are more decisive. A climate change friendly, environmentally safer, biologically richer Nigeria for now and the future is still very possible and forest product society of Nigeria (FFPN) held of the federal university of technology, Akure, Ondo State. States that Nigeria has a total forest area of 14,387,000 hectares in 1990, five years thereafter, the Nigeria forest estate stands at 13,790,000 hectares with an annual change of 0.9% which according to is deplorable, proper utilization of forest resources have not been put in place. The forest is a natural system that can supply different products and services by the natural environment. Climate, topography soil etc. and also human activities. The action of human in forests constitutes forest management.

In developed societies this management trends to be elaborate and planned in order to achieve the objective that are considered desirable. Some forests have been managed and are to obtain traditional forest products such as firewood, fibers for paper and timber with little thinking for other product and services. There has been increase in public awareness of natural resources policy including forest management may have.

There is considerable celibate about current rate of defloration in African. Conversion of forest into small-scale agriculture accounts for nearly two thirds of all tropical forest destruction. Some scientists insist that it means a complete change from forest to agriculture urban areas or deserts; others include logging activities, according to (Food and agricultural organization (FAO), 2008) .

According to Keller and Bolkin (2007), as the human population grows, the use of firewood increases. In this situation, management of the essential including management of wood stands to improve growth however, well planned management of firewood stands has been the exception rather than the rule. They stated that a tree affects the earth by

evaporating water, slowing erosion and providing habitat for wildlife. Trees can also affect climate.

2.2.3 Harvesting trees

Managing forest that will be harvested can involve removing poorly formed and unproductive trees to permit larger trees to grow faster. Planting genetically controlled seedlings controlling pest and disease and fertilizing the soil. Harvesting can be done in several ways according to Keller and Bolkin, (2007); clear cutting, selective cutting, strip cutting, shelter wood cutting and seed tree cutting,

All these are systematic ways of harvesting forest resources which is all effective management of ecosystems and environment.

Conservation of forest in African is also further limited by unequal distribution of research efforts across the different geographic regions.

The West African forest have been poorly understood and have poorly describe biodiversity (Norris *et al*, 2010) but are globally recognized as significant hot spots for biodiversity (Berg *et al.*, 2007).

Norris et al. (2010) and Brokini *et al.* (2012) stated that the tropical forest landscape of West Africa is a changing face of once dense tree cover shifting towards degradation and fragmentation. As trees are felled to make way for agriculture (Norris *et al*, 2010). Tropical rainforest are being cleared rapidly and these forest lands are among the richest and most diverse terrestrial system. Although they now occupy less than 10 per cent of the earth's land surface, these forests are thought to contain more than two-thirds of the higher plant biomass and at least half of all the plants animals and microbial species in the world.

The FAO estimates that only about 40 per cent of those forests remain in their original condition and that about 10 million ha or about 0.6 per cent of existing tropical forest are cleared each year. But deforestation is believed to have increased erosion and caused the loss of an estimated 562 million hectares (1.4 billion acres) of soil world-wide; with an estimated annual loss of 5-6 million hectares. Cutting forest in one country affect other countries according to them.

2.2.4 Harvesting forest recourses

Eno (2017) stated that Forest are pregnant with resources that can change the economic fortunes of any Nation and for the Nation's that are blessed with abundant forest resources, the sustainable Management of these resources can become a great foreign exchange earner. Specifically, in the country's pre-independent era, forestry and agriculture dominantly sustained the growth of the country's economy as trade in timbers accounted for sizeable chunks of its earning (Okojire and Eno, 2017).

According to Food Agricultural Organization (FAO, 2018) the livelihood of over 2.4 billion people depends directly on forest for generation of cash and non- cash income, providing a wide range of social economic, cultural, spiritual and environmental benefits for local communities. The significant contributions to the livelihood and alleviation of hunger and poverty make it a must to have a people –centered approach to Forestry. Recognizing local people as key to forest stakeholders and promoting their involvement in decision-making and sustainable Management of forest, generates positive outcomes for the livelihood, rural development and forest conservation.

Forests are plants communities consisting predominantly of trees and other woody vegetation occupying an extensive area of land in its natural State. Government especially semi-arid region of the World designate areas of forests as forest reserves to stimulate

rainfall, reduce wind erosion, stem the tide of desertification and halt the encroachment of the desert. Forests support life on earth by absorbing carbondioxide and releasing Oxygen thereby maintaining balance in the gaseous atmosphere and also in completion of hydrological cycle to cause rainfall (Lade, 2015).

Lali (2018) stated that forest provides multiple ecosystem services spanning from local livelihood and socioeconomic development, related goods and services such as food, wood, and water to the global ecological and economic services such as ecosystem functioning, biological diversity, carbon dynamics and climate. However, deforestation and forest degradation (D and D) caused a significant reduction in the provisioning of valuable ecosystem goods and services from forest in developing countries in the tropics and currently pose the greatest threat to the forest ecosystem and the goods and services they provide on the other hand. Efforts to save forest have attracted enormous International attention.

Since colonization in the mid-19th century, Nigeria has lost more than 90 percent of the forest cover, (Enoh and Bisung ,2015). In addition, hunting in Nigeria is often driven by cash income, leading to a decline in wild life through overexploitation by local people and professional hunters. This is also due to forest clearing and habitat loss, (Enoh and Bisung ,2015).

The ongoing expansion of urban areas and agricultural land together with new infrastructure and road building projects further reduce the area and quality of forest habitats. Road construction may facilitate access to market to purchase animal protein but easier access into remote area puts additional pressure in forest fertility, timber extraction and hunting. (Mahmud *et al*, 2017)

Laurence *et al*, (2017) stated that deforestation in cross River State is rampant largely due to pressure from Agriculture, Industry, hunters, settlement and infrastructure and the estimated forest loss in Cross River state was 49,000 ha from reliable sources. Government data estimated that the number of people that were engaged in different types of Forestry activities stood at 170,000 in 1933, moved to 36,000 in 1947, was up to 583,000 in 1961. These happened at the time when about 80 percent of the country's rural population engaged in agro forestry and other agro - allied activities. All these took place before stable demand from countries like China and India forced the prices of African sawn wood down.

According to Ane (2017), Forest sector has experienced gradual decline in income generation to Government, partly due to over exploitation of some of the best timber species in previous decades.

Community participation connotes the involvement of local people in decision making processes, involving them in management of forest resources within their areas of abode (Enuameh *et al*, 2015). The expectation of people, preferences and expectations in the decision making process is important aspect of sustainable National resources Management.

According to FAO (2015) participation of rural communities in forest resources Management is necessary to ensure the sustainable maintenance of the resources. Indigenous people and their communities have a vital role in environmental management and development because of their traditional Knowledge and practices. The involvement of rural residents who are closer to people natural resources enclaves is important as forestry department have limited financial and human resources to ensure sustainable use of several hectares of land under their sole jurisdiction (Enuameh *et al*, 2015).

2.2.5 Environmental degradation and community participation

Forests play a central role in economic development, provision of critical environmental services and the supply of social cultural values. They are also vital since they play a role with respect to wood based industries, provision of energy, stabilization of underground water, tourism through their unique environments and habitats, provision of resource materials to pharmaceutical industry and livestock production through feeds.

Forests have a stabilizing role to the environment as evidenced by their ability to absorb carbon, biodiversity conservation, flood control and amelioration of climate. On a social dimension, forests are very important to the communities as they are used for religious purposes and are home to traditional forests dwellers.

2.2.6 Regional perspectives on forest management

Forest management is a problem not only in Kenya but also in other parts of Africa, Asia and Europe. Sri-Lanka, for instance, had a tropical forest cover of 6,500 km², in 1999 and the total estimated canopy was 22% of the total land area. Annual forest loss in the country between 1990 – 2005 is estimated at 1.3% mainly due to shifting of land cultivation, illegal exploitation of timber and damage from periodic wildfires.

Ethiopia has 13 million hectares of forest. Currently, forest cover in the country is under threat as a result of pressure from agricultural expansion and fuel wood production. To address this, the government issued a Forest Development, Conservation and Utilization Proclamation and this proclamation recognized the role of community forest management as an important strategy for environmental protection.

Mozambique has a forest area of just over 19 million hectares and a deforestation rate that has risen in years to approximately 219,000 hectares per year. Mozambique is exploring new prospects for community forest management.

2.2.7 Local perspectives on forest management

Within the Kenyan context, the first site for Participatory Forest Management (PFM) was established in Arubuko Sokoke Forest in Coast region. Forest management in Kenya has undergone several changes overtime in response to the country's changing needs. The most significant, though gradual, has been the introduction of Participatory Forest Management (PFM), a shift from the previous command and control system that alienated communities. The Forests Act of 2005 is, therefore, a positive move for the local communities and this has already begun to act as a catalyst in their involvement in the management of the remaining forest resources (Ongugo *et al.*, 2007).

The Act further encourages local communities to participate in the management of forest resources adjacent to them. Arising from this policy and law, new institutions are emerging to implement the process of involving local communities in the management of forest resources.

2.3 Review of Related Technical Concepts

2.3.1 Normalized difference vegetation index (NDVI)

Normalized Difference Vegetation Index (NDVI) is an index for describing the phenology, greenness, productivity of vegetation. It is indexes of green biomass (Sabellek, 2010). There are several methods for vegetation change detection but NDVI is widely used and suitable for monitoring forest change. NDVI is a good indicator of showing the greenness for vegetation and has been widely used by researchers to estimate green biomass (Prince, 1991). For instance,

Manoj (2010), used NDVI approach and land use/land cover (LULC) to study vegetation change. The study revealed that NDVI is the suitable approach to detect vegetation change.

Similarly, the NDVI is one of the most suitable indexes to detect a green area (Agone and Bhamare, 2012). Furthermore, NDVI gives a measure of the volume and vigor of vegetation at the surface area (Usman, 2016). The Normalized Difference Vegetation Index (NDVI) is the most used indicator of terrestrial vegetation productivity (Pei-Ling and Nathaniel, 2013). The values of NDVI range from 1 to -1. 0 value is representing the area without or no vegetation.

2.3.2 Collaborative participation

This paper finds collaborative participation as another model by which Kenyan citizens have found an avenue to participate in the undertaking of public development projects. In this model, the collaborative approach ensures the sharing of decision-making power among different stakeholders in a project; and all stakeholders are deemed equally important and are linked through knowledge sharing (Probst, 2003). Thus, the basic feature in this model is that it engenders a collective approach to decision-making which comes along with attendant merits. For instance, collaboration in project management has been shown to not only enhance cooperation and foster belief change among stakeholders; it is also credited for generating funds and support for alternative policy measures when problems are too diffuse or difficult to address through regulation and it increases the implementation success of policies and programs as well (Scott, 2015). In Kenya, the wildlife conservation and management program has been undertaken for many years involving the government and the private land owners, because sometimes state owned wild animals roam private land; and tourists also use privately owned resources. Thus, there is always a collaborative decision making process on how to manage state owned wild animals and state sponsored tourists on privately owned ranches.

Nonetheless, the foregoing advantages of the collaborative stakeholder participation model do not mean that it is problem-free. The biggest pitfall in this model is that the constellation of stakeholders in one project often leads to conflicts which may be quite debilitating to the project (Boon et al., 2013; Sultana et al., 2013); implying that realization of the project life cycle that adopts this model will partly depend on the skills by which this model is applied. The application of this model does not therefore guarantee project success. Consultative participation in this approach, most of the key decisions are made by one actor, who wields influence in the project (Probst, 2003). However, emphasis is laid on consultation and gathering of information from other stakeholders, especially for identifying challenges and opportunities, priority setting, and even risk factors; which information is then applied in planning, implementation, monitoring and evaluation of the project.

2.3.3 Community resource for development projects

Today, there are a variety of resources which communities can contribute to projects. Resource mobilization theory (RMT) analysts have made considerable progress in specifying and differentiating between five distinct types of resources: Moral, cultural, social-organizational, human, and material (Edwards & McCarthy, 2004).

- i. **Moral resources:** They include legitimacy, integrity, solidarity support, sympathetic support, and celebrity. These resources are important because some projects cannot succeed without the support of moral resources from the project host community.
- ii. **Cultural resources:** These include tacit knowledge about how to accomplish specific tasks like enacting a Protest event, holding a news conference, running a meeting, forming an organization, initiating a festival, or utilizing new social media, music, literature, magazine/newspapers, or film/videos. Specific cultural

resources are widely available in a given society, but neither evenly distributed, nor universally available (Edwards & McCarthy, 2004). Cultural resources, moral, cultural, social-organizational, human, and material resources have been used widely to promote development projects.

- iii. **Human resources:** This category includes resources like labour, experience, skills, expertise, and leadership. Individuals typically have control over the use of their labour and other human resources and make them accessible to public projects.
- iv. **Material resources:** This category combines the financial and physical capital and includes but not limited to monetary resources, property, office space, equipment, and supplies. Monetary resources are very vital because money can be converted into other types of resources (e.g., rent for office space, hiring of picketers, purchase of opinion ads) while the opposite is less often the case (Edwards & McCarthy, 2004).
- v. **Social-organizational resources:** There are three general forms of social-organizational resources and these are infrastructures, social networks and organizations; each varying in their degree of organizational formality

Edwards & McCarthy (2004) stated that normally, infrastructures are publicly owned while social networks belong to groups and may not be readily available to anyone in need. Socio-organizational resources have been used by communities to help in the undertaking of public development projects in Kenya.

2.4 Review of Related Empirical Studies

United Kingdom's Royal Society in a report titled 'Climate change ; evidence and causes' stated that 'Scientists know that recent climate is largely attributed to human activities

from an understanding of basic physics, comprising the detailed patterns of climate change caused by different human and natural influences’ Pope Frances reminded the World that humans are not smart species. According to him ‘man is stupid ‘for denying climate change. According to him’ when you don’t want to see, you don’t see’. In his 2015 enclitically on climate change and the environment, *Laudato Si*, Pope Francis argues that climate change is inherently a moral and spiritual issue and criticizes local and national governments that refuse to address it.

The climate change of the earth has changed throughout history. In the last 650,000 years, we have had seven cycles of glacial advance and retreat, and end of the ice age about 7,000 years ago. These initial changes were attributable to variations in Earth’s orbit that significantly changed the amount of solar energy that reaches the Earth (National Aeronautics and Space Administration, (NASA) 2018). The current warming is a trend that is 95 percent to be as a result of human activities that are proceeding at a rate that is unprecedented. National Aeronautics and Space Administration (NASA) has done so many studies and have concluded with demonstrable evidence that the heat-trapping nature of carbon dioxide and other gases have the ability to affect the transfer of infrared energy through the atmosphere.

Laah (2018), stated that besides the emission of greenhouse gases, a number of human activities have altered Earth’ energy balance through Changes in land use. Because of human activities, there are continuous changes in the land use. The clearing of vegetation for road or housing construction could lead to changes in the reflectivity of the Earth’s surface. This will affect the amount of sunlight that is sent back into space. Some pollutants from industrial and agricultural concerns are emitted and these pollutants produce aerosols. Because aerosols affect cloud formation, they can have a warming or

cooling effect on the Earth depending on the location. Other pollutants like black carbon particles (or ‘soot’) which are product of the burning of fossils fuels or vegetation, lead to warming of the Earth because they absorb incoming solar radiation.

Nigeria Population is by far the most populous country in Africa and currently it is the 7th most populous country in the World. In 2006 the population of Nigeria was 140 million and was said to be growing at a rate of 2.5 percent per annum (NPC, 2006) .This means that it will take the population less than 30 years to double (Laah, 2018). As at December 2017, the population was estimated at a little over 190 million (NPC, 2006).

Nigeria Population is 2.5 percent of the global population and it is projected that by the year 2050, Nigeria will become the 3rd most populous country in the World with a projected population of 411 million. Nigeria population pattern clearly shows that the distribution of population varies by State and by geographical zone. The present level of fragmented landholding and the seemingly overexploitation of natural resources could escalates as the population continues to grow unchecked.

The support of local communities programmes, is important in terms of maintaining the sites with status to attract more tourists available to the local community through there continuous economics involvement (Jamal, 2017). According to Jamal (2017), in rural (W.H.S) particularly in developing countries political structure usually restricts the participation of communities to planned the economic activities and heritage site promotions throwing out barriers to their involvement in the decision making processes

Several studies have been done using geospatial technologies to detect forest change. For instance, Pavan *et al.*, (2010) used remote sensing and geographic information system (GIS) to monitor deforestation and forest degradation in Jharkhand (India). The study used NDVI time series to monitor deforestation and forest degradation. Further, Agone

and Bhamare (2012) used NDVI to detect vegetation change in Tittur basin. The study compared the map of NDVI of 1989 and 2010 for vegetation change. The study found out that NDVI values vary from vegetation cover type and bare land has zero value. Nathalie *et al.* (2005) used NDVI to investigate ecological responses to environmental change. Furthermore, Stefanie *et al.*, (2005) studied vegetation dynamics in the African Sahel by using NDVI approach. Yang *et al.* (1997); Wang *et al.* (2001) and Mahmoud *et al.* (2001) studied vegetation change through the use of NDVI method. Guang *et al.* (2014) assessed vegetation dynamics in China by using NDVI. The NVDI analysis concluded that human activities affected vegetation dynamics in some regions in China. In a similar study José *et al.* (2009) used NDVI to assess vegetation cover change in Sahel. Moreover, Abdussalam (2008) used NDVI) to assess vegetation degradation in Libya.

Tim *et al.* (2013) used remote sensing and GIS to assess vegetation dynamics in dry land vegetation dynamics. In addition, Xia *et al.* (2013) used NDVI to assess vegetation change Southern Africa over the period 1950–2008. Furthermore, Pei-Ling and Nathaniel (2013) used NDVI to assess the impact of climate and land use impacts on vegetation in central United States. Even within Nigeria, remote sensing and GIS technology have been used for forest change detection. For instance, Alhassan, *et al.* (2014) used NDVI approach to estimate amount of forest degradation and carbon sequestration for Effan forest reserve in Kwara State. The study used NDVI map for Effan forest reserve change detection. Further, Felix, (2013) studied vegetation change by using remote sensing and GIS in the South-Eastern Nigeria.

This study used two approaches: remote sensing/GIS techniques and field measurement approach (Edu local government forest inventory and questionnaire). Forest inventory plays a great role in knowing the type of forest species as land use is resource oriented.

For instance, the forest rich in high timber qualities, logging activities may be intensive within such forest. Several studies have been done by using forest inventory in order to describe the floristic composition of the forest ecosystems. For, instance Oke and Jamala (2013) used inventory approach to determine the woody flora in Adamawa State of Nigeria. They used floristic analysis for the data analysis. Further, Rabi'u and Adamu (2013) collected woody flora in Dutsin-Ma area Katsina State by using inventory. However, Mustapha carried out ethno medicinal studies of medicinal plants with antifungal activities in Keffi local government, Nasarawa state, Nigeria. He used ethno botanical survey for data collection. Several works have been done on the community participation on forests resources Management in different part of the World, Africa, and Nigeria. Most of these works are reviewed thus:

Theresa *et al.* (2016) undertook a study on the Effect of Community Participation in Forest Conservation in Ikom Agricultural Zone of Cross Rivers State. The effect of community participation in forest conservation via participatory approach has recently become a global strategy to development. The general objective of the study was to assess the effects of community participation in forest conservation in Ikom Agricultural zone of Cross River State. The specific objectives include; assessing the need for community participation in forest conservation, to ascertain the benefit of community participation in forest conservation and to identify the areas and levels of community participation in forest conservation. A structured questionnaire was used to obtain data for the study, and it was validated by research experts in the Department of Agricultural Extension and Rural Sociology, University of Calabar. The respondents were selected using simple handling technique. Using the population frame of the various local government areas one hundred and one (101) respondents were selected from Boki local government area, eighty nine (89) from Etung local Government area and one hundred and ten (110)

respondents from Ikom local Government area. A reliability test was conducted using split-half technique while Pearson product moment correlation was used to correlate the data obtained and a coefficient of $r_{xy}=80$ was obtained. Data obtained were analyzed using descriptive statistics such as frequency tables, percentages and range. The result of the analysis showed that the local communities were in a better position to monitor the forest as they have better knowledge of indigenous methods of conservation of both plants and animals.

Peter et al, (2016), worked on Evolution of Community Forestry in Cameroun and innovative Perspective. Cameroon introduced community forestry (CF) in 1994 as a means of improving community engagement in forest management, enhancing forest conservation, and reducing poverty for forest-dependent people. More than 20 years on, reflection on uptake, conceptual evolution, and innovation is necessary to understand how best community forests can contribute to Cameroon's post-2015 sustainable development goals. They investigated, reviewed, and reflected on how community forestry has evolved from an innovation ecosystem perspective, with a view to enhancing innovations and performance. Interest and momentum in community forestry remains strong in Cameroon, with the number of community forests growing, reaching 430 and covering 1.7 million ha (7% of total forest area). Major innovations identified are the introduction of pre-emption rights and steps toward sustainable forest management (ban on industrial logging, development of certification standards, and the introduction of the environmental notice in lieu of a full environmental impact assessment for CF activities). Little or no innovation is registered in areas related to forest enterprise (i.e., products and services value chains) and in terms of practicing sustainable forest management. Evidence suggests that knowledge generated directly feeds innovation. Coincidentally, areas for which little progress was made (enterprise and sustainable practices) also recorded few

publications, suggesting that partnerships aimed at improving knowledge generation and sharing could help catalyze innovation. Other options for unlocking innovations within community forestry discussed include: enhancing intercommunity forest and private sector community forests partnerships and collaboration, increased capacity development and capital investments, and deploying incentives (financial and nonfinancial). Together these options can potentially transform community forestry in Cameroon.

Senganimalunje1 (2017) worked on participatory forest management program for efficient forest resource use and improved rural livelihoods, experiences from Mua-Livulezi Forest Reserve, Malawi. This study evaluated the efficacy of Improved Forest Management for Sustainable Livelihoods Program (IFMSLP) in communities adjacent to Mua-Livulezi Forest Reserve, Malawi. The program is specifically aimed at alleviating poverty and to enhance rural livelihoods through promoting greater community involvement in forest management while providing access and associated benefits. The study, therefore, evaluated the effect of the program on community organization, forest access, forest use, product availability and commercialization of forest products. The results show that despite the program putting in place strategies for the people to access different products for different uses, forest use is restricted mainly to subsistence use rather than cash income. The main forest product collected by the people for livelihood was firewood, mainly for cooking and heating. This is an indication that forests are an important natural capital for subsistence rather than cash income. Gender, location of the village, and distance to the nearest forest area were significant predictors of households' forest use. Introduction of the co-management program has not brought out the expected outcomes in areas of community organization, forest access, forest product availability and commercialization of forest products. A multi-institutional approach was

recommended to draw upon diverse talents and experiences from individual institutions both government and non-governmental in order to achieve meaningful social change.

Schrekenberg *et al.*, (2006), in his work stated that Participatory Forestry Management (PFM) is a term that refers to a wide range of activities such as co-management, Joint Forest Management (JFM) and Community Forest Based Management (CBFM) that represent a new set of relationships between the state and communities adjacent to forests and woodlands (Schrekenberg *et al.* 2006). PFM has the potential to promote good governance, enhance sustainable forest management and livelihoods (Warner 2000; Menzies 2002). PFM has often been facilitated by donor funded projects (Menzies, 2002) and have often failed to deliver the expected and theoretically predicted outcomes (Blaikie, 2006). However, PFM initiatives need to become mainstreamed within national and local government institutions so that they are more responsive to local situations (Thin and Gardingen, 2003)

Onojegbuo *et al.* (2016) assessed the community Participation in Forest Management across protected areas in South Eastern Nigeria. . At present there is limited research on community participation in forest management across Nigeria. Hence, the overall aim of this study was to investigate the roles of local community participation in forest monitoring as tool to mitigating the effects of deforestation across three selected cluster sites in Cross Rivers State. The key objectives of the study included thus: to determine the level of effectiveness associated with local community participation in forest conservation through spatially explicit results obtained using forest cover change analysis; and to conduct focus group discussions for selected local communities in selected cluster sites within Cross Rivers State to ascertain the drivers of deforestation and forest degradation based on local knowledge.

In the study conducted by Ellis and Porter-Bolland (2008), they cited in their work that two distinct study sites, one under community-based forest management and the other, a protected area were compared to evaluate the efficiency of community forest management. The results showed that forest conservation influenced by inputs from local communities greatly assisted in the conservation of forest in comparison to forest with protected area status. The influence and contribution from local communities in forest conservation has shown to be an effective means of reducing deforestation, as the locals tend to depend less on activities that greatly degrade the forest landscape present in such communities.

In Tanzania, local communities are involved in two main forms of forest management: the Joint Forest Management (JFM) and Community Based Forest Management (CBFM) (Zahabu, 2006). Under the JFM, government involves local communities by engaging them in a number of activities (such as patrolling, clearing of boundaries and fire fighting), while for the CBFM local communities are the sole owners of the forests and take full responsibility of all the activities. Results of studies conducted across Tanzania indicated that the involvement of local communities in forest management (be it under full or joint community forest management) has resulted in a significant reduction in deforestation and forest degradation thereby resulting in carbon sequestration rise (Murdiyarso and Skutsch, 2006).

The use of satellite remote sensing combined with ground truth data has shown to be effective tool for determining the extent of deforestation particularly for protected areas in tropical forest regions across the world (De Fries, 2005, Ellis and Luciana, 2008). De Fries (2005) analysed multiple satellite data to examine the spatial extent of forest habitats and loss over a period of two decades throughout the world's moist and dry tropical forests. Results of the study were able to estimate the percentage of protected areas

affected by deforestation and proffer solutions on how well the reserve needed to be managed.

Stephen *et al.* (2014) reviewed Community Participation and Government Vision towards Conservation and Management Ecosystem in Cross River State. The main purpose of this study was to investigate community participation and government vision towards the conservation and management of ecosystem in Cross River State of Nigeria. To achieve this purpose, two hypotheses were formulated to direct the investigation and Ex-post facto research design was adopted for the investigation. This research design was considered appropriate because the researchers had no direct control over the independent and dependent variables. A sample of three hundred (300) respondents was randomly selected for the study. The questionnaire was the major instrument used for data collection. The reliability estimate of the instrument was established through the test-retest reliability method. Pearson Product Moment Correlation analysis was employed to test the hypotheses under study. The result of the analysis revealed that community involvement/participation in the Management of the environment, awareness creation through environment quality, reforestation, sustainable harvest of flora and fauna, enactment of environmental legislations and establishment of forest and game reserves are significantly related to the conservation and management of ecosystem.

Chalene (2017), worked on Community Participation in Forest Management in the Bleih Community Forest, Nimba County, Liberia. Liberia is positioned as part of the humid rainforest belt on the west coast of Africa with a population of 4.4 million people. The entire land space is 9.58 million hectares, of which forests occupy over 4.30 million hectares or 45%. Regardless of Liberia's small size, it contains a substantial amount of biodiversity, including: over 2,900 diverse vascular plants (225 of which are tree species), 600 bird species; 150 mammal species; and 75 reptile species. Forest Policy document of

Liberia Community participation in forest management has gained popularity as one way of ensuring sustainable forest management and so the Bleih Community Forest management was assessed for its adherence to the principles of participation. The study was done in the communities around the Bleih Community Forest, northern Liberia, Sanniquillie Nimba County. A case study approach with focus group discussion and interviews was used to assess stakeholders' perspectives on people's participation in the management of the forest. The data collection was done in November/December, 2015. The interview covered 185 respondents while 85 community members participated in the focus group discussion. Data collected from the interview was subjected to SPSS (version 21) for quantitative analysis and that collected from the focus group discussion was analysed descriptively. Management of the Bleih Community forest was not fully inclusive of the members of the communities surrounding the forest. Eighty four percent (84%) of the respondents did not participate in the development of the management plan to the management and monitoring of the forest. Respondents outside the 36-56 (years old) age category had lower participation likewise females. In terms of people's position in the community, the traditional leaders did not participate at all in the implementation and monitoring of the forest. Also respondents' level of education and place of origin did not increase their level of participation in forest management. The respondents (89%) of all the categories (age, sex, position in the community and level of education) did not show any level of satisfaction with the forest management, their needs were not met as benefits were not given as requested.

Agbelade *et al.* (2015), examined the assessment of incentives for forest biodiversity conservation in rainforest and derived Savannah vegetation zones of Ekiti State. Structured questionnaires was used to obtain information on the level of incentive allocation and impact of incentive measures to the people for forest conservation. Data

collected were statistically analyzed using Multiple Regression analysis at 0.05 significance level of confidence limit. The results showed that personal factors jointly and independently influence respondents' perception on the impact of incentive allocation for forest conservation and sustainability. The beta coefficient showed that the contribution of age to the dependent variable was the only significant variable while gender, marital status, and the level of education were not significant. The level of involvement of government in the conservation of forest is higher than personal and sacred efforts at conserving forest biodiversity. Furthermore, the result showed that there was no significant difference between the incentive allocated in rainforest and incentive allocated in derived savannah for forest conservation and sustainability. Therefore, they recommended that, government and non-governmental organization should shift attention into the area of incentive allocation to the people for forest conservation and sustainable biodiversity.

Shomkegh, *et al.* (2018) in his work on Assessment of Community Participation in Forest Resources Management in Afi and Mbe Mountains, Cross River State, Nigeria examined the participation of adjoining communities in forest management activities in Afi and Mbe mountains in Cross River State. A semi-structured questionnaire was used to obtain data from 392 household heads and 88 key stakeholders involving community chiefs, leaders of associations, women and youth groups in Afi and Mbe mountains. Data collected were analyzed using descriptive likert scale rating and inferential statistics. At least 97.1% of the respondents in both communities were fully aware of forest benefits except in enhancing soil fertility for farmlands which 97% were ignorant. There was good participation in forest management practices in both communities except in afforestation which was embraced by 100% in Afi due to the land degradation effects of a landslide but 75.2% of Mbe people refrained as the community-based approach supported protection

to forest resources. The bottom-up community-based forest management approach in Mbe mountain supported a higher degree of participation (1.0) in all stages of participation while the Government-owned top-down management strategy in Afi affected community participation in planning(0.68), implementation (0.58) and monitoring (0.61). Good gender involvement existed in both communities as women were involved in planning, implementation and monitoring of forest management activities. The study recommended continued awareness, provision of alternative livelihoods and local infrastructure by public and private sector organizations to improve livelihoods and reduce pressure on forest resources.

Dagba (2017) assessed Community Based Forest Management Practices in Benue State, Nigeria Community based forest management had been suggested by various researchers as being capable of stemming the rate of destruction of forests. This study was, therefore, carried out to assess the presence, mode and level of participation in community based forests practices in Benue State with a view to corroborate or dispute the veracity of the practice. Stratified multistage random sampling method was adopted to select 240 Household Heads who were later interviewed using 240 pre-tested semi-structured questionnaires. Data were analysed using descriptive and inferential statistics. Participatory Index analysis (PI) was employed to determine the extent of peoples' involvement in various forestry practices. Likert scale rating was equally used to measure the factors motivating and inhibiting respondents' participation in identified community forestry practices. Modal forestry practice identified was boundary planting (91.2%) with PI of 0.95, followed by home gardens (PI=0.93). Participation in physical execution of work (85.4%) was highest while only 15.8% of the respondents participated in decision making process. Most of the people who participated did so because the practices were relevant to their needs ($WMS = 4.30 > 3.05$) followed by the fact that they themselves were

part of the planning process ($WMS = 3.90 > 3.05$) while others said that level of literacy was not a hindrance to participation ($WMS = 1.55 < 2.95$). It was concluded that community based forest management practices existed in Benue State but participation in the practices was most in physical execution of work. It was recommended that people should be involved at the stage of planning, monitoring and evaluation to enhance better participation in Community Based Forest Management by the people.

Samuel (2017) worked on Adoption of Participatory Forest Management System for Sustainability in Nigeria. Forest is a composite renewable natural resource of multiple values to mankind. Over the years in Nigeria, government has been the sole player in the management of forest resources to the exclusion of the neighbouring forest-dependent communities to forest estates. The consequences of the monopolistic management are widespread illegal and destructive lumbering, degradation, deforestation and varying ecological disasters. This paper, therefore, discussed strategies that could facilitate and foster participatory sustainable forest management which include formulation of people-orientated forest policies and laws, creation of public awareness, stakeholders' consultation, training and capacity building, provision of incentives and creation of market channels for forest products. The aim is to underscore the potency of people-based forest management system, which considers the peoples' interest and welfare while ensuring effective conservation of forest resources. The method adopted is a review and appraisal of the prevailing situations. It is recommended that mass mobilization for participation in sustainable forest resources management and creation of enabling environment for organized private-sector involvement in forest resources activities could engender rapid development in forestry sub-sector of Nigerian economy.

Sunday and Damilola, (2015) examined Participatory approach to conservation and management of protected areas in Nigeria: Case study of Osse River Park Project.

National Parks are classified as protected areas managed for ecosystem conservation and recreation. They fall under Category II of protected areas with clear boundaries drawn sufficiently to contain one or more entire ecosystem which are not subject to material modification by human exploitation or occupation (IUCN, 1994) Biodiversity is thus fundamental for meeting current and future social, cultural, ecological and economic livelihoods demands of the communities and it is an essential component of sustainable development. Thus, any attempt to restrict human from unsustainable exploitation of natural resources tend to receive precarious resistance. Rather than enforcing law, arrest and prosecuting the locals that are custodian of these resources, there is need to develop techniques that will ensure that their needs are integrated. Stakeholder involvement and participation are essential in achieving sustainable integration and sound environmental management of protected areas in Nigeria. Involvement and participation of local communities in conservation and management of Osse River Park were assessed through administration of structured questionnaires while relevant State Government Ministries in Environmental and Nature Resources Management and Non-Governmental Organizations (NGOs) were interviewed to complement the study. Although the local communities were observed to be involved at the inception of the Park, their participation in park management is presently low (25%). Accordingly, 70% of the respondents claimed that the government and NGOs invested more in environmental education, park protection and surveillance than in meeting socio-economic needs of the people. Small proportion of the respondents identified distribution of plant seedlings (20%) and intensification of conservation education (10%) as an urgent need. This result suggests the need to increase financing from the present 5 to 25%, NGO's input in fund raising and the government's commitment in finance. The study identified improving stakeholders' relations, capacity building, and integrating community-based natural resource

management as important. It was recommended that the ministries and NGOs engaged in environmental and biodiversity conservation should direct more efforts toward the development of sustainable practices that facilitate stakeholders' participation in the integration process.

Sam (2015) examined the Level of Community Participation In The Conservation of Natural Resources In Akamkpa Local Government Area, Southern Cross River State, Nigeria. In recent times, the developed communities in Africa have moved from “top-down’s” approach toward more participatory “bottom-up” approaches. The shift in paradigm has occurred in recognition of the fact that local cooperation, participation and management are crucial to achieving both short term development result and long term sustainability. Along the same line, the conservation community is beginning to appreciate the necessity of incorporating local participating in environmental conservation effort (Bamberger, 2006). The development of community participation may be viewed as a process that serves as instrument of empowerment, building beneficiary capacity, increased effectiveness, desire to share cost, improves efficiency relation to project (Paul, 2005). To maximize the chances of sustainable conservation initiatives, rural communities need to be involved in both the concept and approach. This means that participation in decision-making process and in the evaluation, monitoring and management of resources and the environment is crucial. This inclusiveness is more likely to build conservation ethics where people understand that their livelihood depends on health maintenance of the environment. This study on the level of community participation in the conservation of natural resources in Akamkpa Local Government Area of Southern Cross River State, Nigeria is aimed at establishing the extent of community participation in natural resources conservation in the study area. The Ex-post facto research design was adopted. To achieve the purpose of this study, two null

hypotheses were formulated and tested at 0.05 level of significance. The simple random sampling technique was adopted in selecting six communities while the multi-stage stratified random sampling technique and accidental sampling technique was used to select the two hundred and fifty (250) community members used for the study. A fifteen (15) item four points likert scale questionnaire was the instrument used for data collection. To test the hypotheses, Dependent t-test statistical analysis technique was used for data analysis. The results obtained from analysis of data revealed that, the level of participation significantly influences forest resources conservation. In the second hypothesis, the result also shows that community involvement has a significant influence on wildlife conservation. Based on these findings, it was recommended that awareness creation on environmental conservation should become integral part of community organizations.

Ene (2013), writes on Participation of Forestry Officials and Timber Dealers in Community-Based Forestry in Cross River State, Nigeria. The concept of Community based Forest Management(SFM) emanated from sustainable development (SD) and this requires that users of forest goods, ecosystem services, and landscape values and other stakeholders collaborate at multiple levels and develop the adaptive capacity to deal with uncertainties and risks (Mayers and Bass, 2004). Sustainable management of natural resources requires a more comprehensive support for sustainable resource use from the larger community group. This study, therefore, evaluated the participation and working relationships between timber dealers and forestry officials in implementing CBF in Cross River State, Nigeria. Primary data were collected through administration of structured questionnaire to the forestry officials attached to the local communities where CBF are practised as well as timber dealer that are involved in harvesting, transportation, and processing of timber resources obtained from community forests under CBF. Forestry officials as stakeholders in CBF are responsible for regulating and monitoring all

activities as well as exploitation of timber resources. The highest economic benefit derived from CBF by the timber dealer is timber extraction which also leads to income generation and job creation to the rural dwellers. Plantation establishment ranked topmost among the CBF activities involved in by the timber dealers; however, the timber dealers are not involved in forest protection and decision-making process. Introduction of CBF in the selected communities of the state has contributed to community development, improvement in the timber business, and cordial working relationships among the forestry officials, timber dealers and rural people. However, for effective participation in CBF, empowerment of stakeholders in decision-making process has been identified to be very crucial.

Olorunfemi (2014) reported that Traditional Knowledge in the Use and Management of Forest Ecosystem for Livelihoods and Food Security in Nigerian Savannah Indigenous traditional knowledge and biodiversity are complimentary phenomena essential to human development and sustainable resource management. The rural communities have a significant role to play in maintaining the integrity of ecosystems to ensure that they continue to support livelihood activities. This paper focused on the use of traditional knowledge in the management of forest resources in the Nigerian savannah and how this knowledge has been used to improve the livelihoods of the people. It combined focus group discussions, key informants interviews and household survey in 11 communities across 10 local councils with vegetal surveys. The study revealed that the respondents possess wide knowledge of the natural resources they use. It recommends that strategic programmes are more likely to succeed if land degradation, biodiversity loss and ecosystem services are considered in poverty alleviation and food security. Development concerns such as prevention of the degradation of the environment, conservation of scarce natural resources or finding alternatives to them, have wide ramifications in the domain

of culture. Sustainable resource management per se and development in general can be meaningful and successful if formulated in accordance with the cultural parameters and felt needs of the people using tools like indigenous traditional knowledge. In view of the interrelationship between the natural resource, its sustainable management and the cultural, social, economic and physical wellbeing of local people, national and international efforts to implement environmentally sound and sustainable resource management should recognise, accommodate, promote and strengthen the role of indigenous people and their traditional knowledge systems. This paper argues that adopting a social-ecological system perspective that integrates the people-focused rural livelihood approach with conservation-focused natural resource management approach, taking cognisance of the traditional knowledge of the people, is needed to ensure ecosystems sustainability

Ofuoku (2006) assessed the Community development committees' participation in forest protection in Delta Central Zone, Delta State, Nigeria. Community development committee has been a formidable platform for galvanizing the efforts of people to undertake rural development projects in developing countries. It is a group of elected officials of a community charged with the responsibility of coordinating self-help development project of that community.

The study was carried out to investigate the participation of community development committees (CDCs) in forest protection in Delta Central agro-ecological zone, Delta State, Nigeria. Their forest protection measures, perceived benefits and reasons for not participating in forestry extension meetings were also ascertained. Participants who were members of CDCs were purposively selected from the eight local government areas that constitute the study yielding a sample of 80 respondents. The findings show that the major occupations of the respondents are teaching, trading, farming and hunting. Forestry

extension activities they were involved in included conservation campaign; forest exploitation control; supply of hybrid planting materials etc. Perceived benefits for participants were improved economic status, increased income and employment by forestry department. The extension contact most often indicated was personal contact and meetings exhibitions. A majority of the respondents (75%) were of the opinion that the communities decided the extension programmes. The reason given for non-participation in meetings was mainly inadequate publicity for such meetings. The level of respondent's education, sex and occupation had significant correlation with the participation in extension and forestry department's meetings. For sustainable forest utilization, adequate publicity for meetings, more measures to check illegal exploitation and sustained participation of the communities in decision making and programme design were recommended.

Several studies have been done by using questionnaire to find out the perception of the population about climate change and its impacts related to several sectors. For instance, Aphunu and Nwabeze (2012) used questionnaire to find out the perception of climate change impact on forest management in Delta State, Nigeria. Further, Falaki, Akangbe and Ayinde (2013) studied the analysis of Climate change and rural farmers' perception in North Central Nigeria. The instrument used for data collection was a structured questionnaire. Methodological experiences benefited from the reviewed literature have been applied to develop our own methodology found in the next chapter (Chapter3)

2.5 Summary of Literature Review

This chapter has discussed literatures in the field of forest management studies using remote sensing and GIS and Structured questionnaire method. From the review of the various literatures it is evident that lot of research has been carried out in the above fields. Their analysis could be used for the study area to assess the community participation

management as it requires exploring the potential inherent for easy assessment and to overcome over exploitation of the forest in the study area. Most of the studies reviewed used remote sensing and GIS to assess forest change detection, hence there is scanty of studies done about the impact of human activities on forest dynamics in Kwara State using remote sensing /GIS and field measurement. This study inventoried the Edu Local government forest woody flora and to find out the communities perception impact on forest dynamics. This study was to fill this gap mostly as the first intervention in Edu local government forest resources management in Kwara State.

CHAPTER THREE

3.0 MATERIALS AND METHODS

The study used two approaches for data collection, namely remote sensing approach and field data collection on various activities that lead to destruction of forests in the study area. The present research used Landsat images downloaded from USGS Earth-Explorer, and the data from the interview of the population of interest in the study area to collect information from relevant sources and used to achieve the aim of this work. The research method adopted in this study followed two major steps: fieldwork (field data collection) and lab work (remote sensing and GIS analysis). The following softwares were used for preprocessing and GIS analysis; SPSS 20, ArcGIS10, and Microsoft Excel.

3.1 Study Population

The study population is open forest in Edu local governments of Kwara State. Edu local government open forest is found around the three districts within Edu local government, Kwara State of Nigeria. Edu local government open forests lies at a longitude $4^{\circ}54'15''$ East and $5^{\circ}31'00''$ East of the Greenwich meridian and latitude $8^{\circ}35'38''$ North and $9^{\circ}15'00''$ North of the *Equator*. It covers an area of 2,542 km². (NPC, 2006).

3.2 Instrumentation for Data Collection and Analysis

Several materials were used to collect the data and for data analysis. The following equipment were used: GPS, Digital camera, 100 meters measuring tape, questionnaires, pencil, and pen. The following software's was used:

- i. Erdas Imagine 2015 for computerizing NDVI.
- ii. ArcMap version10.5 for images extraction, mapping of study area and NDVI mapping.
- iii. ArcMap 10.5 for the conversion of the images (vector) to raster.

- iv. Excel for the calculations of percentage and for the graphs.

3.3 Data Collection for Objective One

Objective one was to find the level of destructions done to the forestry resources in Edu Local Governments between the periods of 1990-2018. To explore objective one, this study used the Landsat imageries for 1990, 2005, and 2018 to detect forest changes in Edu local government. For this objective which aimed at finding the level of destructions done to the forestry resources in Edu Local Governments, the Normalized Difference Vegetation Index (NDVI) were used as method for detecting any form of changes in Edu local government open forest. For instance, José *et al.* (2009) stated that the created NDVI images could be used to identify the pattern of changes that had occurred between two different dates. The Edu local government open forest (NDVI map) maps were established for 1990, 2005, and 2018. The images were downloaded from USGS Earth Explorer website and the available Landsat images for the study area were used.

3.3.1 NDVI analysis

Normalized Difference Vegetation Index (NDVI) has been in a lot of studies to detect vegetation change Agone and Bhamare, (2012) and Alhassan *et al.* (2014). stated that NDVI is a measure of vegetation vigor, which provides an effective measure of photo synthetically active biomass, and it is calculated as follows:

$$NDVI = (NIR - R) / (NIR + R) \quad (3.1)$$

Where NIR and Red are spectral reflectance values in the near infrared and visible red band respectively. After determining the four NDVI maps for the four years, the mapped NDVI change analysis and NDVI difference between 1990 and 2018 were done by comparing the four NDVI maps for determining the spatio-temporal changes in Edu local government. Open forest were detected by calculating the NDVI value.

3.4 Data Collection for Objective Two

Objective two was to assess the severity of forest burning in Edu local government between the periods of 1990 – 2018. To explore this objective, the study used Landsat imageries for 1990, 2005, and 2018 to detect the changes caused by forest burning in Edu local government open forest. For this objective aimed at assessing the level of destructions done to the forestry resources by way of burning in Edu Local Government, the Normalized Burn Ratios (NBR) were used as method for detecting any form of changes in terms of burning in Edu local government open forest. For instance, Long *et al.* (2019) stated that the created NBR images were used to identify the pattern of changes in terms of burning that had occurred between two different dates. The Edu local government open forest (NBR map) maps were established for 1990, 2000, 2010 and 2018. The images were downloaded from USGS Earth Explorer website and the available Landsat images for the study area were used.

3.4.1 NBR analysis

The Normalized Burn Ratio (NBR) is an index designed to highlight burnt area in large fire zones. The formula is similar to NDVI, except that the formula combines the use of both Near-infrared (NIR) and Shortwave Infrared (SWIR) wavelengths. Healthy vegetation shows a very high reflectance in the NIR, and low reflectance in the SWIR portion of spectrum.

To benefit from the magnitude of spectral difference, NBR used between NIR and SWIR bands, according to the formula shown below. A high NBR value indicates healthy vegetation where a low value indicates bare ground and recently burnt areas. Non-burnt areas are normally attributed to values close to zero.

$$NBR = (NIR - SWIR) / (NIR + SWIR) \quad (3.2)$$

Where NIR and SWIR are spectral reflectance values in the near infrared and shortwave infrared band respectively. After determining the four NBR maps for the four years, the mapped NBR change analysis and NBR differences between 1990 and 2018 were done by comparing the four NBR maps to determine the burn severity in Edu local government open forest.

3.5 Data Collection for Objective Three

Objective three is to look at efforts put in place to protect forestry resources in the past and assess the level of their success or otherwise in Edu Local Government. The questionnaires were translated into the local languages by interviewers especially for the respondents that could neither read nor write.

3.5.1 Sampling and Sample Size

The selection of accurate sample size is very crucial in order to arrive at a reliable result. A sample size therefore is the number of the population elements selected for the research. The study used the 2016 National Population estimates of Edu Local Government.

Sample size was obtained using Yamani's sample size formula. Yamani's formula is focused on applying normal approximation with 95% confidence level and a limit of tolerance level (error level) of 5%. According to 2016 National Population estimate, Edu Local Government area had a population of 272,200.

The 2016 projected population of Edu Local Government was used in determining the sample size using Yamani' population size formula given as

$$n = \frac{N}{1 + Ne^2}$$

n= sample size, N=Population figure, e=Limit of tolerance (0.05)

$$\frac{272,200}{1+272,200 (0.05)^2} = \frac{272,200}{1+272,200 (0.0025)} = \frac{272,200}{1+680.5} = \frac{272,200}{681.5} \quad (3.3)$$

≈ 399 .

The study population was 399 and simple random sampling was employed in distributing the questionnaires among the respondents

3.5.2 Questionnaire data analysis

A descriptive statistical analysis was used to analyze the data obtained from the questionnaires Percentages were used to show the efforts put in place by both government and community to protect forest resources in the past and assess the level of success or failure in Edu local government. Figures such as charts were used for statistical analysis to examine the key forest uses that affect Edu local Government forest dynamic. Results from the field work and analyses obtained were presented in the analysis chapter (Chapter four).

3.6 Data Collection for Objective Four

Objective four is to attempt to evolve alternative community participation approach in Edu local government. The questionnaires were adopted to accomplish this objective and the questionnaires were translated into the local languages by interviewers especially for the respondents that could neither read nor write.

3.6.1 Questionnaire administration

Structured questionnaire were designed and distributed randomly to selected sampling points in the study area. A fixed responsive technique were used in order to serve as a guide to the respondents. Options were provided for the respondents to choose from. The questionnaires proved pertinent and adequate for data sourcing method because the technical response required were obtained. 399 questionnaires were distributed randomly.

The questionnaires were structured in order to find out evolving alternative community participation approach in Edu local government.

3.7 Validity of the Instrument

The instrument of the study was shown to project supervisor to assist in vetting the items on the questionnaire to determine its face and content validity. According to Merriem (2013), validity is how well a test measures what it is purported to measure. The researcher made necessary corrections according to experts' comments and observations before using the questionnaire for the main study.

3.8 Reliability of the Instrument

Reliability refers to the ability of a research instrument to consistently yield the same results when repeated measurements are undertaken of the same individuals under the same conditions. The data collected was subjected to statistical analysis using Cronbach Alpha method. The overall Alpha obtained was 0.725.

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

This chapter presents the result of the study, explanation of the figures, tables and charts of the achieved objectives. The major aim of the research was: to find the level of destructions done to the forestry resources in Edu Local Governments between the periods of 1990 – 2018, to assess the severity of forest burning, look at efforts put in place to protect forestry resources in the past and assess the level of success or otherwise in Edu Local Government and attempt to evolve alternative community participation approach in Edu Local Government.

The total questionnaire administered to the respondents was three hundred and ninety nine (399), the returned questionnaire is two hundred and fifty which were used for data analysis.

4.1 Finding the Level of Destructions Done to the Forestry Resources

The first objective of this study was to assess the level of destructions done to forestry resources in Edu Local Government forest dynamics from 1990 to 2018 by using Normalized Vegetation Index (NDVI) approach. This was intended to determine the human activities that threatened Edu forest resources dynamics. The NDVI map of 1990, 2005 and 2018 were produced.

In this present study, the values of NDVI were categorized as low density, medium density, high density, and very high density. Figures 4.1 to 4.3 show the Normalized Vegetation Index (NDVI) of Edu Local Government for the year 1990, 2015 and 2018. The NDVI values for 1990 range from -0.26 to 0.56, while the NDVI values for 2005 range from -0.23 to 0.48 and the 2018 NDVI values range from -0.11 to 0.35.

4.1.1 Vegetation index map of Edu Local Government forest resources for 1990

Figure 4.1 shows the vegetation reflectance of Edu local government forest for the year 1990 which have NDVI values which range from -0.26 to 0.56 indicating a high biomass. As at this time, Edu Local Government forest was natural plantation which signified that the Edu Local Government forest was still intact. However, Figures 4.1 show the vegetation reflectance of Edu Local Government forest for the year 1990 is negative value (-0.26) which indicated a decrease in the greenness of Edu Local Government forest. This result in Edu Local Government forest re-affirmed the result found by several authors that Nigeria forest areas have been on the decrease. For instance, Njoku (2008) revealed an apparent negative trend of vegetation vigor in the South Eastern Nigeria with NDVI deficit of -0.5 to -0.7 between 1970 and 1980s and a concomitant loss of 78% (166,338m²) vegetation cover. Furthermore, Njoku (2008) stated that Nigeria forest areas have diminished from about 60 million hectares in 1890 to the current value of about 9.6million hectares. Moreover, the lower most NDVI value for Edu Local Government forest 1990 is -0.26. This value is close to the lowest figure of -1 NDVI for no vegetation. The lower value of -0.26 indicated much less vegetative features within Edu Local Government forest in 1984.

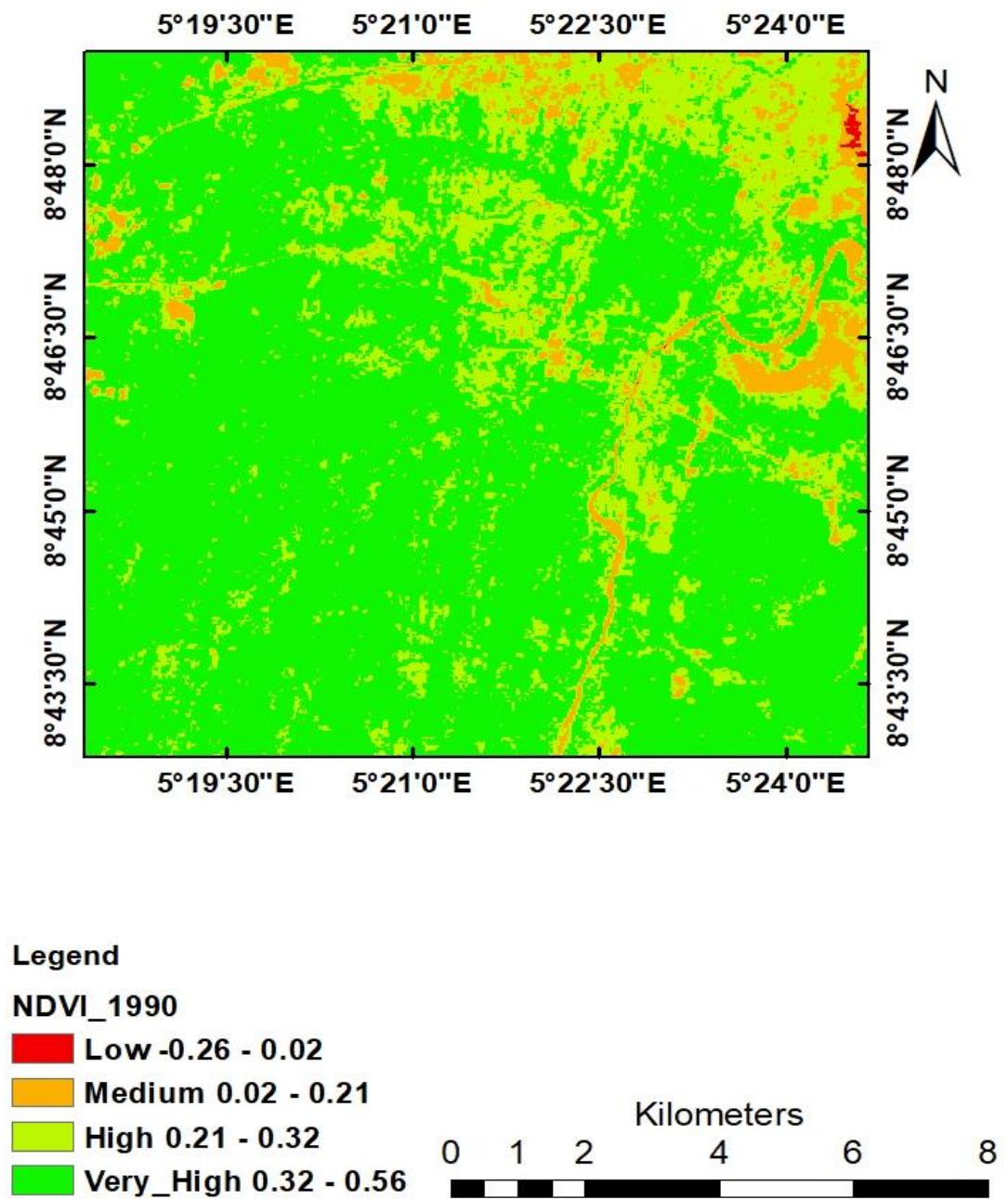


Figure 4.1: NDVI values of Edu Local Government Forest Resource for 1990

Source: Authors work (2019)

4.1.2 Vegetation index map of Edu Local Government forest for 2005

Figure 4.2 shows the vegetation reflectance of Edu Local Government forest for the year 2005 which have NDVI values which range from -0.23 to 0.48. The very high NDVI value for Edu Local Government forest 2005 is 0.48 and indicated comparative dense vegetation. This value confirmed dense forest compared to 1990 NDVI that there is a decrease in Edu forest amount of greenness in 2005.

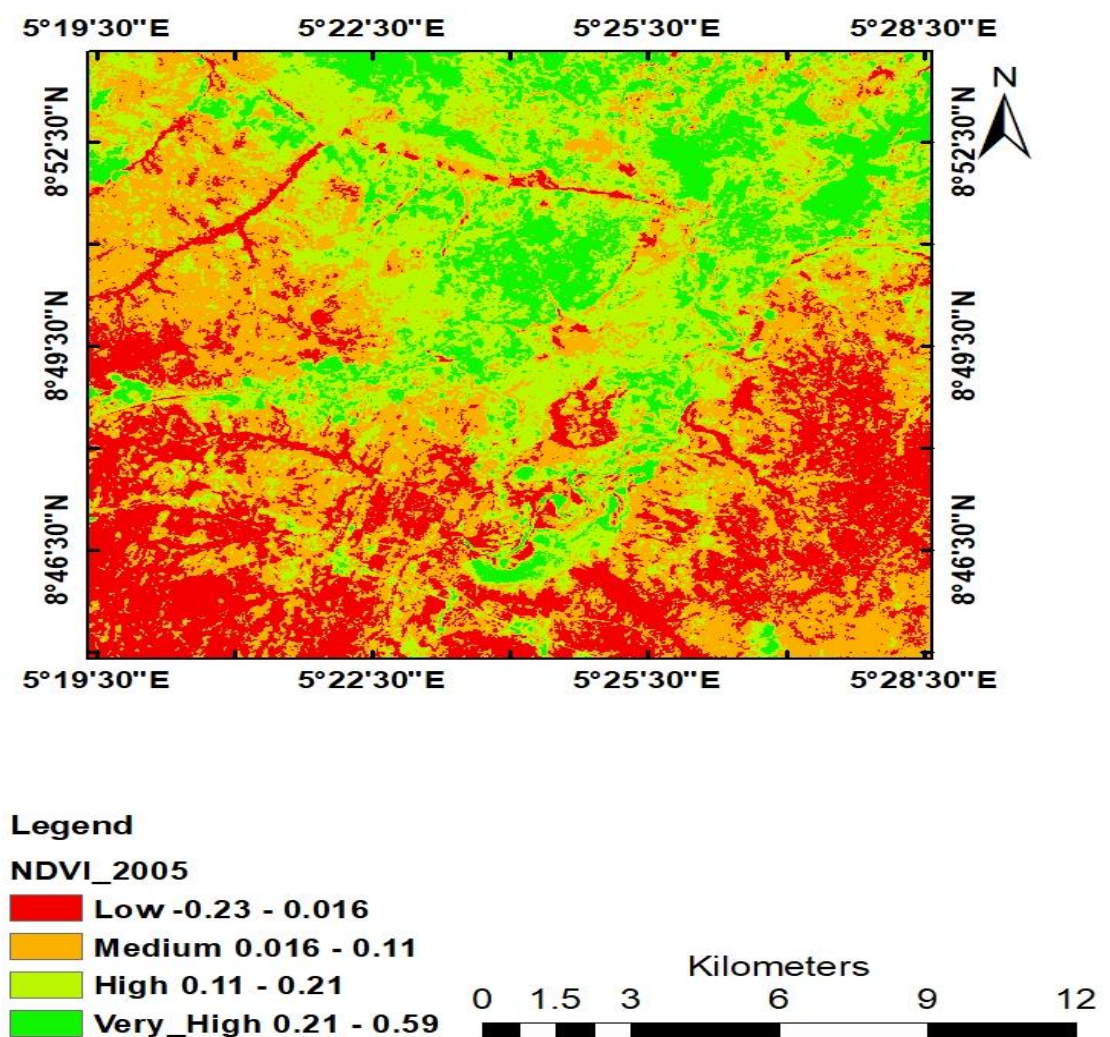


Figure 4.2: NDVI values of Edu Local Government Forest Resource for 2005

Source: Authors work (2019)

4.1.3 Vegetation index map of Edu Local Government forest for 2018

Figure 4.3 shows the vegetation reflectance of Edu Local Government forest for the year 2018 and have NDVI values which range from -0.11 to 0.35. The very high NDVI value for Edu Local Government forest in 2018 is 0.35 and indicated comparative dense vegetation.

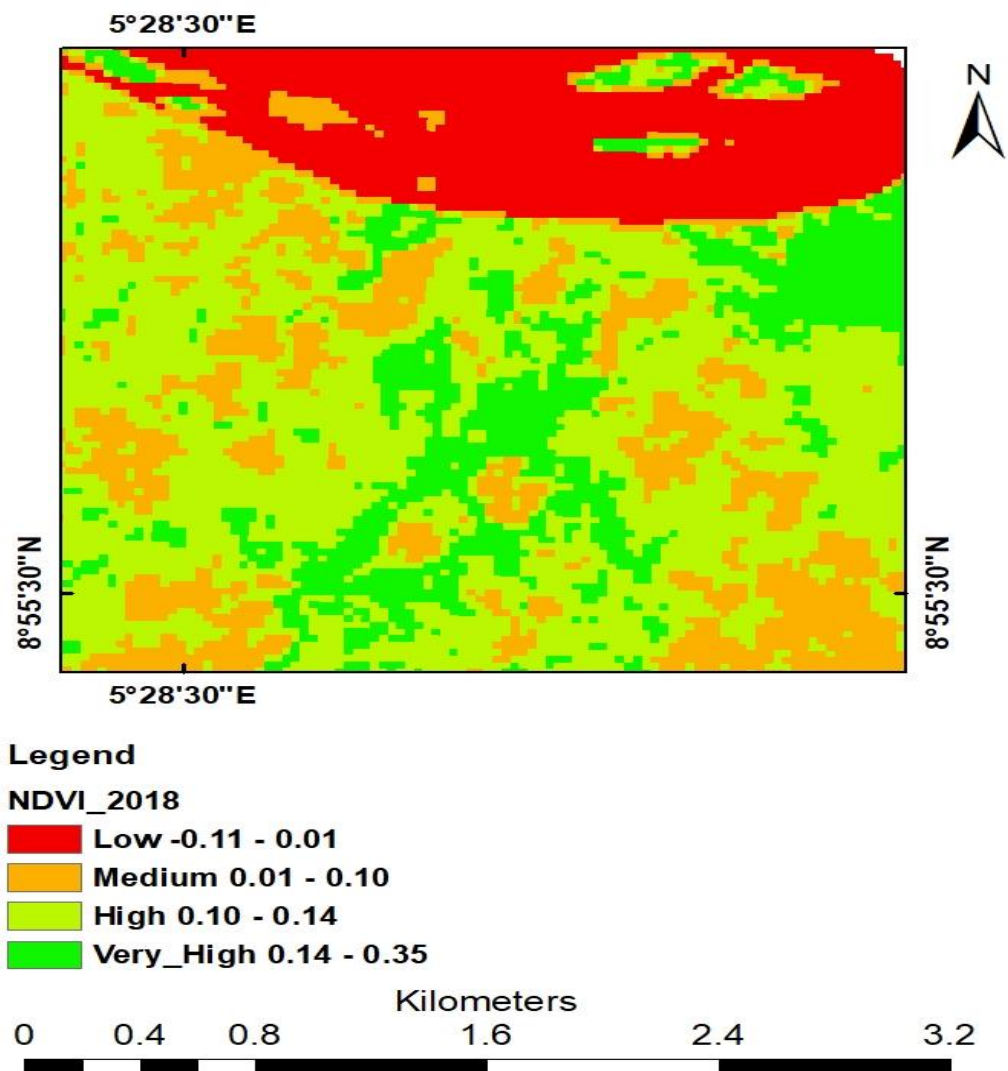


Figure 4.3: NDVI values of Edu Local Government Forest Resource for 2018

Source: Authors work (2019)

4.1.4 Edu Local Government Forest change detection during 1990, 2005 and 2018

Figure 4.4 shows the different NDVI changes of Edu local Government Forest during the period of 1990, 2005 and 2018. The changes occurred in all classes but important changes have occurred in 2018 in all classes. The category of very high NDVI density has decreased from 0.56 in 1990 to 0.48 in 2005. Similarly, the category of very high NDVI density has drastically decreased from 0.48 in 2005 to 0.35 in 2018. The category of high NDVI density has also decreased from 0.32 in 1990 to 0.21 in 2005 and it has decreased (0.14) a lot in 2018. From figure 4.4, the most important reduction in Edu local government greenness occurred in 2018 in all classes.

The thick green colour of 1990, 2005 and 2018 show presence of thick forest which continually decreased from 1990-2018. The light green colour of the same year continue to expand or increased from 1990-2018, which indicates shrubs of a place of re-grow and grasses. The orange colour further indicates dramatic changes to forest cover with only presence of grasses and farmlands. The red colour shown in the three figures shows bare grounds where vegetations are completely eliminated due to different economic activities in the area. This implies that forest resources in the area are seriously threatened due to different anthropogenic activities and unless serious interventions is taking this trend will continue. The implication of this is climate change and global warming effect will continue to rise. Hence the need to take a bold steps to remedy the situations.

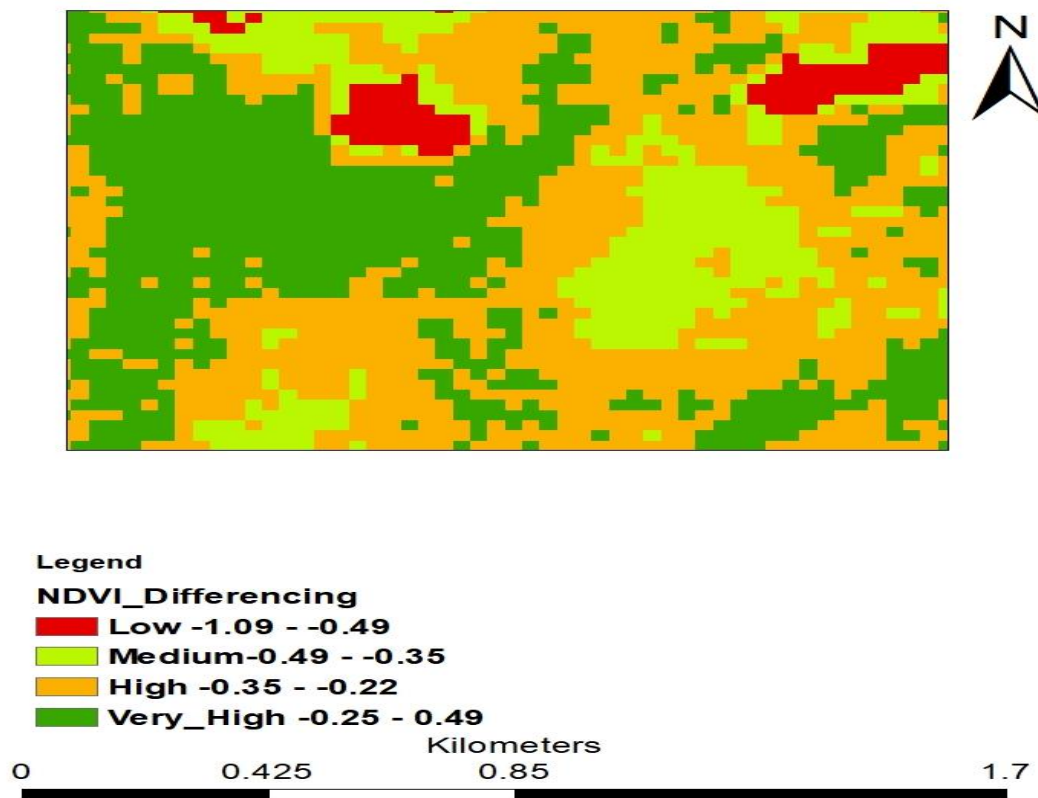


Figure 4.4: NDVI differencing (2018 NDVI- 1990 NDVI)
Source: Authors work (2019)

4.2 Assessing the Level of Forest Burning Area in Edu Local Government between the Periods of 1990 – 2018

4.2.1 Burn Ratio map of Edu Local Government forest for 1990

Figure 4.5 shows the burn severity in Edu Local Government forest for the year 1990 which has NBR Values which range from -0.01 to 0.56 indicating a low burn area. As at this time, Edu Local government forest burn ratio ranges from -0.01 for low regrowth area, -0.07 for high regrowth area, and 0 for unburnt area, 0.23 for low burn area and 0.56 for high burn area. Those burn ratios with negative signs such as -0.01 and -0.07 represent areas where there is regrowth of vegetation in Edu Local Government forest area. The positive burn ratios 0.23 and 0.56 represent the areas where burn is recorded in Edu Local

Government forest area while the burn ratio with 0 represent areas where no burn is recorded in Edu Local Government forest area as at year 1990.

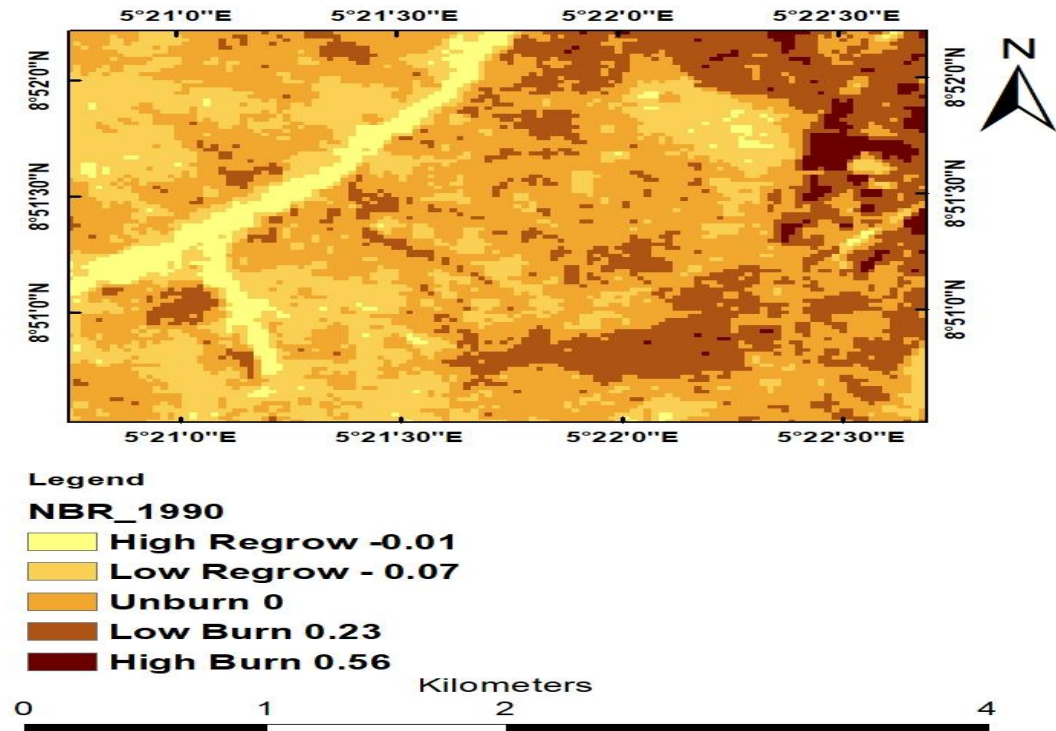


Figure 4.5: NBR values of Edu Local Government Forest Resource for 1990
 Source: Authors work (2019)

4.2.2 Burn ratio map of Edu Local Government forest for 2005

Figure 4.6 shows the burn severity in Edu Local Government forest for the year 2005 which has NBR Values which range from -0.18 to 0.18 indicating a low burn area also as in 1990. As at year 2005, Edu local government forest burn ratio ranges from -0.18 for low regrowth area, -0.13 for high regrowth area, and 0 for unburnt area, 0.01 for low burn area and 0.18 for high burn area. Those burn ratios with negative signs such as -0.18 and -0.13 represent areas where there is regrowth of vegetation in Edu Local Government forest area. The positive burn ratios 0.01 and 0.18 represent the areas where the burn is

recorded in Edu Local Government forest area while the burn ratio with 0 represents areas where no burn is recorded in Edu Local Government forest area as at year 2005.

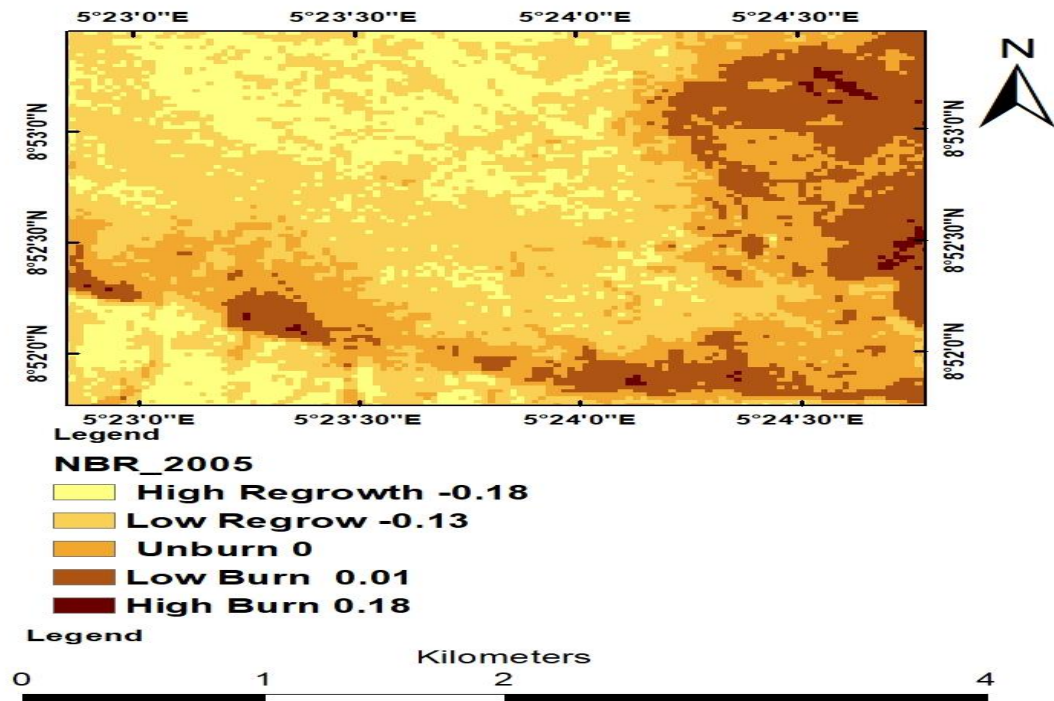


Figure 4.6: NBR values of Edu Local Government Forest Resource for 2005
Source: Authors work (2019)

4.2.3 Burn ratio map of Edu Local Government forest for 2018

Figure 4.7 shows the burn area of Edu Local Government forest for the year 2018 which has NBR values which range from -0.13 to 0.69 indicating a low burn area in 2018 as well. As at year 2018, Edu local government forest burn ratio ranges from -0.13 for low regrowth area, -0.04 for high regrowth area, and 0 for unburnt area, 0.23 for low burn area and 0.69 for high burn area. Those burn ratios with negative signs such as -0.13 and -0.04 represent areas where there is regrowth of vegetation in Edu Local Government forest area. The positive burn ratios of 0.23 and 0.69 represent the area where the burn is recorded in Edu local government forest area while the burn ratio with 0 represents areas where no burn is recorded in Edu local government forest area as at year 2018 as well.

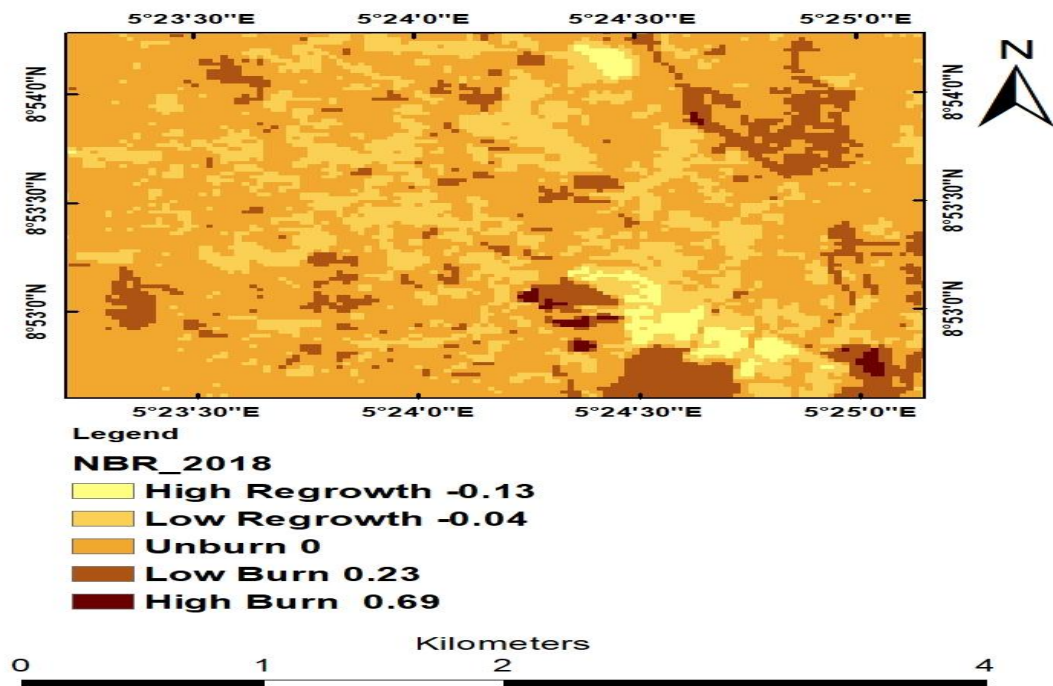


Figure 4.7: NBR values of Edu Local Government Forest Resource for 2018
Source: Authors work (2019)

4.2.4 Edu Local Government Forest Burn Value change detection during 1990, 2005 and 2015

Figure 4.4 shows the different burn ratio changes in Edu local Government Forest during the period of 1990, 2005 and 2018. The large positive (blue) and large negative (red) values indicate changes in the Edu local government forest with -0.5 and 0.5 ratios, while the values close to zero represent little to no change and their ratios are -0.25, 0 and 0.25. The area with 0 index indicates area where there is no change, -0.25 and 0.25 represent the areas where there are little changes but ratio -0.25 indicates the area with changes from little burn to vegetation (regrowth) while the area with ratio 0.25 indicates areas with vegetation to little burn. The large positive blue ratio 0.5 indicates areas with burn in Edu Local Government forest while the large negative red ratio -0.5 indicates an area with tick forest.

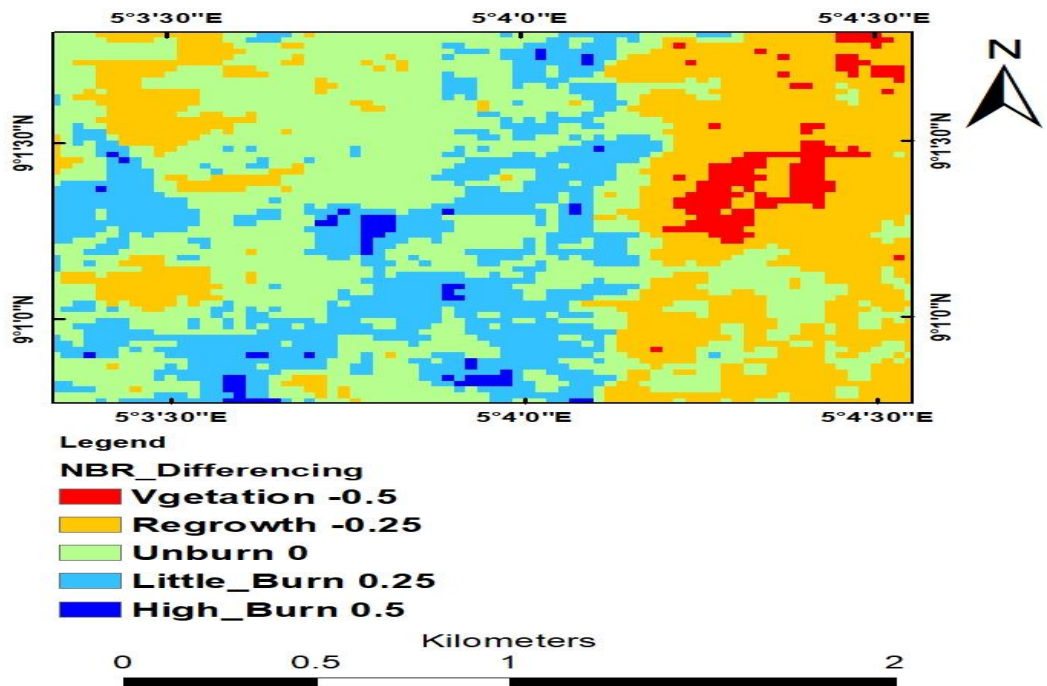


Figure 4.8: NBR differencing (2018 NBR- 1990 NBR)

Source: Authors work (2019)

4.3 Efforts Put in Place in the Past to Protect the Forest Resources in the Last three Decades in Edu Local Government

Table 4.1: Respondents according to District

From table 4.1 (90) 36% of the questionnaires were distributed and administered in the Lafiagi District the headquarters of the Local Government. (160) 64% of the remaining questionnaires were administered equally in the district of Shonga and Tsaragi.

Table 4.1: Respondents according to Districts

District	Frequency	Percent
Lafiagi	90	36.0
Shonga	80	32.0
Tsaragi	80	32.0
Total	250	100.0

Source: (Field Survey, 2019)

From table 4.2 130 (52%) of the questionnaires were administered on the farmers, the remaining 48% (120) questionnaires were administered on the communities leaders, tree loggers and charcoal producers.

Table 4.2: Responses from Farmers, Community Leaders, Tree Loggers and Charcoal Producers

Respondents	Frequency	Percentage
Farmers	130	52
Community Leaders, Tree Loggers and Charcoal Producers	120	48
Total	250	100

Source: Field Work, 2019

Table 4.2: Respondents Farmers, Community Leaders, Tree Loggers and Charcoal Producers

4.3.1 Presence of Forest in the Study Area

From Figure 4.3 (95) 38% of the respondents agreed that there are still forest at the fringes of the River Niger and at the banks of rivers and streams well spread across the local government (83) 33.2% Strongly agreed there are still presence of forests in some parts of the local government, while (42) 16.8 disagree that there is presence of forest in the study areas. Most of the farmers are leaving to neighboring Local Government for farming (Patigi Local Government) and (30) 12% of the respondents strongly disagree that there is presence of forests of in the study area.

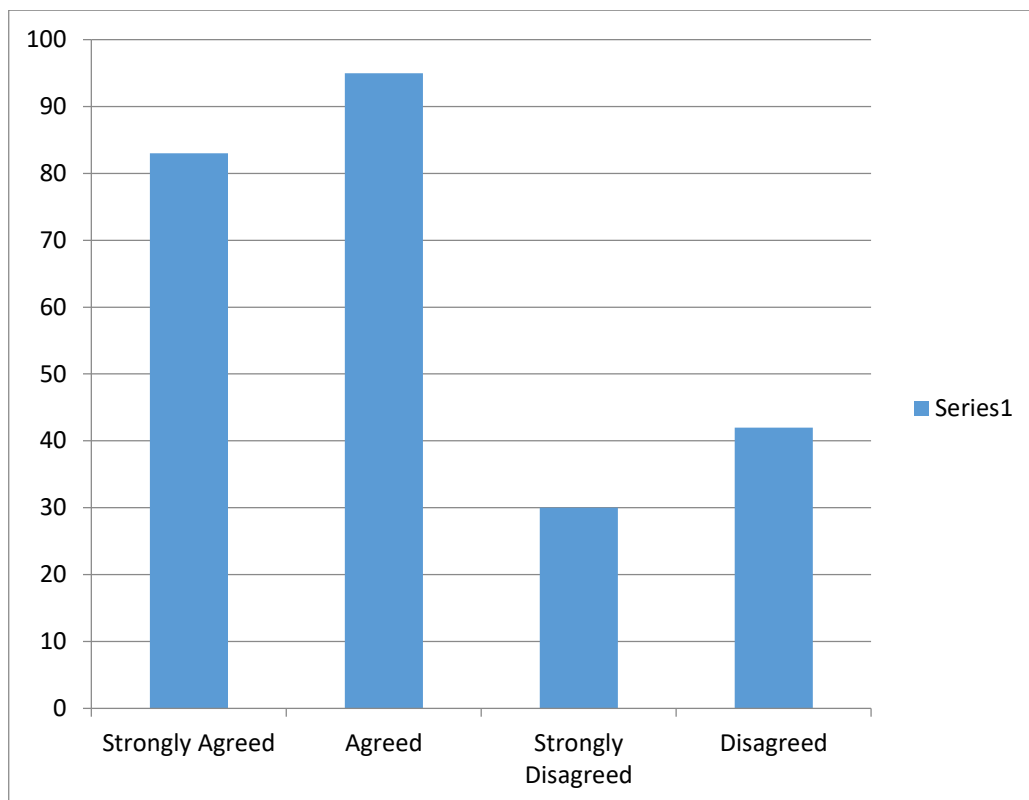


Figure 4.9: Presence of Forest in the Study Area

Source: Authors work (2019)

4.3.2 Seasonal Fire, Hunting and Sourcing Charcoal by Black Smiths

60% 150 respondents incident are caused by seasonal fire, 24% hunting 16% represent black smiths who also source of charcoal for local carving. This implies that firing incidents, hunting and charcoal producers are the major cause of forest destruction the study area.

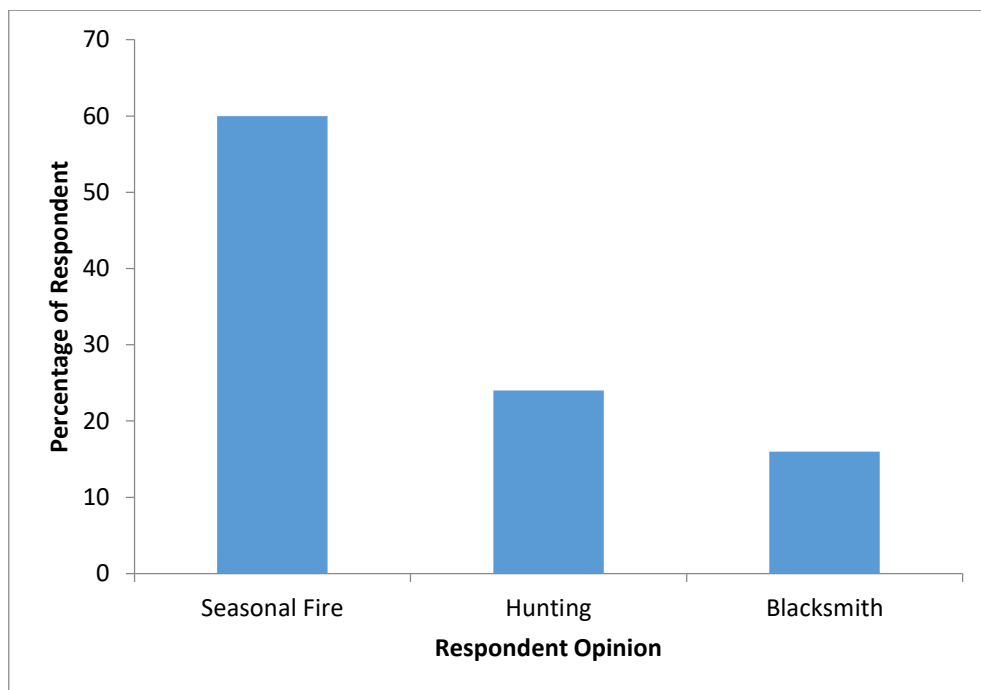


Figure 4.10: Seasonal Fire, Hunting and Sourcing For Charcoal by Blacksmith
Source: Authors work (2019)

4.3.3 Urbanization and Farming and for other Purposes

41% 90 respondents urbanization which 41.2% 103 caused destruction to forest resources 87 34% believed that farming activities is the root cause of forest resources destruction is the study area 10% represents other purposes for which forest resources is been sort. This also shows that urbanization and the agrarian activities is also a contributing factors of forest destruction in the study area.

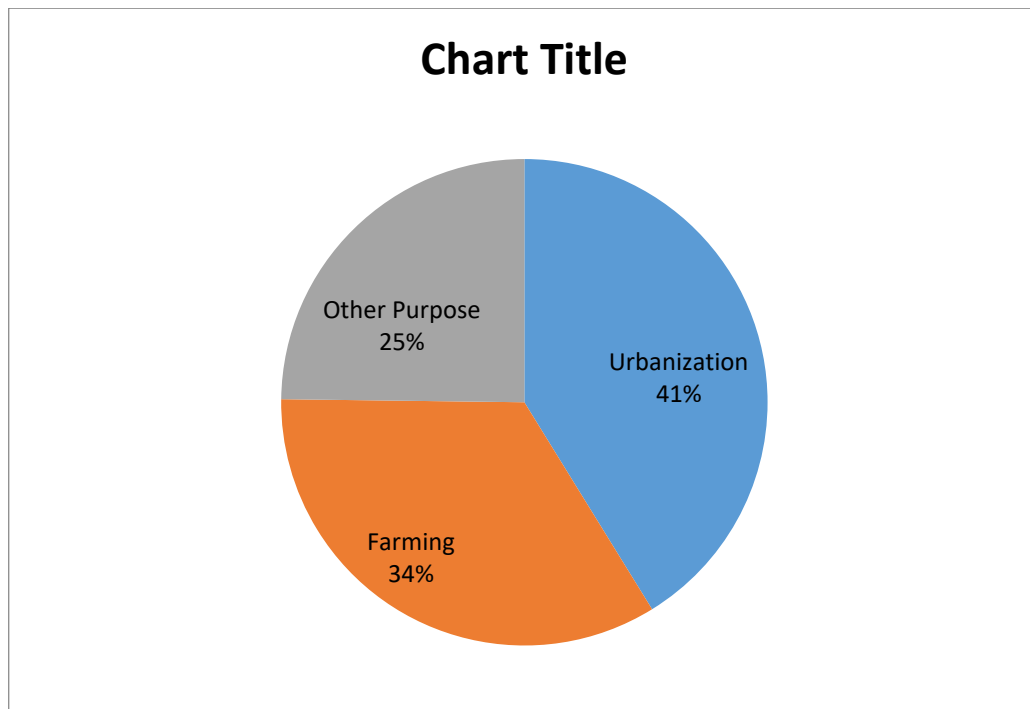


Figure 4.11: Urbanization, Farming and Other Purposes
Source: Authors work (2019)

4.3.4 Charcoal Production, Logging and for Firewood

128 (51.2%) represent charcoal produce which caused more harm to forest resources in the area. 32.8% (82) 16% represent firewood which are sources in the study area. Increasing logging activities and felling of trees for firewood caused major damages to the forest resources in the area.

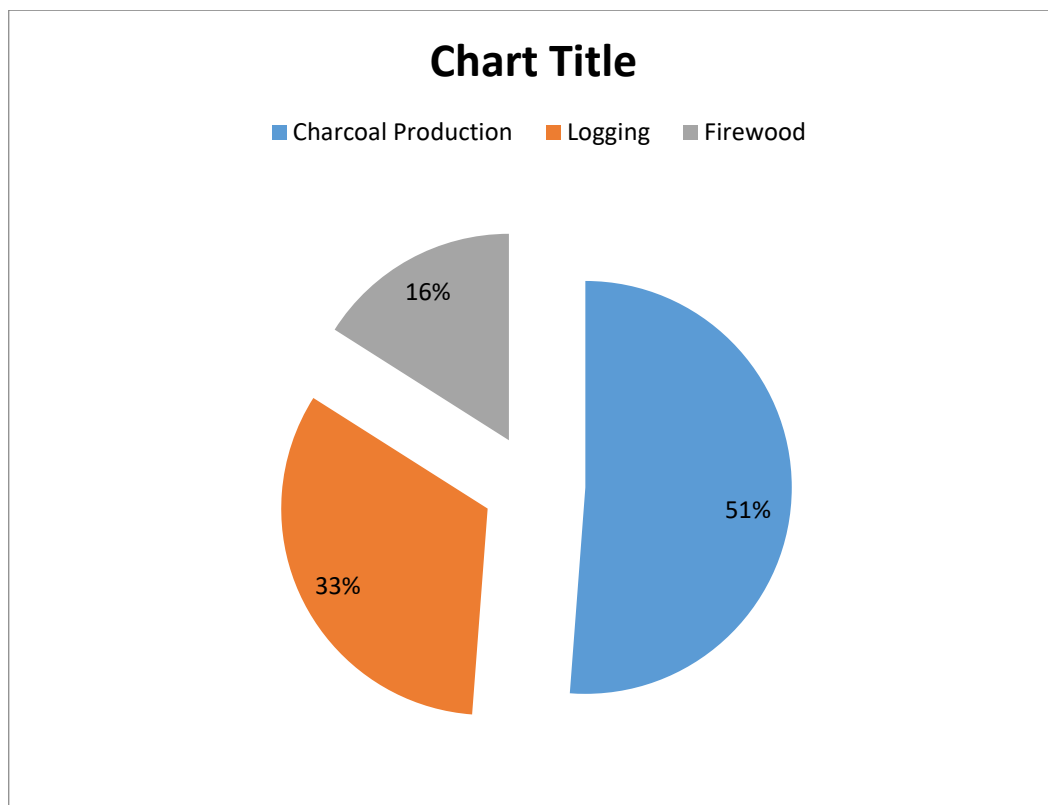


Figure 4.12: Charcoal Production, Logging and Firewood
Source: Authors work (2019)

4.3.5 Subsistence farming, commercial farming in the study area

60% 150 represent subsistence farming activities which is practiced in the area which leads to clearing of forest resources 40% 100 which represent commercial farming activities such as Bacita Sugar Company in Tsaragi district Zimbabwe in Tsonga district and BUA and Abiola Farms in Lafiagi district.

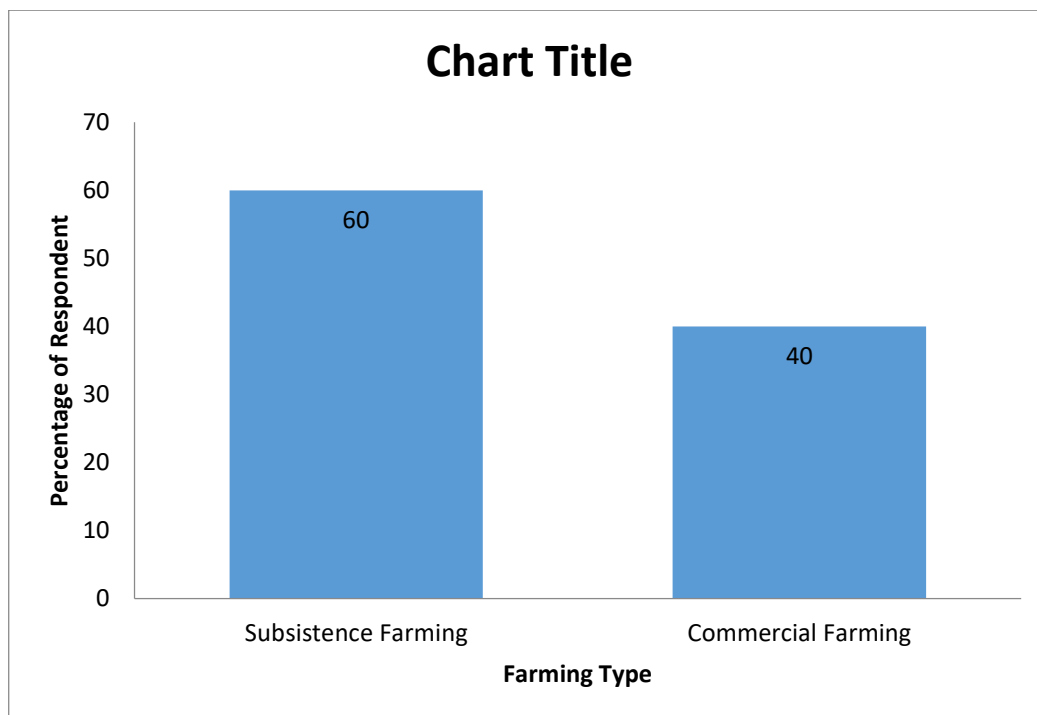


Figure 4.13: Subsistence Farming and Commercial Farming
Source: Authors work (2019)

4.3.6 Communal, family and government land tenure system

This shows that both subsistence and commercial farming activities contributed majorly to the clearing of forest in the area.

60% 150 represent communal land tenure system 75 30% connote family land tenure system and 10% 25 represent tenure by government. This implies that communal land tenure system is still in use in the study area. With little government controlled area

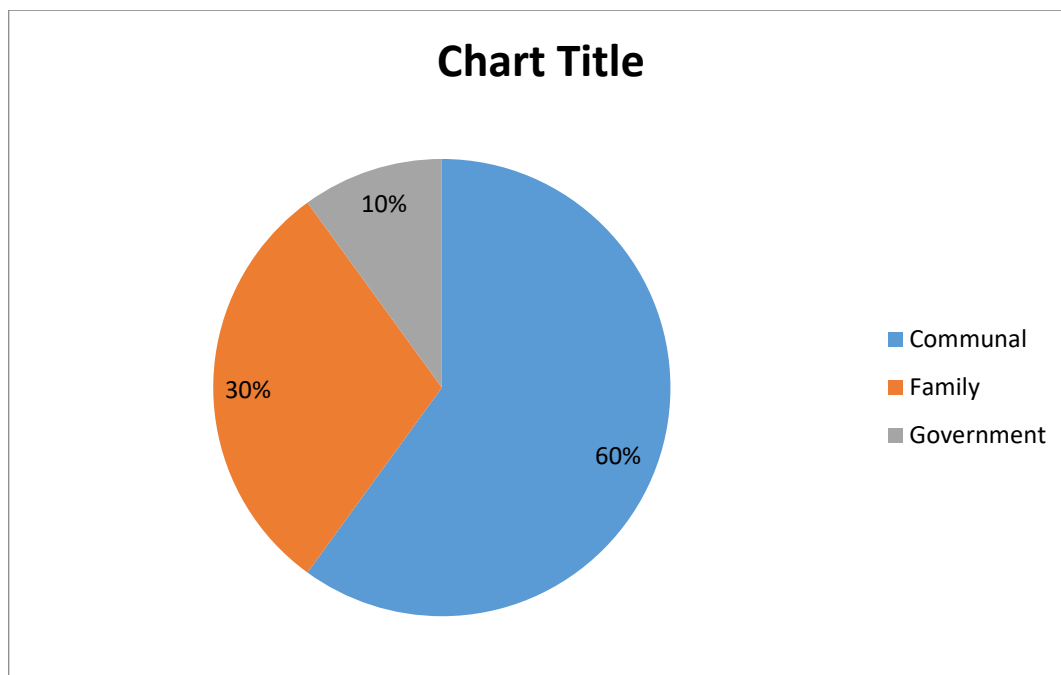


Figure 4.14: Communal, family and government land tenure systems
Source: Authors work (2019)

4.3.7 Loss of family values and cohesion caused forest clearance

From Figure 4.11, (238) 95.2% of the respondents strongly agreed that loss of family values and cohesion indirectly affect forest resources management negatively. (12) 4.8% agree that their loss of family values and cohesion is a problem, 0% strongly disagrees.

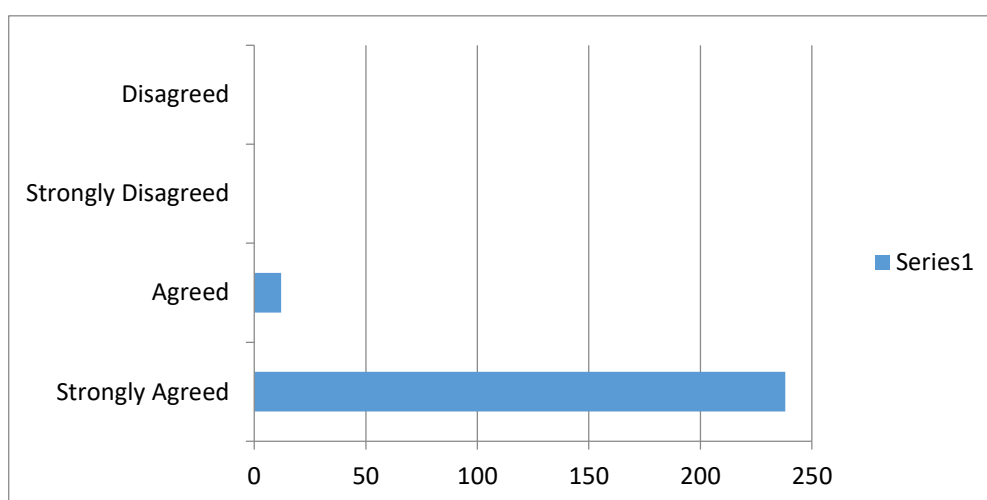


Figure 4.15: Loss of family values and cohesion caused forest clearance
Source: Authors work (2019)

4.4 Better Alternative Community Participation Approach that can be put in place to help to Solve this Problem

4.4.1: Planting of trees/aforestation

48% opted for planting of trees, 52% favours establishment of trees crops and orchard, 0% opted planting of cash crops alone. Planting of trees and the establishment of orchard along side farming is generally acceptable ways of managing forest resources across the districts.

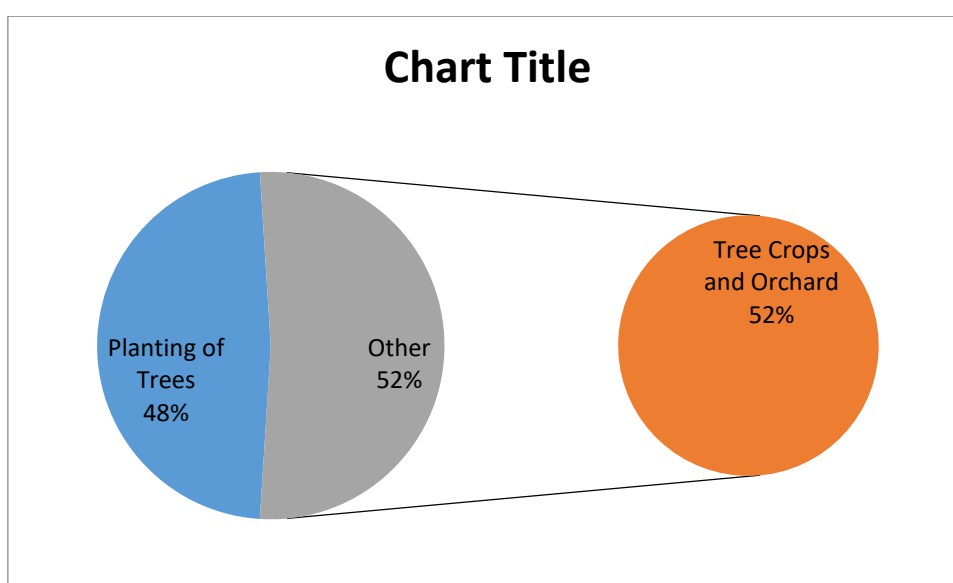


Figure 4.16: Planting of Trees and Tree crops and Orchards
Source: Authors work (2019)

4.4.2: Privatization and old method (communal land tenure system)

0% favoured privatizing of forest resources in the study area while 80% of the respondents favoured communal land tenure and 20% believe government should play some roles in the management of forest. The people of the area believe privatizing forest resource management is not the best method, it will not even be better to revert to old method of communal land tenure system.

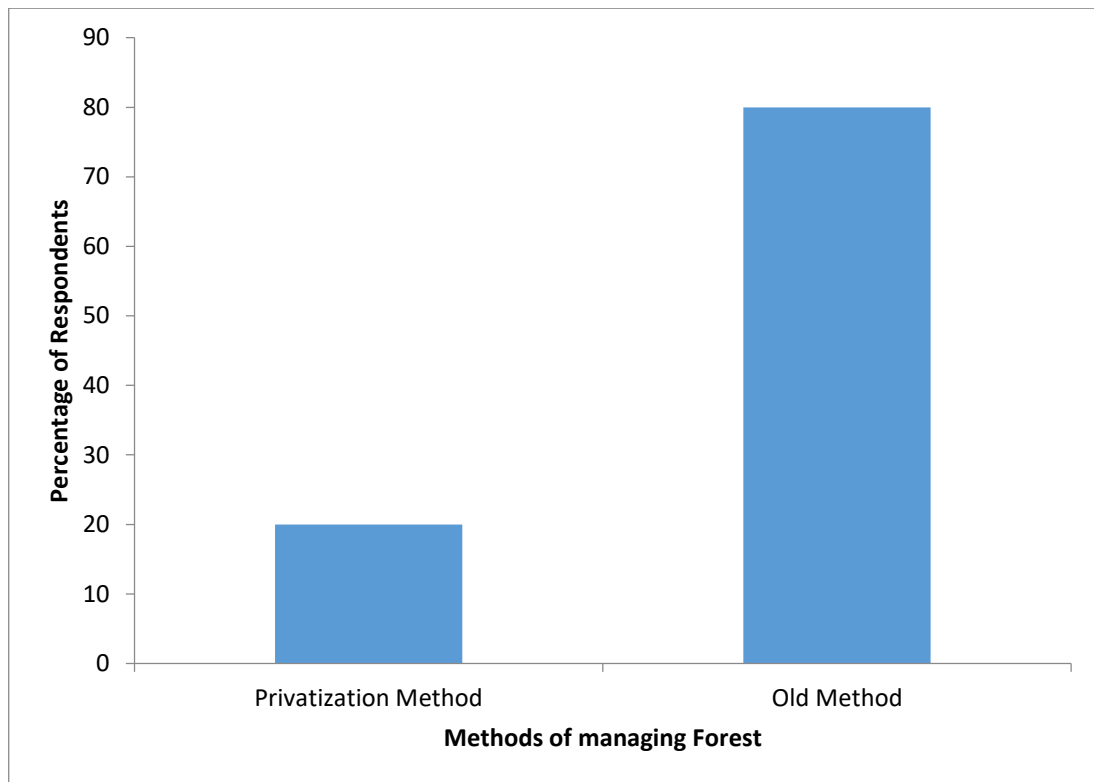


Figure 4.17: Privatization and Old Method of managing Forest
Source: Authors work (2019)

4.4.3 Local vigilantes, environmental officers and farmers

40% favoured vigilantes 40% also favours environmental officers monitoring of forest resources in the part and 20% say farmers themselves should monitor forest resources. Local vigilante and environment officers in collaboration with farmers will go along way in preserving the remaining forest resources in the area.

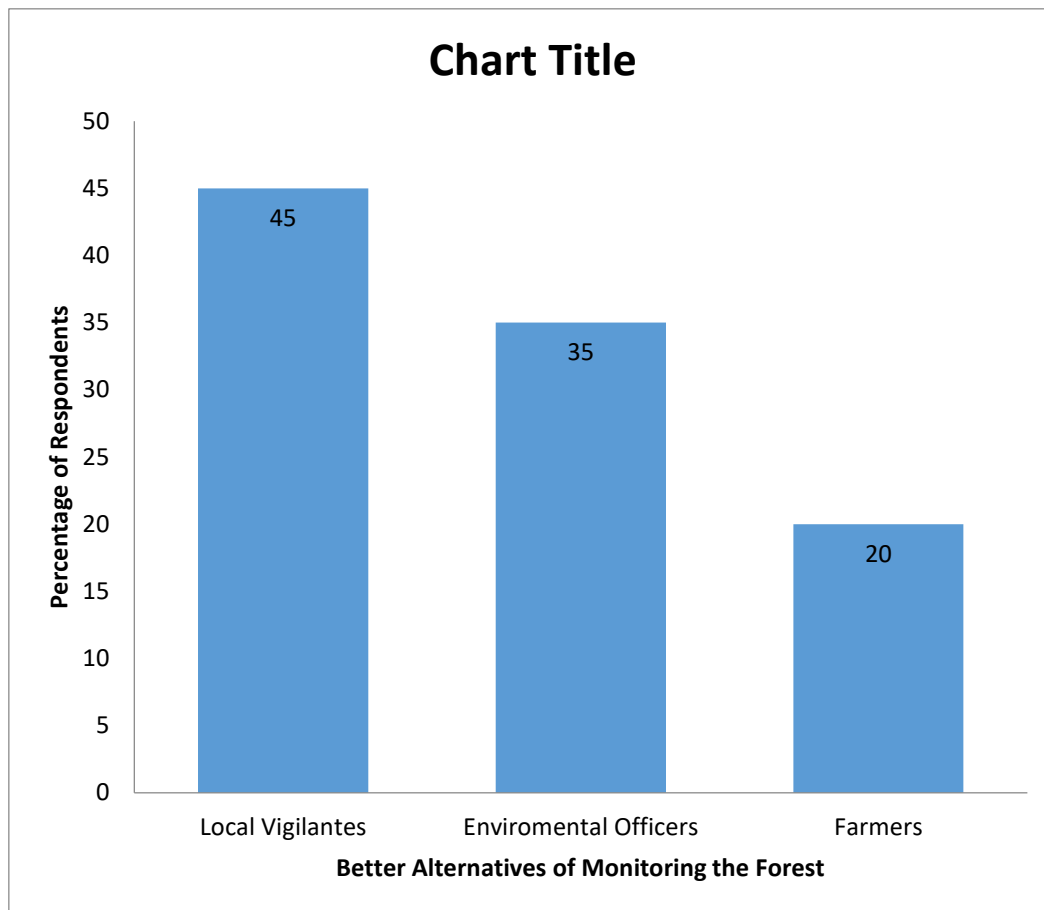


Figure 4.18: Local Vigilantes, Environmental Officers and Farmers

Source: Authors work (2019)

4.4.4 Discussion of Results

The research carried out shows a decline in the forests cover as objective 1 was to examine the level of destruction done to the Forest Resources in the study area between 1990-2018. It was discovered that Forests resources have reduced significantly as shown by NDVI Map of 1990, 2005 and 2018. Since 1984 there were thick Forests present before 1990. The Vegetation index Map of the Study Area for 1990 shows negative value (-0.26) which indicates a decrease in vegetation cover when compared to 1984. The vegetation index map of 2005 also shows further decrease in the vegetation cover in 1990 (0.58) 2005 (0.48). This shows that between the intervals of fifteen years there is significant reduction in the forests cover in the study area. These can further increase the impact of climate change and global warming experienced. Vegetation index map of Edu Local

Government for 2018 with NDVI value (0.35) indicating comparative dense vegetation shows there is significant decline in vegetation cover between 2005-2018 from (0.48) and (0.35) respectively. This means that, there is sharp decline in the Forests cover between the intervals of another fifteen years. These reductions are due to increased Population and competition for the available space for farming due to agrarian nature of their work and fertile nature of the soil. The implication of this is that pressure is set in for the existing Forests and the biodiversity distorted. The surrounding towns and villages experienced excessive heat. Varieties of trees such as Mahogany tree, Locust bean tree Shea butter tree are not in abundance again. The strong and hard roofing planks are difficult to get. Only white and soft trees of Gmelina tree is found due to indiscriminate harvest.

Edu Local Government Forests Burn area change was detected during 1990, 2005 and 2018. The result shows deferent Burn Ratios in the Study Area. The large positive (blue) and large negative (red) indicate changes in the study area with (-0.5) and (0.5) ratios and shows the areas affected most with fire severity. This shows that vegetation cover are exposed to burning through clearing of land for farming, cutting of trees for charcoal production and black smiths for farm implements and farm tools. The implication of this is serious because vegetation takes longer time to regrow in the areas affected. The micro-organisms that support Biodiversity are completely eliminated which hindered quick regeneration.

Further Study revealed that vegetation resources have been substantially cleared due to anthropogenic activities such as Seasonal fire and hunting, urbanization and construction of houses across the Local Government through farming both subsistence and commercials, Charcoal production and logging and sourcing for fire wood. Communal

Land Tenure systems used in the past to monitor Forests Resources had not helped in preserving the Natural Forests Resources due to loss of family values and cohesion among community members and between the communities. The urge for personal benefit is the order of the day.

Government's part has not yielded positive results for forest resources Management according to the findings to effectively protect biodiversity in the Study area. Government Policy and programmes encouraged cutting down of trees to fetch more revenue through granting of licenses to individuals who paid up front into Government coffer and individuals go back to mount pressures on the loggers and the charcoal makers in order to recoup their expenses. This is not good for biodiversity. Traditional institutions (village heads community members) who are charged to take care of the forest have failed to do so for personal gains. They sometimes connived with the Charcoal producers.

Better alternative is community participation approach that can help reverse the trend as revealed in the study. Majority of the populace in the study area are farmers, both indigenes and the settlers, and virtually all the areas deforested were put to use for farming purposes. The study have revealed that majority of responses favoured planting of trees and establishment of aforestation, planting of trees and establishment of orchard farms in the study area. This shows general acceptability of these programmes if introduced. This can easily be done as was done in the past through community and traditional institutions (Emirs, Etsus, village heads and family heads) especially when they are reminded of looming danger ahead of the consequences of forests destructions. Traditional rulers are well respected in Nupe Kingdom. Once the ideals are sold to the traditional rulers they disseminate and pass on the message and instructions to the generality of the people. They can instruct their subjects and those assigned with that responsibility to do so. Provision of tree seedlings, fund and incentives by the Government which are handed down to the

farmers will go a long way in reversing the injury inflicted, these trees can be nurtured in collaboration with State Ministry of Environment and Forestry and Department of Agriculture and Natural Resources, Edu Local Government. The Staff of the Local Government are well acquainted with the people and terrain, and farmers seem to believe and are comfortable with their kinsmen and relations. This can rule out the doubt among the Community members and can lead to high level of success.

It is also generally agreed that the loggers and charcoal makers should be monitored to reduce indiscriminate logging and cutting of trees in the study area. Forests resources are products of one community or the other Communities share boundaries with one another Family members are well known. Measures should be put in place to monitor the harvesting of trees to protect the remaining forest resources as measures are taken to reverse the already lost ones .This could be done through collaboration with the Ministry of Environment and Forestry in the State in collaboration with Department of Agriculture and Natural Resources Edu Local Government. Once this is done with all seriousness it will go a long way to check the illicit activities of the loggers.

Since there is Change of Government in Kwara State, urgent steps need to be taken to revoke licences given to individuals. Revenue generation should not be more important than the life and property of the generality of people and the generations yet unborn. Any resources gathered now will be spent on ecological problems such as Flooding, erosion, sedimentation.

The Study also revealed that all the respondents were in support of adopting tree cropping and orchard plantation (Mango,Guava,Cashew citrus) In the 90s this was practiced through the traditional rulers, Mango seedlings were brought in and shared among the farmers and it yielded the required result then. Suddenly it stopped according to the study.

If reintroduced through Government, community and traditional leaders knowing fully well that if introduced and nurtured, can boost the economic fortunes of the people. It also can help to replace the lost vegetation through collaborative approach. Planting of tree crops and nurturing them is labour and Capital intensive. Encouraging and embracing communities through little financial support as labour wages will serve as a boost and enable other communities to join. Government can take advantage of festive periods (Eid Fitr and Eid Kabir) when villages in each district converged in town to catch fun, felicitate with each other. Such opportunities could be exploited through the support of the traditional rulers. Cinema films could be shown at that period to showcase the benefit of planting tree and the need to protect our forest for ourselves and our grandchildren.

The repeated cases of flooding day in day out in Nigeria call for urgent steps. Edu Local Government border River Niger and the Local Government is always at the receiving end of annual flooding recorded in the Country. Large expanse of farm lands have been destroyed with their crops this year especially the communities at the banks of River Niger and its tributaries. The affected communities are: Puta, Efagi, Likpata, Edogi-Dunkun, Shonga, Chiji, Tada Kusogi, Fanangun and Bele, and they had their properties destroyed. In Shonga alone, thousands of hectares of land meant for Federal Government anchors farm programmes submerged last year and the programme could not take off this year due to billions of Naira involved. This is not good for our food sufficiency and sustainability drive. The cause of these is a collection or aggregate of what every individual have caused in his locality. So forests degradation is among the cause. The need to take that bold step is now, to stop forests degradation and embrace measures that will protect the remaining ones by evolving Community Participation Model in Forests Resources Management in the Study area. These efforts should be replicated everywhere to reduce the effect of Climate Change and Global Warming.

CHAPTER FIVE

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 Summary

Vegetation in the study area has greatly reduced due to anthropogenic activities such as farming, firewood fetching, logging, and charcoal production as shown in the study. Urbanization and building construction, commercial farming (BUA Sugar Company, Abiola Farms and Bacita Sugar Company and Zimbabwe Farm) have greatly impacted negatively on the vegetation of the area. Subsistence farming activities across the three districts is amongst the major factors of forests destruction in the area. A lot of virgin land have been exhausted and people are forced to move to neighbouring Local Governments for farming.

Vegetation index map of Edu Local Government for 2018 with NDVI value (0.35) indicating comparative dense vegetation shows there is significant decline in vegetation cover between 2005-2018 from (0.48) and (0.35) respectively. This means that, there is sharp decline in the Forests cover between the intervals of another fifteen years. These changes have been depicted with the images of 1990, 2005, and 2018. These show that the local government has substantially lost vegetation and biodiversity.

The study revealed a decline or degeneration of vegetation with NDVI values of 1990-0.26 to 0.56, 2005 -0.23 to 0.48, 2018-0.11 to 0.35 and the level of forest burning NBR at 1990 0.01 to 0.56, 2005 -0.18 to 0.18 and 2018 -0.13 to 0.69.

This is due to different anthropogenic activities such as agricultural activities (substance and commercial farming) and lumbering activities, result to clearing and burning of forest resources in the study area.

Burn Ratios in the Study Area .The large positive (blue) and large negative (red) indicate changes in the study area with (-0.5) and (0.5) ratios and shows the areas affected most with fire severity. This shows that vegetation cover are exposed to burning through clearing of land for farming, cutting of trees for charcoal production and black smiths for farm implements and farm tools. The implication of this is serious because vegetation takes longer time to regrow in the areas affected. The micro-organisms that support Biodiversity are completely eliminated which hindered quick regeneration.

The rate at which fire and hunting in the study area lead to burning and loss of valuable vegetation resources is greatly high, as also shown in the Normalized Burn Ratio (NBR) 1990, 2005 and 2018.

From the study conducted, the communal land tenure system that is traditional method of forest resources management in the study area is a thing of the past. 60% of the studied population said that communal land tenure systems lead to effective Forest Resources Management. 30% of the studied population said that family land tenure can be used in the area to manage some parts of the forest. Only 10% of the respondents agreed that government tenure system leads to effective Forest Resources Management. This means that communal land tenure system practice contributed to forest resources degradation. Farms have been fragmented among the family members and those outside for crop sharing at harvesting period.

Successive Governments in Kwara State have contributed negatively to the vegetation loss in the state through their policies and programmes, especially in the area of revenue generation. Licenses approved for individuals to generate revenue have inadvertently led to forest resources destruction, as shown in the study. No concern is shown to

environmental sustainability and this is not healthy to our ecosystem and environment at large.

95.2% of the studied population strongly agreed that loss of value and cohesion have negatively contributed to forest resources degradation. 4.8% also agreed that loss of family values and cohesion contributed to forest resources loss.

Findings revealed that charcoal producers, logging activities, firewood fetchers contributed to the devastations of the forests in the study area

Findings also showed that studied population totally reject that forest resources should be privatized. Majority of people from the Local Government resisted any attempt to forcefully acquire their ancestral land. Though they are in support of the old methods with stringent measures in place by the community. This is corroborated in the constant clash between the members of the community and traditional rulers such as, the crisis that happened in Lafiagi in the year 1994 and the recent one in 2017 and that of Shonga between the community and Zimbabwean Farmers. The most recent one happened in Lafiagi with arrival of BUA Group of Company.

48% of the studied population are in support of establishing new forests belts like the one done in the past in the 1960s in North Eastern part of Lafiagi and the South Western part of the Local Government will help in replacing the lost vegetation. 52% favours embarking on tree crops and not only concentrating on cash crops alone.

97% of studied population strongly agreed that loggers should be constantly and closely monitored during their logging activities to prevent indiscriminate forest resources destruction. This could be done through committed Government effort at both Local and State through proper legislation.

48% of the studied population supported that economic trees should be introduced through distribution of tree crop seedlings to farmers. 52% favours establishment of tree crops and orchards. Since the major economic activity in the Local Government is farming, and in the process, forest resources are tampered with, the need to replace the lost vegetation is eminent. Tree crops such as mango trees, guava, shea butter, locust beans, and citrus trees were recommended.

Finding revealed that collaborations between the Local vigilantes, environmental Officers and the Farmers should be used as alternative way of Forests resources Management in the area. This can help in detecting anybody found wanting in the area.

5.2 Conclusion

The recent challenge of emerging environmental issues of Climate Change and Global Warming for the rapidly increasing population in Nigeria and pressure of increasing demand on environmental forest resources has attracted attention nationally and internationally.

Community Participation Model and Management of Forest Resources can be used to monitor and reduce forest resources degradation. Though, Government failed to pay attention to incorporating community in their management plan in the past, doing that will do more good than evil. Collaboratory effort towards implementation of policies and programmes will be helpful. Replacing the lost vegetation in the study is a huge task as more forest is continuously affected; putting measures in place will help in mitigating its adverse effect.

5.3 Recommendations

Generally, the effect of forest resources degradation is felt globally in Climate Change and Global Warming. The aggregate individual activities in our various Localities

resulted into these challenges such as flooding, increase in temperature, sedimentation, desertification, and soil erosion, etc, hence, the need to correct the trend. The recommendations are:

1. **Privatizing Forests Resources Management:** Privatizing Forests Resources Management will help to reduce the tragedy of commons that sees Forests resources as Public property that belongs to everybody and so no one cares of its wellbeing. Though it is part of the measures suggested but 100% threw it out due to peculiar problems of the study area. If privatized with close monitoring of Government in collaboration with Traditional institutions it will help to better manage Forests resources as no individual will fold his arm and allow his property destroyed.
2. **Community policing:** community should be included in the Management of Forests Resources in the Study area to check in and out movement. Loggers should be constantly checked to reduce indiscriminate harvest of forest resources. Only the matured trees should be allowed to ensure environmental sustainability and maintenance of biodiversity.
3. **Planting of trees should be encouraged in the study area:** Tripartite efforts between State Government, Local Government and the Communities should be undertaken. Each Community should be made to provide land (fallow land) that can be used for this purpose, State Government should provide tree seedlings and other incentive and Local Government should monitor and ensure the survival of the programme. When this is done and sustained will help to correct the mistake of the past and reduce the impact of Climate Change and Global warming
4. **Planting of tree crops:** such as Mango Gwava Cashew Orange and citrus trees should be included in the establishment of Forests in the Study area. Apart from

economic benefit that can be derived from this it will serve same purpose as afforestation.

5. **Tree planting campaign:** should be publicized by the Government at both print and Electronic media, public and private owned Radio stations .This campaign should include the recent flooding events that ravaged communities, solutions to this problems as planting of trees and protection of existing forests resources. When this is done it can help to change the narration.
6. **Seminars and Symposium:** Seminar and Symposium where a resource person will give lecture in form of sensitization with community Leaders , traditional rulers, and member of the Communities all in attendance and the lecture should cover benefits of planting trees, effect of Climate Change that is already with us and Global warming. Majority will carry the message home and can help to change the perception of the members of the Community on the forests destruction.
7. **Cinema, films and short drama:** Cinema that will depict the benefit of tree planting, effect of Climate Change, Communities ravaged by flooding, and erosion. These can be helpful as people learn from other people's experiences
8. **Provision of alternative means of livelihood:** Farmers should be provided with alternative ways of income generation such as small scale businesses, social investment programmes that will trickle down to the beneficiaries and not hijacked by the elites. This will go a long way in reducing pressures on forest resources.
9. **Alternative cooking equipment:** Provision of alternative cooking equipment /materials that are environmental friendly will help to reduce firewood usage in our locality.

10. **Government should recruit more staff:** More qualified staff with requisite experience should be recruited by the Government for proper monitoring of the forest resources as shortage of staff is a major problem in the Local Government.
11. **Assigning forest guards to monitor the forest resources:** Forest guards should be constantly assigned to monitor and protect the forest resources if established. They should work in consonant with the communities
12. **Punishing the offenders:** Those found cutting down the trees indiscriminately, when caught, should be punished within the community to serve as deterrent to others. This will go a long way in discouraging others.

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