PRINCE ABUBAKAR AUDU UNIVERSITY, ANYIGBA, KOGI STATE, NIGERIA

15th

INAUGURAL LECTURE

AGROFORESTRY:
The Magic Bullet for Agricultural Land Degradation and Food Insecurity

By

FAITH ALADI SALE

Ph.D, M.Agric.Tech, PGDE, B.For
PROFESSOR OF AGROFORESTRY AND SILVICULTURE

Tuesday, 18th November 2025.

AGROFORESTRY: THE MAGIC BULLET FOR AGRICULTURAL LAND DEGRADATION AND FOOD INSECURITY

BY

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Being the text of the

15TH INAUGURAL LECTURE

Delivered

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Prince Abubakar Audu University, Anyigba, Nigeria

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PROFESSOR OF AGROFORESTRY AND SILVICULTURE

NATIONAL ANTHEM

Stanza I

Nigeria, we hail thee
Our own dear native land
Though tribe and tongue may differ
In brotherhood we stand
Nigerians all, are proud to serve
Our sovereign Motherland

Stanza II

Our flag shall be a symbol
That truth and justice reign
In peace or battle honoured
And this we count as gain
To hand on to our children
A banner without stain

Stanza III

O God of all creation
Grant this our one request
Help us to build a nation
Where no man is oppressed
And so with peace and plenty
Nigeria may be blessed

PRINCE ABUBAKAR AUDU UNIVERSITY ANYIGBA, ANTHEM

Prince Abubakar Audu University, you stand in strength and pride,
Showing the way for all who yearn
Standing firm in wisdom and truth
In unity we grow
Committed to imparting knowledge, skills and learning
To all who long for excellence
Prince Abubakar Audu University, the pride of the world
We honour your virtues

Table 1: Preceding Inaugural Lectures of Prince Abubakar Audu University, Anyigba

S/N	Inaugural Lecturers	Title	Date
1.	Professor Sunday S. Arogba	Phenolics: A Class of Nature's Chemical Weapons of Self-Preservation	26th August, 2008
2.	Professor Zacchaeus O. Apata	Unburdening the Colonial Burden: Lessons from History	17th August, 2010
3.	Professor Steve Metiboba, Jp	Matrimony between two Healthcare Systems: An Unholy Wedlock?	27th June, 2014
4.	Professor Stephen I. Ocheni	Accounting for Public Funds: The Leviathan of Government Bureaucracy	25th June, 2018
5.	Professor Eniolorunda A. Tai Oluwagbemi	Scientific Elegance and Political Naivety of Food and Wood Sufficiency In Nigeria: The Take of An Agroforester	28th June, 2018
6.	Professor Charles I. Oyewole	Coroner's Inquest: An autopsy of the Man with the Hoe	15th August, 2019
7.	Professor Odin Eboh Monday	Insanity and Life Pain Two Ancestral Curses: The Role of Village Herbalist	24th August, 2019
8.	Professor Jimoh Habibat Isah	The Geography of Erosion in Nigeria: An Explanation	30th August, 2019

9.	Professor Marietu Ohunene Tenuche	Neoliberalism: Forecasting Nigeria's Ungodly Romance with the East	29th September, 2020
10.	Professor James Omale	Remedy or Poison? Double –Edge Sword PARADOX of Alternative Medicine: The concern of Toxicologist.	11th March, 2021
11.	Professor Stephen Jimoh Ibitoye	If Agricultural Revolution is the Answer, What is the Question?	20th September, 2022
12.	Professor Eneojo Simon Attah	Intercropping: That there may be Enough Food	19th February, 2025
13.	Professor Cornelius Ojo Orishagbemi	Food Research Innovations as Panacea for Post-Harvest Losses, Food Security and Safety: Renown Contributions of a Certified Scientist	7th August, 2025
14.	Professor Daniel Friday Atidoga	The Annihillator's Sexual Intent: The Crime of Crimes and Demise of Tomorrow	13th September, 2025

PROTOCOL

The Vice-Chancellor
The Deputy Vice-Chancellor (Administration)
The Deputy Vice-Chancellor (Academic)
The Registrar
The Bursar
The University Librarian
Provost, College of Health Sciences
Dean, School of Postgraduate Studies
Dean, Faculty of Agriculture, other Deans and Directors
Heads of Departments and Heads of Units
Professors and Members of the University Senate
Academic and Non-Academic Staff
Chairman and Members of Inaugural Lecture Committee
Past Inaugural Lecturers
My Ph.D. Supervisor, Prof. T.O.S Kadeba
My Husband, Children and Siblings
My Family Members and Well-Wishers
Friends of the University
My Lords Spiritual and Temporal
Gentlemen of the Print and Electronic Media
Staff and Students of Forestry and Wildlife Department
Staff and Students of Faculty of Agriculture
Staff and Students of the University
Distinguished Ladies and Gentlemen

PREAMBLE

I count it a high privilege and honour to deliver the Fifteenth Inaugural Lecture of Prince Abubakar Audu University, Anyigba. The Second Female Inaugural Lecturer from the University and the First Female Inaugural Lecturer from Faculty of Agriculture. This lecture is the Sixth from the Faculty of Agriculture and the Second from the Department of Forestry and Wildlife to which I belong.

Inaugural Lecture, to my own understanding, is an academic exercise and a very important occasion in the ivory tower during which an academic occupying a Professorial Chair in his/her area of specialization, summarizes his or her research findings over the years and present same to an intellectual, interested audience and the larger society with the view of providing solution to the never ending societal problems.

My Professorial position at the Department of Forestry and Wildlife, Faculty of Agriculture, in this great citadel of learning did not come by accident, but by the divine grace of God Almighty. Jeremiah 1:5 of the Holy Scripture:

> ***Before I formed thee in the belly, I knew thee, and before thou came forth out of the womb, I sanctified thee and ordained thee a prophet (Professor) unto the nations (unto your generation).***

Consequently, my academic journey to this exalted chair began when I was a little child, crying to be allowed to follow my older sister and brother to school. These circumstances led my parents to enroll me in school at a very tender age. My passion for education is reflected in all aspects of my career, as I believed that without reading, dedication and commitment to study I would not succeed in life. This has exactly paid off, and that is why I am standing tall before you today to present this Inaugural Lecture.

Vice-Chancellor Ma, it may interest you to know my academic sojourn. I attended primary school from 1978 to 1984 at the Qua-Iboe Primary School, Ogugu. I proceeded to Ogugu Community Secondary School in 1985 and thereafter went to the Federal University of Agriculture, Makurdi in 1992 as a remedial student. By 1998, I finished my undergraduate programme with a Second Class Degree (Lower Division) in Forestry. Driven by my passion for academic excellence, immediately after my National Youth Service Corps (NYSC) in 2000, I proceeded to the Federal University of Technology, Akure and graduated in 2002 with Master of Agricultural Technology Degree. In 2003, I picked up a Ph.D form and bagged the higher Degree Certificate (Doctor of Philosophy) in 2009. I joined the service of Prince Abubakar Audu University, Anyigba, in 2002 as Graduate Assistant and rose steadily through all ranks to become a Professor of Agroforestry and Silviculture in 2018. I was the first female Agroforester in Nigeria and the fourth in the whole Africa.

Going Down Memory Lane

The Vice-Chancellor, I crave your indulgence to begin my lecture by going down memory lane and make a brief remark about my personal life and activities in this great Institution of learning, Prince Abubakar Audu University, Anyigba.

I was born into a family of seven, and I am the third born. My parents had six daughters and one son. My father, though not having a Western Education, knew the value of sending his children to school, irrespective of gender. My father, Late Elder Shaibu Oguche was a peasant farmer and made sure that all his children followed him to the farm even after returning from school. I happened to be the laziest among my siblings, and my father kept warning me that if I didn’t take my education seriously and I failed to do well academically, he would buy hoe and cutlass for me, so that I could follow him to the farm on daily basis. For the fear of becoming a full-time farmer, I developed interest and passion for education from a tender age, which then reflected in my educational pursuits.

Vice-Chancellor Ma, it may interest you to know that I was employed to the Department of Forestry and Wildlife in 2002. However, when I assumed duty and came for documentation, I was told the Department of Forestry and Wildlife did not exist in the Faculty of Agriculture, so my colleague and I, Mr. J.S. Alao, were housed in the Department of Crop Production in 2002 under the Headship of Mallam U.T. Tanko. In 2004, our files were moved to the Department of Animal Production at the directive of the then Dean, Faculty of Agriculture Prof. T.F. Balogun. I remained in the Department of Animal Production until I was promoted to Senior Lecturer in 2012. I was again deployed back to the Department of Crop Production, having waited patiently for Forestry and Wildlife programme to take off in the University.

Vice-Chancellor Ma, the long-awaited Department of Forestry and Wildlife had approval of the Senate of this great Institution in 2015. In October 2016, to be precise, I was appointed the pioneer Head of Department of Forestry and Wildlife by the then Vice-Chancellor, Prof M.S. Abdukadir. In December 2020, under the leadership of our dear Vice-Chancellor, Professor Marietu Ohunene Tenuche, Forestry and Wildlife programme after a successful NUC Resource Verification obtained approval of the National Universities Commission (NUC) to commence the programme in February 2021 and had full Accreditation Status in 2023.

My Service

The Vice Chancellor, Ma, Distinguished Ladies and Gentlemen, I have served this institution, the State and also gained recognition at National and International levels in the following capacities since my appointment in 2002 to date:

The pioneer and the current Head of Department of Forestry and Wildlife, Member, Prince Abubakar Audu University Senate; Member, Representation of congregation on senate of the then Kogi State University, Anyigba, Member Fifth and Sixth convocation committee of the university; Member Economic Tree Management Committee; Council Member Representation of Senate on the Governing Council of the University; Council member Senior Staff Disciplinary Committee (SSDC); Director Student Industrial Work Experience Scheme (SIWES); Coordinator Gender for Women Studies, Prince Abubakar Audu University, Anyigba, Chairman Joint Universities Preliminary Board (JUPEB), Chairman Entertainment Committee for the seventh convocation ceremony and the current President of Savanna Cooperative Thrift and Credit Society Limited, Prince Abubakar Audu University, Anyigba.

Others are: External Board member of the Governing Council of Kogi State College of Education, Ankpa (An appointment given to me by the then Governor of Kogi State, His Excellency Alhaji Yahaya Adoza Bello), Member, Technical Advisory Group (TAG) Committee of TETFUND, Coordinator, North Central, Forestry Association of Nigeria (FAN), Member, National Forestry Development Council, Life member and Fellow, Forestry Association of Nigeria, to mention a few.

I have also enjoyed the following appointments: Sabbatical Lecturer at Taraba State University (TSU), Jalingo, Undergraduate and Post Graduate External Examiners to the following institutions: Joseph Sarwuan Tarka University, Makurdi, Federal University of Technology, Akure, Federal University of Technology, Owerri, Federal University of Agriculture, Abeokuta, Bayero University, Kano, Federal University, Uyo, Federal University, Port Harcourt, Usmanu-Danfodio University, Sokoto, Modibo Adamawa University, Yola, University of Calabar, Chukwuemeka Odumegwu Ojukwu University, Uli, Nnamdi Azikiwe University, Awka, Federal University Wukari. Appointments as External Assessor to over fifteen applicants on Professorial Cadre from different Universities across the country. Panel member, Accreditation of Academic Programmes in Nigeria University Commission (NUC) and also appointment as Member of Accreditation Team, National Commission for Colleges of Education (NCCE).

NOW TO THE LECTURE

"AGROFORESTRY AS THE MAGIC BULLET"

1.0 INTRODUCTION

The Vice-Chancellor Ma, I will address the following issues in today's lecture: agroforestry as a magic bullet and an alternative land use option in efforts to overcome food shortages and land degradation. In discussing the potential of agroforestry systems, emphasis will be placed on the various processes by which agroforestry can enhance agricultural diversification/commercialization and further increase agricultural productivity.

1.1 Agroforestry Option

Agroforestry is the collective term for land-use systems and technology in which woody perennials (trees, shrubs, palms and bamboos, etc.) are used deliberately on the same land-management units with agricultural crops and/or animals in some form of spatial arrangement or temporal sequence. It is a land system in which trees or shrubs are grown in association with Agricultural crops, pastures or livestock. Cultivation of trees and agricultural crops in close combination is an ancient practice used by farmers worldwide.

Agroforestry can be viewed as a societal response, primarily driven by the need to meet immediate basic human needs for food, fuel, fodder, shelter, and protection. It involves the management and integration of trees, crops and/or livestock on the same plot of land and can be an integral component of productive agriculture. It may include existing native forests and forests established by landholders. It is a flexible concept that involves both small and large landholdings.

Scientifically, agroforestry is derived from ecology, and it is one of the three principal land-use sciences: the other two being Agriculture and Forestry. Agroforestry has much in common with intercropping (the practice of planting two or more crops on the same plot), with both emphasizing interactions among different plant species. Generally, both agroforestry and intercropping can increase yields and reduce operational costs.

Vice-Chancellor, Ma; it is pertinent to note that agricultural scientists in the tropics face the formidable challenge of increasing and sustaining food production on inherently erodible and infertile soils without external inputs. Also, it is pertinent to recall that when physicists faced similar frustrations about the state of matter some decades ago, they circumvented the problem by formulating the laws of thermodynamics. For example, when they faced the frustration of the inability to obtain energy from nothing, the law of conservation of energy, which states that energy in a closed system is constant, was proposed. I believe that Foresters, Soil Scientists and Agronomists took a cue from Physicists with the emergence of agroforestry as a new approach to tropical land management (Kadeba, 1998).

Agroforestry has been credited with the potential to address food insecurity and land degradation (Sale and Olujobi, 2014). The past two decades have therefore witnessed great interest in the development of agroforestry technologies characterized by relatively low input costs, high efficiency in the use of internal resources, and, hence, more sustainable production in both economic and ecological terms (Muthee *et al.*, 2022; Scholes *et al.*, 1994).

1.2 Soil Conservation and Improvement of Agroforestry

Soil degradation is a widespread and serious problem that continues to negatively impact the sustainability of agricultural production in Nigeria (Oke, 2001). Agroforestry is based on the premise that land-use systems which are structurally and functionally more complex than either crop or tree monocultures lead to greater efficiency in the capture and utilization of resources such as nutrients, light, and water and promote greater structural diversity, resulting in a tighter coupling of nutrient cycles (Nair, 2007). Research over the past two decades shows that three main tree-mediated processes determine the extent and rate of soil improvement in agroforestry systems. These are: increased N input through biological nitrogen fixation by nitrogen-fixing trees (NFTs); enhanced availability of nutrients resulting from production and decomposition of tree biomass; and greater uptake and utilization of nutrients from deeper layers of soils by deep-rooted trees (Nair *et al*., 2022; Buresh and Tian, 1998; Rao *et al*., 1998). Furthermore, the presence of deep-rooted trees in the system can improve soil physical conditions and increase soil microbial activity under agroforestry (Prasad *et al*., 2023; Buresh and Tian, 1988).

A considerable number of agroforestry experiments have been carried out, particularly in Southern Nigeria. Numerous studies have demonstrated the effectiveness of agroforestry in addressing soil nutrient depletion and environmental degradation issues related to the ozone layer (Ayilara *et al*., 2025; Akanwa *et al*., 2020; Kang *et al*., 1990; Juo *et al*., 1995; Adejuyigbe *et al*., 1998; Oke, 2012a; Oke, 2012b; Sale, 2009).

1.3 The Benefits of Agroforestry

Over the past two decades, numerous studies have examined the variability of agroforestry. The combined research has highlighted that agroforestry can reap substantial benefits, both economic and environmental, producing greater output and proving more sustainable than Forestry or agricultural monocultures. Agroforestry systems have already been adopted in many parts of the world. According to the Agroforestry Research Trust, agroforestry systems have the following benefits.

1. They can control runoff and soil erosion, thereby reducing water loss, soil material, organic matter and nutrients.
2. They can maintain soil organic matter and biological activity at levels satisfactory for soil fertility.
3. They can maintain more favourable soil physical properties than agriculture through organic matter maintenance and the effects of tree roots.
4. They can check the development of soil toxicities or reduce existing toxicities, including both soil acidification and salinization.
5. They utilize solar energy more efficiently than monocultural systems
6. They reduce insect pests and associated diseases.
7. They can be employed to reclaim eroded and degraded land.
8. Agroforestry can augment soil water availability to land use systems
9. Nitrogen-fixing trees and shrubs can substantially increase nutrient inputs to agroforestry systems.
10. The trees can probably increase nutrient inputs to the agroforestry system by retrieval from lower soil horizons and weathering rock

11. The decomposition of trees and pruning can substantially contribute to maintaining soil fertility.
12. In the maintenance of soil fertility under agroforestry, the role of roots is at least as important as that of the above-ground biomass
13. Agroforestry can provide a more diverse farm economy and stimulate the whole rural economy, leading to more stable farms and communities. Economic risks are reduced when systems produce multiple products.

2.0 SUSTAINABILITY CONCEPT IN AGROFORESTRY

2.1 Concern for Sustainability

The emphasis on sustainability stems from the increasing deterioration in environmental quality and associated processes, such as soil erosion and land degradation, and the loss of biodiversity, which are known to have adverse effects on agricultural productivity. Consequently, sustainable development has become a rallying point for diverse views of ecologists, economists, politicians, agriculturists, environmentalists, and non-governmental organizations. Thus, the term sustainability may mean different things to different people. A rigorous discussion of this concept lies outside the title of this lecture.

It would be appropriate to adopt the definition of sustainability according to the Consultative Group for International Agricultural Research (CGIAR). A sustainable agricultural production system is one that:

(a) Over the long term, it enhances environmental quality and the resource base upon which agriculture depends.
(b) Provides for basic human food and fiber needs.
(c) is economically viable; and

(d) enhances the quality of life for farmers and the society (Harmsen and Kelley, 2013).

2.2 Sustainability in the Context of Agroforestry

Agroforestry systems provide a range of services and products. No agroforestry system produces just one product or performs just one service. Therein lies the appeal of agroforestry: farmers can meet multiple needs through agroforestry systems while reducing the risks of market and ecological failure due to the system's increased diversity.

The diversity of outputs and the positive environmental attributes of trees enable agroforestry to fulfill many of the requirements of sustainable land use. In the context of agroforestry interventions, sustainability can be described as conserving soil, enhancing biodiversity, conserving carbon in terrestrial ecosystems, enhancing nutrient capture and retention (efficient nutrient cycling), and enhancing farmers' income.

3.0 AGRICULTURAL LAND DEGRADATION: A LARGE-SCALE CHALLENGE

Low-input agricultural systems on land with poor to moderate land resource potential are at the root of human-induced soil degradation in Africa. About 55% of Africa's land is desert or marginal land unsuitable for agriculture. Only 11% of the area spread among many countries has high-quality soil that can be efficiently managed to sustain more than double its current population (Eswaran *et al.*, 1997). Most (63%) of the remaining usable land has medium- and low-potential, with major constraints for low-input agriculture. These lands are at high risk of degradation under a low-input system.

Soil moisture is perhaps the overriding inherent constraint on land productivity, not only because of low and erratic precipitation but also because of soils' low water-holding capacity. Only 14% of the continent is relatively free of moisture stress (Fu *et al*., 2024). Soil phosphorus deficiency is widespread across regions and remains a major constraint on agricultural productivity. Soil fertility decline is associated with several simultaneous degradation processes that feedback on one another, producing a downward spiral in productivity and environmental quality. For example, as forests are cleared and put into low-input crop production, litter is inevitably produced. At the same time, tillage and other soil disturbances accelerate the decomposition of soil organic matter. These two factors lead to a decline in soil organic matter, which not only directly reduces retention of essential plant nutrients but also breaks down soil physical structure, thereby reducing water infiltration and storage capacity.

Low nutrient and organic matter inputs, along with poor crop management, contribute to poor crop growth, leaving the soil exposed to wind and water erosion. Finer soil particles, which contain most of the organic matter and nutrients, are then easily mobilized and transported by wind and water erosion to other parts of the landscape and into waterways, where they cause environmental damage. Large, costly inputs are then required to rehabilitate degraded soils and reverse environmental damage. Preventing these processes is cheaper than trying to repair the damage they cause.

The Global Land Assessment of Degradation (GLASOD), although based on expert opinion rather than direct field data, suggests that about 30% of the total agricultural, permanent pasture, forest, and woodland areas in Africa are affected by soil degradation. Approximately 65% of agricultural land, 31% of permanent pastures, and 19% of forests and woodlands are affected (Oldeman, 1994). About three-quarters of these degraded lands are in dryland regions, which also have the highest prevalence of extreme poverty. Desertification processes are believed to affect 46% of Africa, with 55% of that area at high risk; the worst-affected areas are along desert margins, affecting about 485 million people (Raich *et al*., 2001).

Human-induced soil degradation is the most fundamental natural resource management problem threatening Africa's development. Water (46% of area) and wind erosion (38%) are the most important processes, but soil chemical (12%) and physical degradation (4%) are also important (Oldeman, 1994; Oyun and Oguche, 2004). Chemical soil degradation includes nutrient loss, salinization, pollution, and acidification.

Soil fertility degradation, including soil organic matter depletion, affects 200 million hectares of cultivated land across 37 African countries. This situation is becoming increasingly recognized as a primary constraint to agricultural development (Sanchez *et al*., 1997; Conway, 2016). However, as noted above, these degradation processes are usually closely interlinked and must be managed in an integrated manner. The large variation in soil fertility across African landscapes, with the highest variability of ten at the smallest scales (within farms), poses additional challenges for diagnosing constraints and recommending improvements.

4.0 FOOD SECURITY SITUATION IN NIGERIA

4.1 Concept of Food Security

There are different definitions of food security in the literature. Food security is a situation in which all people, at all times, have physical, social, and economic access to sufficient, safe, and nutritious food that meets their dietary needs and preferences for an active and healthy life. This definition highlights the now generally accepted four dimensions of food security: food availability, food access, utilization and stability.

Carter and Barrett (2006) defined food security as the ability of food-deficient regions or countries, or households within these countries, to meet target levels of consumption on a yearly basis. It also always involves all people having access to enough food for an active and healthy life. Idachaba (2004) defined food security as the ability of individuals and households to meet their staple food needs year-round. It is also a situation in which everyone, at all times, have access to safe, nutritious food to maintain a healthy, active life.

The concept of food security initially focused on ensuring food availability and the price stability of basic foods, due to the extreme volatility of agricultural commodity prices and turbulence in currency and energy markets at the time. The occurrence of famine, hunger, and food crises required a definition of food security that recognized the critical needs and behaviour of potentially vulnerable and affected people. A deeper understanding of how agricultural markets function under stress conditions, and the challenges faced by at-risk populations in accessing food, led to the expansion of the FAO's definition of food security to include securing access to available supplies for vulnerable people; economic access to food became part of the concept of food security. Furthermore, there was an extension of the concept of food security to include: “access of all people at all times to enough food for an active, healthy life” in 1986 when the World Bank published its seminal report on Poverty and Hunger; and eventually became a human right issue in 1994 following the UN Development Programme’s Human Development Report (UN Development Programme, 1994).

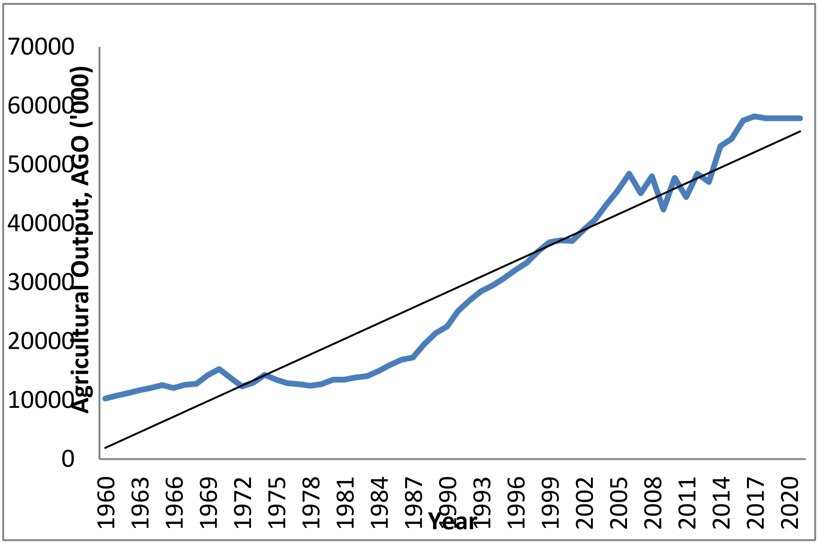
4.2 Food Security Situation in Nigeria

National food security exists when a country's residents have physical and economic access to sufficient, safe, and nutritious food at all times, enabling a healthy and productive life. Food and Agriculture Organization, FAO (2016) identified food availability, per capita food production, percentage of under-five who are underweight, percentage of under-five who are stunted, domestic food price volatility, and depth of food deficit as some of the key indicators of food security. Food availability and affordability are key objectives of any serious economy, as the survival of human beings, who in turn pilot the affairs of other sectors of the economy, depends on them.

In line with FAO's position and the need for food availability, Sale and Shaibu (2021) conducted a trend analysis and included agricultural output as one of the food security indicators in Nigeria. The author reported that Nigeria's agricultural output generally increased during 1960-2020 (Figure 1). However, in 1960-1969, the country's agricultural output was relatively low. This was attributed to poor planning and inefficient use of Nigeria's resources. Activities during this period led to a shift in taste, driven by the importation of new crops and by low demand for traditional crops such as local rice, yams, and cowpeas. This led to a reduction in crop production, despite the government's substantial subsidies for domestic production during that period.

The oil boom, which led to a naira inflow into the economy, also increased public sector wages and thus drained labour from rural areas, thereby depriving the agricultural sector of the much-needed manpower through migration. Furthermore, domestic industries were protected through tariff concessions, making it more lucrative to invest in industry rather than in agriculture. The country experienced an impressive increase in the mid-to-late 1980s to early 2000s. After some gradual growth, Nigeria's agricultural output rose sharply before 2015 and continued to increase after 2016. The increase in agricultural output has implications for food security, particularly food availability.

Figure 1: Graph of Nigeria's Agricultural Output, 1960 – 2020



Source: Sale and Shaibu (2021).

5.0 LINKAGES BETWEEN AGROFORESTRY AND FOOD SECURITY

Vice-Chancellor, Ma: A question may be asked: What is the business of a Forester in food production when the problem of wood production is to be satisfactorily addressed? There are compelling reasons for the involvement of Foresters:

- The problem of sustainable food production is so complex that it is beyond the capability of agronomists alone and cannot be solved unless people from other discipline work together.

- For over five decades, forestry through taungya afforestation has made a significant contribution to food production in the tropics by intercropping food crops with trees in the early stage of plantation establishment.
- In nearly all cases, forests are the ransom for poor crop husbandry as they bear the repercussions of unsustainable agriculture through further forest clearance and deforestation.
- More trees are needed on farmlands to sustain agricultural production and to avert fuelwood scarcity, which often adversely affects the nutritional status and health of rural farmers.
- By cultivating high-value trees on the farm, farmers can contribute directly to food supply and nutritional well-being, as well as provide income to purchase food or protect the agricultural base on which food production depends.
- Forest and farm trees contribute to food security and agriculture by preventing soil erosion, improving soil fertility, enhancing the quality and reliability of water supplies, and helping to ameliorate microclimates.

6.0 MY CONTRIBUTION

The Vice-Chancellor, Ma, I wish to showcase selected research efforts from my over seventy-two (72) publications in esteemed peer-reviewed journals and conference proceedings, either as a sole author or in collaboration with other colleagues in the fields of Agroforestry and General Agriculture. The crux of my research efforts is to improve crop productivity and ensure sustainable food production in support of food security through soil improvement.

My research activities for over twenty-three (23) years have been in all fields of agriculture and forestry, with a bias in agroforestry and silviculture. I have worked on various aspects of increasing crop yield, focusing on food and cash crops, soil improvement and management, farming household participation in agroforestry for livelihood. My evidence-based empirical contributions in these aspects can therefore be discussed under the following sub-headings:

6.1 Agroforestry and Improved Agricultural Productivity vis-à-vis Food Security

In agroforestry practice, the choice of species combination must consider compatibility between trees and companion crops to avoid interference and enhance productivity. The use of plant residues in a low-input soil fertility management system is often accompanied by improvements in crop production through their decomposition and the subsequent release of nutrients. Consequently, plant residues are used in agroforestry systems to protect soil from erosion, conserve moisture, and supply nutrients. In view of the above, Oguche and Kadeba (2004) evaluated the phytotoxic effects of *Gliricidia sepium* (Quick stick) and *Acacia auriculiformis* (Earleaf acacia) leaf mulch on early growth of maize. The authors found that the beneficial effect of nutrient addition during mulch decomposition explains why an increased rate of mulch application led to a corresponding increase in plant biomass and nutrient storage, provided the leaf mulch application rate did not exceed 10 t ha^{-1}.

Both economic and environmental concerns have led to renewed interest in legume residues as a source of Nitrogen (N) in agricultural systems to increase productivity and food security. One approach to manipulating plant residue quality is by mixing the pruning of high-quality plants with that of low-quality plants. Oyun and Oguche (2004) investigated the influence of litter quality and placement method on growth, nutrient storage, and yield of maize in a deficient soil in Akure, Nigeria. It was discovered that the maximum crop yields achievable using mineral fertilizer input can be approached or exceeded by optimizing the quality of organic nutrient sources. There was no significant difference ($P \geq 0.05$) in N storage between aboveground and belowground placement of mixed litter for all the phases of growth observed. However, the effect of plant residue application was significant ($P \leq 0.05$) in maize dry matter production.

The Vice-Chancellor, Ma, note that millet is an important cereal crop, alongside maize, wheat, and rice. It is a major food source for millions of people, especially those living in hot, dry areas of the world. It is grown mostly in marginal areas under agricultural conditions, e.g., with limited rainfall, and it is unsuitable for the cultivation of other cereals such as maize, wheat, and rice. The term "millet" is used primarily to refer to several types of small-seeded annual grasses belonging to five genera in the tribe *Paniceae - Panicum*, *Setaria*, *Echinochloa*, *Pennisetum*, and *Paspalum* and to one genus, *Eleusine*, in the tribe *Chlorideae*. There are many varieties of millet. The four major varieties are Pearl millet (*Pennisetum glaucum*), which constitutes 40% of total world production, Foxtail millet (*Setaria italica*), Proso millet or white millet (*Panicum miliaceum*), and Finger millet (*Eleusine coracana*).

In 2022, millet production in Nigeria was estimated at 2 million metric tons. Between 2005 and 2021, millet output in the country decreased significantly. The largest drop in production was registered in 2011, when the crop volume decreased by over 75 per cent compared to 2010. In contributing to the growth and productivity of millet in Nigeria, Sale (2013b) examined the effect of mulch of selected tree species on the growth and yield of millet (*Panicum miliaceum* L.) in Akure, Nigeria. Decomposition of plant residues may release secondary metabolites that can favourably or adversely affect other plants. The overall objective of the study was to find out if the decomposition products of leaf mulch of *Acacia auriculiformis*, *Eucalyptus citriodora*, and *Gliricidia sepium* have phytotoxic effects on the growth of millet. The field experiment was carried out at the forestry plantation site of the Teaching and Research farm of the Federal University of Technology, Akure, in the humid lowland of Southwestern Nigeria. The site was a plot of land that had been cropped previously, prior to the commencement of the study. The plot was divided into 45 plots; each plot was 2 m x 1 m, with 0.5 m borders between treatments. The plots were arranged in a complete randomized block design (RCBD). After ensuring adherence to scientific procedures, the collected data were subjected to analysis of variance (ANOVA) using the SPSS statistical package. Table 2 below presents the results of chlorophyll content measurements for the millet plant under field conditions.

Table 2: Effects of mulch from leaves of selected tree species on chlorophyll content of millet

Period	Mulch rate (t ha^{-1})	Chlorophyll content (mg/100g tissue		
		Acacia	**Eucalyptus**	**Gliricidia**
4 WAP	0	1.61[a]	1.61[a]	1.61[a]
	5.0	1.52[a]	1.59[a]	1.52[a]
	6.7	1.46[a]	1.51[a]	1.23[a]
	8.3	1.40[a]	1.04[a]	0.98[b]
	10.0	1.21[b]	1.10[b]	1.12[b]
8 WAP	0	2.45[a]	2.45[a]	2.45[a]
	5.0	2.34[a]	2.25[a]	2.68[b]
	6.7	2.28[a]	2.79[b]	2.73[b]
	8.3	2.41[a]	2.84[b]	2.95[b]
	10.0	2.31[a]	2.97[b]	3.04[b]

Values are means of three replicates; means with the same superscripts in column are not significantly different ($p \geq 0.05$). WAP = Weeks After Planting

The application of different rates of *Acacia, Eucalyptus,* and *Gliricidia* leaf mulch on millet dry matter yield is presented in Tables 3, 4, 5, 6, and 7. These Tables also show dry matter yields at different growth stages (2, 4, 6, and 8 weeks after planting).

Table 3: Effects of *Acacia, Eucalyptus* and *Gliricidia* leaf mulch on dry weight (g/plant) of millet at 2 WAP under field conditions

Much rate ($t\ ha^{-1}$)	Dry weight (g/plant)		
	Acacia	*Eucalyptus*	*Gliricidia*
0	0.83^{a}	0.88^{a}	0.96^{a}
5.0	1.11^{a}	1.03^{a}	1.09^{a}
6.7	1.17^{a}	1.25^{a}	1.31^{a}
8.3	1.22^{a}	1.12^{a}	1.21^{a}
10.0	1.19^{b}	1.22^{a}	1.32^{a}

Values are means of three replicates; means with the same superscripts in column are not significantly different ($p \geq 0.05$). WAP = Weeks After Planting

Table 4: Effects of *Acacia, Eucalyptus* and *Gliricidia* leaf mulch on dry weight (g/plant) of millet at 4 WAP under field conditions

Much rate ($t\ ha^{-1}$)	Dry weight (g/plant)		
	Acacia	*Eucalyptus*	*Gliricidia*
0	9.15^{a}	9.01^{a}	8.86a
5.0	8.95^{ab}	8.63^{ab}	7.58^{ab}
6.7	8.57^{ab}	8.59^{ab}	8.52^{ab}
8.3	8.43^{ab}	8.16^{ab}	6.98^{b}
10.0	7.78^{b}	7.97^{b}	7.11^{b}

Values are means of three replicates; means with the same superscripts in column are not significantly different ($p \geq 0.05$) WAP = Weeks After Planting

Table 5: Effects of *Acacia, Eucalyptus* and *Gliricidia* leaf mulch on dry weight (g/plant) of millet at 6 WAP under field conditions

Much rate ($t\ ha^{-1}$)	Dry weight (g/plant)		
	Acacia	*Eucalyptus*	*Gliricidia*
0	23.28^{a}	24.68^{a}	24.08^{a}
5.0	29.02^{ab}	31.69^{b}	32.79^{b}
6.7	33.15^{b}	37.40^{c}	46.83^{c}
8.3	41.84^{c}	41.95^{cd}	51.52^{c}
10.0	45.07^{c}	48.32^{d}	60.71^{d}

Values are means of three replicates; means with the same superscripts in column are not significantly different ($p \geq 0.05$) WAP = Weeks After Planting

Table 6: Effects of *Acacia, Eucalyptus* and *Gliricidia* leaf mulch on dry weight (g/plant) of millet CC under field conditions

Much rate ($t\ ha^{-1}$)	Dry weight (g/plant)		
	Acacia	*Eucalyptus*	*Gliricidia*
0	32.39^{a}	32.59^{a}	34.44^{a}
5.0	37.53^{ab}	39.53^{ab}	42.30^{a}
6.7	40.24^{bc}	45.31^{bc}	56.03^{b}
8.3	47.92^{cd}	52.92^{c}	62.39^{b}
10.0	56.74^{e}	64.74^{d}	74.10^{c}

Values are means of three replicates; means with the same superscripts in column are not significantly different ($p \geq 0.05$) WAP = Weeks After Planting

Table 7: Dry matter yield of millet panicle as influenced by *Acacia, Eucalyptus* and *Gliricidia* leaf mulch at 8 WAP under field conditions

Much rate (t ha^{-1})	Dry weight (g/plant)		
	Acacia	*Eucalyptus*	*Gliricidia*
0	42.97^{a}	42.63^{a}	41.39^{a}
5.0	31.67^{ab}	43.96^{a}	38.44^{a}
6.7	32.82^{b}	30.36^{b}	33.86^{b}
8.3	44.71^{a}	35.93^{c}	34.31^{b}
10.0	41.55^{a}	37.50^{c}	32.10^{b}

Values are means of three replicates; means with the same superscripts in column are not significantly different ($p \geq 0.05$) WAP = Weeks After Planting

At two weeks after planting (WAP), the treatment did not affect dry weight accumulation; however, after four weeks of growth, treatment plots that received 10.0 t ha^{-1} of leaf mulch showed a significant decrease in dry weight. From 4 to 8 weeks, biomass increased with increasing amount of applied mulch in all three species. The inhibitory effect of the mulch was confined to the early growth stage (4 WAP). From thereon, the effects of phytotoxicity waned, and the plant responded by accumulating dry matter. As the amount of mulch increased, the rate and amount of dry matter accumulation increased, and they were highest in plots that received *Gliricidia* leaf mulch. Under field conditions, the rate of mulch decomposition was primarily dictated, among other factors, by environment and mulch quality. The decomposition process is normally accompanied by the release of both nutrients and phytotoxic products. Furthermore, the occurrence of phytotoxic interference of leaf mulch with chlorophyll content appeared to have been associated with early stages of millet growth. The study's outcome demonstrated an appreciable and variable degree of phytotoxicity in the mulch species toward the millet plant, as evidenced by chlorophyll content and growth. It was established that the severity of phytotoxicity interference followed this order: *Gliricidia, Eucalyptus, and Acacia*.

6.2 Agroforestry and Soil Improvement

The Vice-Chancellor, Ma, most Nigerian soils, especially those in the humid forest region of the country, are susceptible to nutrient depletion under intensive farming due to their low buffering capacity. High crop yields can be achieved with judicious fertilizer use. The availability and accessibility of fertilizer to smallholder farmers remain a major bane. It has been established that legumes have the capacity to provide nitrogenous fertilizer through bacteria that are found in the nodules of roots. Consequently, integrating nitrogen-fixing trees into agricultural systems can make a major contribution to restoring soil fertility. Following this, Sale (2013a) conducted a study on soil fertility replenishment using leguminous trees in the humid forest region of Nigeria. The study focused on the effects of Nitrogen Fixing Trees (NFTs) [*Leucaena leucocephala* plot (LLP), *Acacia auriculiformis* plot (AAP), *Gliricidia sepium* plot (GSP)], and a non-nitrogen fixing, *Gmelina arborea* plot (GAP)] on the soil in which they grew as compared to a cultivated farm plot (CFP) as the control. It was observed that NFTs can improve degraded soils by decreasing bulk density and increasing moisture retention (water-holding capacity), benefiting companion and subsequent tree crops. The greatest potential for increased forest productivity lies with enhanced nitrogen fixation on forest sites, to alleviate the need for fossil fuel-manufactured fertilizers. NFTs were found to be ecologically significant in providing nitrogen to natural habitats.

The Vice-Chancellor, as you are aware, Prince Abubakar Audu University has a greenhouse. Greenhouses are used extensively for both research and teaching. It provides facilities and support for the production of agronomic, horticultural, ornamental, and forest plants. In 2015, Sale *et al* conducted a study at the Prince Abubakar Audu University greenhouse in Anyigba to investigate the influence of soil from three locations and different watering regimes on early growth characters of *Moringa oleifera* in the Southern Guinea Savannah region of Nigeria. The crux of the study was to identify the best soil location and watering regime for the propagation of *M. oliefera*. This was paramount, given the crop's relevance to mankind. It may interest you to know, the Vice-Chancellor Ma that the *M. oliefera* propagated through both sexual and asexual means was found to have low demand for soil nutrients and water, making its production and management easy. The incorporation of the plant into the agricultural land-use system benefited both the owner (farmer) and the surrounding ecosystem. Furthermore, the demand for these plant products has been on the rise in recent times due to their medicinal properties.

Sale *et al*. (2015) adopted a 2x3 factorial experiment in a Completely Randomized Design (CRD). Soils were obtained from the Prince Abubakar Audu University Animal Production and Research Farm (SL_1), Prince Abubakar Audu University Students Research and Demonstration Farm (SL_2) and Prince Abubakar Audu University Faculty of Agriculture (SL_3), while watering regimes were once and twice daily, including the control (WR_1, WR_2 AND WR_0). Thirty-six pots were used as replicates for each treatment, and seedlings were transplanted for the 10 weeks the experiment lasted. The parameters measured were plant height, stem diameter, and leaf number. The collected data were subjected to a one-way analysis of variance (ANOVA) for a CRD. Fisher's Least Significant Difference was used to separate the significant mean differences. We found that soil location was less significant for early growth characters, as there were no significant differences among soils from the three locations. However, watering regimes were found to be significant ($P < 0.05$) for some growth parameters; the number of leaves showed the best yield for vegetative growth, while WR_0 showed the least yield.

6.3 Agroforestry and Household Welfare

Vice-Chancellor, Ma; recent statistics shows that over 7 million people in Nigeria are facing acute food insecurity, and about 133 million people are multidimensionally poor; a larger percentage of this population depends on agriculture for their livelihoods. Expectedly, to meet the global demand for food, which is to increase by 60% in 2050, agricultural production must increase by 70–100% and most of this will be sourced from smallholder farmers in rural areas (FAO–WFP, 2018). The concept of food security in Nigeria could go simultaneously with poverty alleviation. Essentially, to alleviate poverty and its multiplier effect on food security, there is a need to improve agricultural production and productivity. One potential option to increase production and productivity is agroforestry. The contribution of agroforestry to household food security cannot be overemphasized. Participation in agroforestry services offers various benefits. Although rural households have been practicing agroforestry, attempts to empirically assess the level of participation and to quantitatively determine the relationship between this participation and food security status have not been thoroughly examined.

Consequently, Sale and Shaibu (2020) established the nexus of participation in agroforestry and food security status among rural households in Kogi State, Nigeria. This study adopted the survey research design. A multistage sampling procedure was used to select 240 rural households for the study. Primary data obtained through questionnaire administration were analyzed using descriptive statistics, the food security index, and chi-squared statistics. The food security line was estimated as two-thirds of the mean per capita monthly expenditure of all respondents. Households were then classified into food-secure and food-insecure groups based on the food security line. The formula is given as;

$$FS_i \frac{per\ capita\ of\ food\ expenditure\ for\ ith\ household}{\frac{2}{3}\ mean\ per\ capita\ of\ food\ expenditure\ of\ all\ households}$$

The chi-squared statistic used in this study is given as:

$$X^2 = \sum(F_O - F_e)^2 / F_e$$

Where X^2 = chi-square calculated value; F_O = observed frequencies in each cell; F_e = expected frequencies in each cell; $\sum$ = summation.

Findings from the study above revealed that most of the rural households in the study area, 158 (65.8%), planted economic trees on their cropland. During the discussion, it was observed that a larger proportion of the respondents who planted trees on cropland planted cashew trees and oil palms. The purposeful planting of these trees could be associated with their income-generating capacity. Presently, Kogi State is one of the leading producers of cashew nuts and oil palm. The results further show that 102 respondents (42.5%) planted trees along their farm boundaries. Aside from its economic implications, these trees serve as a mark or symbol to differentiate one's farmland from another. Oil palm tree was mostly used for this purpose by rural households in the study area. This finding was associated with the fact that the study area is not totally prone to soil erosion. It was also revealed that a few (4.6%) of the respondents planted trees and grass in rows on their farms alongside crops. The practice of integrating crop, livestock, and tree planting was also very low among respondents (1.3%).

The food security index, which is the per capita food expenditure for the ith household divided by two-thirds of the mean per capita food expenditure of all households, was used by Sale and Shaibu (2020) to determine the food security status in the study. The result (Table 8) reveals that the monthly mean per capita food expenditure for the total household was ₦4,092.75, and the two-thirds mean per capita food expenditure for all households was ₦2,728.50.

Table 8: Food security status of rural households in Kogi State

Food security status	Frequency	Percentage
Food insecure	163	67.90
Food secure	77	32.10
MPCHHFE/month ➔₦4,092.75		
FSL ➔ ₦2, 728.50		

Source: Sale and Shaibu (2020)

MPCHHFE = Mean Per Capita Household Food Expenditure.
FSL = Food Security Line (NOTE: FSL = [2/3 (MPCHHFE)]).

Using the mean per capita household food expenditure, the selected households were divided accordingly. The findings show that 32.1% of the sampled households had per capita food expenditure equal to or greater than 2/3 of the mean per capita food expenditure, while 67.9% fell below the line. This implies that most (67.9 %) of the rural households in the study area were food insecure. The Chi-square analysis on the relationship between rural household participation in agroforestry activities and their food security status is presented in Table 9. In applying this technique, the assumption of independent observations was not violated. Hence, all the included variables were categorical. Depending on the number of agroforestry activities engaged in, the respondents were grouped into three broad categories: high participation (involvement in more than 3 agroforestry activities), medium participation (involvement in 3–2 agroforestry activities), and low participation (involvement in 1 agroforestry activity or none). Aside participation level, the Chi-square model included age, gender, education, and marital status.

Table 9: Participation in agroforestry activities and food security status

Variable	Df.	Chi-Squared Value	P_value	Decision
Participation level	2	5.679	0.050	Significant @ 5%
Age	2	24.395	0.000	Significant @ 1%
Sex	1	24.068	0.000	Significant @ 1%
Education	1	25.331	0.000	Significant @ 1%
Marital status	1	0.688	0.407	Not Significant

Source: Sale and Shaibu (2020)

The results in Table 9 showed a significant relationship between the selected variables and rural households' food security status, except for marital status, which was not significant at the level of measurement. The Chi-square value for participation level was significant at the 5% level of confidence (95%). This implies an association between rural households' participation in agroforestry activities and their food security status. A similar association was found between age, gender, and education and the household's food security status. Respondents' age, gender, and education showed a very strong association with food security status compared with participation in agroforestry activities. Indicatively, household participation in agroforestry activities contributes substantially to rural households' food security. Rural households with high participation in agroforestry activities are more food-secured than households that do not participate.

Vice-Chancellor Ma, it may interest you to know that food insecurity is not limited to rural areas. *The rich also cry!* As a coping strategy to address food insecurity in urban areas, there appears to be an increasing level of participation in agricultural production among urban dwellers. Urban Agriculture (UA) involves the production of food and non-food items within urban areas and their peripheries, for home consumption and/or the market. It is also the practice of producing vegetables, fruits, and other food within the urban environment for household consumption. A major function of urban agriculture is food supply and income generation in the cities. UA has become a contemporary trend, gaining prominence especially in developing nations, as it has been found to be a viable poverty-reduction strategy for the urban poor.

Access to adequate food is the most challenging situation facing urban dwellers in Nigeria, and in Kogi State in particular. High inflation, food price hikes, instability, and relatively low wages for income earners have left the average urban Nigerian vulnerable to food insecurity. Consequently, Ibitoye *et al.* (2016) assessed the influence of urban agriculture on household income in Kogi State, Nigeria. The study adopted the descriptive survey design. A multistage sampling technique was used to select 120 urban farmers. Primary data obtained through questionnaire administration were analyzed using descriptive statistics, the Ordinary Least Squares (OLS) regression model, and Likert-scale mean scores. The regression result revealed that urban farm income increases household income at a 10% level of significance. Urban farmers were, however, constrained by inadequate capital, poor extension services, and the high cost of labour.

The Vice-Chancellor, Ma, note that forest fruits play an important role in ensuring adequate nutrition. The world has moved beyond the availability of calories as the most important issue in addressing global hunger; food quality, vis-à-vis nutrition security, is currently on the front burner. By providing many essential micronutrients, forests products help improve the physical and mental well-being of rural and urban dwellers. For instance, many trees are rich in oilseeds, edible leaves, and fruits. All of which are sources of vitamins. *Parkia biglobosa* and *Prosopis africana,* whose seeds could be processed into a dish condiment and rich in Vitamin A. This vitamin is essential to prevent nutritional blindness. *Treculia africana, Spondia mombin, Chrysohylum albidum, Irvingia gabonensis,* among others, serve as sources of Vitamin C.

At an International gathering of the Organization for Women in Science for the Developing World (OWSD) held in Kenya, Nairobi, Sale (2015) presented a paper titled "Forest Development: A Sub-Sector of Agriculture as Agent of Food Security and Wealth Creation." In that paper, I x-rayed the vital and indispensable role of forestry in enhancing food security. Also, according to Sale, (2024) the indigenous tree species such as: *Vitellaria paradox* (Shea tree), *Irvingia gabonensis* (Bush mango), *Adansonia digitata* (Baobab), *Dacryodes edulis* (African pear), *Tamarindus indica* (Tamarind) and *Mangifera indica* (Mango) are usually retained or planted in agroforestry system. Multiple harvests of these species at different times of the year are made possible by the various agroforestry system components. Agroforestry as magic bullet improves the availability of fuelwood, raises food output and hence ensures food security, enhances soil fertility, enhances biodiversity and benefits animals and ecosystems, amongst other benefits.
A significant direct contribution of forests to the food supply comes from wildlife. In many areas, small rodents, birds, snails, and insects, as well as larger animals, make up a much more important part of the human diet. In Ghana, approximately 75%

of the population regularly consumes wild animals; in Liberia, 70%; and in Botswana, 60%. In the Peruvian Amazon, more than 80% of animal protein is obtained from bush meat, and the national average of bush meat consumption in Peru is 41% (Ojo *et al*., 2008; FAO, 1989).

7.0 CONCLUSION

It is no gainsaying that smallholder farmer in sub-Saharan Africa and Nigeria face land degradation, food insecurity, low livelihoods, declining crop productivity, and unsustainable production practices, among others. These problems can be attributed to complex interactions of soil properties. Soil fertility depletion and land degradation remain the major setbacks to achieving self-sufficiency in food production. Consequently, it is advocated that investment in soil fertility replenishment and the intensive use of agroforestry trees as nitrogen fixers are crucial ingredients for transforming smallholder farms into productive and sustainable enterprises. Besides producing high-value products that meet farmers' needs, agroforestry trees can also be vital for replenishing soil fertility, thereby guaranteeing food security. Agroforestry systems have the potential to meet multiple objectives—soil improvement and increased production —by reducing costs or increasing benefits have been discussed.

Consequently, the services that agroforestry systems perform can be tailored to the specific needs of farmers across a wide spectrum of landscapes, ecological zones and socioeconomic conditions. Apparently, the most important challenge of agroforestry is food security. During this lecture, Vice Chancellor Ma, I have drawn attention to my evidence-based studies which showed that:

- Improved agroforestry systems in Nigeria can contribute to farmers' welfare, agricultural productivity and sustainability.
- Improving farmers' welfare and crop productivity guarantees food production, encompassing poverty alleviation, increased income, food and nutritional security.
- Improving environmental sustainability encompasses replenishing soil fertility, enhancing biological diversity, sequestering carbon, and reducing greenhouse gas emissions.

8.0 RECOMMENDATIONS

1. Government and relevant stakeholders should work to intensify and diversify land use through agroforestry. Farmers should be encouraged to deliberately incorporate trees into their farming systems. Such trees should be planted along the farm boundaries, in rows within the farm, or scattered across the farm.
2. Techniques being developed to convert indigenous wild species into domesticated, high-yielding components of agroforestry systems should be refined.
3. Greater priority should be given to developing a wide range of agroforestry systems that make effective use of trees and shrubs, including fruit trees and plantation crops, in integrated production systems with food crops.
4. Government and relevant actors should prioritize the incorporation of agroforestry in academic programmes in Universities and Colleges of Agriculture to enable them produce graduates capable of developing, disseminating and implementing agroforestry practices.

5. There should be informed linkages among institutions involved in education, research, and extension in agroforestry and related land-use fields.
6. The Agricultural Development Project (ADP) in each State and the FCT should empower Forestry extension workers to disseminate research findings from institutions. Consequently, such extension staff should undergo regular training and retraining to equip them with up-to-date skills on modern agroforestry practices.

9.0 ACKNOWLEDGEMENT

The Vice-Chancellor Ma, "I returned, and saw under the sun, that the race is not to the swift, nor the battle to the strong, neither yet bread to the wise, nor riches to men of understanding, nor yet favour to men of skill, but time and chance happened to them all", (Ecclesiastes 9:11). It is often paraphrased as "the race is not for the swift" to mean that success in life does not always go to the fastest or the strongest, but it is influenced by timing, circumstances, and God's providence. Therefore, I return all Glory, Honour, Adoration and Praise to my creator, God Almighty, the maker of heaven and earth.

I acknowledge my parents, Late Elder Shaibu Oguche and Mrs Daina Awa Shaibu, for the discipline, love, sacrifices, outstanding parentage, and the good moral values instilled in me. May your souls continue to rest in peace!

I would like to extend my special appreciation to my role model, my mentor, the incumbent Vice-Chancellor of Prince Abubakar Audu University, Anyigba, Prof. Marietu Ohunene Tenuche, for this uncommon opportunity and for presiding over my Inaugural Lecture today. All former Vice-Chancellors of this great University contributed to my academic development during their tenures. I acknowledge Prof. S. K. Okwute, who appointed me as Graduate Assistant, Late Prof. F.S. Idachaba, Prof. H.S. Isah, and Prof. M.S. Abdulkadir, who announced my promotion to the rank of Professor.

I am profoundly grateful to the incumbent Dean of the Faculty of Agriculture, Prince Abubakar Audu University, Anyigba, Prof. A.E. Agahiu, and all the past Deans for their support at various times during their Deanships.

I thank all my friends and colleagues in the Faculty of Agriculture and across the University, too many to mention, for their support and friendliness. I am grateful to all my colleagues in the Department of Forestry and Wildlife: Prof T.E. Oluwagbemi, Dr. S.O. Opeyemi, D.O. Popoola, F.O. Iyagin, J.I. Alfa, S.O.S. Jatto, N. Shaibu, and all Non-teaching staff, most especially Mr. Micheal Eyinade and Juliana Jacob, for their understanding and cooperation.

My appreciation goes to all staff of the SIWES Unit of Prince Abubakar Audu University, Anyigba and to the Director and members of the JUPEP Board for their cooperation.

I acknowledge and appreciate all members of the Savanna Cooperative Society for entrusting their resources in my care. Thanks for your presence.

My profound gratitude goes to my Ph.D. and M. Agric. Tech supervisors, Profs. T.O.S Kadeba, M.B. Oyun, D.O. Oke, and. B. Ajayi for their support and mentorship. I also thank my Late B. Forestry supervisor, Late E.O. Okefiena, for laying the foundation of my professional career. To all my teachers/tutors at primary and secondary school levels, I extend my sincerest gratitude.

I extend my gratitude to all my project students in PAAU and students from other Universities. I thank all students of the Department of Forestry and Wildlife at the Prince Abubakar Audu University, Anyigba, for making themselves available for mentorship, which has contributed immensely to my present academic feat.

I appreciate the presence of the President and members of the National Association of Women in Academics (NAWACS), PAAU, Chapter for honouring this invitation. I appreciate all my secondary school mates at Ogugu Community Secondary, Ogugu, Olamaboro Local Government Area, Kogi State (1989 set), and my postgraduate course mates for their support and encouragement. Worthy of mention are: Mrs. Abigail Abba, Mrs Martha Okpe, Late Mrs. Mary Mamodu, Late Daniel Akoh, Profs. E. Dishan, A.G. Adedayo and J.O. OluJobi.

Throughout my career, I have been honoured with several research grants, including Agroforestry and Natural Resources Education (ANAFE), Tertiary Education Trust Fund (TETFUND), Institutional-Based Research (IBR) grants and National Research grants (NRF), which have significantly contributed to my academic achievements.

I appreciate my friends, sisters, and brothers within and outside Kogi State who believed in me and supported my academic dream and career. Notable among them are Elder Yunusa Agada, Profs. Francis Agbidye; Kayode Ogunsowo; Umar Buba Nformi; Sabo Zaku; Anthony Ibe; S.I Udofia; Albert Abegunde; Olagunju John Olujobi; Adesoji Gideon Adedayo; Usman Ogbo; Muhammed Kabir Ibrahim; Alhaji Dayo Adewumi; Late Prof Ibrahim Omale, Mrs Mary Ibrahim Omale; Dr. (Mrs) Magareth Omada; Mrs. Racheal Oshanisi; Mrs. Ojochide Ebikwo; Mrs. Joy Ahiaba, Dr. Sukunmi Kolapo; Mr. Anthony Ijaja, Mr. M. Amodu, Mr. John Idachaba, Mr. Ishaq Yumusa;

Mr. Illeasu Musa; Dr. (Mrs) Pauline Ann Baba; Mr Ruben Ejigbo; Pastor and Deaconess Eric Chukwu; Bar. And Mrs. Godon Esa. The good Lord bless and reward you all.

I acknowledge my brother and sisters; Pastor S.S. Oguche and his wife, Mrs. M.S. Umoru and her late husband, Mr and Mrs G.E. Ochai, Mrs J. John, Mrs. J.U. Adoyi, and Mrs P.E. Abah and their husbands and all their children for the love they have extended to me and my family and for finding time to celebrate with us. I thank you all.

I acknowledge my extended family members and my In-laws, Elder D.A. Adejoh, Elder Abu Christian, Bar. S.U. Oguche, Engr. Abuh Salifu and their dear wives, Pastor Grace Okpeke, Bar. R.R. Andrew-Adejoh, Mrs Fatima Philip, Mrs Veronica. U. Musa, Mrs Ruth Ajuma Sule, and their husbands, for their love and prayers. I say a big thank you.

I extend my heartfelt appreciation and gratitude to my Chaplain, Pastors, and Spiritual mentors who are present: Evangelist Tokunbo Salami, Pastor. Sam Omede and Pastor Moses Afolabi (Chapel of Restoration, PAAU, Anyigba) and their wife. I thank you for your prayers and support. I appreciate all the Restored Women of Chapel of Restoration, Anyigba, and the entire congregation for honouring my Invitation.

I appreciate Dr. U.M. Shaibu and Ameh Louis, for your support and encouragement in putting this Lecture together. The Lord bless you immensely.

I sincerely and openly appreciate the support of my dear husband, Ass. Professor John Friday Sale for being a strong pillar of support. I particularly appreciate your understanding, thanks for holding the fort during my numerous travels and burning the midnight candle. I salute you, Sir. Thank you for *training my hands to war*. I thank God Almighty for the blessings of his fruits arising from our union: Bar.

Miracle Ojochegbe, Favour Ojomideju, Shalom Ojoma and Divine-Wisdom Ojonegon. I thank you all for your understanding and I appreciate the love we share. You all are my source of inspiration.
My Vice-Chancellor Ma, distinguished guests, ladies and gentlemen,

I thank you all for listening.

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