UNIVERSITY OF PORT HARCOURT

FORESTS FOR REST FOREVER

An Inaugural Lecture

By

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ORDER OF PROCEEDINGS

2.45P.M. GUESTS ARE SEATED

3.00P.M. ACADEMIC PROCESSION BEGINS

The procession shall enter the Ebitimi Banigo Auditorium, University Park, and the Congregation shall stand as the procession enters the hall in the following order:

ACADEMIC OFFICER
PROFESSORS
DEANS OF FACULTIES/SCHOOL
DEAN, SCHOOL OF GRADUATE STUDIES
PROVOST, COLLEGE OF HEALTH SCIENCES
LECTURER
AG. REGISTRAR
COORDINATOR ACADEMIC AFFAIRS
AG. VICE CHANCELLOR

After the Ag. Vice-Chancellor has ascended the dais, the congregation shall remain standing for the University of Port Harcourt Anthem.
The congregation shall thereafter resume their seats.

THE AG. VICE-CHANCELLOR'S OPENING REMARKS.

The Ag. Registrar shall rise, cap, invite the Ag. Vice-Chancellor to make his opening remarks and introduce the Lecturer.
The Lecturer shall remain standing during the Introduction.

THE INAUGURAL LECTURE

The Lecturer shall step on the rostrum, cap and deliver his Inaugural Lecture. After the lecture, he shall step towards the Ag. Vice-Chancellor, cap and deliver a copy of the Inaugural Lecture to the Ag. Vice-Chancellor and resume his seat. The Ag. Vice-Chancellor shall present the document to the Registrar.

CLOSING

The Ag. Registrar shall rise, cap and invite the Ag. Vice-Chancellor to make his Closing Remarks.

THE AG. VICE-CHANCELLOR'S CLOSING REMARKS.

The Ag. Vice-Chancellor shall then rise, cap and make his Closing Remarks. The Congregation shall rise for the University of Port Harcourt Anthem and remain standing as the Academic [Honour] Procession retreats in the following order:

AG. VICE CHANCELLOR
COORDINATOR ACADEMIC AFFAIRS
AG. REGISTRAR
LECTURER
PROVOST, COLLEGE OF HEALTH SCIENCES
DEAN, SCHOOL OF GRADUATE STUDIES
DEANS OF FACULTIES/SCHOOL
PROFESSORS
ACADEMIC OFFICER

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- Visiting Academics and Colleagues
- Esteemed Administrative Staff
- Captains of Industries
- Cherished Friends and Guests
- Unique Students of UNIPORT
- Members of the Press
- Distinguished Ladies and Gentlemen.

DEDICATION

This inaugural lecture is dedicated to my parents - Pa Ezra Adebiyi Aiyeloja and Madam Comfort Titilayo Aiyeloja.

and

My Father-in-Law, Pa Richard Agie

They joined the Saints triumphant 11 years, 4 years and 6 years ago, respectively.

ACKNOWLEDGEMENTS

To God be the glory great things He has done. I am an embodiment of God's absolute grace and mercy. I AM THAT I AM made me what I am. I therefore ascribe to the Immortal, Invincible, Only wise God through my Redeemer, Lord and Saviour Jesus Christ, all glory, honour, power, majesty, praise and adoration forever for making something out of my nothingness.

To my wife – Mrs. Joy Osaretin, Aiyeloja (World Famous Mama J). Thank you for being my dependable ally; and to our lovely children – Omo-Olorun Gold, Toluwani Godson, Ini-Oluwa Godwin and my little cousin Olayemi Rashidat, Alamu – thank you all for believing in me.

I am indebted to several individuals who have contributed in one way or the other to my life. I thank the Acting Vice-Chancellor Professor Steve Okodudu, for granting this opportunity. I had the priviledge of working under him in the University Strategic Plan Committee and we had a wonderful time together, you are such a wonderful leader. God bless you sir. My mentor and friend, Professor N.E.S. Lale. There is no better time to further register my profound love for you than now that you are done as the 8th Vice-Chancellor of our great University. God bless you sir.

To Professor Labode Popoola, the Vice-Chancellor, Osun State University, my Ph.D. supervisor and academic mentor, your boy is eternally grateful. I also had the privilege of learning from some of the finest forestry professionals in the world, namely: Emeritus Professor S. Kolade Adeyoju – the first African Professor of Forestry and my MSc project Supervisor,

Emeritus Professor D.U.U Okali, Professor S. O. Bada, Late Professor P.R.O. Kio and Professor R.K.A. Egharevba.

I appreciate my students, some of who are now colleagues in the department and in other Universities all over the world. Most especially, the immediate past Acting Head, Department of Forestry and Wildlife Management, University of Port Harcourt, Dr. B.A. Oyebade. I will be glad to see you stand here in the near future. Two of my mentees stand out: Dr G.A Adedeji, my 'son' and business partner and Dr. Mrs. O.A. Bello, I appreciate you both.

I acknowledge the immense contributions of my senior colleagues in the profession – Professors O.I. Ajewole, O.Y. Ogunsanwo, P.C. Kalu, V.A.J. Adekunle and S.O. Jimoh. God bless you all.

Similarly I gratefully acknowledge the support and encouragement from, Professors A.C Agumagu, M.I Godwin-Egein, E.S Erondu, E.C. Wokoma, who are all my senior colleagues in the Faculty of Agriculture, University of Port Harcourt. I appreciate the Dean, Faculty of Agriculture, Professor I. Etela and the Acting Head, Dpartment of Forestry and Wildlife Management, Dr. A.T. Oladele. I also place on record the contributions of all my colleagues and friends in the Department of Forestry and Wildlife Management, in the Faculty of Agriculture and the University of Port Harcourt, Wildlife Society of Nigeria and Forestry Association of Nigeria too numerous to mention. My heartfelt gratitude goes to my sister-in-law Mrs. Rita Akhibi and her husband, thank you for being there. Also my uncles and aunts from the Pa Salami Adigun Aiyeloja and High Chief Jinadu Alamu Agoro dynasties, siblings and in-laws are deeply appreciated for unquantifiable all round support.

I also acknowledge with thanks the encouragement and support of the families of Ajewole, Ogunsanwo, Adedeji, Fayefunmi, Adekunle, Akuro Douglas, Tekena Ikoko and Prof. M.A. Adeyemo.

The ELOOKKOO family of Uniport under the able leadership of Professor Abdurasaq Kilani is highly appreciated. A o kere oko dele o.

I acknowledge my spiritual fathers and mentors – Pastor W.F. Kumuyi and Rev. Stephen O. Akinola. The spiritual support of my fellow ministers of the gospel of Jesus Christ; Pastors Kayode Ilori (Kings Chapel Intl), Ayo Ajayi, Biodun Akande, Adesida, Adedigba and Williams Emina is highly appreciated.

I am also indeed grateful to Pastors Japheth Onwuegbu, Soberekon Afiesimama, Bourdilon Omijeh, Akinrotimi Ojo and all the members of Shiloh Assembly of the Redemption Ministries.

Dr. B.A. Oyebade and Dr. U.D. Chima painstakingly proof-read the manuscript of this lecture, I sincerely appreciate you both.

I am most grateful to several others, who for one reason or the other are not mentioned or adequately acknowledged. Please, forgive me. I am just a mere mortal with many limitations. This is one of such.

PREAMBLE

As a young child growing in a rural setting called Ijagbo near Offa in Kwara State, receiving strokes of the cane every other day was a normal occurrence. My sin was following the village children on hunting expeditions against the wish of my parents who were teachers. While in the secondary school, I ignorantly absconded from Physics classes because my father had said I must study Medicine and Surgery while my mind was in Forestry and Wildlife– needless to say, that I suffered severely in the University when I was confronted with four Physics courses at the 100 Level Forestry class.

As a teacher in the secondary school, having obtained the National Certificate of Education in Biology and Chemistry; I had a friend with an Ordinary Diploma in Forestry. While he was the superintendent of Forestry for the entire Local Government with a big office situated within the ambience of *Tectona grandis* and *Gmelina arborea* plantations overlooking a lake meant for regular supply of fish, I was just down the ladder in the hierarchy of teachers in my school with my table at the back of Biology Laboratory with two other teachers.

My contact with Bro Victor, now Professor Victor A.J. Adekunle, the Head of Department of Forestry and Wood Technology, Federal University of Technology, Akure rekindled my love for forestry. I wrote JAMB with some of my Students who thought I came for invigilation and I pretended so. I studied Forestry and Wildlife at the University of Benin and Forest Economics and Management at the University of Ibadan. Much later, after I had obtained the Doctor of Philosophy from the University of Ibadan, I realized that my father actually wanted to be identified as Baba Dokita (Doctor's Father) not necessarily a medical doctor.

To the glory of God, I made my father happy by becoming a doctor (in the local parlance, not the one that gives injection) and I also achieved my heart desire. Therefore, standing before this great audience today, by the mercies of God Almighty is a Forester by choice.

Anybody can make an inaugural speech, but only Professors give inaugural lectures. I thank God for the opportunity to deliver the first inaugural lecture from the Department of Forestry and Wildlife Management and the second from the Faculty of Agriculture, exactly eleven years and three months after the then Dean and the immediate past Vice-Chancellor, Professor Ndowa E.S. Lale, delivered the 68th Inaugural lecture titled *"Stealthy Thieves in Homes and Foodstores"* on 25th February, 2010.

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1.0 INTRODUCTION

The title of my inaugural lecture is one of the shortest in University of Port Harcourt with just three key words out of four *"Forests for Rest Forever"*. The shortest title by my findings was the 78th Inaugural Lecture delivered by Professor B.C. Didia titled *Man: Know Thyself*. Nine other Inaugural lecture titles had four words like my own; these are Profs Otonti Nduka's *In the Socratic Tradition* (2nd) Onofeghara's *Botany in Human Affairs* (3rd) Anosike's *In Praise of Enzymes* (6th), E.C. Nduka's *Statistics has it that..* (57th), Ngochindo's *Chef, Recipes and Kitchens* (70th), O.A. Ejele's *Blood Sacrifice-How Saving?* (85th), Oforka's *Man, Materials and Civilization* (89th), D.V. Dapper's *Your Life; Your Blood* (113th) and Wegwu's *The Power of Food* (163rd). In coining this title, I had in mind the saying of our fathers in forestry – *"make it brief like the skirt of a young damsel, but long enough to cover the subject matter"* This was exemplified by Emeritus Professor S Kolade Adeyoju in the first forestry inaugural lecture in Nigeria titled *Our Forests and our Welfare* in 1978; Emeritus Professor DUU Okali's *Ecology in Science and Society* in 1987; Professors Julius Okojie's *Once upon a Forest* and Labode Popoola's *Imaging a Planet without Forest* among others. That is exactly what I have done.

FOREST

The Oxford Advanced Learner's Dictionary defines a forest as a large area of land that is thickly covered with trees. This definition excluded the animals and the environmental resources with which they interact. However, Aiyeloja and Chima (2011a) defined forest as a community of plants and associated organisms utilizing common environmental resource~- soil, water, light, air, etc., to develop, grow, attain maturity, produce and reproduce. While this definition may be generally acceptable, it could go for a 'stand' if it is a

contiguous area that contains a number of trees that are relatively homogeneous or have a common set of characteristics. (Brack, 1999). It has often been said that a tree cannot make a forest, we don't normally ask, how many trees can make a forest?

According to FAO (2010, 2015) a forest is defined as a land spanning more than 0.5 hectares (5000 m^2) with trees having a canopy cover of more than 10 percent (500 m^2) or trees able to reach these thresholds *in situ* and of course interacting with other biotic and abiotic components. Therefore, a simple definition of a forest is a piece of land whose area is not less than three quarter of a standard football pitch with more than 200 trees (if spacing is 5m by 5m) and a canopy cover of not less than a lawn tennis court area in a dynamic equilibrium with other biotic and abiotic components making up the environment.

Forests cover about 31% of total land area in the world with the livelihoods of more than 1.6 billion people depending on it. Forests provide a home to more than 300 million people worldwide (Aiyeloja and Larinde 2006). In Nigeria, forest estates are under serious threat due to the anthropogenic activities of humans that are inimical to their growth and development (Aiyeloja and Popoola, 2005). Reservation of land for forestry purposes was at its peak during the colonial era and efforts to increase the size of the reserves (forest estate) since then have not been too successful. Hence, less than 10% of the land area of the country is currently under forest reserves. The State forest departments have not been able to curtail the spate of requests from corporate and influential individuals for excision from the forest; land for the establishment of infrastructure and other amenities. There has been a continuing demand for de-reservation because the

unfortunate impression is that the forest estate exists as a land bank for other sectors (Aiyeloja and Faleyimu, 2011).

REST

Again, the Oxford Advanced Learner's Dictionary defines rest as a period of relaxing or sleeping on one hand or to have a break from something unpleasant, or breathing space on the other hand. The Encarta English Dictionary defines rest as a state or period of refreshing, freedom from exertion and mental or emotional anxiety. Rest could also mean, respite or repose. In Genesis Chapter 2 verse 2: *And on the seventh day God ended his work which he had made; and he rested on the seventh day from all his work which he had made.* This was not as a result of exertion or lack of strength by the Immortal but an example to be followed by the mortals who are susceptible to exertions and whose strengths do fail.

FOREVER

The English Dictionary defines forever as endless or limitless time, world or time without end, eternally, indefinitely, *ad infinitum.*

The forest and its products provide in time and space, materials and means for man's relaxation and relief, succour from the scourge from other elements, respite from poverty, sicknesses and diseases. According to Genesis, chapter 18 verse 4 (Holy Bible KJV) *"Let a little water, I pray you, be fetched, and wash your feet, and rest yourselves under the tree":* This was Abraham's request to the three angels that passed through his place on their way to Sodom and Gomorrah. Mr. Vice-Chancellor, sir, there is rest under the tree (Fig.1)

Fig.1: People having a good time under the tree at Nkpolu, Rivers State Nigeria

2.0 FOREST GOODS

Forests provide food and render services for man and animal. According to Aiyeloja, (2010) the goods include;

Provision of Food

Fruit - Mango (*Mangifera indica*), Guava (*Psidium guajava*), African Star Apple or Cherry (*Chrisophyllum albidum*), African Pear (*Dacryodes edulis*), Bush Mango (*Irvingia gabonensis*) Cashew (*Anacardium occidentalis*), Silk-cotton *Ceiba pentandra*, Baobab (*Adansonia digitata)* (Fig.3), African Bread Fruit (*Treculia africana*), Soursop (*Annona muricata*), Almond (*Terminalia catappa*), Walnut (*Tetracarpidium conophorum*). The results of proximate analysis carried out by Bello and Aiyeloja (2015) showed that the seed and seed coat of *Tetracarpidium conophorum* contained crude protein (20.43%, 7.22%), moisture content

(44.95%, 38.11%), Ash (2.17%, 0.82%), crude fibre (19.62%, 1.30%) in seed and seed coat, respectively. The mineral analysis indicated the presence of zinc (0.035mg/ml, 0.04mg/ml), copper (-0,0038mg/ml, 0.04mg/ml) calcium (12.26mg/ml, 105.90mg/ml), iron (0.15mg/ml, -0.27mg/ml), lead (0.198, mg/ml, 0.11mg/ml) and magnesium (30.28mg/ml, -0.13mg/ml) in seed and seed coat (Kernel) respectively. The results showed that the seed (cotyledon) of Walnut is a very good source of protein, minerals and dietary fiber. Its seed coat (kernel) also contained high content of calcium which can be used as ingredient in animal feed formulation.

Leaf – Ukasi (*Gnetum Africana)* bitter leaf (*Vernonia anygdalina*) pumpkin Ugu (*Telfaria occidentalis*) water leaf (*Talinum triangulare*)

Seed – Ogbono (*Irvingia gabonensis*), *Kola pachicarpa* (Fig.2) Cashew Nut (*Anacardium occidentalis*)

Fig. 2: *Adansonia digitata* in Kano State University (photograph taken by the Author)

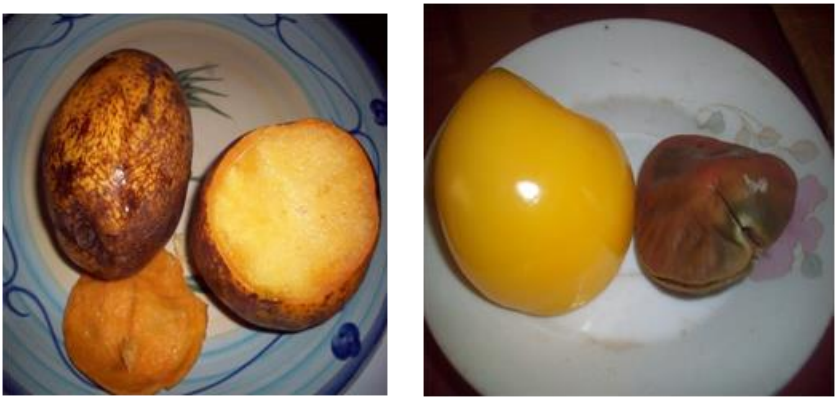

Fig. 3: Fruits and seeds of *Irvingia garbonensis* and *Kola pachicarpa*

Wine – palm wine from *Raphia hookeri* and *Elaeis guinensis.*

Provision of Wood

Wood is a major product of the forest. Timber species include; Opepe (*Nauclea didderichii,* Iroko (*Milicia excelsa),* Afara *(Terminalia ivorensis and T. superba),* Mahogany *(Khaya sp).* Obeche *(Triplochiton schleroxylon),* Masonia *(Masonia utilisima)*. These and many more are used in furniture industries.

Paper Production

Tree species like *Sterculia setigera, Gmelina arborea* and *Tectona grandis* are found useful in pulp and paper industries. In recent times, plants like *Thaumatococcus danielli* and *Hybiscus sabdariffa* have been used. According to Aiyeloja and Azeez (2010) for optimal production of *Sterculia setigera* in the nursery, 0.20g of NPK, 0.66kg of Urea and daily watering regime are required per seedling.

Poles

Long cylindrical wood is often used as electricity pole. Other forms of poles include pit prop, mining, staking and roofing poles. e.g. *Tectona grandis, Nuclea diderrichi* and *Pinus caribaea.* (Fig.4)

Fig.4: *Pinus Caribaea* Plantation at Ondo State Afforestation Project

Non Timber Forest Products (NTFPs)

Most NTFPs have been neglected for many decades and are only coming to prominence in recent times due to reduction in the availability of timber products and awareness of their importance.

Provision of Medicinal Remedies

There is virtually no tree without usefulness. However, many of them have not been explored. Common tree species of medicinal values include *Azadirachta indica, Alstonia congensis, Mangifera indica, Ficus exasperata*. etc (Aiyeloja and Bello, 2006).

Matches – matches are made up of splints and ignitable heads/tops. The box is usually coated with phosphorus to give a striking surface.

Toothpick – a small stick of wood or bamboo sharpened at one or both ends used to remove particles from the teeth after a meal.

Chewing Stick - examples include the stem of *Massularia acuminata* and the root of *Rauwolfia vomitoria.*

Leaves- e.g**.** the leaves of *Tectona grandis* and *Thaunatococcus daniell*i are used for wrapping.

Mat – The stem of *Thaumatococcus daniell*i is used in making mat. (Fig.5)

Fig.5: Mat from the stem of *T. danielli* at Ipetu-Ijesa, Osun State.

Fig.6: Cane furniture Production, Maryland, Lagos

Bamboo and Cane: - *Bambusa vulgaris* commonly known as 'poor man's timber' and cane are used in furniture and decoration industries, for making chairs, beds, baskets and hampers, (Fig.6) roofing, and fishing traps (Ogunjinmi *et al* 2009).

Spices - food additives for flavour, colour or as a preservative. It could be dried seed, fruit, root, bark etc. e.g. Garlic (*Allium sativum*), Onion (*Allium cepa*), Ginger (*Zingiber officinale*)

Condiments –a sauce or seasoning added to impart a particular flavor or to complement the dish. e.g. Ethiopian pepper (*Xylopia aethiopica*) Pepper (*Capsicum annum*)

Dyes – these are coloured substances that have affinity to the substrates to which they are being added. Majority of the natural dyes are from the roots, barks, leaves, fruits of trees. e.g. young shoot of *Tectona grandis*

Oils – these are liquid substances at ordinary room temperature and hydrophobic. e.g. Palm oil is obtained from Palm tree (*Elaeis guineensis*), Eucalyptus oil from the leaf of Eucalyptus species (*Eucalyptus globulus*), Coconut-oil from Coconu tree (*Cocos nucifera),* Shea butter oil from the seed of *Vitellaria paradoxum*

Exudates – e.g. Rubber tree (*Hevea brasiliensis)* exudes latex which is used to manufacture numerous products including car tyres.

Gum – extracts from the stem of *Acacia Senegal* and *Acacia seyal* are edible gums used as stabilizer in food industries.

Faunal products – honey, hide (skin of bigger animals e.g. Rhimos and buffaloes with size ranging from 1.5 to 4.5 m^2 and

weight 15-30 kg) and skin (duiker and kob)- size 0.4-0.5 m^2 weight 2 kg) (FAO, 2010) (Fig.7), ivory (teeth of big animals) and tusk, bush meat etc.

Fig.7: Hide from Antelope

3.0 FOREST SERVICES

As documented by Aiyeloja, (2010), forests also render services which include the following:

Maintaining the quality and availability of freshwater supplies.

According to Sousson, Shrestha and Uprety (1995), this is categorized under the ecological services and include; regulation of water regimes, maintenance of soil quality and provision of organic materials, limiting of erosion and protection of soil from the direct impact of rainfall.

More than three quarters of the world's accessible freshwater comes from forested catchments. Water quality declines with decreases in forest condition and cover, and natural hazards such as floods, landslides, and soil erosion have larger impacts.

For every 5% of tree cover added to a community, storm water runoff is reduced by approximately 2%.
(www.unep.org/wed/).

Climate change Mitigation

Forests play a key role in regulating the world's climatic system; storing carbon and sucking in carbon (iv) oxide from the atmosphere and locking it into their biomass. This is sucintly captured in a line from Joyce Kilmer's poem: "I think I shall never see a carbon eater like a tree". One of the important ways to reduce the amount of carbon (iv) oxide in our air is to make sure there are enough trees to "eat it up!'' (Fig.8)

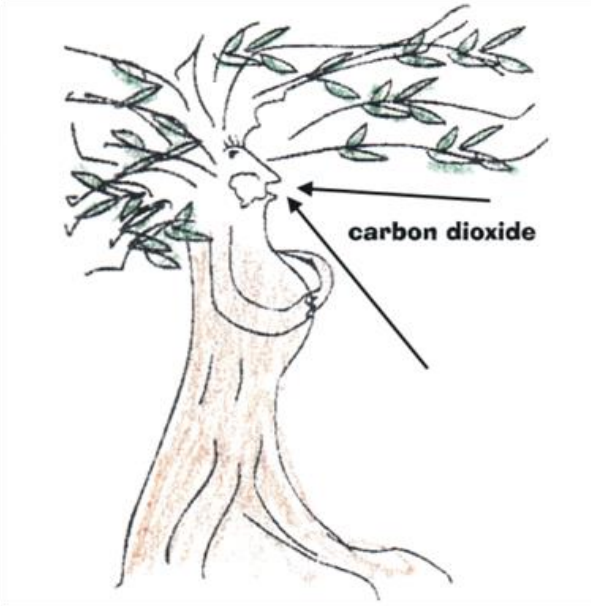

Fig.8: Maggie's Earth Adventures, LLC 2001

Trees are natural reservoirs that accumulate and store large quantity of carbon containing chemical compounds for an indefinite period. This is called carbon sink. The process by which carbon (iv) oxide from the atmosphere is removed and stored is known as carbon sequestration. It is becoming expedient for people and companies to plant trees to make up for the amount of carbon (iv) oxide they put into the atmosphere This is the thrust of the Kyoto Protocol to the United Nations Framework Convention on Climate Change of which many countries are signatories.

Heat from Earth is trapped in the atmosphere due to high levels of carbon (iv) oxide (CO_2) and other heat-trapping gases that prohibit it from releasing heat into space -- creating a phenomenon known as the "greenhouse effect." Trees remove (sequester) CO_2 from the atmosphere during photosynthesis to form carbohydrates that are used in plant structure/function and return oxygen back to the atmosphere as a byproduct. Trees therefore act as carbon sinks by removing the carbon and storing it as cellulose in their trunk, branches, leaves and roots while releasing oxygen back into the air (Popo-ola, Aiyeloja and Adedeji, 2012)

An average person in the U.S. generates approximately 2.3 tons of CO_2 each year out of which 329 kg come from respiration, since average man breathe out 0.9 kg of CO_2 per day (1 ton = 1000 kg). A healthy tree stores about 13 pounds of carbon annually (1 lb = 0.45 kg). An acre of trees absorb 2.6 tons of CO_2 per year, gives off over 2.8 tons of Oxygen and absorbs enough CO_2 over one year to equal the amount produced by driving a car 26,000 miles (Nowak, 1993).

One acre of trees provides oxygen for 14 people and over a 50-year lifetime, a tree generates $31,250 worth of oxygen, provides $62,000 worth of air pollution control, recycles $37,500 worth of water, and controls $31,250 worth of soil erosion (USDA Forest Service, Undated)

Trees also sink heavy metals. A single tree of 30.4 cm diameter at breast height (DBH) has been recorded to sink 60mg cadmium, 140 mg chromium, 820 mg nickel, and 5200 mg lead from the environment in one growing season. This is in addition to absorbing CO_2 at a rate of 48lbs. /year and releasing enough oxygen into the atmosphere to support 2 human beings. It takes 300 trees to counter balance the amount of pollution one American produces in 70 years (McAliney, 1993).

Carbon Trading: This is not in practice in Nigeria yet. It involves using a market-based approach to control pollution by providing economic incentives for achieving reductions in the emissions of carbon. It is a form of paying for carbon stored.

Biodiversity

As the most biologically diverse ecosystems on land, forests are home to more than half of terrestrial species, from the great apes to the smallest of creatures. There are about 100 million different species of plants and animals living on this planet.

With one third of the earth's surface covered with forests, it is no surprise that they are among the most notable storehouses of biological diversity on the planet. Forests house over two-thirds of known terrestrial species, including the largest share of threatened species.(WWF,2003).

Economics and Livelihoods

Forests provide homes, security and livelihoods for 60 million Indigenous people, whilst contributing to the livelihoods of 1.6 billion people worldwide. About 150 types of NTFPs are significant in international trade. They are also increasingly being acknowledged for their role in sustainable development and conservation of biological diversity. Up to 80% of the population in developing countries depend on NTFPs for subsistence, both economically and for nutrition. NTFPs are especially important to women in developing countries from Latin America, Asia, Africa and Far East. (www.fsc.org)

Socio cultural and Religious Services

Many people have strong cultural and spiritual attachments to the forests. The leaves of *Newbouldia laevis* is used in coronation ceremonies of Yoruba kings. Hundreds of Prayer Mountains are situated in the forests of Southwest Nigeria (Fig.9). Sadly, the prayer montains are giving way to bandits and killer herders' hide out. Studies have shown that hospital patients with a view of trees out their windows recover much faster and with fewer complications than similar patients without such views. (American Foresters, 1999). Such exposure to trees has been recorded as a good therapy for psychiatric patients.

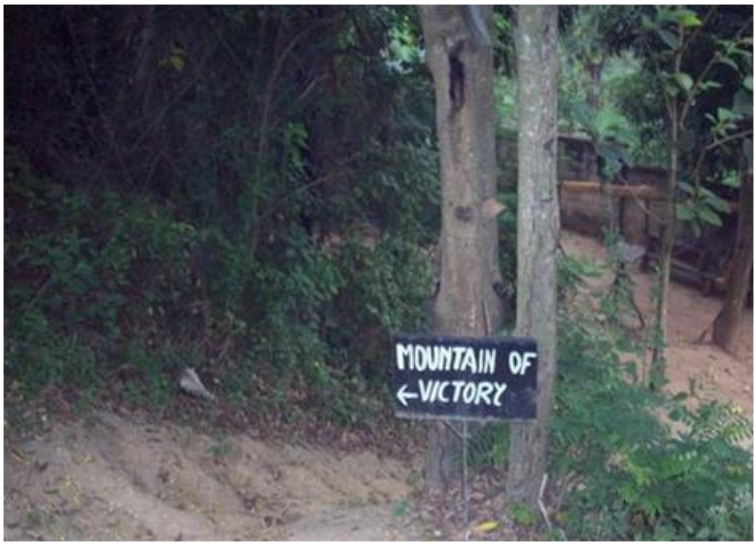

Fig.9: Prayer Mountain in a forest in Ibadan,

Researchers at the University of Illinois found that violence is reduced in homes that had trees outside the buildings. Of the residents interviewed, 14% of residents living in barren conditions have threatened to use a knife or gun against their children versus 3% for the residents living in green conditions. (Prow, 1999). Other services include tourism, wind break, noise reduction, recreational, scenic and landscape services.
While goods are obtainable from living trees and dead wood, only living trees render services.

4.0 BRANCHES OF FORESTRY

The various branches of Forestry include; Silviculture and Forest Biology, Forest Mensuration and Biometry, Wood and Fiber Science, Forest Engineering and Forest Economics and Management.

Silviculture and Forest Biology: Application of biology principles in managing the forest. This involves pre-germination treatments of dormant seeds, sowing and planting, nursery techniques and plantation establishment. This branch also include; forest ecology, pathology, entomology, genetics and breeding, taxonomy and some aspects of Agroforestry.

Forest Biometry: Technically, forest biometry is a tool in forest management. It entails using mathematical principles in managing the forest. Forest Biometry includes; forest inventory, measurement, mensuration, programming, remote sensing and geographic information system applications.

Wood and Fibre Science: This deals with the technology of wood production and utilization, wood anatomy, wood properties and wood preservation.

Forest Engineering: This involves the use of engineering principles in forestry. It includes forest operations, construction of forest bridges, culverts and forest roads.

Forest Economics and Management: This involves the use of economic principles and management techniques in order to achieve the objectives of management. Under this are; social forestry, urban and environmental forestry, forest policy, law, administration and governance, forest extension, forest industry and forest enterprises development.
Mr. Vice-Chancellor sir, I am in forest economics and management and I have carved out a niche for myself in forest enterprises development. In the words of Popoola (2014); "Through the forests and forestry, I have seen the world"! (Figs. 10, 11, 12, 13, 14 and 15).

Fig.10: Ready for a research trip in Korup National Park, Cameroon

Fig.11: Field work on hollowless bamboo in Kano State

Fig.12: Field work with Colleagues from the University of Ibadan and the Swedish University on research for hollowless bamboo in Osun State

Fig.13: Guest Speaker, National Environment Summit House of Representatives

Fig.14: On a 5 Km walk in a forest in East Lansing, Michigan, USA

Fig.15: At the W.J. Beal Botanical Garden, Michigan State University

The Journey so far

I have categorized my contributions under three areas in Forest Economics and Management: Ethnobotany, Forest Environmental Service Functions and Small Scale Forest Enterprises.

5.0 ETHNOBOTANY

The Encarta Dictionary defines Ethnobotany as the scientific study of the traditional classification and uses of plants in different human societies. In this part of the world, on one hand, we are familiar with the exaggerating assertions of most traditional medicine practitioners where a mixture of plant extracts is called *awogba arun* (cures 200 ailments) and another one called *gbogbo nise* (cures all ailments) (Figs 16). There is another brand, they tagged *ajebiidan* (works like magic) (Figs 17). On the other hand, we are not unfamiliar with the orchestrated alarms of many Orthodox Medicine Practitioners who believe that 'nothing good can come out of Nazareth' However, neither the exaggerations of most traditional medicine practitioners nor the orchestrated alarms of some orthodox medicine practitioners can negate the potency and efficacy of the plants as created by God.

Aiyeloja and Bello (2006) documented 96 plant species with ethno botanical potentials in Enugu State, Nigeria (Table 1). Ajewole and Aiyeloja (2004) also established the importance of urban forest reserves as major sources of medicinal remedies ahead of recreation, timber, firewood and even recreation in Ibadan metropolis.

Fig.16: 'cures two hundred ailments'

Fig.17: 'All round cure'

Table 1. Ethno botanical potentials of common herbs handled by herbal sellers in Enugu State of Nigeria.

No	*Botanical name*	*Common name*	*Family*	*Yoruba*	*Igbo*	*Hausa*	*Uses*	*Part used*
1	*Ananas comosus*	Pineapple	Bromeliaceae	Ope oyinbo	Akwu-mbe/akwu-olu	Nkwu aba/abara	Anti hypethesion consitaption	Unripe fruit
2	*Carica papaya*	Pawpaw	Caricaceae	Ibepe	Okworo-beke/ojo	Gwanda	Boil purgative	Latex fruit / seed
3	*Psidium guajava*	Guava	Myrtaceae	Gurofa	Ugova/ugwoba	Gwaabaa	Reduce frigidity	Unripe fruit
4	*Mangifera indica*	Mango	Anacardiaceae	Mongora	Mango sawamsop	-	Malaria	Leaves
5	*Annona muricata*	Soursop	Annonaceae	-	Sawamsop	-	Relaxing nerves	Leaves
6	*Anacadium occidentals*	Cashew	Anacardiaceae	Kaju	Sashu	Kanju	Cough high vit.c	bark, fruit
7	*Musa nana/sapientum*	Banana	Musaceae	Ogede Wewe	Ule/uneri	Ayaba	High blood pressure	Fruit
8	*Musa paradisiaca*	Plantain	Musaceae	Ogede Agagba	Abrika	Okamu/ayaba	Potent astrigent high iron	Fruit
9	*Abelmosch*	Okro	Malvaceae	Ila/ilasa	Okwuru	Kubewa	Sperm count	Fruit

	us esculentus						fever	leaves
10	*Capsicum annum*	Pepper	Solanaceae	Ata wewe	Ose/totashi	Barkono	Stimulant	Fruit
11	*Allium cepa*	Onion	Alliaceae	Alubosa	Yabasi	Alabasa	Antidiabetic	Bulb
12	*Allium sativum*	Garlic	Alliaceae	Aayu	Ayo-ishi	Tafarunua	Antibiotic antidiabetic anti hypertension	Bulb
13	*Zingiber officinale*	Ginger	Zingibercenae	Ata-ile	Jinga	Chita	Detoxify liver bronchitis	Corm
14	*Zingiber officinale*	Ginger	Zingibercenae	Ata-ile	Jinga	Chita	Detoxify liver bronchitis	Corm
15	*Citrullus lanatus*	Water Melon	Cucurbitaceae	Egunsi	Elili egwusi/ogili	Egbsi/guna	Laxative digestion	Dried pulp
16	*Piper guinenses*	Black Pepper	Piperaceae	Iyere	Uziza	Uda	Cleanse womb	Seed/leaves
17	*Myristica fragrans*	Nutmeg	Myristiceae	Ariwo	Ehuru		Anti parasitic	Fruit
18	Monodora *mystrica*	Nutmeg	Anonaceae	Ariwo	Ehuru		Rheumatism	Oil
19	*Persea americana*	Avocado / pear	Lauraceae	Igba/apoka	Ube-beke		Anti hypertension ulcer/stomach	Fruit
20	*Solanum melongena*	Garden °gg	Solanaceae	Igba ijesu	Ayanra/afefea	Yalo/jauta	Kidney problem / vit c	Seed & leaves
21	*Telfairia occidentalis*	Fluted Pumpkin	Curcurbitaceae		Ugu		Anti anaemic [blood tonic]	leaves
22	*Crysophylum albedum*	Star apple	Sapotaceae	Agabalumo	Odara/udala	Agwaliba	Anti nausea	Fruit
23	*Cocos nucifera*	Coconut	Arecaceae	Agbon	Aku oyinbo	Mosara	Anti poison/neutralizes poison/drug	Nut
24	*Elaeis guineensis*	Palm kernel	Arecaceae	Ekuro	Aku	Kwakwa	Easy flow menses	Nut
25	*Saccarum officinarum*	Sugar cane	Poaceae	Ireke	Okepte	Ireke	Laxative	Stem
26	*Aframonum*	Alligator pepper	Zingiberaceae	Ataare	Ose-orji/okwa	Chilla/citta	Stimulant Sleeping	Seed Seed

	melegueta						sickness	
27	*Citrus paradise*	Grape	Rutaceae	Osan paya	Oroma-nkeresi	Lemu yamiku	Antibiotic	Fruit
28	*Citrus sinensus*	Sweet orange	Rutaceae	Osan	Oroma	Lmu	Vit c bowel moist	Fruit Roughages
29	*Cola nitida*	Kolanut	Sterculiaceae	Obi	Orji	Goro	Stimulant	Fruit
30	*Citrus limon*	Lime	Rutaceae	Osan Wewe	Olomankilisi	Lemunoisami	Deworm	Juice/fruit
31	*Solanum lycopersicum*	Tomato	Solanaceae	Tomati	Tomato	Tomati	Anti hypertensive	Fruit
32	*Tetracapidium conophorum*	Walnut	Europhorbiac eae	Awusa/asal	Ukpa	Hawuusa	Aprodisiac	Fruit
33	*Vernonia amygdalina*	Biter leaf	Asteraceae	Ewuro	Onugbu/olubu	Shiwaka/chukwuaka	Pile lower sugar content	Leaves
34	*Thymus vulgaries*	Curry leaf	Lamiacea	Efinrin Wewe	Nchanwu		Antibiotic, carminative	Leaves
35	*Ocimum aratissimum*	Mint	Lamiaceae	Efinrin nla	Nchanwu	Dadoya	Stomach problem	Leaves
36	*Xanthosoma sagittifolium*	Cocoyam	Araceae	Koko	Akaso/ede/uli/mmuo	Ghrsa/guaza	Heart problem anti hypertensive	Leaves Corn
37	*Zea mays*	Maize	Poaceae	Agbado	Oka	Masara	Anti hypertensive	Silk
38	*Oryza sativa*	Rice	Paoceae	Iresi	Osi-kakpa	Chinkafa	Energy-giving food	Grains
39	*Dioscorea alata*	Water yam	Dioscoreacea	Isu ewura	Awoke/ji-abana	Dugura	Fever	Leaves
40	*Dioscorea cayennensis*	Whire yam	Diocoreaceae	Ako isu	Ji-ocha	Doya danzaria	Anti diarrhea	Tubers
41	*Manihot esculenta*	Cassava	Euphorbiacea e	Ege / gbaguda	Abacha/akpu	Rogo	Diabetes	Tubers
42	*Vigna unguiculata*	Beans	Papilionaceae	Ewa/eree	Agua	Agwa/wake	Protein	Seed
43	*Artocarpus altiles*	Bread fruit	Moraceae	Pere	Ukwa		Starch	Fruit
44	*Corchorus olitorius*	Jew fiber	Titiaceae	Ewedu	Ariraa/ulogburu	Lalo	Blood purifier	Leaves

		telteria Jews mallow						
45	*Bridelia micrantha*		Euphorbiaceae	Ira	Oha (ola)	Kirni	Oral flora	Stem bark
46	*Afalia africana*		Caesalpiniaceae	Apa	Akpalata	Kawo	Condiment	Seed
47	*Alstonia boonei*	Stool wood/patten wood	Apocynaceae	Ahun	Egun		Fever tumour	Stem bark, root
48	*Xylopia aethipica*	Ethiopian pepper	Annonaceae	Eeru/ Erunie	Uda	Kimba	Analgesic/stimulant	Fruit
49	*Tetrapleura tetraptera*		Mimiossaceae	Aidan	Okpokrikpo/os osho		Sickle cell	Fruit
50	*Ceiba pentandra*	Silk cotton	Bombacaceae	Araba	Akpu owu	Rimi	Stimulant/laxative	Thorns on the stem
51	*Syzygium aromaticum*	Clove	Myrtaceae	Kanafuru	Osasagbogbo	Kanumfari	Tooth ache/mouth infection	Fruit
52	*Azadirachta indica*	Neem tree	Meliaceae	Dongoyaro	Atu yabasi / ogwu akom	Maina	Boils Anti malaria	Fruit juice Leaves & tree bark
53	*Cymbopogon citratus*	Lemon grass	Poaceae	Koriko-oba	Nche awula		Malaria	Leaves
54	*Garcinia kola*	Bitter kola	Clusiaceae	Orogbo	Adu/aku-inu	Namiji goro	Cough	Fruit
55	*Neubouldia laevis*	African tylip tree	Bignoniaceae	Akoko	Ogilisi/ogirisi	Aduruku	Asthma	Leaves
56	*Rauvolfia vumitoria*	Inidan snak root/African rauivofia	Apocynaceae	Asofeyeje	Akanta	Wadda	Sedative , mental disorder	Root bark
57	*Anthodeista diaglomensis*		Loganiaceae	Sapo	Akpakoro	Putaa	Diabetes inflammation	Stem bark

58	*Nauclea latifolia*		Rubiaceae	egbesi	Uburu inu/ mbitinu	Marga	Yellow fever	Root
59	*Spondia mombin*	Hogplum	Anacardiaceae	Lyeye	Ngulungwu / isikarA	Isada	Infertility	Fruit
60	*Morinda lucida*		Rubiaceae	Oruwo	Eze ogu		Fever	Leaves
61	*Bliqhia sapida*	Akee apple	Sapindaceae	Isin	Okpu	Gwanja kusa	Anti ulcer	Fruit/seed
62	*Terminalia catapa*	Umbrella tree/almod tree	Combretaceae	Igifuruntu	Ibulu		Insomnia sleeplessness	Leaves
63	*Argemone mexicana*	Bean spp	Papaveranceae	Ahon-ekun	Akede		Anti pasmodic	Leaves, stems seeds
64	*Zanthocylum zanthoxyloides*	Candle wood	Rutaceae	Ata	Aga	Fasakwari	Sickle cell/ tooth ache	Root
65	*Vitellaria paracloxum*	Shea butter	Sapotaceae	Ori/emi-emi	Osisi	Kadanya	Rheumatic pains	Fat
66	*Cajanus cajan*	Pigeon pea	Papilionaceae	Otiili	Fiofio		Malaria	Leaves
67	*Kalanchoe pinnatum*	Never die/leaf of life	Crassulaceae	Abamoda	Odaa-opue / nkwonkwu	Gawa	Anti-inflammatory	Leaves
68	*Cactus sp*	Cactus	Cactaceae	Oro	Utamazi-ngwulo		Gonorrhea	Leave/stem
69	*Ertyphleum suaveolens*		Caesalpinaceae	Obo	Nyi/ihi	Gwaska	Poison	Bark
70	*Milicia excelse*	Mulberry	Moraceae	Iroko	Orjih/oji	Loko/liko	Rheumatism	Root
71	*irvingia excelsa*	Bush mango	Irvingiaceae	Oro mopa	Ogbono/ube	Mamujigoro	Condiment	Seed
72	*Shorgum bicolar*	Millet	Poaceae	Oka baba	Sorgum	Jero	Blood tonic	Leaves
73	*Gossvpium arboreum*	Cotton	Malvaceae	Igi owu	Osisi-owu / kotiini	Ali diga	Anti malaria	Leaves
74	*Talinum triangular*	Water leaf	Portulacaceae	Gbure	Nte-oka/inene	Alenyruwa	Rat poison	Root
75	*Parkia bigglobos*	Locust beans	Papilionacea	Igba iru	Ugba/ogiri	Dadawa	Anti-hypertension	Seed

	a							
76	*Ficus exasperata*	Fig tree	Moraceae	Oporo/opoto	Ogbu	Achedinnini	Venereal disease	Root
77	*Kigelia africana*	Sausage tree	Bignoniaceae	Pandoro	Uturubein	Rawuya	Fibroid	Fruit
78	*Calotopis procera*	Sodom apple	Asclepeceae	Bomubomu		Tumifafiya	Measles	Leaves
79	*Dialium guinenses*	Black tumbler	Caesalpinacea	Awin	Icheku	Tsamiyar	Anti ulcer/ Vit. C	Fruit
80	*Annona senegalensis*	Custard apple	Annonaceae	Abo/abobo	Ubunu-ocha	Gwandar daji	Yellow fever	Leaves
81	*Abrus precatorius*	Crab's eye	Papilioniaceae	Iwerejeje/ ojuologbo	Anya nnunu	Da marzaya	Cough	Leaves
82	*Amacanthus spinosus*	Green	Amarantaceae	Tete	Opotoko		Malaria	Leaves
83	*Boehaavia diffusa*	Hogweed	Nyctagineae	Etiponola	Azeigwe	Babba-juju	Root Leaves	Dropsy Infertility
84	*Dennettia tripetala*	Pepper fruit	Annonaceae	Igberi	Mmimi		Stimulant	Fruit
85	*Urena lobata*		Malaceae	Akeeri	Odoazezo	Rama-rama	Malaria	Leaves
86	*Trumfetta rhomboidea*	Burweed	Tilaceae	Molanganrsn/ak o bolobolo	Odo	Yanka-dafi	Gonorrhea	Leaves Flower Fruit
87	*Cassia occidentalis*		Caesalpinaceae	Rere	Akede-agbara	Rai dore		
88	*Citrus aurantium*	Sour orange	Rubiacae	Osan ghanhin-ghanhin	Oloma-oyinbo	Babban lemu	Fibroid	Fruit
89	*Khaya ivorensis*	Mahogany	Mehaceal	oganwo	Ono		Blood tonic	Stem Bark
90	*Ipomoea batatas*	Sweet potato	Convolvulaceae	odunkun	Ekimako	Dankali	Pile	Leaves
91	*Nicotiana tobacum*	Tobacco	Solanaceae	Ewe taba	Utaba	Taba	Stimulant Infertility	Leaves
92	*Daucus carota*	Carrot	Apiaceae	karoti	Carrot	Carrot	Male infertility	Fruit
93	*Detarium microcarpum*		Caesalpinaceae	ogbogbo	Ofo	Taura		
94	*Treculia africana*	Africa breadfru	Moraceae	Afon	Ukwa		Heart problem	Leaves

		it						
95	*Europhorbia convolvuloides*	Asthma herb	Euphorbiaceae	Egele	Udani	Nonan kurdiiya	Asthma	

Most of these plant species have been screened and the active ingredients identified. Aiyeloja, Bello and Akintayo (2010) documented twenty three species used in traditional family planning. The active ingredients of these plant species were identified. Also, 40 plant species of ethno botanical importance were identified at the popular Ikogosi Warm Spring in Ekiti State (Aiyeloja and Bello. 2012). In addition, Bello and Aiyeloja (2015) documented 19 plant species of ethno botanical importance in the mangrove region. The seed of *Mucuna pruriens* has been successfully used to prevent conception in swine while the powder from the dried fruit (Fig.18) mixed with honey has been used as worm expeller.

Èdà – a major cause of infertility in women is not captured by orthodox medicine. Symptoms of *Ẹda* include: pouring out of seeds (sperms) immediately and long after intercourse; stomach making noise and hotness of stomach. Plant species used as remedies include the stem bark of *Anthocleista djalonensis* and *Capsicum frutescens* fruits or *Rauvolfia vomitoria.* Miscarriage has been stemmed using the stem bark of *Enantia chlorantia* (Awopa, Dokita Igbo – Yoruba; Upe – Ijaw Bayelsa) or *Cissampelos owariensis (Jokoje)* (Fig.19). *Euphorbia laterifolia* (Oro Adete) (Fig.20) *and Erythrophleum suaveolens stem bark have been used to enhance milk secretion in lactating mothers. Lagenaria breviflora* fruits, (Fig.21) have been used as preventive measure for measles, chickenpox and smallpox. Extracts from older leaves of *Telfaria occidentalis* (Hook.F) has been used in killing rats (Aiyeloja, Bello and Ogunsola, 2010). *Zanthoxylum zanthoxyloides* has been screened to have Fagaronin which is anti-retroviral in nature (Ojinaka, 2011).

Fig.18: Mucuna fruits and seeds

Fig.19: *Cissampelos owariensis*

Fig.20: *Euphorbia laterifolia*

Fig.21: *Lagenaria breviflora*

6.0 FOREST ENVIRONMENTAL SERVICE FUNCTIONS

According to Aiyeloja and Inengibo (2010), the people of Yenagoa were willing to embark on urban forestry development. Willingness to participate (money, time) in urban forestry development by an average low income earner was ₦374.19/month with a time value of 7.20hrs/month. Medium income earners were willing to pay an average of ₦719.35/month and a time value of 6.40hrs/month while the high income earners were willing to pay ₦1234.78/month and time value of 8hrs/month. Cumulatively, the average Yenagoan was willing to pay the sum of ₦776.10 and contribute a time value of 7.20hrs/month. The people of Yenagoa recognize the benefits of urban forests and are willing

to embark on its development (Fig. 22). However, they prefer the department of forestry in higher institutions to handle such funds.

Fig 22: Agumagu Street, Yenagoa (one of the various streets that needed to be planted up)

Eludoyin, Aiyeloja and Ndife (2014) worked on the spatial analysis of trees composition, diversity and richness in the built up area of University of Port Harcourt and observed that species composition and diversity in UniPark was the highest with 134 species and 0.866 diversity index. Species richness was highest in Choba Park with a value of 2.496.

The correlation between the size of park (special coverage) and species composition was 0.99 while the correlation between the size of the park and species diversity was 0.78. There was direct Relationship between species composition and diversity while the relationship between species composition and species richness was inversely proportional. The essence is to have a beautiful and serene environment conducive for teaching and learning. Figures 23 and 24 are illustrative of the seedling of *Terminalia mantaly* and *Tectona grandis* planted in 2011 and what they look like in 2021.

Fig. 23 *Terminalia mantaly* seedling 2011 and the tree in 2021

Fig. 24 *Tectona grandis* seedlings 2011 and the trees in 2021

Also, Aiyeloja and Adedeji (2015) worked on the Impact of weaver birds *(Ploceus cucullatus* Muller) nesting on the ornamental trees shade management in the University of Port Harcourt and observed that a total of 116 trees of 7 species

belonging to 5 families were used by *Ploceus cucullatus* for their nesting activities. From the utilization standpoint, two classes of tree species were recognized: nest building material species (NBMS) (Figs 25&26) and nest building supporting species (NBSS) (Fig. 27). We observed that 102 trees or 87.93% were NBMS with Arecaceae family dominating while 14 trees or 12.07% were NBSS with Anacardiaceae family dominating. The result demonstrated that weaver birds nesting activities were distinctly more damaging on NBMS than NBSS, and strongly associated with massive defoliation of NBMS. Consequently, NBMS were remarkably inflicted resulting in poor shade provision and management. It can be inferred that the cardinal goal of shade provision of NBMS was defeated. The beautification aspect was also compromised. Some of the tree species are now dead.

Considering the magnitude of heat-loading on human beings during the daytime (working-hours) in the University, massive planting of known shade providing trees species that are well-adapted to the local or peculiar environmental conditions and not susceptible to weaver birds like *Ficus elastica,* (Fig. 28) *Chrysophyllum albidum* (Fig. 29) *Terminalia catappa* (Fig. 30) *Hura crepitans* (Fig. 31) among others is highly recommended in order to eliminate and prevent future avian pests. We observed migration of birds instead of colonizing these species.

Fig. 25: Royal Palms (NBMS) completely defoliated in front of Ebitimi Banigo Hall in Abuja Campus

Fig. 26: Royal Palms' (NBMS) stumps in front of Ebitimi Banigo Hall in Abuja Campus

Fig. 27: Nests on *Casuarina equisetifolia* (NBSS) at Delta Park

Fig. 28: *Ficus elastica* Non-avian attractive species in Abuja Campus

Fig. 29: *Chrysophyllum albidum* Non-avian attractive species in Abuja Campus

Fig. 30: *Terminalia catappa* Non-avian attractive species providing shade for students in Choba Park, University of Port Harcourt

Fig. 31: *Hura crepitans***:** Non-avian attractive species providing shade in front of Faculty of Agriculture, University of Port Harcourt

According to Adedeji and Aiyeloja (2017), avenue and environmental trees are often planted for ecological, social and economic stability. Therefore, tree suitability study is a prerequisite for any tree utilization venture if the objective of management will be achieved. This is succinctly put as the ability of a given species of tree to support a defined use for a long term socioeconomic and environmental benefits without degradation. It is a function of tree requirements and soil characteristics, compatibility, and a measure of how well

the quality of land or soil unit matches with the requirements for tree growth and development. Studies have shown that a tree's site-related needs and its ability to withstand environmental extremes are to a very large extent dependent on its native origins. Tree suitability may involve assessment of attributes ranging from adaptability first to the prevailing soil conditions, root systems, stem and crown formations, degree of resistance or attractiveness to pests among others. Soil provides trees with physical support, water, nutrients, and oxygen for the roots (Kuhns and Rupp .2000). Shortage or excessive moisture affects a soil's ability to provide these benefits to trees. Niger Delta region especially Delta, Bayelsa and Rivers States experience frequent and prolonged soil water inundation due to climate. This soil moisture inundation represents a major threat to the long-term sustenance of tree component of landscaping systems in Niger Delta (Figs.32&33).

Fig. 32: Fallen *Delonix regia* (Flanboyant tree) behind Uniport fence

Fig. 33: Fallen *Azadirachta indica* (Neem) tree at Uinpark Gate

The daunting task of improving environmental conditions lies in the peril of using unsuitable tree species. This results in weak rooting situations, proliferation of fungi and termite attacks, trees degradation, and eventual death. The problems can be nipped in the bud or eliminated through the huge utilization of shade proven indigenous trees like *Alstonia boonei, Lonchocarpus cyanenscens, Artocapus spp. Brachystegia nigerica, Piptadeniastrum africanum, Khaya ivorensis, Lophira alata, Pycnanthus angolensis, Ricinodendron heudelotii, Sacoglottis gabonensis, Uapaca spp., Hallea ledermannii, Albizia adianthifolia, Irvingia gabonensis, Klainedoxa gabonensis, Treculia africana, and Ficus vogeliana.* etc in Niger Delta (Aiyeloja and Popo-ola 2013). Landscaping, being an essential forest-based industry in Nigeria, has no policies or frameworks directed towards the utilization of indigenous tree species native to

each ecological zone of use. The potential consequences of alien trees are numerous which include reduced tree life span, and having to plant new trees in quick successions. The main causes of decline and death of trees in the University of Port Harcourt landscape are stresses induced by human activities. These activities include wrong choice of tree species; alien tree species after some years become stressed by soil moisture and become susceptible to certain fast killing fungi and insects. Improper pruning and peeling of bark for medicinal use can create artificial openings and opportunity for invasion by certain disease causing organisms. The problematic species and their associated symptoms found in Uniport are replica of what is obtainable in Niger Delta as a whole.

Adedeji, Eludoyin and Aiyeloja (2016) assessed the stands of *Casuarina equisetifolia* and *Alstonia boonei* for comparative environmental suitability between 2013 and 2015 in the University of Port Harcourt, Nigeria. The results revealed that *Alstonia boonei*, (native tree) had excellent superior adaptability compared to *Casuarina equisetifolia,* (non-native) tree. The population and strategic positions or arrangement of the two species strongly indicated that *A. boonei* was not planted but retained. The intensive loss of over 30% of *C. equisetifolia* stands and 0% of *A. boonei* recorded in this study indicated the non- suitability of *C. equisetifolia* for environmental restoration in swamp and mangrove forest of Nigeria. The cause of the loss probably began with the inability of *C. equisetifolia* to withstand the soil moisture conditions which rendered the species weak and subsequently susceptible to fungi and termites and eventually death. *C. equisetifolia* being a suitable host for fungi and termites, its number remains poorly unstable. These species (fungi and

termites) have population of threshold killing that have infested all the remaining stands and were even colonising many other non-native species as host biomass. In 2013, there were 54 stands of *C. equisetifolia* in the three campuses. They reduced to 42 in 2014(22.2% loss), 37 in 2015(31.5% loss) and 20 with 5 juveniles in 2021 with none of them healthy. The increased death of trees recorded was closely linked to the increased activities due to the increased population of degrading agents. However, despite the relatively small population of *A. boonei* in the University, the stands population remained unchanged (0% loss). This is closely related to the excellent superior adaptability of the species and as such indicative of its suitability as excellent candidate for restoration of Nigeria swamp forest environment. The consequences of inability of *C. equisetifolia* to adapt to local growing conditions perhaps resulted into die back, stem decaying, stem and branches fallings, and eventually death as compared to strong, firm, and healthy stems of *A. boonei* over the years despite the removal of the bark by humans. From this study, *A. boonei* has a large potential for restoring a sustainable beautiful environment in synergy with other desirable native species. The most important implications of the degree to which *C. equisetifolia* stands have been degraded are that planning and management should emphasize the retention and utilisation of native tree species for restoring ailing environments. The suitability status of common environmental trees in the University of Port Harcourt, is presented in Table 2 below.

Table 2. The suitability status of common environmental trees in the University of Port Harcourt

S/N	Common Ornamental Tree Species\	Origin	Family	Suitability Status
1	*Alstonia boonei* De Wild.	Tropical West Africa	Apocynaceae	Suitable
2*	*Anacardium occidentale* L.	Northeasthern Brazil	Anacardiaceae	Not suitable
3*	*Azadirachta indica* A. Juss	Indomalaysian dry region	Meliaceae	Not suitable
4*	*Casuarina equisetifolia* L.	Australia and Southeast Asia	Casuarinacea	Not suitable
5	*Chrysophyllum albidum* G. Don.	Tropical Africa (wet region)	Sapotaceae	Suitable
6*	*Cocos nucifera* L.	Southeast Asia	Arecaceae	Not suitable
7*	*Delonix regia* (Boj. Ex Hook) Raf.	Tropical dry forest region	Fabaceae	Not suitable
8*	*Elaeis guineensis* Jacq.	West African coast	Arecaceae	Not suitable
9*	*Eucalyptus camaldulensis* Dehnh	Australia	Myrtaceae	Not suitable
10	*Ficus elastica* Roxb. Ex Hornem	Tropical Asia	Moraceae	promising
11	*Gmelina arborea* Roxb.	Asia	Verbenaceae	Moderately suitable
12*	*Mangifera indica* L.	Asia	Anacardiaceae	Not suitable
13	*Musanga cecropioides* R. Brown	Tropical Africa	Urticaceae	suitable

14*	*Peltophorum pterocarpum* (DC.) K. Heyne	Southeastern Asia	Fabaceae	Not suitable
15*	*Polyalthia longifolia* Sonn.	India and Sri Lanka	Annonaceae	Not suitable
16*	*Roystonea regia* (Kunth) O. F. Cook	North America	Arecaceae	Not suitable
17	*Terminalia catappa* L.	Asia	Combretacea	Moderately suitable
18	*Terminalia ivorensis* A. Chev.	Tropical West Africa	Combretacea	Suitable
19	*Terminalia mantaly* H. Perrier	Madagascar	Combretacea	Moderately suitable
20	*Terminalia superba* Engl. & Diels	Tropical West Africa	Combretacea	Suitable

Adedeji, Eludoyin and Aiyeloja (2016)

The primary conservation policy should be formulated and directed towards the utilization of indigenous native species for landscaping in Nigeria as a whole. For instance, as far as the *Milicia excelsa* (Iroko) planted in the Departments of Social and Environmental Forestry and Forest Production and Products, University of Ibadan on 14 July, 1967 by the late Chief Akin Deko (Popoola,2014) is concerned, life begins at 54. Also for the one planted at our sport complex life is just beginning (Fig.34)

Fig. 34: *Milicia excelsa* (Iroko) planted in U.I and Uniport

A lot of uproar heralded the removal of the Neem trees *Azardirachta indica* for the construction of walk way in Abuja campus, the University Management therefore put modalities in place and planted up the stretch again with *Polyathia longifolia;* another unsuitable species. However, Adedeji, Aiyeloja and Omokua (2014), documented the impacts of *Ganoderma lucidum*, on the rows of *Azardirachta indica* rendering them unsuitable. We examined the occurrence and severity of *Ganoderma lucidum* on the Neem trees (*Azardirachta indica)* from Delta axis road to Senate/Ofrima roundabout for 3 years (January 2011-December 2013).

The study showed that 146 or 40.78% of the initial total number of 358 trees died within this period. Two types of *Ganoderma* were recognized: *G. lucidum* attacked live and deadwoods; and *G. applanatum* attacked only dead stump/wood. The fungus is a soil and air-borne pathogen whose pronounced occurrence and wide spread were observed in rainy months of April to July. Occurrences were severe in

March, August, September, October and November with less severity in December, January and February. The trends were similar for the 3 years of study. There was progressive increase in the damaging impact of *G. lucidum* in all trees and the total mortality associated with its occurrence was greater than 40% as at end of 2013. Other ornamental trees attacked by *G. lucidum* in the University premises include *Casuarina equisetifolia, Delonix regia, Terminalia catappa, Terminalia superba* and *Mangifera indica.* (Figs.35, 36, 37 & 38)

As at April 2021, there were 98 *Azardirachta indica* trees on the row in Abuja Park and none of them was healthy.

Fig. 35: *G. lucidum* on trunk of *Casuarina equisetifolia* tree

Fig. 36: *G. lucidum* on trunk of dead *Azadirachta indica* tree

Fig. 37 Cracking of trunk bark of a dying *Azadirachta indica* tree with dead fruiting bodies of *G. lucidum*

Fig. 38 Secondary pest termite attacking heartwood of live tree

Human pest situations in University of Port Harcourt

Some human pest situations have also been observed in the University. These are the human inhuman treatments of trees which I tagged 'tree abuse'; these include;

Burning of refuse under trees:

Deliberate burning of refuse under trees is common human pest situation in Nigeria. The situation becomes worse when the base of the tree is designated as waste dumpsite, which then exposes the tree to regular fire burn (Fig 39). The refuse burning effect has deepened into the heartwood section and the ability of the tree to close the wound is impossible. The tree has since died.

Inflicting Cuts on the stems of trees

The damage caused to the stem of trees seemed only superficial but the cuts are deep and capable of obstructing the cambium layer beneath as well as creating entry for pathogens. This will definitely shorten the rotation of the tree. (Fig, 40)

Girdling:
The girdling effect of ropes tied for spreading of washed clothes has caused the death of many ornamental trees (Fig. 41)

Stripping:
The stripped tree was then attacked by *G. lucidum* (Fig.42)

Fig 39: Impacts of refuse burning on live *Mangifera indica* tree

Fig. 40: Several cuts on *Terminalia mantaly*

Fig.41: Girdling of ornamental trees

Fig. 42: Stripping of trees

Awareness campaign and education is advised in other to control human pests' situations while adequate planting of quality trees in our dwelling environments is encouraged.

7.0 SMALL SCALE FOREST ENTERPRISES (SSFES)

Features of SSFEs

Small scale forest enterprises as a whole are a major source of rural livelihood in developing countries often next only to agriculture in terms of current rural employment. As the capacity of agriculture to generate additional livelihood progressively declines, more rural people have turned, and many more will still turn to employment in small scale forest enterprises. Basically, small scale forest based enterprises are characterized by (i) Small size with employment not more than 50 workers, (ii) Technologically simple operations which demand limited skills (iii) reliance or dependence on the entrepreneur and his or her family members for much of the labour input (iv) low capital which according to CBN (2003) is less than a million naira (v) predominantly rural location which makes them accessible to the poor, the landless and women. Although most small scale forest based enterprise activities form part of a broader industrial spectrum, which includes furniture making, charcoal production etc., in practice they are very small. Though they were defined in most literatures to encompass all enterprises with up to 50 employees, average employment in practice ranged from about 2 to 10 workers per enterprise (Aiyeloja, 2007).

The diversity of activities or enterprise types in small scale forest enterprises differs from country to country This is as a result of difference in forest – based raw material endowments or availability. Apart from the dominant ones such as wood furniture and charcoal that are common to most countries,

there are many other enterprises that are peculiar to some regions or countries. For example, there are the extraction of resin from trees in India, weaving reed matting in the Philippines and shingles production in Guyana and China (Aiyeloja, 2010). While some of these activities can be viewed as safety nets, some others could be poverty traps in which case it is perceived that the people are engaged in the activities because they are poor whereas in actual sense, they are poor because they rely solely on such enterprise for which economic dividend and remuneration are meagre. Such a situation often makes it very difficult if not impossible for those who depend on such enterprises to rise above poverty line.

Aiyeloja and Popoola (2008) noted that it is very tricky to rely solely on benefit-cost ratio and returns on investment to ascertain the economic viability and sustainability of small scale enterprises. Therefore, we postulated that SSFEs are economically viable only when the profits are able to sustain a family of six above the poverty line. It was observed that without adequate funds, many small scale enterprises will only remain potentially viable. However, Aiyeloja and Oyebade (2011) noted that with high regression coefficients of determination (R^2) on the rate of returns on investment on twenty enterprises investigated in Southwest Nigeria, if adequate funding is made available, the enterprises will sustain a family of six above poverty line. According to Ravi and Lyn (1999), a family of six has been the standard family size since 1910 when Benjamin Selbohm Rowntree used it to calculate the socially acceptable amount of money for the family. This approach has been used in many places ever since. Also according to the World Development Report (1990), the commonly used poverty line for monitoring progress in reducing poverty worldwide was the one dollar – a – day

measure. However, the World Bank reserves the prerogative to adjust the poverty line at periodic intervals as the cost of living changes across the globe. In 2008, it was updated to $1.25 per day and $1.90 per day since 2015 (Kenton, 2020).

Sensitivity analysis shows the degree of responsiveness of a project or an enterprise to increase or decrease in one or more variables while other variables remain constant. It is used to establish the minimum and maximum values a variable should have for a project or an enterprise to appear worthwhile. It shows how the variation in the cost or benefit affects profit margin in an enterprise. It is also defined as a technique for systematically changing variables in a model to determine the effects of such changes in the output. According to Lewis (1998), the usefulness of Cost-Benefit analysis and also rate of returns on investment (RORI) depends largely on addressing the presence of uncertainty in the analysis. Variables that are usually considered in economic analysis are discount rates and costs of production.

Sensitivity analysis is one of the principal quantitative techniques used for risk management and has been applied in various fields and disciplines including Complex Engineering Systems, Economics, Physics, Social Sciences, Medical decision making and others (Frey and Patil, 2001).
The most common approach to conducting a sensitivity analysis involves the following steps;

i) select one or more variables to be re-analysed
ii) select likely high or low estimates (as the case may be) for the variable(s).
iii) compute the analysis using the selected estimates.
iv) repeat the analysis changing the estimates until a possible worst case scenario is reached.

Sensitivity analysis revealed that 17 enterprises out of the twenty investigated in Southwest Nigeria between 2003 and 2006 were still viable when the cost of production was increased by 60% (b/c ratio > 1.1:1) while 11 enterprises had viable (RORI > 43 %). Also 7 enterprises were viable at 60% reduction in revenue (b/c > 1.1:1) while 5 enterprises had viable RORI (RORI > 38%). (Aiyeloja, 2007).

Various SSFEs investigated

The enterprises I worked on include: charcoal production, cane furniture making from rattan and willows, canoe making, mat weaving using the petioles of *Thaumatococcus danielli* (miraculous berry), honey production, mortar and pestle making, arts and craft works, snailery, cane rat farming, seedling and sapling production, cane rat/snail feed milling and wood furniture making.

Charcoal Production

Charcoal, a form of amorphous carbon, is produced when wood, peat, bones, cellulose or other carbonaceous substances are heated with little or no air present. A highly porous residue of microcrystalline graphite remains. This process of pyrolysis does not start until the temperature in raised to about 300 degree Celsius. The technique used in Nigeria is the traditional earth mound kiln method. Here, the woods (Sticks) are stacked in a rectangular manner with bigger ones below to a dimension of about 3.7m length, 1.8m breath and height of up to 1.2m. These are covered with dry grasses and then soil with few holes bored into it to regulate the air present in the kiln. It takes about 10 days for wood to be completely

pyrolised and the whole process of charcoal production about two weeks (Aiyeloja, 2007).

This enterprise has generated a lot of controversies between Forest Economics and Ecology. According to Aiyeloja and Chima (2011b), while the enterprise was viable in Oyo State, with benefit-cost ratio of 1.80:1 and mean rate of returns on investment of 79.15%, the practice was unsustainable with indiscriminate harvesting of trees of economic value for the production (Fig. 43). Adedeji and Aiyeloja (2014) also noted the negative effect of charcoal production on the availability of wood cavities for the survival of honey bees in Ogun State. The preferred wood species include; *Anogeissus leiocarpus* (Ayin), *Vitellaria paradoxum* (Emi) *Nauclea diderrichii* (Opepe) *Terminalia superba* (Afara), *Hallea ciliata* (Abura), *Afzelia bipindensis* (Aayan) *Afzelia africana* (Apa) *Blighia sapida, Erythrophleum suaveolens, Vitex doniana,*and *Lophira lanceolata*.

Ogunsanwo, Aiyeloja and Uzo (2007) documented the calorific values and moisture content of some of these species: *Anogeissus leiocarpus,* 11.63 kcal g^{-1} (5.12%), *Vitellaria paradoxum* 10.09 kcal g^{-1} (5.60%), *Daniella oliveri* 8.90 kcal g^{-1} (7.53%), *Terminalia superba* 8.25 kcal g^{-1} (5.28%). The uses of charcoal include; cooking of food in homes, roasting of food items like maize, yam and plantain, smoking of fishes and meats (including suya), tobacco curing, manufacturing of lime and cement and in the extraction of metal in the steel industries. Production is all year round. Aiyeloja, Adedeji and Oliver (2018) posited that charcoal provided nearly 100% of the processing energy for roasted plantain (popularly called bọlẹ) production and contributed 5.29% to the cost of production with average daily consumption of 5.99kg, among

the 94 vendors interviewed in Port Harcourt, Rivers State. Charcoal production could be better managed under plantation forestry and certification.

Fig. 43: Charcoal Production Site in Delta State, Nigeria

Cane Furniture Making.

Cane furniture are produced from rattans which are endemic to the mangrove and high forest vegetation of southern Nigeria. There are four genera and ten species of rattan found in various location in Nigeria. The four genera found in Nigeria are: Laccosperma, Calamus, Oncocalamus, and Eremospatha. The ten species are: *L. secundiflorum, L. opacum, E. hookeri, E. wendlandiana, E. macrocarpa, C. deeratus, C. bateric, O. mannii and O wrightianus*. Rattan has a variety of uses which include, building construction – frames, ceilings and walls; general construction – fish traps, rafters and construction of local xylophones; agricultural articles - mats, trays baskets,

sieves and winnowers, arts and handicrafts – furniture, flower vases, wig holders, lamp shade and stands, mirror and picture frames, gift baskets, shelves, wardrobes and walking sticks. Rattan is made up of two categories – cane and willow. Cane is rattan with small diameter stem while willow is rattan with big stem diameter. Rattan is collected from the wild in southern Nigeria all the year round most especially in the Niger Delta region of Delta, Bayelsa, Rivers and Cross River States. Oladele, Aiyeloja and Aguma (2013) evaluated the viability of the enterprise among cane furniture producers in Eleme, Obio/Akpor, Oyigbo and Port Harcourt city Local Government Areas (LGAs) of Rivers State, Nigeria. Results revealed that cane furniture production is profitable in all the four (4) LGAs assessed. Mean profit margins over three years were lower in Eleme (₦225, 933.00) and Port Harcourt (₦ 170,334.00) LGAs because the entrepreneurs were mainly on part-time production, while producers in Obio/Akpor (₦ 1,621,386.00) and Oyigbo (₦1,061, 219.00) LGAs had higher profits because they operate on full-time basis. Computed RORI showed that the enterprise is worthwhile in the area, with 210.72%, 182.72%, 66.32% and 29.82% in Obio Akpor, Oyigbo, Eleme and Port Harcourt city, respectively. Also benefit cost analysis showed viability of the business ranging from 1.14 to 2.45. However, Aiyeloja (2007) recorded 3.46 for Lagos State, and 1.71 for Oyo State

Canoe Making

Apart from the ark of Noah which was the first ship or canoe ever built (Genesis 5:14-16, 22), the earliest known boats were constructed from a frame of animal bone or light wood covered by animal skins or bark. Historians believe people used such boats as early as 16, 000 BC. Several thousand years later, round skin boats, called coracles, were developed in

Asia, Africa, the British Isles and the plains of North America. The earliest wooden boat, a dugout, dates from about 6000 BC and was discovered in the Netherlands. Ply wood boat construction began in the United State about 1918 and aluminum boats became common after World War II (1939 – 1945). The greater numbers of boats today are molded from composite plastic materials (Fiberglass) (Encarta Encyclopedia, 2006).

Canoe making is a common enterprise in the water side of southern Nigeria. This covers the coast of Lagos, Ogun, Ondo and the Niger Delta. Locally made canoes come in different sizes, ranging from 1.52m to 7.62m in length. Commercial canoes are fitted with engines which propel the canoes as they navigate the sea. Prominent among the wood species used in the construction of canoes are *Lophira alata* (Eki), *Uapaca heudelotii, Anophyxis klaineana. Piptadeniastrum africanum* and *Nauclea diderichii* (Opepe). Wood species such as *Uapaca heudelotii, Nauclea pobeguinii, Anophyxis klaineana, Lophira alata* and *Piptadeniastrum africanum* were used for dugout canoe production and have specific gravities of 0.74, 0.45, 0.75, 0.95 and 0.67, moisture content of 70.42, 158.54, 48.95, 40.11, and 83.01 and percentage shrinkage of 9.75, 19, 14.5, 14.5 and 9.75 respectively (Aiyeloja, Adedeji and Harcourt, 2018). The most durable canoes are made from the wood of *Croton lobatus* (Eru) and *Chenopodium ambrosoides* (Koriko). Canoes from *Lophira alata* last for 15 to 17 years *while Chenopodium ambrosoides* lasts for 18-20 years and *Croton lobatus* 25 to 30 years (Aiyeloja, 2007). Rate of returns on investment was above 100% for Lagos, Ondo and Rivers States.

Mat Weaving

There are varieties of mats obtainable from non-timber forest products. However we investigated the ones produced from the stems of *Thaumatococcus danielli*. *Thaumatococcus danielli* is also known as miracle berry, miracle – fruit or sweet prayer plant due to its versatility. It is a member of maranthaceae family. It usually has long petioles about 2 to 3 meters long arising from the rhizomes. At the end of these petioles are large, broad and oval papery, tough, versatile leaves that are about 45 cm long and 30 cm broad. The fruit which is usually green in colour but turns red when ripe contains thaumatin – a chemical substance that is more than 2,000 times sweeter than sucrose. The stalk (Petiole) is used for local roofing and construction of fish traps. When this petiole which is roughly about 2cm in diameter is beaten into fibre, it is allowed to dry under the shade after the roughages have been removed. This is then used in weaving mat, bags, hats and other handicrafts. A very big mat required about 400 pieces of *Thaumatococcus danielli petioles* (stalks) and an average woman will weave a very big mat in two days. This enterprise is prominent among women in Ipetu-Ijesha, Osun State and very profitable with benefit-cost ratio of 3.57 and rate of returns above 200% (Popoola, Aiyeloja and Ogunjinmi, (2009). In addition to mat production, the leaf of *T. danielli* is used extensively in cooking and wrapping food for both domestic use and commercial enterprise. As a matter of fact the use of leaves of *Thaumatococcus danielli* transcends the confines of the rural dwellers, as evidenced by its use for special packaging of rice by a prominent and well spread urban-based fast food restaurant in Southwest Nigeria. The leaves are also used for preserving *Cola nitida, Cola acuminata* and *Garcinia cola* and as food supplement to some ruminant animals. The fibrous nature of the leaves enhances

their use in combination with some other materials for roof thatching in hamlets and as resorts, while the root features in traditional medicine. The rate of returns on the sales of *Thaumatococcus danielli* leaves ranged between 52.17 and 57.69%, in the Five Local Government Areas covered in Osun State with an average of 55.88% and a standard deviation of 2.58. (Aiyeloja and Ajewole 2005)

Mortar and Pestle Making.

Mortar is a wooden bowl designed for pounding (Fig. 38) and grinding by means of a club –shaped tool called pestle. The pestle is made of hard wood with a rounded end that is used for crushing, pounding or grinding substances in a mortar. In rural setting and some urban contents, mortars and pestles are used to pound boiled yam to produce pounded yam. Other crops such as grains, cassava, rice, and dried parboiled yam peels are grounded to smaller bits. This local and ancient technology is still very much in use despite the advent of pounders and grinders which are automated machines. Larinde and Aiyeloja (2015) documented the contributions of this enterprise (Fig. 44) to livelihood improvement and household income in rural communities of Southwest Nigeria. Wood species used include *Milicia excelsa, Vitellaria paradoxum, Daniella olliveri., Nauclea diderrichii, Pterocarpus soyauxii*, The cost benefit ratio (CBR) was 1.79 while the mean RORI was 78.07%, which indicated the profit potentials of the enterprise. Apart from generating income to local artisans, M & P production facilitates long-term locking-up of carbon in utilized wood thereby contributing to carbon sequestration.

Fig. 44: Mortal Depot in Ibadan, Oyo State

Arts and Craft Works

These have to do with the creative design of everyday objects i.e, the hand production of decoratively designed everyday objects (Encarta, 2006). There are varieties of arts and crafts ranging from wood carving, bronze casting, clay, sculpture to jewelry smiting and cane weaving. Wood carving involves the production of traditional items such as bowls, cups, spoons, knife sheath, tool handle, wooden pestle and mortar, musical instrument like the guitar, cello, violin, double bass and talking drum, walking sticks, dishes, stools, vases, drums, bee hives, masks and other decorative (Ogunsanwo, Aiyeloja and Owowa, 2007). According to Larinde and Aiyeloja (2012) the rate of returns on the sales of laminated wood products ranged from 38.9% to 133.3% while the benefit-cost ratio is 1.90:1

After human voice and of recent other social media, talking drum is perhaps the most popular medium by which most southwestern Nigerians communicate, share ideas, views, thoughts and policies.

To a large extent, the voices are directly and largely dependent on the specific wood species used. The sound from the talking drum has both a base and treble tone and it is principally

dependent on length and thickness of the wooden frame neck. Formerly, the length of the hourglass shaped talking drum was 6 by 14 inches but with the inclusion of talking drum in modern music, the length was reduced to 11 inches. However, the longer talking drum (6 by 14 inches) is still in use today especially in Kwara State and among the Fulanis.

Aiyeloja, Adedeji and Adebisi (2015) investigated the Suitability of *Gmelina arborea* (Roxb.) wood for making talking drum in Ibadan, Oyo State, Nigeria. This became necessary due to the scarcity of *Cordia millenii* which hitherto was the choice species for drums carving. The results of social surveys and interactions revealed the scarcity of *Cordia millenii* in the three states but confirmed the wide utilization and acceptance of *Gmelina arborea* as suitable substitute for production of drums generally. The bigger girth stems was employed and observed to be used for deity and small god special drums. However, the recent scarcity of *Gmelina arborea* has forced the wood carvers to explore non-suitable species like *Tectona grandis, Funtumia elastica, Alstonia congensis, Celtis zenkeri, Anogeissus leiocarpus.* The explanations by the master drummers in the surveyed areas were expressive of other species being not suitable in that they could easily split when they mistakenly fall. Giving economic explanations for the utilization of the above species, both the wood carvers and master drummers admitted that these species were highly vulnerable to splitting and other drying defects.

Gmelina arborea wood was easy to machine, turn and dig without any significant wear to the crude tools used. This workability was likely due to the fine and less open structures as well as the moisture content of the wood and the consistency of wood density. The drum frame (Fig.45) dried

fairly quickly with no defects. It is noteworthy that for 42 years, the drum made from local *Gmelina arborea* wood apparently showed resistance to wood borers, splitting, even with exposures to sunlight, the drum remained stable and sound (Fig.46). Resistance to wood borers could be probably attributed to appreciable amount of Alkaloids present in *Gmelina arborea* wood and age. This resistance to both wood borers and splitting demonstrates the suitability of the species for drum production.

Fig.45: Hourglass drum frame

Fig.46: 42-year-old talking drum made from *Gmelina arborea*

Carving of wood and drum production

The hourglass drum frame with a neck at the centre (Fig. 43) was carved from a solid *Gmelina arborea* wood. The neck was 5 inches long while each of the both jaws was 3 inches. The carved frame was air dried under shade and room temperature. The carved frame was intermittently hand tested for desirable acoustical value in the course of drying until the expected acoustical property was realized. Thereafter, the drum frame was conditioned under room temperature for about one week

before application of cow fat as sealant into the inner part of the frame. The cow fat was used as stabilizer and retardant of the occasional movement of moisture into the inner part when having contact with moisture sources. Goat skin was processed with the pulp of *Lagenaria breviflora* fruit (Tagiri, Yoruba Nigeria), (Fig.21) into leather. The use of *Lagenaria breviflora* fruit pulp was not limited to depilation capability but also impacted preservative property against leather boring insects.

After processing the goat skin into fine leather, the two ends of the drum frame were covered with the leather sheets and connected to each other in varying degree of tautness by strings stretched all round the drum. *Gmelina arborea* wood showed high resistance to twisting and splitting during machining, carving and tautness of the strings. The drum was periodically tested by master drummer and kept in clement environment devoid of moisture contact.

Density of a material has often been considered to be the important factor that governs the sound absorption behaviour of the material. The 12-year old *Gmelina arborea* wood had basic density of 476±0.20kg/m^3 and coefficient of variation (CV) of 6.86% which was in congruity with the reported 480kg/m^3 (Ogunsanwo, Adeleye, and Anjah 2011). It also has comparable basic density with those reported for *Cordia millenii* - 436.51±14.39kg/m^3

Based on our findings, *Gmelina arborea* wood is considered as most suitable for drum production and ready substitute for *Cordia millenii* in Nigeria.

Snail Farming

Until very recently, snails have been obtainable only from the wild, most especially during the rainy season. However, due to increasing rate of deforestation and conversion of forest to agricultural land, there has been a downward trend in the availability and supply of snails. This makes the idea of snail farming very noble and acceptable. Snail farming is also called heliculture. Snails are hermaphrodites and can lay about 50 – 95 eggs which hatch to young snails in about 20 – 30 days.

Young snails show sign of sexual maturity between 9 – 10 month of age and species of Archachatina can live for up to 5 years. Snails feed on pawpaw (fruits and leaves) maize chaff, cassava leaves and tuber, potato leaves and tuber and cocoyam leaves and tuber. They are cold-blooded animals and very sensitive to temperature, salt and humidity. They thrive well with temperature below 30^{o}C and high humidity. According to Aiyeloja and Ogunjinmi (2010), snail production in Ondo State was profitable with benefit-cost ratio of 2.34 and average rate of return on investment of 149.04 with regression coefficient (R^2) = 0.67.

Cane rat Farming

Grasscutter (Cane rat) (*Thryonomis swinderianus* Temmick) is a rodent endemic to Africa. The animal occurs in savannah grass lands, cultivated lands and secondary forests. Grass cutter is preferred to domestic livestock as a source of protein by many people without any cultural taboo. In Africa, forest is often referred to as the bush thus wildlife and meat derived from it is referred to as bush meat. Grasscutters are herbivorous but will readily take sugar cane, corn stalks. leafy materials from cassava, guinea grass, elephant grass, spear grass, fresh groundnut, centro, sand paper leaf, sweet potato,

African giant star grass, tubers and underground stem of spear grass, cassava, yam, sweet potato and fruits and grains of mango (unripe) oil palm, pineapple and maize in captivity.

Grasscutter has a gestation period of about 152 days and average litter size of four to twelve. The young are littered with their eyes open and the coat fully developed and are able to follow the mother immediately after birth. Two litters are possible in a year if the female is crossed a month after parturition. Average weight of wild grass cutter is 5 kg but 10 kg has been recorded in capacity. Depending on the size of cages used, stocking rates of one male to five females are possible. Pregnant females must however be separated from the male since cannibalism on the newly born young ones is common. Based on the outcome of the research carried out by Aiyeloja and Ogunjinmi (2013), Oyo, Osun and Ondo States had benefit-cost ratio of 2.09, 3.64, 1.77 and rate of returns on investment of 134.33%, 331.82 and 78.06% with regression coefficients (R^2) valies of 0.99, 0.97 and 0.71 respectively. Other wild animal species under domestication include giant rat (*Cricetomys gambianus*), guinea fowl (*Numida meleagris*), giant african snails *Achatina sp* and *Archachatina sp*, Crocodile (*Crocodylus niloticus*), Ostrich (*Struthio camelus*) and Kob (*Adenota kob*).

Wood Furniture Making

This is arguably the most popular of the small scale forest enterprises and the one with the largest number of artisans. Furniture include beds, chairs, tables, cabinets, desks and chests. These could be wood, metal or plastic made. Wood furniture has passed through various stages of development right from the medieval to the present age. There are big companies dealing with wood furniture on a medium or large

scale. There are however, numerous small scale wood enterprises all over Nigeria. According to Aiyeloja, Oladele and Ozoemena (2014), the outcome of the socio-economic analysis of wood furniture production in Port Harcourt City showed benefit-cost ratio of 2.56, 2.71, 1.97 and 2.43 for Artisanal, cottage, medium and large scales respectively. The rate of returns on investment stood at 148.78, 163.42, 104.08 and 194.61 percent respectively. Sensitivity Analysis on B/C showed a threatened investment at 100% (0.89) and 160% (0.93) increase in cost for medium and large scale production respectively. Similarly, Sensitivity Analysis on RORI showed that large scale production was more resilient to increase in cost up to 120% (33.92). Thus, wooden furniture industry in Port Harcourt was found to provide employment, sustained livelihood, and was highly profitable and viable. Aiyeloja, Oladele and Furo (2013) had earlier observed a booming business among sawn wood dealers from whom furniture makers purchase raw materials. A study conducted at Illoabuchi and Marine Base Timber Markets in Port Harcourt metropolis revealed that the plank marketers were all male with 70% and 43.3% possessing high school education in Illabuchi and Marine base markets respectively. The average net incomes from sawn wood sales were ₦184, 239.00 and ₦70, 355.00 for Illabuchi and Marine Base plank markets respectively, while RORI was 78.7% and 30.2% for the two markets. Benefit –Cost analysis showed that plank marketing is a viable investment in Port Harcourt (1.81 and 1.33 for Illabuchi and Marine base markets respectively), Net Present Value was higher in Illabuchi (₦107, 180.70) than Marine Base markets (₦42, 630.44). Educational level of the marketers was significant (0.032, 0.018, 0.012, 0.024, $p \leq 0.05$) in four regression functions tested on profitability of sawn wood marketing. Wood quality (65%), availability (20%)

and price (15%) were identified as the main factors of consumer preference in the study area. Findings showed that ten (10) timber species were mostly preferred for building and other wood works. The order of preference was *Khaya ivorensis* A. Chev. (Meliaceae), *Khaya gradifoliola* A.Juss (Meliaceae), *Entandrophragma cylindricum* Sprague (Meliaceae), *Mansonia altissima* J.R Drum. ex Prain (Sterculiaceae), *Terminalia superba* Engl.& Diels (Combretaceae) and *Triplochiton scleroxylon* Schumann (Sterculiaceae). Other wood species common in the market during the survey include *Milicia excelsa* (Welw.) Benth & Hook.f (Moraceae), *Brachystegia erycoma* Harms. (Leguminosae - Caesalpinioideae), *Terminalia ivorensis* A.Chev. (Combretaceae) and *Hallea ciliata* J. Leroy (Rubiaceae). Sawn wood marketing was found to be a viable enterprise in Port Harcourt.

Given the increasing population and logging pressures globally and the indiscriminate and unsustainable logging pattern in Nigeria, Aiyeloja, Ogunsanwo and Asiyanbi (2011) studied the many lesser-known species (LKS) in Oyo and Osun States so as to unveil the potential they have to improve supply of wood and maintain forest sustainability. Nigeria has about 600 species of timber but only about 100 are on sale in the South-west; less than 50 species are regularly in use in the cabinet industry, while about 20 which are high in demand are presently faced with intense scarcity. It is therefore necessary to widen species utilization to increase value and profit, without expanding the area of harvest. Making available information on the resource base, outputs from research and development, as well as carrying out systematic and aggressive marketing and above all, cooperation between consumers and producers are vital in conservation of LKS. This will ensure

that subsequent promotion and marketing are based on predictable rates of supply and an adequate level of availability. Forty-nine (49) lesser known species were identified. (Table 3).

Table 3: List of Lesser Known Species, Use Intensity and Substitutes

S/N	LKS	Local Name	Family	Use Intensity	Substitute
1.	*Syzygium guineense*	*Adere*	Myrtaceae	9	Babo
2.	*Chrysophylum albidum*	Agbalumon*	Sapotaceae	-	-
3.	*Brachystegia eurycoma*	Ako	Caesalpinaceae	24	Iroko
4.	*Markhamia tomentosa*	Akoko*	Bignoniaceae	-	-
5.	*Pycnanthus angolensis*	Akomu	Myristicaceae	2	Efo
6.	*Cleisthopholis patens*	Apako	Annonaceae	3	-
7.	*Ericarpus sp.*	Ara		16	Apa
8.	*Ceiba pentandra*	Araba, Ogungun	Bombacaceae	29	-
9.	Babo	Babo		17	Ara
10.	*Anacardium occidentalis*	Cashew*	Anacardiaceae	-	-
11.	*Cassia sp.*	Cassia	Caesalpinaceae	5	-
12.	*Azardirachta indica*	Dongoyaro*	Meliaceae	-	-
13.	*Treculia africana*	Efo	Moraceae	4	-
14.	*Vitalaria paradoxum*	Emi	Sapotaceae	1	-
15.	*Ricinodendron heudelotii*	Epuu	Euphorbiaceae	15	-
16.	Eriri	Eriri		2	Iya

17.	*Erythrophylum ivorense*	Erun*	Caesalpinaceae	-	-
18.	*Artocarpus uttilis*	Gbere/ MTN	Moraceae	4	Araba
19.	*Gmelina arborea*	Gmelina	Verbenaceae	55	-
20.	*Parkia biglobosa*	Igba	Mimosaceae	7	Mango
21.	*Alstonia boonei*	Ihun/Ahun	Apocynaceae	8	-
22.	*Ficus exasperata*	Ipin	Moracea	3	Epuu
23.	*Funtumia elastica*	Iree	Apocynaceae	20	Ayunre
24.	*Blighia sapida*	Isin	Sapindaceae	2	-
25.	*Celtis integrifolia*	Ita	Ulmaceae	23	-
26.	*Daniellia Ogea*	Iya	Ceasalpinaceae	26	Ori
27.	*Spondias mombin*	Iyeye*	Anacardiaceae	-	-
28.	*Sterculia oblonga*	Koko'gbo	Sterculiaceae	8	-
29.	*Amphimas pterocarpoides*	Koleagbe	Papilionaceae	1	-
30.	Kuere	Kuere		2	Emi
31.	*Boscia augustifolia*	Lahoro	Capparacea	2	-
32.	*Santalum album*	Lofinda	Santalaceae	1	-
33.	*Mangifera indica*	Mango	Anacardiaceae	7	Igba
34.	*Cola nitida*	Obi	Sterculiaceae	3	Agbohin
35.	*Ficus mucuso*	Obobo	Moraceae	28	-
36.	Odugbe*	Odugbe*		-	-
37.	*Canarium schweinfurthii*	Ole	Burselaceae	28	-
38.	*Tetracera alnifolia*	Opan	Dilleniaceae	2	-
39.	*Elaeis guineensis*	Ope*		-	-

40.	*Pterygota macrocarpa*	Oporoporo	Sterculiaceae	5	-
41.	*Vitex doniana*	Ori	Verbenaceae	15	Iya
42.	*Antiaria afrricana*	Oriro	Sterculiaceaea	19	Obobo
43.	*Irvingia gabonensis*	Oro	Irvingiaceae	2	-
44.	*Malacantha alnifolia*	Osan	Sapotaceae	4	Gmelina
45.	*Chrysophylum delevoyi*	Osandan	Sapotaceae	13	-
46.	Oyedu*	Oyedu*		-	-
47.	Oyodo*	Oyodo*		-	-
48.	*Triaspis monadelpha*	Rere	Malpighiaceae	1	Epuu
49.	*Delonix regia*	Sekeseke*	Caesalpinacea e	-	-

Species marked with an asterisk are those that were listed as new (LKS) but with which cabinet-makers were not willing to identify because they consideered these species inferior or rarely if ever used, hence the paucity of information about them. Frequency of mention as reported in the table above signifies use intensity and availability of species. Species with higher frequency are likely to have higher use intensity and are also likely to be more available

Other Non-Timber Forest Products

Despite the wide varieties of food items being fed to 'domesticated' wild animals, there is still need to feed them with compounded formula to cater for their entire nutritional needs. Such feed is made from the mixture of different percentages of palm kernel chaff (PKC), rice bran, maize bran, wheat offal, bone meal, blood meal, oyster shell, maize, salt and other mineral contents. Some groups of individuals have been making their living through this noble enterprise.

Aiyeloja (2007), documented benefit-cost ratio of 2.87:1 and rate of returns on investment of 261.81% in Oyo State.

Another beautiful enterprise is seedling production where tree seedlings are raised for sale. Composts, top soils and seeds are also produced for sale. Most of the seeds are obtained from the wild. However, in recent times efforts have been made towards forest genetics and seed multiplication and improvement. Benefit-cost ratio of 1.80:1 and rate of returns on investment of 82% were reported in Oyo State (Aiyeloja, 2007).

According to Aiyeloja and Ajewole (2006), Forest management in Nigeria has been largely focused on timber production ever since the beginning of organized forestry. However, in the recent time, there has been increasing recognition of the fact that this approach to forest management is neither conducive to sustainable management of the forests particularly of the tropical moist forest nor is it in the best economic interest of the predominantly rural societies in the tropics.

The term non-timber forest product preferably called non-wood forest products in some regions of the world has been used (of recent) to replace minor forest product or intangible forest product as it was formerly particularized. Due to the relative scarcity of most of the NTFPS now as a result of deforestation, and the present awareness of their importance, more value is being added which has made them (NTFPS) highly marketable. Aiyeloja and Ajewole (2006) identified more than 50 non timber forest products traded in Osun State. Kalu and Aiyeloja (2002) reported marketing of bush meat in Benin City and its environs as a very viable enterprise.

Aiyeloja, Oladele and Ezeugo (2012), documented the viability and contributions of twelve NTFPs traded in the local markets in Ihiala Local Government Area of Anambta State to the livelihood of the people (Table 4). This was in consonance with the findings of Larinde and Aiyeloja (2009), Omokhua, Ukoima and Aiyeloja (2012), Aiyeloja, Alex and Bello (2012), Oladele, Aiyeloja and Hycent (2013), Oladele, Aiyeloja and Okosun (2014) who worked on marketing of chewing stick, *Treculia africana* fruit, fruits and seeds of *Irvingia garbonensis*, forest leafy vegetables, and wild edible mushroom in Southwest, Edo, Bayelsa and Rivers States respectively.

Table 4: **Profit margins of commonly traded NTFPs in Ihiala LGA**

Species	Family	Part	Averag	Processi	Sales	Profit
Bambusa	Poaceae/Gra	Stem	-	-	N50/metr	N50/me
Calamus	Arecaceae/Pal	Stem	N10/kg	N500/ba	N1000/b	N490/ba
Dacryod	Burseraceae	Fruit	N152.5	N06.5/k	N195.7/k	N36.7/k
Garcinia	Gutifferae	Seed	N918/k	N50	N1225/k	N257/k
Garcinia	Gutifferae	Stem	N10/kg	-	N120/kg	N110/k
Gnetum	Gnetaceae	Leav	N240/k	-	N300/kg	N60/kg
Gongron	Asclepiadace	Leav	N100/k	-	N130/kg	N30/kg
Irvingia	Irvingaceae	Drie	N1000/	N20	N1400/k	N380/k
Pentaclet	Mimosaceae	Seed	N270/k	N15/kg	N356/kg	N71/kg
macroph	Piperaceae	Drie	N500/k	N50/bag	N700/kg	N200/k
Piper	Piperaceae	Fresh	N200/k	-	N350/kg	N150/k
Treculia	Moraceae	Seed	N200/k	-	N220/kg	N20/kg
Xylopia	Annonaceae	Fruit	N500/k	-	N700/kg	N200/k
		Total	N4100.	N641.5	N6746.7	N2054.

(Note: ₦ - Nigerian Naira, 1 USD = N165)

Raphia wine is an important forest product with cultural significance besides its use as medicine and food in southern Nigeria. *Raphia* wine has potentials to generate household

income, enhance food security and improve quality of life in rural, semi-urban and urban communities. Raphia palm (*Raphia hookerii* G.Mann & H. Wendl) is an important palm species in moist forest of West Africa for local wine production, leaves for shelter and local furniture. It is prevalent in moist forests and wetlands of southern Nigeria. The most important local economic products from Raphia palm is the wine, research developments recently include other products such as *Raphia* fibre (Piassava broom), pulp for paper production and oils from the seeds that have prospects for industrial uses. Within a period of two month, a single *Raphia* tree has been reported to yield 870 litres of palm wine from cutting to death, but average yields are about 100 litres per palm generally (Brink, 2011). The root and wine are used in local medicines as prevention and therapeutics for malaria fever, stomach pain and related diseases. Medicinal herbs are soaked in palm wine to extract active ingredients for the treatment of wide variety of ailments. In almost all social-cultural ceremonies across southern Nigeria such as; traditional weddings, births, chieftaincy coronations and funerals, palm wine is served as refreshments. Aiyeloja, Oladele and Tumuno (2014) noted that *Raphia* wine enjoyed high preference among the people of Sapele LGA for its distinctive sweet taste which accounted for its acceptability among the people; hence it is preferred to other local wines. Ability to intoxicate due to the alcohol level accumulated during fermentation on exposure to air is another factor that attracted young people especially to *Raphia* wine. It is also erroneously consumed as energy drink particularly among the farmers (operating with local cutlass and hoe for land tilling) and artisans that engage in other energy sapping activities. *Raphia* wine producers and marketers operate at small scale profitably (daily sales between ₦9, 000 and ₦15, 000) with good returns on investment (50%

for marketers, 100% for producers) in the different communities studied. It is consumed by both rural and urban populations. Despite the economic importance to the people, Adedeji and Aiyeloja (2016) noted that the two major uses of *Raphia hookeri* in Niger Delta are production of wine and edible insect larvae (*Rynchophorus phoenicis*) from stem sap and wood (trunk) of Raphia palm. Except rational utilisation is employed, it will be inconsistent with long term environmental enhancement, because it is usually associated with death of the utilised palms. Other sustainable uses investigated include; basket production from the fronds, cages for avian domestication, fishing gear, sieves for sorting and grading farm products, seat and beds, ladder, ceiling materials and items for cultural festival dance.

The flexibility, light weight, durability, and high compressive strength parallel to grain demonstrated by *Raphia hookeri* frond have probably made it the only suitable item for 'Gagalo' or 'Agere' cultural festival dance among the 'Egba' and 'Yewa' people of Ogun State Nigeria over the years. The indigenous manner of *Raphia*. *hookeri* fronds stands (legs) aided dance has assumed a tremendous socio-cultural value to the 'Imeko' people both home and away. Variation exists in thickness and height of the Gagalo legs depending on the age class, weight, and the ability of individuals to move the legs effectively (Fig.47). However, 'Arinbioloye' (Fig. 48) which literarily means 'working majestically', is usually the tallest and dances last to close the sport festival.

Fig. 47: Youth twins Gagalos using one leg up, one leg down dance to entertain spectators in Imeko, Ogun State

Fig. 48. Arinbioloye Gagalo (adult) standing majestically prior his dancing display at Gelete market, Imeko, Ogun State, Nigeria.

Honey Production

Honey, a pure, natural sweetener prepared by bees from nectar collected from wild and cultivated flowers, was the first sweetener known to man (Draper, 2006). Early civilization like the Greeks and Romans called honey the nectar of the gods". The common honey bees, *Apis melifera* which belong to the class-insecta, order-hymenoptera and family – apidae produce honey with a flavor and color typical of the particular flower they colonize. They also make natural blend from many different flowers in areas where no particular flower predominates. The flavor of honey does not affect its quality though light – colored honeys are usually of higher quality than darker honey. (Encarta Encyclopedia, 2006).

Other products obtained from honey bees include bees wax, bee pollen and royal jelly. Bee wax is sold as a byproduct for candles, polishes and as a component in cosmetics. Royal jelly – a secretion of the glands of the worker bee is the queen bee's sole source of nourishment. It is promoted in retail sales as a nutrient and as a source of energy. It is currently selling at $250 per kilogram. A small scale investment in the bee industry might start out with about 25 hives, 6 bee suits, 4 smokers and other accessories. Such establishment requires up to five hundred thousand naira only.

Aiyeloja, Popoola and Ogunjinmi (2010), carried out the economic analysis of honey production in Southwest Nigeria and observed that the enterprise is economically viable with mean annual profit conveniently above poverty line for a standard family size and RORI of about 85%. Of all these enterprises, only bee farming does not involve consistent daily activities. Provide accommodation for the bees and get them work for you. This made me to go into full scale research on

bee activities and bee farming. Mr. Vice-Chancellor Sir, I am a bee farmer and in farming, there is no alternative to practical (Aiyeloja and Adedeji, 2012).

The first thing we did was to investigate the wood species cavities colonized by honeybees in Nigeria for a period of four years. Aiyeloja and Adedeji (2014) identified 24 wood species belonging 15 families used for nesting by honeybees (table 5). The predominant wood families used for nesting by honeybees were Fabaceae, Malvaceae and Verbenaceae which accounted for 11.90%, 19.04% and 26.19% respectively with *Adansonia digitata* (Malvaceae) holding multiple nests. Other families include Anacardiaceae, Apocynaceae, Arecaceae, Combretaceae, Irvingiaceae, Moraceae, Myristicaceae, Ochnaceae, Rubiaceae, Rutaceae, Sapotaceae and Ulmaceae. Among individual tree species; *Gmelina arborea* cavities were most encountered (13.10%), followed by *Vitex doniana* (10.71%), *Adansonia digitata* (8.33%) and *Anacardium occidentalis* (8.33%). Nineteen species were indigenous forest/savannah woods (trees), one exotic forest tree while four were agricultural tree crops including palm. Results showed that honeybees significantly preferred Verbenaceae wood cavities (both living and dead). Families Apocynaceae, Malvaceae and Moraceae were preferred alive while others were preferred in dead state. The study further revealed that Nigerian honeybees have affinity for white and yellow coloured woods which makes them colour specific. Alternative cavities encountered were rock (primary rock), termite mounds and deserted rodent and soldier ants' burrows (Fig. 49).

Table 5. Identified Wood Species

S/N	Wood species	Local name (Yoruba	Families	Colour	Tree Condition	Vegetation type found
1	*Adansoniadigitata*	Ose	Malvaceae	White	Living	Savannah
2	*Anacardium occidentals* L.	Kaju	Anacardiaceae	Light yellow	Dead	Forest/ Savannah
3	*Anogeissusleiocarpus* (DC.) Guill.	Ayin, Orin	Combretaceae	Dark yellow	Dead	Savannah
4	*Bombaxbuonopozense* P. Beauv.	Ponpola	Malvaceae	White	Living	Forest/ Savannah
5	*Ceiba pentandra* (L.) Gaetn.	Araba	Malvaceae	White	Living	Forest/ Savannah
6	*Celtiszenkeri* Engl.	Ita	Ulmaceae	Whitish yellow	Dead	Forest/ Savannah
7	*Citrus paradise* Macf.	Osan grape	Rutaceae	Light yellow	living/dead	Forest/ Savannah
8	*Citrus sinensis* (L) Osbeck (pro.sp)	Osandidun	Rutaceae	Light yellow	living/dead	"Forest/ Savannah
9	*Cocosnucifera* L.	Agbon	Arecaceae	Dark yellow	Dead	Forest/ "Savanna
10	*Daniellaoliveri(Rolfe)* Hutch.	lya	Fabaceae	Brownish	Dead	Savannah
11	*Delonix regia* (Boj.ex Hook.)	Panseke	Fabaceae	Whitish yellow	living/dead	Forest/ Savannah
12	*Ficus*	Obobo	Moraceae	White	Living	Forest
13	*GmelinaarboreaLinn.*	Gmelina	Verbenaceae	White	living/dead	Forest
14	*Irvingia gabonesis*	Oro	Irvingiaceae	Light yellow	Living	Forest/ Savannah
15	*Lophira lanc*	Panhan	Ochnaceae	Yellow	Living	Savannah
16	*MorindalucidaBenth.*	Oruwo	Rubiaceae	Yellow	Dead	Forest/ Savannah
17	*Nauclea diderrichii* (De	Opepe	Rubiaceae	Golden yellow	Dead	Forest
18	*Pterocarpus erinaceousPoir.*	Apepe	Fabaceae	Dark yellow	Dead	Forest/ Savannah

19	*Pycnanthus angolensis* (Welw.)	Akomu	Myristicaceae	Whitish yellow	Living/dead	Forest/ Savannah
20	*Rauwolfia vo*	Asofeyeje	Apocynaceae	White	Living	Savannah
21	*Tamarindus indica* L.	Tamarind	Fabaceae	Whitish pink	living/dead	Savannah
22	*Vitellaria para*	Emi	Sapotaceae	Dark yellow	living/dead	Savannah
23	*Vitex doniana*	Ori	Verbenacea	White	living/dea	Savannah
24	*Vitex ferru*	Ori eta	Verbenaceae	White	living/dead	Forest

Dead *Cocos nucifera* L.

Adasonia digitata L. Branch

Vitex doniana S. Trunk

Abandoned Termite Mound

Fig.49: Honey bee nesting

Adedeji and Aiyeloja (2014) also observed that *Apis mellifera* has special preferential nesting behaviour for white and yellow woods'

cavities in Nigeria contrary to the use of brown coloured wood like *Milicia excelsa* as suggested in Ghana on the ground of durability. We investigated the suitability of one exotic white coloured wood species (*Gmelina arborea*), one indigenous white coloured wood species (*Vitex doniana*) and one

indigenous brown coloured wood species (*Erythrophleum suaveolens*) for beekeeping for three years. Colonisation of hives made of *G. arborea* and *V. doniana* woods within two months of placement at the 3 sites was observed. Honeybees colonized *E. suaveolens* wood hive and absconded in the same month of colonisation. Quantitative analysis of the wood samples' extracts indicated the presence of 39.62mg/g total alkaloids, 1.38mg/g total flavonoids, 84.19mg/g total phenol, 366.52mg/g total Saponins and 101.18mg/g total tannins in *E. suaveolens*; 35.19mg/g total alkaloids, 1.24mg/g total flavonoids, 3.98mg/g total phenol, 5.69mg/g total Saponins and 4.49mg/g total tannins in *G. arborea*; and 4.52mg/g total alkaloids, 0.42mg/g total flavonoids, 1.00mg/g total phenol, 0.66mg/g total Saponins and 1.59mg/g total tannins in *V. doniana* (Table 6). The results suggested that colour and non-structural chemical composition might be involved in choice and colonisation of cavities (hives) by honeybees. Colonisations were reliably stable in white wood hives with quantifiable honey production. The colonisations choice of white woods' hives and rejection of brown wood hives confirmed the suitability of *G. arborea* and *V. doniana* woods and non-suitability of *E. suaveolens* wood for beekeeping in Nigeria.

Table 6: Mean Values of Woods Non-Structural Chemical Composition

Wood species'	Alkaloids ($^{m}g/g$)	Flavonoids ($^{m}g/g$)	Phenol (mg/g)	Saponins ($^{m}g/g$)	Tannin (mg/g)
E.	39.62±0.17	1.38±0.02	84.19±0.02	366.52±0.04	101.18±0.02
G.	35.19±0.03	1.24±0.01	3.98±0.055	5.69±0.120	4.49±0.120
V doniana	4.52±0.115	0.42±0.01	1.00±0.015	0.66±0.025	1.59±0.120

For pest situation, Small hive black beetles (*Aethina tumida*) were scantly found in all the hives during the dry season. It is a honey eater and not combs destroyer like moth wax. Moth wax was once a notable threat pest that caused high rate of absconding in the study area when hives' covers were not properly reinforced most importantly during rainy season. Termites have also been observed as major pre and post colonisation pest of honeybees' wooden hives in Nigeria. Aiyeloja, Adedeji and Larinde (2014) investigated the influence of seasons on the intensity of hives attacks by termites for 2 years at the University of Port Harcourt Experimental Apiary Unit using 15 Kenyan's top bar hives made of *Triplochiton scleroxylon* wood (Fig.50).

The colonised hives consistently showed comparatively lower termite's infestation levels in the dry season and consequently, also lower attacks on the colonized hives. The result indicated rainy season as a distinct period for more destructive activities of termites on the hives and strongly associated with dryness of the hives. Adedeji, Aiyeloja and Emerhi (2015) submitted that honeybees showed highest preference for colonising hives in the month of October. This was probably due to the fact that October was the reproductive swarming month for honeybees in the ecological zone. Swarming of honeybees in the month of October have some strong association with setting and fruiting of some crops like *Anacardium occidentalis* (Cashew), *Mangifera indica* (Mango), *Theobroma cacao* (Cocoa), *Citrus* sp.(Oranges), *Azadirachta indica* (Neem), *Irvingia* sp. (Bush Mango), etc. which provided nectars and pollens for honeybees' nutrition. Colonisation has also taken place between December and March on few occasions. Non-colonised hives are usually expected to be removed from the field at the onset of rainy season. The best period for the

placement of hives in the Niger Delta region is between August and September since colonisation usually occurs around October to reduce hives degradation by pests. Baiting has also been proved to be counterproductive due to attraction of pests thus hindering bee colonisation. Pest situation can also be minimised when hives' environment is kept in clean conditions.

Fig. 50: Hives placement in the Departmental Arboretum

Aiyeloja, Adedeji and Emerhi (2015) assessed the impacts of beehive stands' heights and hives' types on the ergonomics of honey harvesting in Port Harcourt, Nigeria. Eight experimental hives were used; consisting of four Kenyan Top Bar hives and four Langstroth frame hives mounted on two varying iron stands' heights of 40cm and 70cm in the Apiary Unit of the Department of Forestry and Wildlife Management, University of Port Harcourt. The study showed that the most impactful task of harvesting was the cutting of the honey combs which demanded much bending of the waist, wrist, neck, and awkward postures (Fig.51).

Fig. 51: Bending while Harvesting

Moreover, utilisation of Langstroth frame hives impacted more negatively to ergonomic harvesting conditions than Kenyan top bar because of the manner in which the inner bars were constructed making it difficult for easy removal and placement (Fig.52). Dehydrating effect of the protective clothes (bee suite) (Fig. 53) was also recognized as contributing to the debility of harvesting.

Fig. 52: Langstroth frame. Harvesting very difficult

Fig.53: Protective clothes cause Dehydration

Experiences in the two stand heights and hive types showed that 70cm stand height and Kenyan top bar hive seemed moderately adequate to improve ergonomic conditions in honey harvesting for an average human height (1.5–1.8 metres). Ergonomic guideline of 80-84cm stand height and Kenya top bar hive with falling buffer for beekeeping is recommended. For hive size, ***cut your wood according to your size*** (Fig.54).

Fig. 54: Cut your wood according to your size

My Vice-Chancellor sir, there is yet another enterprise that people hardly include in the catalog of furniture. The producers don't advertise their products, no 'promo' – buy one, carry two; yet they are in business. This reminds me about a chat between a family friend and her little kids. She was just delivered of a baby boy, after having two girls. The second child would always want the mum to carry her instead of the baby. One afternoon, she screamed at the little girl "leave this boy alone, let him rest". The first child retorted "yes o, leave Sam alone; let him rest in peace". The mother quickly responded, "No, he will not rest in peace", and the poor girl was left confused. Mr. Vice-Chancellor sir, distinguished

ladies and gentlemen, may we not rest in peace yet in Jesus name.

However, when the inevitable happens and depending on the prevailing circumstance, culture and/or religion, one is either cremated or buried. The business of making wooden casket/coffin furniture has been in existence since time immemorial. Coffin makers have been thriving well in their businesses going by the limited number of people that are involved in the business.

According to Aiyeloja, Adedeji and Dumaye (2018), wooden casket production in Port Harcourt, Rivers State is a profitable and viable enterprise with mean annual profit of ₦3,960,192.00; ₦5,099,264.00, ₦4,671,120.00 and ₦10,374,720.00 for the four consecutive years investigated; and rate of returns of investment of 197.9%, 142.4%, 107.1% and 178.8% respectively. Price has a wide range of between ₦20, 000 or slightly less (Fig.55) to several thousand of naira (Fig. 56). Sales of over a million naira per casket had been recorded. People of Rivers State are predominantly Christians and therefore make use of wooden caskets in burying the dead. The species of wood mostly used here in Rivers State, Nigeria, in making casket include; Iroko (*Milicia excelsa*), Mahogany (*Khaya grandifolia*), Obeche (*Tripochiton scleroxylon*), *Masonia utilisima*, Cedar wood and *Mitragyna ciliata*.

Fig. 55 Slab Casket

Fig. 56 Solid wood Casket

A major difference between casket and coffin is in the design; while casket is four-sided rectangular box, (Fig.57) coffin is anthropoidal in shape (hexagonal) (Fig.58).

I advocate non usage of casket/coffin for burial as practised in some other religions. However, knowing the difficulty in changing people's perception and belief, the use of bamboo or rattan coffin instead of solid wood is advised. This is highly biodegradable and will allow quick mineralization of the container and the content while the enterprise is protected. Solid wood coffins should only be produced from certified forests.

Fig. 57 Casket made with Bamboo
Source: https://i.pinimg.com

Fig. 58: Coffin made with Rattan
Source: A.R. Adams https://www.pngwave.com

Popoola (2014) in his inaugural lecture titled "Imagine a Planet without Forest" succinctly and passionately explained the importance of forests to mankind on planet earth. Also Fuwape (2000) in his inaugural lecture titled "Wood Utilization: From Cradle to the Grave" analysed the importance of wood to mankind from the early age in wooden court to wooden toys, slates (in those days), pencil and papers, to school age with benches and tables and on graduating from school received a paper certificate, got job with salary paid in paper currency, slept on wooden bed, used a wooden walking stick at old age, and laid in wooden coffin at death.

If our stories end here (in the grave), then we are of all creatures most miserable. Mr. Vice-Chancellor sir, the death of a man is not the end of his existence because when a man dies, he does not cease to exist. According to Hebrews chapter 4 verses 1 and 9 (Holy Bible KJV) *let us therefore fear, lest a promise being left us of entering into His* ***rest****, any of you should seem to come short of it. There remaineth therefore a* ***rest*** *to the people of God.* This rest will not be complete

without forests. According to Revelations chapter 22 verses 2 and 14 (Holy Bible KJV) *In the midst of the street of it, and on either side of the river, was there the tree of life, which bare twelve manner of fruits, and yielded her fruit every month: and the leaves of the tree were for the healing of the nations. Blessed are they that do his commandments that they may have right to the tree of life, and may enter in through the gates into the city.* There are forests in the city of God.

No Geneticist has been able to bud twelve different species of fruit trees on one stalk. Also no fruit tree produces fruits perpetually on monthly basis. All these are possible beyond the terrestrial.

Wegwu (2019) in his inaugural lecture titled "The Power of Food" said *The hope that burns within my heart is that someday, the lost Eden will be restored and humans would have unlimited access to the tree of life that bears twelve types of fruits (foods) with their leaves possessing bioactive compounds that would eliminate all forms of diseases within a split second.* In response, the Bible has this to say; I John chapter 3 verse 3 (Holy Bible KJV). *And every man that hath this hope in him purifieth himself, even as he is pure.*

8.0 CONCLUSION

In concluding his inaugural lecture titled 'Imaging a Planet without Forest', my academic mentor - Popoola (2014) submitted that *without forest, the planet earth will cease to breath, it will be blank, naked, lifeless, hash and unlivable. Life without forest will be nasty, brutish and short.*

In my conclusion, I cannot imagine an eternity in heaven without forests. The only place in eternity where there are no trees is the lake of fire – Please avoid it.

Mr. Vic-Chancellor Sir, distinguished Professors, colleagues, ladies and gentlemen, you will agree with me that forests are meant for rest and that forever.

9.0 RECOMMENDATIONS

National level

The Nigerian National College of Natural Medicine should be upgraded to a University status

The Centre for Research in Traditional Complementary and Alternative Medicine should be upgraded to Alternative Medicine Research Institute of Nigeria (AMRIN).

There should be a review of the entry requirements into practicing traditional medicine. Nigeria Medical & Dental Practitioners Acts of 1988 Section 17.6 "Where any person is acknowledged by people in the community to have been trained on traditional medicine in that community, it is not an offence for him to practise". He should however not perform surgical operations except male circumcision.

The curriculum of the department of Forestry should be reviewed to incorporate every aspects Ethnoforestry.

University of Port Harcourt Management should establish Campus Trees Management Committee with the Chairman from the Department of Forestry and Wildlife Management. Other members should include the Departmental SIWES Coordinator from Forestry and Wildlife Management, B. Agric. SIWES Coordinator, representative from Physical

planing and the chain saw operators from the Campus Environmental Beautification and Sanitation (CEBAS).

Every Nigerian male should plant or facilitate the planting of 50 trees in Nigeria in his life time, while every Nigerian female should plant or facilitate the planting of 25 trees in her life time.

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Professor Adedapo Ayo Aiyeloja, the University's 169th Inaugural Lecturer was born on the 9th day of June, 1966 into the family of Late Pa Ezra Adebiyi Aiyeloja and late Madam Comfort Titilayo Aiyeloja. He is the fifth child (first son) of eighteen children and first from his mother. He is a full blooded Nigerian.

He attended two primary and two secondary schools in Kwara State between 1972 and 1983. Ayo obtained the Nigerian Certificate in Education from the Oyo (now Osun) State College of Education in 1987 and taught Chemistry and Biology for three years before he gained admission into the University of Benin. It is pleasant to note that he deliberately

chose Forestry and Wildlife. Ayo obtained B.Agric. (Hons) in Forestry and Wildlife and was the best graduating student in his set. He was a University of Benin Scholar.

Having been exempted from the mandatory National Youth Service Corps (NYSC) programme on the ground of age, he proceeded to the University of Ibadan where he obtained a Master of Science (M.Sc.) degree in Forest Economics and Management in 1998. He was also the best graduating student in the unit. He subsequently went back to the University of Ibadan, where he obtained a Ph.D. degree in Forest Economics and Management in 2007. He was a post graduate scholar and in the employment of the University of Ibadan Postgraduate School, before joining the service of University of Port Harcourt on February 28, 2006.

He has received a number of awards which include:
Google Scholar Ranking Award by the Centre for Research Management and Development 2017
Award of Excellence in Service. Faculty of Agriculture. 2015
Award of Recognition. World Food Day Committee 2014
Award of Excellence, by the national body of the National Association of Agricultural Students. 2009
Professor Aiyeloja was promoted to the rank of Professor of Forest Economics and Management in 2015. His area of specialisation is Forest Enterprises Development
He was the pioneer Coordinator and Acting Head, Department of Forestry and Wildlife Management, University of Port Harcourt. (2006-2012). Head of Forest Economics and Management Unit and the Departmental Postgraduate Coordinator. At the Faculty level, he is the Editor-in-Chief of the Faculty of Agriculture Journal (AJATE), Chairman, Academic Planning and Development Committee, Chairman, Building Maintenance Committee, member Appointment and

Promotion Committee and Disciplinary Committee, At the University level, he is a member, University of Port Harcourt Senate. He was a member of the Strategic Plan Committee, Staff Certificate Verification Committee, Academic Policy Review Committee, Senate Committee on Academic Policies and Programmes, Board of Basic Studies, Board of Distance Learning and the immediate past Director, Students' Industrial Work Experience Scheme. He was the Chairman of the Research Fair and Exhibition sub-committee in the 31st and 32nd Convocation Ceremonies. At the professional level, he is Business Manager, Forestry Association of Nigeria, Vice President I, Forestry Association of Nigeria, Rivers State branch. He is a life member of the association. He is the Vice President of ELOOKKOO - the Yoruba Community in Uniport.

Outside of the University, Professor Aiyeloja is the chairman, welfare committee, member, building committee and Associate Pastor in Redemption Ministries, Shiloh Province, Owhipa, Choba.

He has a total of 108 publications comprising of 75 scholarly articles in reputable international and national journals, 3 edited books, 7 book chapters, and 23 conference proceedings. Professor Aiyeloja has been appointed external examiner to some tertiary institutions for undergraduate and graduate programmes, and external assessor for professorial promotions. He has supervised several undergraduate and postgraduate students.

In addition, he was a research associate in the "Evaluation of Willingness to Pay for Reforestation in Nigeria", a study conducted for FAO in 2002. Evaluation of Trans Boundary Trade in Non- Timber Forest Products in Humid Lowland of

West Africa 2002-2005, the Impacts of Charcoal Production on Biodiversity in Selected Countries of West-Africa, for the African Forestry Research Network AFORNET, 2005, Evaluation of the Pulping Potential of two Non- wood Forest Products in selected countries of West Africa and Central Africa for the African Academy of Sciences, Nairobi, Kenya. 2007, the Ethno botany and Conservation of Selected Medicinal Plants in the Rainforest Belt of West Africa for the African Academy of Sciences, Kenya. 2008.

Professor Aiyeloja is a visiting Professor to the Michigan State University, East Lansing, USA.

His hobbies include driving, singing and bee farming
Finally, Professor Aiyeloja is a man of one wife. He is happily married to Joy Osaretin Aiyeloja, whom he met at the University of Benin. In fact, he was her choir master. The marriage is blessed with a beautiful girl and two handsome boys.

Distinguished Ladies and Gentlemen, I present to you, an accomplished forester; a seasoned teacher; a practising farmer, commited family man and according to his mentees, Pastor of Practical Christianity (PPC) - PROFESSOR ADEDAPO AYO AIYELOJA, to deliver the 169th Inaugural Lecture of the University of Port Harcourt titled: *FORESTS FOR REST FOREVER.*

Professor Stephen A. Okodudu
Ag. Vice Chancellor