

**CLIMATE SMART ACTIONS (CSA) AQUACULTURE, AGROFORESTRY  
AND RESOURCES MANAGEMENT**

*GLOBAL ISSUES & LOCAL PERSPECTIVES*

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***Global Issues & Local Perspectives***

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**TABLE OF CONTENTS**

Preface

Editorial Note

Table of Contents

Acknowledgement

**CLIMATE SMART ACTIONS (CSA) AQUACULTURE, AGROFORESTRY AND  
RESOURCES MANAGEMENT-- ISBN 978-978-60709-1-6**

Dedication

## **Part one: CLIMATE SMART ACTIONS (CSA)**

Chapter 1:

### **Restoration and Sustainability of Ecological Resource for Biodiversity Conservation in Nigeria**

<sup>1</sup>Salami, K.D., Muhammad S.I. Adeniyi, K. A. and <sup>1</sup>Nasir, T. Y.

Chapter 2:

### **Application of Electronic Monitoring and Control Systems in Climate-Smart Aquaculture (CSA) Management**

Dr. Reagan N. Robinson

Chapter 3:

### **Determinants of Climate Change Adaptation among Arable Crop Farmers in Akwa Ibom State, Nigeria**

Et-eye Nyong ; Udoh, Enobong Donald Udosen, Idem-Obong

Chapter 4:

### **Climate-Smart Weed Management Strategies for Sustainable Crop Production and Ecosystem Health**

\*Shittu, E.A<sup>1</sup>., and Abubakar, A<sup>2</sup>

Chapter 5:

**Gender-sensitive, Gender-responsive and Gender-transformative Climate Smart  
Actions**

**Okwor, Uchechi Mercy<sup>1</sup> , Amanze Alice Nnenna<sup>2</sup>, and Ujoh, Stella Ukachi<sup>3</sup>**

Chapter 6:

**Smart-Climate Change Adaptation Practices among Smallholder Farmers in  
Nigeria**

**Edoka, M. H., Adiel, K. B, and Fahad, I.**

Chapter 7:

**Restoration and Sustainability of Ecological Resource for Biodiversity  
Conservation in Nigeria**

**Salami, K.D., Muhammad S.I. Adeniyi, K. A. and Nasir, T. Y.**

## **Part two: AQUACULTURE: RESOURCES MANAGEMENT**

Chapter 8:

**Integrating Nature into Urban Planning for Climate-Resilient Fisheries Systems**

**Victoria Folakemi Akinjogunla<sup>1\*</sup>, Emmanuel Ebuka Nwankwor<sup>2</sup> and Binta Isyaku  
Usman<sup>1</sup>**

CHAPTER 9:

**Climate Smart Aquaculture**

**CLIMATE SMART ACTIONS (CSA) AQUACULTURE, AGROFORESTRY AND  
RESOURCES MANAGEMENT-- ISBN 978-978-60709-1-6**

**Muhammad Usman Mairiga and Aliyu Mohammed,**

**CHAPTER 10:**

**Aquatic Food Systems at the Climate Frontier: Vulnerability, Adaptation, and  
Resilience in Fisheries and Aquaculture**

**Afia, O. Edet and Ekanem, I. Emmanuel**

**CHAPTER 11:**

**Blue Carbon and Aquaculture: The Role of Coastal and Inland Culture Systems in  
Climate Mitigation**

**Akinjogunla, V. F.<sup>1</sup> and Olatunji, E. O.<sup>2</sup>**

**CHAPTER 12:**

**Rice-Fish Integration Systems: Climate-Smart Innovation for Sustainable Food  
Security and Livelihood Enhancement in Nigeria.**

**\*MAHMOUD Ibrahim Opene<sup>1</sup> and <sup>1</sup>BASHIR, Abdullahi Kobe<sup>1</sup>,**

**CHAPTER 13:**

**Climate-Smart Hatchery Management as Climate Smart Action  
(CSA): Sustainable Breeding, Larval Rearing, and Fish Health in  
Aquaculture Systems**

**Victoria Folakemi AKINJOGUNLA<sup>1\*</sup>, Mahmoud Opene IBRAHIM<sup>1</sup> and Bashir Abdullahi  
SANI<sup>1</sup>**

## **Part three: AGROFORESTRY AND RESOURCES MANAGEMENT**

### CHAPTER 14:

#### **Adoption and Scaling of Climate-Smart Aquaculture and Agroforestry Practices: The Role of Agricultural Extension Services**

**Dr. Taibatu Abdullahi Manga and Dr. Yohanna John Alhassan**

### CHAPTER 15:

#### **Ecological Engineering in Agroforestry: Resource Management Approaches to Enhance Wildlife Services and Reduce Conflicts**

**Ogunsusi Kayode**

### CHAPTER 16:

#### **Climate-Smart Pest and Resource Management Strategies in Agroforestry and Aquaculture Systems: A Comprehensive Review**

**Efurumibe, P.E and Opara, E.U**

### CHAPTER 17:

#### **Climate-Smart Strategies for Sustainable Insect Vector Control and Integrated Malaria Prevention in Agroforestry and Agricultural Landscapes**

**<sup>1</sup>Adeniyi, K. A., <sup>2</sup>Tolani, R. T., <sup>3</sup>Mohammed, A. O., <sup>4</sup>Salami, K. D. and <sup>5</sup>Ihemanma, C. A**

**CHAPTER 18:**

**Enhancement of Soil Fertility and Nutrients Sustainability on Arable Crops  
Production in Agroforestry Ecosystem**

**Nsien, I. B., Okonkwo, H. O., Akpan, U. F. and Eric, E. E.**

**CHAPTER 19:**

**Rhizosphere Engineering and Soil-Microbe-Plant Interactions along Aridity Gradients:  
Climate-Smart Strategies for Enhancing Agroforestry Resilience in Northern  
Nigeria**

**Abubakar, A., and Shittu, E.A**

**CHAPTER 20:**

**Climate Smart Approaches to Forest Resources Management and their  
Implications for Rural Farmers' Livelihoods in North Central Nigeria.**

**Mohammed, U. and Maimuna, A. A.,**

## **Preface**

This book adopts an exegetical approach as well as a pedagogic model, making it attractive agriculture and environmental economics teachers, professional practitioners and scholars. It eschews pedantry and lays bare the issues in such clarity that conduces to learning. The book elaborates on contemporaneous **Climate smart actions (CSA) aquaculture, agroforestry and resources management** issues of global significance and at the same time, is mindful of local or national perspectives making it appealing both to international and national interests. The book explores the ways in which **Climate smart actions (CSA) aquaculture, agroforestry and resources management** issues are and should be presented to increase the public's stock of knowledge, increase awareness about burning issues and empower the scholars and public to engage in the participatory dialogue **Climate smart actions (CSA) aquaculture, agroforestry and resources management** necessary in policy making process that will stimulate increase in food production and environmental sustainability. **Climate smart actions (CSA) aquaculture, agroforestry and resources management : *Global Issues & Local Perspectives*** is organized in three parts. Part One deals with The Concept of **Climate smart actions (CSA)**, Part Two is concerned with The Concept of **aquaculture**, and Part Three deals with the Concept of **agroforestry and resources management**

**Eteyen Nyong; March 2026**

Chapter 20:

**Climate Smart Approaches to Forest Resources Management and their Implications for Rural Farmers' Livelihoods in North Central Nigeria.**

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**TABLE OF CONTENTS**

1.0 INTRODUCTION ----- 2

2.0 OBJECTIVES OF CLIMATE SMART FOREST RESOURCES MANAGEMENT FOR ENHANCING RURAL FARMING LIVELIHOODS ----- 3

3.0 FOREST RESOURCES MANAGEMENT BY RURAL FARMERS ----- 4

4.0 TYPES OF FOREST RESOURCES MANAGEMENT BY THE RURAL FARMERS ----- 5

5.0 SOCIAL INDICATORS AND MANAGEMENT PATTERNS OF FOREST RESOURCES----- 6

6.0 CONCEPT OF LIVELIHOOD ----- 8

6.1 KEY ASPECTS OF CLIMATE- SMART LIVELIHOODS ----- 10

7.0 POLICY IMPLICATIONS AND SUSTAINABLE FOREST MANAGEMENT ----- 10

8.0 CONCLUSION ----- 12

REFERENCES ----- 12

**1.0 INTRODUCTION**

In developing countries like Nigeria where the majority of families both farm and non-farm sectors derive their livelihoods from agriculture, sustainability of agriculture cannot be discussed or even defined in isolation of the issue of livelihoods. Livelihood is defined as adequate stock and flow of food and cash with an individual or a family to meet its basic needs (Adetunji, 2025). Livelihood security then means secured ownership of, or access to, resources and income-earning activities, including reserves and assets to offset risks, ease shocks and meet contingencies (Arabo, 2023).

Forests are plant communities consisting predominantly of trees and other woody vegetation occupying an extensive area of land. Forest resources are essential natural resources for rural

farmers, provide them with both subsistence and market oriented livelihood strategies (Adetunji, 2025). Globally, many wood forest products like fuel wood, construction materials and non-wood forest products such as wild foods, leave litters, leaves for wrapping, medicinal products and land snails provide rural farmers with several entrepreneurship livelihood opportunities. Forest products are known to be essential sources of income generation for rural farmers of their livelihood, expansion of farms and diversified commercial activities (Campbell *et al.*, 2025).

Fonta *et al.* (2024) reported that more than 300 million people in the world especially the poor, depend largely on forest gathering for daily subsistence and survival. The potential benefits include: daily subsistence and survival from forest product gathering, income redistribution and poverty reduction, recreational facilities, firewood, timber and medicine. Agwai (2023), stressed that rural farmers are highly dependent on forest products for subsistence foods and materials. Over ninety percent of rural residences rely on forest to meet their family requirements. It was estimated that between 1.095 billion and 1.745 billion people in the world depend on wide range of forests products for their livelihoods and about 200 million indigenous rural farmers are almost fully dependent on forests (Chado, 2024).

Forest resources are the key components of the natural resources base of any community, region or country and they play a fundamental role in the socio-economic well-being of the people of those communities (Sheshi, 2024). This is prevalent in sub-Saharan Africa, where the majority of rural farmers depends on natural forest resources Management for their livelihood (Amina, 2025). Nigeria 'stropical forest resources are integral component of the livelihoods of the majority of rural farmers and a lower proportion of urban households (Borokini *et al.*, 2025). Apart from meeting the socio-economic needs of rural farmers for food and shelter, tropical forests are also major sources of both industrial wood products and fuel wood. Fuel wood and charcoal make up fifty-six percent of global wood production and approximately ninety percent of this is produced in developing countries such as Nigeria. Fuel wood also known as fire wood is the most important source of energy in Nigeria rural farmers (Iasisi, 2022). Olujimi and Adekunle (2025) reported that the average annual value of forest products collected in North Central Nigeria such as (fuel wood, construction materials, wild fruits and leaf litter) were estimated to be thirty-nine percent of average gross cash income per year.

## **2.0 Objectives of Climate Smart Forest Resources Management for Enhancing Rural Farming Livelihoods.**

**CLIMATE SMART ACTIONS (CSA) AQUACULTURE, AGROFORESTRY AND RESOURCES MANAGEMENT-- ISBN 978-978-60709-1-6**

This study Aims and Objectives on forest resources Management and on livelihood of rural farmers in North Central Nigeria” become imperative in order to better the livelihood of rural farmers. It has been observed that there are many untapped forest resources that could improved rural farmers income if seriously harnessed at the same time improving their standard of living. However, finding on socio-economic characteristics of respondents has provide information to government on the socio-economic attributes of rural farmers living in forest communities for designing and implementing policy regarding forest resource s Management. Similarly, finding on the Management of forest resources would provide information to the relevant stakeholders in agricultural sectors such as agricultural extension agents on the type of forest resources Managed, frequency of Management as well as forms of Management for compare with recommended international safety measures for edible forest products. Also, the study has provide information to the extension agents and concerned non-governmental organization on the factors influencing forest resources Management for appropriate measures and enlightenment to prevent or reduce over-exploitation of the forest resources in North Central Nigeria. The forest resources Management on livelihood would give an insight to the development partners, researchers and policy makers on the effect of Management various forest resources on the total livelihood status of the rural populace in the area for improvement and enhancement of livelihood as well as poverty reduction.

Furthermore, on the practice of sustainable forest strategies the study has provide information to agricultural extension agents to educate farmers on the need to adopt measures that will limit over-exploitation of forest resources in order to sustain forest resources for future generation.

Climate-smart agriculture (CSA) is a forward-thinking approach to agriculture that addresses food insecurity and climate change simultaneously. It adapts farming practices, weather forecasting technology, and entire food system to adapt to climate change and promote efficient resource use. The food and Agriculture Organization identifies three main objectives of climate-smart agriculture.

- Sustainably increase forest productivity and incomes
- Adapt and built resilience to climate change
- Reduce and/or removing greenhouse gas emissions

Embedding these three objectives into food security and livelihoods programmes helps communities adapt and thrive despite changing seasonal patterns. Resilience buildingis especially

crucial in poor, rural areas, where forestry is the most important form of income and communities are the most vulnerable to hunger.

### **3.0 Forest Resources Management by Rural farmers**

Forest resource use involves the extraction of resources (such as grasses for livestock), cultivation of crops and cutting of trees, hunting of wildlife and harvesting and collection of non-timber products (FAO, 2024). The problem of over Management of forest resources arose from the wrong concept that forest resources are naturally renewable and therefore the amount, or quantity as well as the methods of removal or harvest is inconsequential in renewability. FAO (2024) stated that Nigeria has a total forest area of 23,387,000 hectares in 2017. Five years thereafter, the Nigerian forest reserve stands at 22,780,000 hectares with an annual change of 0.9% which according to Habibu (2024) is deplorable. Proper Management of forest resources have not been put in place. Most at times, resources are over-exploited beyond the required need, either as food or for healthcare. This leads to loss in resources due to uncontrolled harvest. Proper Management of forest resources ensure that resources are not over-exploited and wasted. Since forest resources could also serve as food and other needs, they play complementary roles in agriculture in as much as they provide food in conjunction with agricultural production. Proper Management of forest resources could therefore ensure sustainability in agriculture. Reserve depletion due to over Management would not arise when resources are sustainably Managed. A major concept of forest resources management is the conservation of the resources, which is the method of using the resources wisely (Habibu, 2024).

Mohammed *et al.* (2022) stated that in most of forest bank in North Central Nigeria, people rely on forests trees, fodders and timber for housing and agricultural implements such as ploughs and fuel wood, which is the most important, and often the only source of energy for cooking and heating for most rural farmers. Firewood, poles and honey are harvested from the community forests whilst the natural forest provides firewood, poles, seeds, medicine, fruits, leaves, roots, and honey. This heavy reliance on the natural forest for poles arises from the need to construct carts which are used to transport poles and other products.

### **4.0 Type of forest resources Managed by the rural farmers**

Sunday *et al.* (2023) and Aminu and Rasaq (2024) reported that hundreds of people derive a significant part of their livelihood from a vast range of non-wood and wood products harvested

from forests in North Central Nigeria. Non wood forest products (NWFPs) and wood forest products (WFPs) provide substantial inputs to livelihoods of very large numbers of people within the communities and their uses constitute one of the main demands placed upon the forest resources. However, Shadarak *et al.*(2022) posits that different NWFPs and WFPs contribute to household food needs, income generation, accumulation of saving and risk minimization. NWFPs based "activities can be important in filling seasonal food shortage gaps and can serve as a buffer in time of hardship or emergency.

Richmond *et al.*(2024) stressed that Management and use of the NWFPs WFPs have increased among the rural populace in all the ecological zones of Nigeria. These are fundamental for socio-economic well-being of the rural farmers. Forest products play an important role in supporting rural farmers livelihood and therefore can be used to raise the value of forests resources. Ahmed (2025) stated that in developing countries, such Tanzania and Nigeria, majority of the rural farmers and a large proportion of urban households depend on NWFPs and WFPs to meet some of their nutritional and health needs. WFPs are used for construction purposes. Also, income from selling these products is used to raise households' income. Forest resources form an integral part of the rural population lives especially around the forest resources base.

Richmond *et al.* (2024) reported that in North Central, WFPs and NWFPs such as. dry firewood, fodders, honey and construction materials were the most collected forest products at household level for utilisation. The researcher emphasized that, there are also significant benefits accruing from environmental goods and services such as water from catchment forests, increasing rainfall occurrence and spiritual sites present in the forests. These contribute to both monetary and non-monetary benefits, which serve as incentives for improved livelihood. Ahmed (2025) observed that NWFPs and FWP provide more income support options. The author noted that forest products always augment rural populace income during crisis and emergency situations such as floods, drought, war and famine. They are always used as safety nets, since they could serve as important shocks to cushion hunger and dwindling income effects during adverse conditions when other foods are scarce. Forest products can facilitate adaptations to environmental and economic shock as well as promoting long-term ecosystem integrity and human well-being. Richmond *et al.* (2014) also stressed that majority of the rural farmers' conserve-forests because they provide means of getting WFPs and NWFPs such as, fodder fuel wood and honey for consumption and sale by the populace.

Paul and Halima (2024) stated that forest resources are extracted in order to smooth the households' consumption and income. This typical use of forest resources represent risk-coping strategy of rural farmers that is a strategy that deals with the consequences of food shortages and income risks. The insurance role of forest resources is particularly important in the rural systems of North Central Nigeria. However, agricultural crops face many risks, such as price shocks, seasonal flooding, unpredictable degradation soil quality, pests and outbreak of crop diseases. Shefiu and Haruna (2024) noted that forest resources can be used directly for consumption or sold to fill cash gaps. Bala and Francis (2024) opined that people in most rural farmers visit forests to exploit resources if crops fail or if they face a negative shock

### **5.0 Social Indicators and Management patterns of forest resources**

i **Taboos:** Taboos are classified into two broad categories: holy and unholy. The so called holy species are used by man to meet his daily needs while the unholy ones are' not Manage by humans (Lasisi, 2022). The Management of forest resources at the local level is guided by myths and legends. Changes in religion from traditional to Christianity and Islam have changed the use pattern of various forest resources. Therefore, the significance of taboos in forest resources Management, though weak, it is significant in reducing pressure in the over use and abuse in forest resources at local level (Shadarak *et al.*,2022).

ii **Social acceptance:** Social acceptance of a resource determined the status of consumption at local, regional and national level. Over 60% of the total forests resources are consumed at the local level while about 20% consumed at the regional level and 18-20% is consumed at the national level. The social acceptance of forest resources is also influenced by taboos, religions and cultural practices. The social, religious and cultural factors affect the acceptance or the use of snails and monkeys for food in areas in North Central zones (Amina, 2025). Moreover, the fruits of *Irvingiagabonensis* are not fully accepted in the North Central Nigeria and *Adansoniadigitata* is not also fully accepted in the rainforest areas of Nigeria based on cultural and religious factors. The forest resources such as chew sticks, palm oil, rattan canes and the oil palm have attained national acceptance status. This is principally so, because the resources do not have any socio-cultural factors limiting their Management in most of the ecological-zones of the country. In areas where the resources do not occur, they are brought from other areas for use, meaning to ensure equal distribution of such resources nation-wide for household's Management (Ahmed, 2025).

The diversity of resources Management is important and this affects its consumption rate. This is applicable to the consumption of oil palm as it is used to produce wine, edible oil, industrial oil, mats, brooms, baskets, soap, fodder, traditional medicine and thatch roof. Also, *Afromomummelagueta* is used as a common material in traditional medicine, it is consumed in all the agro-ecological zones. However, many forest resources particularly leaves can be used for wrapping food, roofing houses, designing of masquerades and ritual purposes (Mohammed *et al.*, 2022).

iii **Tenure issues** :It has been said that forest resources outside government protected areas are managed under common property regimes. The resources are managed under sets of regulations based on beliefs, culture, tradition and ecological knowledge (Bala and Francis, 2024). Tenure issues which affect access to resources and mode of resources use determine the level of resource Management. Forest resources are managed by the application of free access, open access, restricted access and closed to season user rights (Okafor *et al.*, 2024). These factors affect access to utilisation and control the abuse and misuse of forest resources. The consumption pattern of forest resources in Nigeria have been estimated to be between 10-30% for households' materials. These exclude gum arabic, rattan canes, chew sticks and palm wine which are essentially produced for the market. By implication therefore, the bulk of the forest resources are produced for the market either at local, regional and national levels and their consumption is influenced by many socio-eco-cultural factors (Okafor *et al.*, 2024).

According to (Arabo, 2023), the history of man's dependence on natural forest resources for survival is as old as the origin of man. Thus, since ages, man has exploited forest resources for food, shelter and as a means of survival. However, improper Management of forest resources has led to decimation of biodiversity and loss of their values for the survival of mankind (Chado, 2024). The researcher further reported that there is a steady growth on the population of the communities around forest areas. However with the growing human population and challenge of providing food for the teeming population even reserved areas are being encroached. There is rapid depletion of the forest stock as a result of over dependence on the forest resources owing to growing human population. Amina, (2025) on the other hand posited that apart from population pressure, lack of indigenous people's participation in the conservation strategy has contributed to poaching, this is one of the major factor to depletion of the forest stock. People feel alienated from the conservation efforts as such develop apathy towards forest conservation.

Mohammed et.al (2022) emphasized that rapid population growth and the resultant anthropogenic activities have exerted great pressures on the natural forest resources. Most of these activities include agriculture, urbanisation, road construction, mineral exploitation, industrialization and among others are driving factors to forest resources depletion globally Shadarak *et al.*(2022) stressed that while the world population is rapidly growing, the world natural resources base has continued to be at a diminishing state leading to changes in every aspect of the natural environment.

## **6.0 Concept of Livelihood**

Livelihood comprises the capabilities, the assets (natural, physical, human, financial and social capital), the activities and the access to these (mediated by institutions and social relations), that together determine the living gained by the individual household (Borokani et.al, 2025). The Nigerian economy is basically agrarian, with most of the people living in below poverty line with inadequate access to social services and infrastructures (Bola and Francis 2024). Poverty commonly defined as the scarcity of human basic needs. In poor rural farmers, forest can be an integral component of development, contributing to sustainable livelihoods and enhancing social well-being. Forest has therefore, contributed significantly to food security, income generation, trades and improved living standards in many developing countries (Lasisi, 2022).

A livelihood is sustainable when it can cope with, recover from stresses and shocks as well as maintain or enhance its capabilities and assets both now and in future, while not undermining the natural resource base. On the other hand, poverty is a vicious cycle that keeps the poor in a state of destitution and utter disillusionment. Poverty is the main cause of hunger and malnutrition, which are aggravated by rapid population growth, policy inadequacies and inconsistencies or weak administrative capabilities, unhealthy food storage and processing techniques (Agwai, 2023).

There are four principal ways of acquiring livelihoods by the rural farmers. First is the production-based livelihood. A large proportion of the small and marginal farmers gain livelihoods through production on small plots of land. For these households, availability or access to inputs and improved methods of production are quite critical for their livelihoods. Second is the labour-based livelihood. Most of the small landholders and landless rural farmers derive livelihoods by selling their labour. For their livelihoods, demand for labour, wage rates and prices of food are the critical factors. Third is the exchange- or market based livelihood. The rural farmers that produce surplus

food and non-food agricultural products or non-farm goods earn their livelihoods by selling these surpluses in the market. The marketing system for these products and relative prices of what they sell and what they buy, affect their livelihoods. The fourth set of livelihoods is transfer-based entitlements. The households without any income-earning asset or able-bodied person to work depend on their livelihoods on transfers from the government or other social organizations. Government's social security and food assistance programmes are relevant for this group of rural farmers in fulfilling their livelihood requirements.

Climate-smart action improves rural livelihoods by increasing productivity, enhancing resilience to climate shocks, and reducing greenhouse gases. Adopting techniques like conservation agriculture, agroforestry, and drought-resistant crops boosts yields by 15–30% in areas like the Nile Basin, directly enhancing income and nutritional security.

### **6.1 Key Aspects of Climate-Smart Livelihoods**

- **Improved Productivity and Income:** CSA interventions, such as crop rotation, residue management, and the use of improved seeds, can increase yields significantly. For example, in Nigeria a study by Okafor, *et al.*, (2024) found that utilizing improved crop varieties and better soil management boosted household incomes.
- **Water Management and Resilience:** Techniques like rainwater harvesting, drip irrigation, and mulching are crucial in arid regions to manage water scarcity. These practices help farmers withstand drought, reducing crop failure risks.
- **Soil Health and Sustainability:** Practices like minimum tillage and, composting help maintain soil fertility, reducing reliance on costly chemical fertilizers.
- **Diversification and Livestock:** Integrating livestock with crop production (e.g., using manure for compost) improves farm efficiency, while as shown in this study, agroforestry adds new income streams.
- **Gender-Sensitive Approaches:** Research from Shadarak *et al.*(2022) indicates that addressing gender-specific barriers to adopting CSA is crucial, as women often face more

constraints but benefit significantly from improved according to this labor-saving techniques.

## **7.0 Policy Implications and Sustainable Forest Management**

According to Robert (2023), sustainable forest Management is the practice of regulating forest resources to meet the needs of society and industry while preserving the forest's health. The aim of sustainable forest Management is to strike a balance between the demand for the forest's natural resources and the vitality of the forest. Forest can be sustained by planting a new sapling for every tree that is removed. Proper practices of a forest must take into account the financial factors, which are assessed by a forest manager, or forester, who is the individual responsible for managing the balance of a forest's environmental, commercial, and recreational viability.

The sustainable of forest Management has become an issue in the past decade, out of concerns of both over-exploitation of the resource, and climate change effects on mankind (Robert, 2023). Sustainable Forest Management are difficult to define and when defined is hard to measure (Amina, 2025). According to Global Environmental Facility (GEF) (2023), there is no universally agreed definition for Sustainable Forest Practices (SFP). The GEF fully supports the definition, which indicated that sustainable forest Management is a dynamic and evolving concept that aims to maintain and enhance the economic, social and environmental value of all types of forests, for the benefit of present and future generations.

Robert (2023) further stressed that sustainable forest management in its broadest sense implies an ability for the productivity and ecological integrity of the forest to be maintained in perpetuity. This idea is conditioned on two different yet interacting scales as noted by Robert (2023) these include: sustainability over what time period, and over what size area? Mohammed (2022) defined sustainable forestry as comprising a host of practices regimes to maintain and enhance the long-term health and integrity of forest ecosystems and forest-dependent communities, while providing ecological, economic, social, and cultural opportunities for the benefit of present and future generations. This definition included the biological, sociological, political, and economic factors (Robert, 2023).

However, concerns from sustained forest yield to sustainable forest Management were first internationally initiated by (World Commission on Environment and Development, 1987) and later

taken as an idea at the Earth Summit in Rio de Janeiro in 1992, with the adoption of the Forest Principles (Robert, 2023). In response, several initiatives and international agreements have been forged to attempt to quantify broad-scale sustainable. Conceived sustainable forestry as meeting the needs of the present without compromising the ability of future generations to meet their own needs, they considered responsible forest practices to be sustainable forestry practices that are both economically and environmentally responsive. (Robert 2023) further stressed that one of the examples of sustainable forest Management that a forest manager might employ to avoid the complete removal of a forest is to use selective logging. Selective logging mean practice of removing certain trees while preserving the balance of the woodland. Selective logging is more time consuming and more expensive than clearing the trees, but it preserves the forest's assets. Another example of a sustainable forestry Management is allowing young trees to mature. Young tree may have value, its value will increase as it matures. Proper forest practices will take into account the potential value of trees and delay the harvest of immature trees. However, sustainable forest Management protect the long-term value of the forest. Other examples of sustainable forestry involve the planting of trees to extend forest lands, as well as the creation of protected forests that provide safe habitats for various plant and animal species, massive afforestation, control of excessive felling of forest trees, felling of only mature forest tree, planting two forest trees seedlings to replace one mature tree, controlling or restriction of bush burning, control or restrict excessive hunting of wild life in the forest, limit excessive harvesting of non-timber forest resources, practicing taungya and mixed farming, prolong fallow system, prune trees for wood and charcoal production instead of felling the entire forest tree.

## **8.0 Conclusion**

Climate-smart actions in forest resource management play a pivotal role in enhancing the livelihoods of the rural farming populace in North Central Nigeria. These strategies are essential for ensuring the sustainable utilization, conservation, and regeneration of forest resources while strengthening community resilience to climate change. For climate-smart forest management to achieve its intended impact as a key driver of national sustainability, deliberate efforts must be made to promote education and awareness along the entire value chain—from farm to forest to fork. Strengthening transparency and traceability systems, fostering cross-sectoral collaboration among stakeholders, and implementing regenerative forest management practices alongside nature-based solutions are critical components. Collectively, these measures will accelerate the

transition toward effective climate-smart forest resource management and significantly improve the socio-economic well-being of rural farming communities.

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