RIVERS STATE UNIVERSITY, PORT HARCOURT

GREEN CITIES, ECOTOURISM AND FOREST ECOSYSTEM SERVICES: BENEFITS FOR SUSTAINABLE DEVELOPMENT, CLIMATE CHANGE MITIGATION AND ADAPTATION

AN INAUGURAL LECTURE

By

PROFESSOR

SODIENYE AUGUSTINE ABERE

BSc (Hons) Zoology, ABU (Zaria), M.Sc Wildlife & Range management UI (Ibadan), PhD Wildlife Ecology & Ecotourism, UI (Ibadan), FWMSON, FSM, LMFAN, GPA, MIAIA, MNGS

Department Of Forestry & Environment,

Faculty Of Agriculture

SERIES NO. 74

Wednesday, 23rd February 2022

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FACULTY OF AGRICULTURE

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DEDICATION

This Inaugural Lecture is dedicated to God Almighty and to the loving memory of my parents, WariAlabo Alexander Alamienengiya Abere Allison and Mrs Grace Tamunotemewarifagha Abere Allison, who toiled and shunned acquisition of vain glory to ensure that all their children became better than they.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF PLATES

PROTOCOL

The Vice-Chancellor

Deputy Vice-Chancellors (Admin and Academic)

Registrar and other Principal Officers

Provost of College of Medicine; Dean of Postgraduate School and Deans of Faculties

His Majesty, The King of Grand Bonny Kingdom

Directors of Institutes and Heads of Departments

Your Emenence, Se Alapu of Grand Bonny Kingdom

Distinguished Professors and Emeritus Scholars

Most Distinguished Titled Citizen's of Grand Bonny Kingdom

Staff and Students of Rivers State University

Captains of Industries — NLNG, SPDC, MPNU

Distinguished Ladies and Gentlemen

Chapter 1

INTRODUCTION

I consider it an honour and privilege to have been granted the opportunity to deliver the 74th Inaugural Lecture of this great institution of learning- the Rivers State University. As a professor of this university and the 74th Inaugural Lecturer, it is my desire to make known today my contributions to knowledge through research findings and new initiatives in my area of specialization before this unique and respected audience. This for me is the whole essence of

an inaugural lecture. Today's inaugural lecture provides an opportunity to share with our respected guests and the entire public my academic achievements, and the areas I wish to explore and to make impact in the future.

While recalling and recognizing that an Inaugural Lecture may not be delivered more than once in my academic career life, I would like to try my best to use this very inaugural lecture to showcase what I profess and the extent to which my work over many years have contributed and imparted positively on the lives of my students, colleagues, our university community and knowledge for humanity at large.

1.1 The Inaugural Lecture

Let us recall the account of creation in the book of Genesis chapter 1, verses 27-29. The injunction and command given by God to man at creation is very clear, However, for thousands of years ago, man in an attempt to obey Gods command at creation has today contributed to the destruction and degradation of our planet, the Earth. As humanity faces the challenges of climate change and seek for solutions to avert the climate crisis, we at this juncture reaffirm that we must follow the path of sustainable development. We further recognize that our planet, the Earth is our common home. In this lecture, I would like to reconnect and reaffirm the call made by the Catholic Pontiff, His Holiness Pope Francis in his 2015 published encyclical letter on "Care for our common home "titled: Laudato Si". In this important and landmark social teaching of the church, the Pope affirms that "there is nobility in the duty to care for creation through little daily actions and it is wonderful how education can bring about real changes in life styles"(Laudato Si, 211, 2015). The Pope further acknowledged in Laudato Si, 32, regarding loss of

biodiversity that "the earth's resources are also being plundered because of short-sighted approaches to the economy, commerce and production and that the loss of forests and wood land entails loss of species……". He then asserts that "Humanity is called to recognize the need for changes in life style, production and consumption in order to combat climate change or at least the human causes which produce or aggravate it"- (Laudato Si,2015).

In this Inaugural Lecture, I therefore draw our attention to the lecture theme entitled "Green Cities, Ecotourism and Forest Ecosystem Services: Benefits for Sustainable Development, Climate Change Mitigation and Adaptation"

The pertinent questions we must answer are these:

- What changes are we willing to make in our lifestyles and in our production and consumption patterns to achieve green and resilient cities for today and for tomorrow?
- What are we ready to do to ensure that positive benefits from our abundant forest ecosystem services are not lost?
- To what extent are we prepared to improve ecotourism, urban forests and wildlife management to enshrine sustainable development and combat climate change?
- As Nigerians and Niger Deltans, as Africans and as a big part of humanity, what sacrifices are we willing to make to remedy and build back better and to care for our common home-the Earth.

Abere, et al. (2018) asserts that today humanity is in need to restore degraded ecosystems. We are in the age where urgent actions are required to fight climate change. It is an age of sustainable development. It is therefore obvious that we must

return back to the word of God at creation and follow the right course to 'fruitfulness and increase' as commanded by God. We have to sustain the resources and gifts which God gave humanity at creation.

1.2 Background and Reasons Behind the Choice Of Inaugural Lecture Theme

My Vice-Chancellor Sir, in preparing to deliver this lecture, the greatest challenge I had, was how to simplify the language and depth of information to the level that may make sense to all the people gathered here today. The concept of climate change, ecosystem services and green cities may sound and seem abstract or even technical but after several years of academic research and teaching and engagement in social and public services it became clear that my inaugural lecture should focus not only on my core career and professional specialty but on a theme that draws contemporary attention from the media, state, federal, regional and international government and organizations. It was still difficult to arrive at this theme. But with a deep sense of interest and passion to foster urban wild life and forest conservation with a view to contribute to the global fight on climate change, I finally chose this lecture theme which seeks to address a wide range of issues bothering on green and resilient cities, sustainable development, ecotourism, forest ecosystem services, wild life conservation, climate change mitigation and adaptation.

Let me emphasize here that Human beings seem to have forgotten that exploitation and to subdue does not necessarily mean to destroy. So in obedience to the Creator's charge at the beginning of creation has been misinterpreted by humanity thereby dealing deadly blows on the very nature of which human's are a part of.

The irony seems to crystallize in this short verse "…man in the wild, of the wild yet the greatest destroyer of the wild through science and technology"

Humanity should know that life forms on our planet are meant to coexist in order to forestall the inadvertent invasion of our built up areas by wildlings. The answer is on urban forestry and urban wildlife management where man can still hold sway.

Hence my inaugural lecture theme titled: GREEN CITIES, ECOTOURISM AND FOREST ECOSYSTEM SERVICES: BENEFITS FOR SUSTAINABLE DEVELOPMENT, CLIMATE CHANGE MITIGATION AND ADAPTATION.

Chapter 2

AN OVERVIEW OF CLIMATE CHANGE AND SUSTAINABLE DEVELOPMENT

Scientists across the world are trying to better understand how the climate is changing, what changes we can expect in the future, and what role human activities play to aggravate climate change. There is a broad scientific consensus that the warming of the climate system is unequivocal and that human influence on the climate system is clear (IPCC, 2013). The heightened impacts of climate change in Nigeria and other developing countries, which are likely to intensify in the coming years, have overwhelmed local and traditional knowledge and technologies, leaving many people with inadequate information and little means to deal with the challenges (Patricks, 2021).

IPCC (2007) asserts that an understanding of climate change science provides important information for decision-making at various levels. For example, sound weather data and forecasts can help us

determine when the best time would be to plant and/or harvest our lands. It can also help us plan appropriately for emergency responses, in case of climate-related hazards, such as floods or cyclones. Climate models help to forecast long term climate scenarios and are important for proactive planning.

Let us recall that what is happening in the atmosphere at any given time is considered as weather which will include wind speed and direction, precipitation, barometric pressure, temperature, and relative humidity (Patricks, 2021). Weather changes in the short term such as daily, weekly and monthly. Climate on the other hand is average weather and occurs over long time frames ranging up to 30 years. A common confusion between weather and climate arises when scientists are asked how they can predict climate 50 years from now when they cannot predict the weather a few weeks from now. The chaotic nature of weather makes it unpredictable beyond a few days. Projecting changes in climate (long-term average weather) due to changes in atmospheric composition or other factors is a very different and much more manageable issue (IPCC, 2007).

The IPCC defines climate as the average weather, or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years. The classical period for averaging these variables is 30 years, as defined by the World Meteorological Organization.

The relevant quantities are most often surface variables such as temperature, precipitation and wind. Climate in a wider sense is the state, including a statistical description, of the climate system." (IPCC, 2013).

According to IPCC (2007), in a broader sense, climate is the status of the climate system which comprises the atmosphere, the hydrosphere, the cryosphere, the surface lithosphere and the biosphere. These elements all determine the state and dynamics of the Earth's

climate. An important mechanism within the climate system is the greenhouse effect. Since the beginning of the 20th century, scientists have been observing a change in the climate that cannot be attributed to any of the "natural" influences of the past only. This change in the climate, also known as global warming, has occurred faster than any other climate change recorded by humans.

The United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural variability observed over comparable time periods." (UNESCO/UNEP, 2011).

2.1 WHAT ARE THE CAUSES OF CLIMATE CHANGE

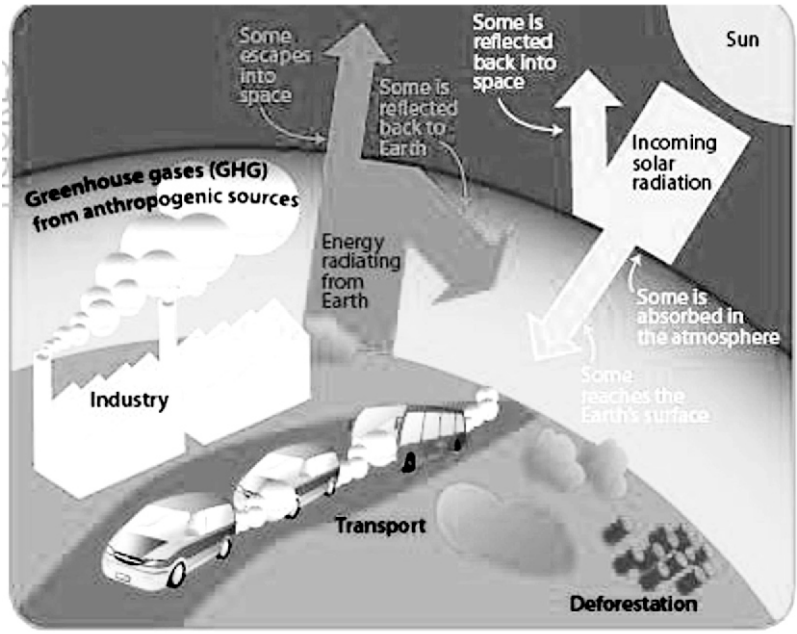
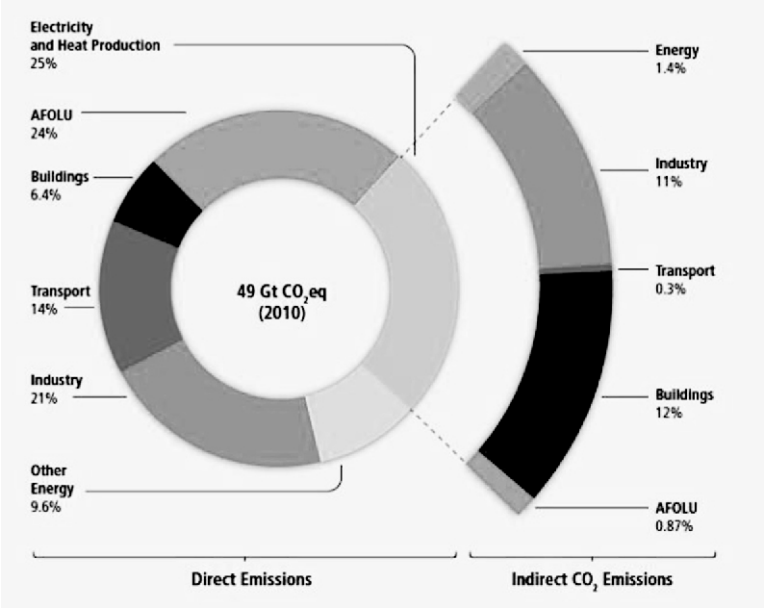


Figure 2: Sources of greenhouse gases. (Source: UNESCO/UNEP, 2011)

The state of the Earth's climate is determined by the amount of energy stored by the climate system, and especially the balance between energy received from the Sun and the portion of this energy which the Earth releases back to space (Patricks, 2021).

Since the beginning of the 20th century, scientists have been observing a change in the climate that cannot be attributed to any of the "natural" influences of the past only. This change in the climate, also known as global warming, has occurred faster than any other climate change recorded by humans (UNCC-Learn, 2013).

Patricks (2021) confirmed that there are multi sectoral contributions to the sources of greenhouse gas emissions and climate change.



Source and diagram: IPCC, Fifth Assessment Report (Ar5). Cambridge, 2014

Figure 2.1: Sectoral contributions to greenhouse gas emission

IPCC (2007) asserts that the main cause of global warming is the increased concentration of greenhouse gases in the atmosphere since the industrial revolution in the late 18th century. The increased amount of gases which absorb and re-emit thermal radiation, have directly led to more heat being retained in the atmosphere and thus an increase in global average surface temperatures. The increase in temperature is also leading to other effects on the climate system. Together these affects are known as anthropogenic or human induced climate change.

Adding more of a greenhouse gas, such as CO2, to the atmosphere intensifies the greenhouse effect, thus warming Earth's climate. The amount of warming depends on various feedback mechanisms. For example, as the atmosphere warms due to rising levels of greenhouse gases, its concentration of water vapour increases, further intensifying the greenhouse effect. This in turn causes more warming, which causes an additional increase in water vapour, in a self-reinforcing cycle. This water vapour feedback may be strong enough to approximately double the increase in the greenhouse effect due to the added CO2 alone.

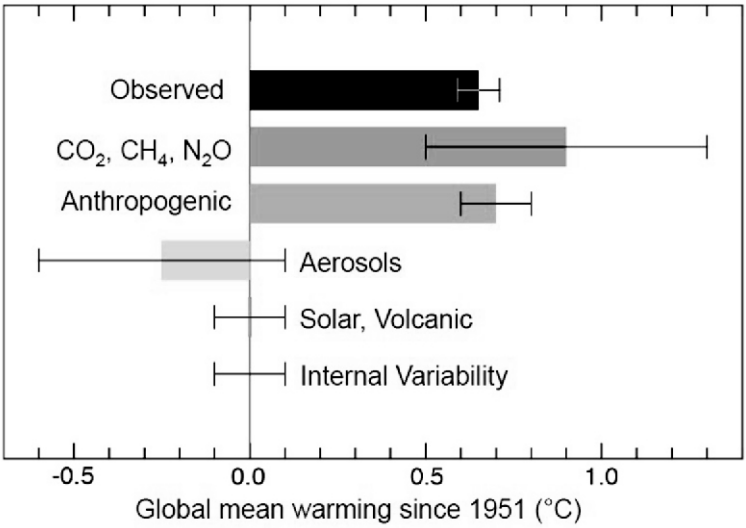


Fig 2.2: Global mean warming since 1951

Source: IPCC (2013). Climate Change 2013: The Physical Science Basis - Summary for Policymakers, p11-12

This figure illustrates the important impact of human activities on the climate. It shows the contribution of different anthropogenic and natural factors to the observed temperature increase of about 0.6°C since 1951 (black bar). The graph shows that GHGs such as carbon dioxide, methane and nitrous oxide (green bar) are the main causes of the observed temperature change. The yellow bar depicts the influence of aerosols (tiny particles found in the atmosphere) which have a negative forcing effect (cooling) on the climate. In fact, aerosols and their interaction with clouds have offset a substantial portion of positive radiative forcing by GHGs. Atmospheric aerosols are not to be confounded with aerosol sprays which often contain GHGs and hence have a positive radiative forcing effect.

Overall, human activity has led to positive radiative forcing (global warming) as indicated by the orange bar. Radiative forcing due to changes in energy output from the sun and volcanic eruptions only played a minor role in the reference period (IPCC, 2013).

Greenhouse gases (GHGs) are trace gases in the atmosphere that absorb and emit long wave radiation. They naturally blanket the earth and keep it at about 33° C warmer than it would be without these gases in the atmosphere. There are seven most important greenhouse gases as regulated under the Kyoto Protocol. The seven gases each have a different capacity to trap heat in the atmosphere, or a so-called "*global warming potential*" (GWP) and are considered as long lived greenhouse gases. Some of the GHGs occur naturally (e.g. CO_2, CH_4 and N_2O) but increases in their atmospheric concentrations over the last 250 years are due largely to human activities. Other greenhouse gases are entirely the result of human activities. These gases include HFCs, PFCs, SF_6 and NF_3 (IPCC, 2007).

Patricks, (2021) asserts that Climate change has an overwhelming impact on sustainable development. Climate change is set to worsen the environmental and survival problems faced by the people living in many parts of Africa if measures are not taken to mitigate climate change impacts or to build and sustain the adaptive capacity among the dependent populations, then we may be heading for the worst times for humanity (Patricks, 2021)

Human influence on the climate system is clear. This is evident from the increasing greenhouse gas concentrations in the atmosphere, positive radiative forcing, observed warming, and understanding of the climate system. Warming of the climate system is unequivocal, and since the 1950's, many of

the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, sea level has risen, and the concentrations of greenhouse gases have increased (IPCC, 2013, SPMAR5).

Considering strong evidences that anthropogenic or human interference with the climate system is occurring and the fact that climate change poses risks to human and natural systems makes it crucial for an urgent action to curb climate change as depicted in the sustainable development goal number 13 (Patricks, 2021).

The theme of this inaugural lecture is an attempt to catalyze actions and push for a step change towards efforts to reduce the emission greenhouse gases or sustain natural carbon sinks through mitigation.

2.2 THE IMPACTS OF CLIMATE CHANGE

Climate change which is characterized by increasing atmospheric and earth's surface temperatures, changes in precipitation (rain fall pattern) and rising sea level and ocean acidification will have adverse impacts on human health, agriculture, urban infrastructure and human systems, biological diversity and species, forest and ocean ecosystems, water resources and coastal communities (Patricks, 2021). These will in turn threaten food security, resource availability leading to conflicts and civil security challenges and inequalities in income generation and livelihood support opportunities.

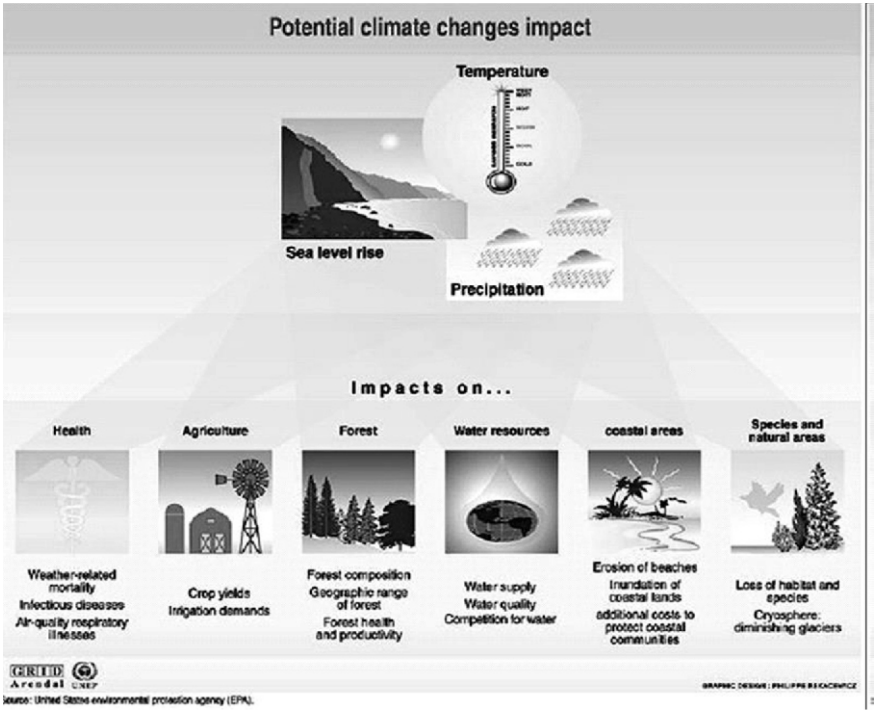


Figure 2.3: Impacts of climate change (Source: UNEP/GRID Arendal, 2005)

Promoting Green cities, ecotourism and forest ecosystem services conservation will build win-win opportunities to combat climate change and achieve sustainable development (Abere, et al., 2018).

2.3 SUSTAINABLE DEVELOPMENT

Let us recall the 1987 Brundtland commissions report "Our common future" and down to the year 2012 Rio+ 20 report of "The future we want". It is now obvious that we are in the age of sustainable development. In the contest of this inaugural lecture, we can only achieve sustainable development when humanity makes environmental justice, equity in natural resource utilization and resource conservation a fundamental value and priority concern for this generation. It is on this basis I reaffirm the definition given to sustainable development by the Brundtland commission to mean "development that does not compromise the ability of future generations to meet their development needs. A paradigm shift to focus and give strong attention to Green cities, ecotourism and forest ecosystem services conservation with a view to understand their values and benefits to an age that is driving to achieve sustainable development amidst growing concerns of climate change and subsequent extreme events becomes a pathway to success (Abere et al., 2018)

Greenpeace (2012) affirms that a holistic view on sustainable development comprises:

- Food security: production, access and nutrition
- Integrated water management for sustainable growth
- Access to renewable Energy
- Sustainable and resilient cities
- Healthy and productive oceans
- Enhanced capacity of natural systems to support human welfare
- Sustainable consumption and production patterns
- Enhanced employment and livelihood security

Promoting green cities, ecotourism and forest ecosystem services conservation is key to achieving sustainable development and combating climate change (Abere et al, 2018).

As the world's population rises above 7 billion, resource consumption and utilization will increase. New cities will emerge and more pressure will be put on the forest ecosystem, wild life and various biological species will be under threat. Maintaining a balance and equitable utilization of natural capital to benefit man and his future generation becomes vital and is a subject for further discussion even after this inaugural lecture.

A walkthrough the past till date points to the urgency and need to achieve sustainable development through our everyday actions, policies and decisions for development. The Millennium declaration of September 2000 drove the sustainable development agenda through its eight (8) Millennium development goals (MDG's). The last decade stating from September 2015 strongly pushed the sustainable development agenda through the new set of 17 Sustainable development goals (SDG's).

The critical questions which this inaugural lecture tends to pose are as follows:

- To what extent are we willing to use our respective leadership positions to actualize green, resilient and sustainable cities for Nigerians, Niger Deltans and the most vulnerable cities of sub-Saharan Africa
- Are we able to visualize a green and resilient city of the 21st century and beyond?
- Why have we continued on the trajectory of unsustainable pathways for production, consumption and resource utilization?

- How can the academia through research and learning intervene to mainstream climate change education and sustainable development in the fabric and DNA of our society?
- To what extent are we committed to build human, institutional and infrastructural capacities towards a climate change knowledge economy that supports innovative thinking, creative research, learning and development capable of bridging the knowledge gap and skill deficit to climate change problem solving?+

A flash back on the Millennium development goals (MDG's) of the year 2000 to 2015 emphasizes on the early works towards achieving sustainable development. Although the MDG's focused more on the global south and developing countries of Africa, Asia and Latin America, the current SDG's is for all countries to achieve.

Fig 2.4: A list of the 8 Millennium Development Goals (MDG's) and the new UN 17 SDG's

Source: ESDN, 2013

2.4 AN INTERLINK BETWEEN SUSTAINABLE DEVELOPMENT AND CLIMATE CHANGE: WHY WE MUST ACT.

A focus on the Inaugural lecture theme: "Green cities, ecotourism and forest ecosystem services: Benefits for sustainable development, climate change mitigation and adaptation" presupposes that there is a strong link and relationship between Sustainable development and climate change mitigation and adaptation. It is obvious that a change in climate will have a substantial impact on sustainable development. Below interlink can clarify this assumption.

Table 2.1: Link between sustainable development and climate change

Sustainable Development Goals (SDG's) Number 1-9	Interlink with Climate change
Goal 1. End poverty in all its forms everywhere	**Target 1.5** – reduce exposure and vulnerability to climate-related extreme events.
Goal 2. End hunger, achieve food security and improved nutrition, and promote sustainable agriculture	**Target 2.4** – sustainable food production systems, resilient agriculture and capacity for adaptation to climate change and extreme weather events.
Goal 3. Ensure healthy lives and promote well-being for all at all ages	No mention of climate effects on, for example, tropical diseases.
Goal 4. Ensure inclusive and equitable quality education and promote life-long learning opportunities for all	
Goal 5. Achieve gender equality and empower all women and girls	No mention of climate leading to increased frequency and intensity of natural disasters, which have heavily gendered impacts.[34]
Goal 6. Ensure availability and sustainable management of water and sanitation for all	No mention of climate impacts on drought, or use of water in energy production.
Goal 7. Ensure access to affordable, reliable, sustainable and modern energy for all	**Target 7.2** – increase the share of renewable energy.
	Target 7.3 – double the rate of improvement of energy efficiency – this can be taken as directly mitigation-related, although climate is not referenced.
	Target 7.a – clean energy research and efficiency.
Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all	**Target 8.4** – resource efficiency in consumption and production, in accordance with the 10-year Framework of Programmes on Sustainable Consumption and Production, developed countries to take the lead.
	Target 8.9 – sustainable tourism.

Source: adapted from CDKN, (2014) - Climate Development, Knowledge Network

Table 2.1 — continued

Sustainable Development Goals (SDG's) Number 9 - 17	Interlink with Climate change
Goal 9. Build resilient infrastructure, promote inclusive and sustainable industrialisation and foster innovation	**Targets 9.1 and 9.3** –sustainable and resilient infrastructure and retrofitting industries.
	Target 9.2 – promote sustainable industrialisation.
	Target 9.a – financial and technical support to African countries, LDCs, LLDCs and SIDS to facilitate sustainable and resilient infrastructure development.
Goal 10. Reduce inequality within and among countries	No mention of climate effects increasing economic and other inequalities between climate-vulnerable countries and more developed nations.
Goal 11. Make cities and human settlements inclusive, safe, resilient and sustainable	**Target 11.2** – sustainable transport systems.
	Target 11.3 – sustainable urbanisation.
	Target 11.5 – reduce deaths and economic losses from disasters.
	Target 11.b – integrated policies including resource efficiency, mitigation and adaptation to climate change and DRR, in line with the upcoming Hyogo Framework for Action.
	Target 11.c – support LDCs for sustainable and resilient buildings.
Goal 12. Ensure sustainable consumption and production patterns	Targets relating to SCP, including sustainability reporting. **Target 12.c** – phase out fossil fuel subsidies.
Goal 13. Take urgent action to combat climate change and its impacts* *Acknowledging that the UNFCCC is the primary international, inter-governmental forum for negotiating the global response to climate change	Direct climate goal which acknowledges the work of the UNFCCC.
	Targets on national planning, education and finance, including implementing the UNFCCC commitment on the US$100 billion annual flow of climate finance from developed to developing countries.
	No emissions- or mitigation-related goals.
Goal 14. Conserve and sustainably use the oceans, seas and marine resources for sustainable development	No mention of climate impacts on ocean acidification.
Goal 15. Protect, restore and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss	No mention of climate impacts on desertification, ecosystems or loss of biodiversity.
Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all, and build effective, accountable and inclusive institutions at all levels	No mention of climate-related resource scarcity increasing the risk of conflict.
Goal 17. Strengthen the means of implementation and revitalise the global partnership for sustainable development	

Source: adapted from CDKN, (2014) - Climate Development, Knowledge Network

2.5 THE JOURNEY FROM STOCKHOLM (1972) TO PARIS (2015)

The quest to achieve green cities, ecosystem services and biodiversity conservation as well as the need to build climate resilience and sustainable development dates back several decades in history.

For instance, Patricks (2014) asserts that the World Commission on Environment and Development was initiated by the General Assembly of the United Nations in 1982, and its report, "Our Common Future" was published in 1987. It was chaired by then–Prime Minister of Norway Gro Harlem Brundtland, thus earning the name the "Brundtland Commission." As with previous efforts, the report was followed by major international meetings such as the United Nations Conference on Environment and Development (UNCED) in Rio de Janeiro in 1992 (also called "Earth Summit") which issued a declaration of principles, a detailed Agenda 21 of desired actions, international agreements on climate change (UNFCCC) and biodiversity, and a statement of principles on forests. Ten years later, in 2002, at the World Summit on Sustainable Development in Johannesburg, South Africa, the commitment to sustainable development was reaffirmed.

It will be important to note that starting from the first United Nations conference on Human Environment held at Stockholm in 1972, humanity has made tremendous efforts to emphasize on the importance of today's inaugural lecture theme.

Whereas the Stockholm conference on human environment set the global stage for other international conferences and treaties, ranging through Rio Earth Summit of 1992, the Rio+ 20 conference of 2012 and the Climate change agreement at Paris of 2015 as well as the New York 2015 declaration on

sustainable development goals, ***one might then ask and wonder.. What extra do we have to do to actualize green and sustainable cities in the 21st century and beyond?***

Chapter 3

BUILDING GREEN AND RESILIENT CITIES: ACTIONS FOR TODAY AND THE FUTURE

Patricks (2021) asserts that green cities refer to a low-pollution and low carbon society. This is a city in which cleaner air, land, water; enable people to lead healthy, productive lives. It is also a city in which cleaner production standards spur innovation, whether through reducing air pollution, or encouraging waste recycling and circular economy. It is a city in which industries are built around clean technologies either for energy, water, transportation, or housing. Green cities are similar to clean cities but depict more to a world in which natural resources are conserved and sustainably managed to improve livelihoods over time. It is a world in which ecosystems are healthy and ecosystem services are sustained and conserved (Patricks, 2021).

In a resilient city, ecosystems are healthy and well managed, and they are a key part of reducing vulnerability to climate impacts. In this world and society the inhabitants are able to cope and bounce after any climate shock. A resilient city in characterized by reduced vulnerability and increased adaptive capacity.

UN-Habitat (2013) states that cities play an important role in the economic development of a country as many businesses are located in urban areas. Similarly, UN-Habitat (2011) asserts that the world has been urbanizing rapidly and this trend will continue. However, different regions have very different rates of urbanization Cities both contribute to and are affected by climate change. The world's cities are responsible for up to 70 per cent of global greenhouse gas

emissions while occupying just 2 per cent of the world's land surface. This trend is likely to continue in the future with most population growth taking place in cities. At the same time, the effects of climate change, such as rising sea-levels and extreme weather events, can impact negatively on the urban infrastructure and people, and more broadly on economic growth.

A focus on green cities is an attempt to low carbon development and a sure way to reduce our carbon foot print and greenhouse gases.

In this Inaugural lecture, I wish to present to this unique audience, especially those involved in facility and city planning with these questions.

- ❖ Are we ready to mainstream climate change into our planning process?
- ❖ Who needs to be involved in the city and in the community and how can they be engaged?
- ❖ How is climate change affecting the city and who is most vulnerable to these changes?

Urban forestry and green spaces, energy efficiency, proper waste management, mass transit using BRT-Bus rapid transit as an example and other low carbon development initiatives can help cities build resilience.

3.1 WHAT IS THE PROBLEM WITH OUR CITIES?

Today due to emigration from rural areas, more than 54 percent of the world's populations live in the cities. The combination of globalization, rapid unplanned urbanization, and ageing populations is leading to an increase in the incidence of non-communicable diseases which constitutes a major cause of global mortality (FAO, 2018).

Climate change, which is leading to increases in urban floods and heatwaves, is complicating the situation. A major global challenge is to design and customize cities to overcome such problems (World Health Organization, 2017).

This is a major problem spotted for this inaugural lecture and driving its theme to present to this unique audience a need for a nature- based solution that urges us to make a shift to value the need to build green infrastructures and urban landscape which will promote green city outlook and ecotourism and promote urban forest ecosystem conservation.

The last century has been characterized by increasing urbanization, with cities worldwide expanding in both number and size. For example, the world urban population increased from 746 million people in 1950 to 4 billion in 2015 (FAO, 2018). This growth is expected to continue in coming decades, with low- and middle-income countries projected to more than double and triple their urban populations, respectively, by 2050 (United Nations, 2016).

Africa and Asia are urbanizing fastest: Africa had the highest urbanization rate of all the regions between 1995 and 2015 and Asia which is already home to 17 megacities has by far the largest number of people living in urban areas and, overall, 53 per cent of the world's urban population (United Nations, 2014).

FAO (2018) asserts that managing urbanization poses huge challenges. Cities can be hubs of socioeconomic development, but the rapid pace of urban growth and the limited resources available to accommodate increasing demand for food and basic services can also present huge barriers for the equitability and sustainability of city development (United Nations, 2016).

FAO, (2018) states that in less-developed countries, exponential urban population growth has not been matched by a corresponding increase in the availability of goods and services such as clean drinking water adequate housing and sanitation, and energy. In most less-developed countries, urbanization has translated largely into unplanned urban expansion accompanied by unsustainable production and consumption patterns, leading, in turn, to the overexploitation of natural resources in and around urban areas. As a result, cities have become more vulnerable to natural disasters and to the effects of climate change and many urban and semi-urban communities are highly exposed to food insecurity and poverty (FAO, 2018).

The question we have to consider and seek for an answer is:

What is the fate of African cities and in particular Nigerian cities and bringing it home to our door steps, what is the fate of Port Harcourt city?

3.2 THE WAY FORWARD

In 2015, urban sustainable development was also at the heart of the two main global development agreements endorsed by the international community: the 2030 Agenda for Sustainable Development and the Paris Agreement on climate change. Building on the Millennium Development Goals, the 2030 Agenda which includes 17 Sustainable Development Goals (SDG's) calls on countries to "mobilize efforts to end all forms of poverty, fight inequalities and tackle climate change, while ensuring that no one is left behind" (FAO, 2018).

The 2030 Agenda recognizes urban sustainability as a key element for achieving sustainable development and includes a specific goal on urban development in SDG number 11

which states "make cities and human settlements inclusive, safe, resilient and sustainable". This is a key driver to my choice of theme for this inaugural lecture.

It is of interest to note that about one-third of the 231 indicators in the SDG Global Monitoring Framework are related directly to urban policies with clear impacts on cities and human settlements and can be measured at the local level (UN-Habitat, 2017).

The key role of cities in achieving the sustainability goals set in the Paris Agreement was recognized at the 22nd Conference of the Parties to the United Nations Framework Convention on Climate Change, held in Marrakech, Morocco, in 2016. During this conference, Parties agreed that, given that cities are the main source of carbon emissions and contain most of the human population (UN-Habitat, 2011). Hence, the most important efforts for climate-change mitigation and adaptation will have to be implemented in urban areas.

FAO (2018) further brings to the fore the essence of the Habitat III conference, held in Quito, Ecuador, in 2016. According to FAO (2018), the essence of that conference was to put equality and socio-economic and environmental sustainability at the heart of discussions on sustainable urban development. The main outcome of that conference was the endorsement of the New Urban Agenda (NUA), which sets out a global strategy for addressing urbanization issues in coming decades (FAO, 2018).

According to the NUA, cities must develop urban strategies that are people-centric, helping their citizens to thrive rather than simply survive. The NUA is based on three "interlinked" principles which are:

- Leave no one behind
- Ensure sustainable and inclusive urban economies
- Ensure environmental sustainability.

The New Urban Agenda (NUA) and the Sustainable Development Goals (SDG's) especially the SDG 11, highlight the importance of green spaces in improving living standards in cities, increasing community cohesion, improving human wellness and health, and ensuring sustainable development (FAO, 2018).

3.3 BENEFITS FROM GREEN CITY CONCEPT AND URBAN GREEN SPACES

Green cities will offer the following benefits:

- Provide urban dwellers with multifunctional areas designed for social interaction and inclusion (SDGs 10 and 11)
- Contribute to human health and wellbeing (SDG 3)
- Promote economic exchange, cultural expression and dialogue among a wide diversity of people and cultures (SDG 8)
- Support human development to build peaceful, inclusive and participatory societies (SDGs 10 and 16), as well as to promote living together, connectivity and social inclusion.
- Urban forests and green spaces create sustainable habitats for urban wildlife management
- Promote city aesthetics and side attraction to tourists
- Creates financial benefit to the real estate industry.

Table 3.1: Role of urban forestry against known climate hazards and risks

Hazard	Role of urban and peri-urban forests
Natural	
Strong winds (e.g. cyclones, hurricanes)	Act as barriers; reduce wind speed; work as protection screens
Flooding and drought	Reduce stormwater volumes and flood risk; increase precipitation interception; increase water infiltration and groundwater recharge
Landslides	Increase stability of steep slopes by reducing surface run-off and erosion
Soil loss	Prevent soil erosion; reduce impact of raindrops on soil surfaces; improve soil-water retention
Extreme heat and cold events, urban "heat island" effect	Cool by shading, evapotranspiration, etc.; protect from hot and cold winds
Wildfires	Reduce fire intensity, flammability and spread when properly designed and managed
Biodiversity loss	Conserve species and habitats; limit spread of invasive species
Pests and diseases	Limit spread and impacts
Anthropogenic	
Air pollution	Sequester carbon; reduce ozone formation; capture particulate and gaseous pollutants; reduce emission of allergens
Pests and diseases	Provide buffer against invasive species
Reduced physical and mental health	Provide pleasant spaces that increase well-being, social cohesion and interaction, and leisure activities, etc.

Source: FAO, 2018

It is of interest to note that the New Urban Agenda (NUA) calls for the sustainable management of natural resources in cities and human settlements in a manner that protects and improves urban ecosystems and their ecosystem services, reduces greenhouse gas emissions and air pollution, and promotes disaster risk management (FAO, 2018). Urban and semi-urban forests and trees help mitigate climate change by directly capturing and storing atmospheric carbon dioxide. Also, trees provide shade and reduce wind speeds, thereby indirectly lowering carbon emissions by reducing the need for

air conditioning and heating and thereby cutting emissions from power plants (Nowak et al., 2013).

3.4 PRACTICAL AND SMART CLIMATE CHANGE SOLUTIONS FOR THE NIGERIAN 21ST CENTURY CITIES.

We can adopt and engage in the following

3.4.1 Enhancing Investments in Clean Energy and Energy Efficiency

The African Development Bank (AfDB, 2012) asserts that the increased provision and use of energy and its associated services is a fundamental element of enhanced economic development. Increased access to energy is a proven link to economic development and hence poverty alleviation. Africa has the world's lowest electrification rate; nearly 75% of the African population lack access to electricity.

According to AfDB (2012), in recent years there has been rapid urban growth leading to increases in aggregate commercial energy demand and linked emissions. On average, the demand for access to modern energy in Africa is growing faster than the supply.

AfDB (2012) further states that the need for Africa to comply with the global agenda of greenhouse gas reduction while ensuring economic growth remains a key issue. Balancing demand with the need to promote clean energy that relies on renewable energy resources is essential for a low-carbon development pathway.

A case study example is the solar and wind energy project for rural water supply in Ethiopia. Description: The objective of the project is to promote and pilot the use of solar and wind energy for water pumping in rural areas of Ethiopia. Before this project, the energy required for pumping water is typically costly and polluting. It is expected that the use of solar and wind energy will reduce greenhouse gas emissions and costs over time, particularly in the context of rural Ethiopian agricultural irrigation needs. The total cost of the project is EUR 2,165,680. The Africa Water Facility (AWF) grant contribution is EUR 1,991,880 and the contribution from the Government of Ethiopia is EUR 173,800 (AfDB, 2012).

Can a similar project of this type and magnitude be executed in Nigeria? Please I leave you to think about this…

3.4.2 Enhancing Sustainable Land Use and Forestry Management, REDD+

AfDB (2012) notifies that Africa's rate of deforestation is about twice the world rate, and the continent is losing more than 4 million hectares of forest cover every year. Deforestation and poor agricultural practices account for about 65% of Africa's emissions. Addressing climate change requires action in reversing deforestation in the continent. AfDB has invested substantially in preserving Africa's forests, and it has contributed substantially to reducing greenhouse gas emissions particularly in the Congo Basin Forests (AfDB, 2012)

A project in this regard brings the case of the Participatory Integrated Watershed Management Project (PIWAMP) in the Congo Basin to our review. The project was developed to address soil degradation and water management issues, taking into consideration the concerns of the farmers and the government and their desire to improve household food security and rural incomes. Prior to the project the land was not cultivable due to lack of access to some of the fertile lowland areas and degradation of the uplands as a result of soil erosion and the lowlands due to siltation. The project's main beneficiaries have been poor smallholders dependent on traditional upland crops (groundnuts, millet, and sorghum) and lowland rice cultivation for their livelihoods. The most significant output has been that 5,800 hectares of land in the lowlands have become available for cultivation after the construction of 33 kilometers of spillways and 68 kilometers of dykes. The construction of 195 kilometers of contour bunds and a sizeable number of diversion bunds has reduced soil run-off and erosion, and the flooding of settlements has decreased. Additionally, less soil erosion in the uplands and less siltation in the lowlands has substantially helped maintain soil fertility. The combination of more land for cultivation and improvements to land already under cultivation has led to substantial increases in agricultural output, with total crop production growing from 4,503 to 25,573 metric tons a year and the project areas' contribution to national rice production increasing from 3.57% to 12.08%. To execute this project, the AfDB provided USD 7 million from the Nigeria Trust Fund (NTF) alongside other donors,

including IFAD and beneficiary contributions, to cover the USD 17.5 million projects.

Can we attract such investments into our own region? I leave you to ponder on this possibility and opportunity to build a sustainable and resilient Nigeria and Rivers state.

3.4.3 Promoting Sustainable Transport

Africa has several opportunities for developing greener transport links that ensure more inclusive economic growth, engender further social integration, and contribute to combating climate change (AfDB, 2012)

For a case study illustration, we can recall the Lagos Cable Transit, embarked by the Lagos state government. The average commuter in Lagos spends over 3 hours in traffic every day. In 2008, to respond to the lack of formal mass transit systems in Lagos, a Bus Rapid Transit (BRT) system was introduced to cater to some 200,000 commuters. Thus, the Lagos Cable Transit system is being pursued. With over 16 million inhabitants, Lagos is one of the most densely populated cities in in the world. Rapid urban growth, decades of inadequate urban planning, and a challenging natural topography have resulted in road congestion and related pollution (AfDB, 2012).

This project has succeeded in taking a reasonable number of cars and buses off the street and could be considered to have significantly reduced congestion and carbon emissions in Lagos. The Project stands to provide an affordable and reliable mass transit system for over 350,000 people in Lagos, a city classified as

Nigeria's economic and commercial capital. The Project stands to impact the lives of up to 350,000 commuters through 10 km of Tricable Ropeway Technology, reducing commuting times from 2 to 3 hours to 15 minutes (AfDB, 2012).

The AfDB has been appointed as Mandated Lead Arranger in this transaction. In addition to providing a USD 60 million senior loan, the AfDB has played a leading role, advising Project Sponsors on scaling up this project from pilot to city-wide mass transit solution. The AfDB has also played a leading role in applying for Carbon Credits from the UNFCCC.

Perhaps we might explore this opportunity in Rivers State

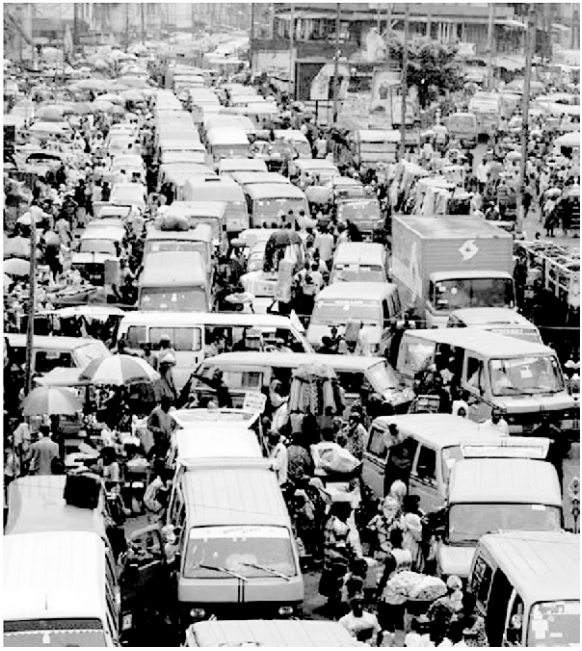


Figure 3.1: A typical Lagos Traffic congestion
Source: AfDB, 2012

3.4.1 Supporting Innovative thinking, Knowledge sharing and Technology

The development and deployment of innovative thinking, appropriate technology, knowledge sharing and collaborations plays a critical role in the global response to the challenges of climate change. Vulnerable communities in particular require both financial and technological and knowledge support to adapt to climate change.

I recall that in the year 2017, my department (Forestry and environment) through the faculty, proposed to establish a climate change knowledge Centre through collaboration with Environment & Millennium Targets (EMT) and African Climate reality Project (ACRP).

We might reconsider to revisit that proposal to establish a Climate solutions knowledge Centre.

Chapter 4

4.1 ECOTOURISM AND FOREST ECOSYSTEM SERVICES

According to Abere, et al (2015) and Patricks (2021), Climate change impacts on ecosystems and the important services they provide which include oxygen production and protection from flooding. Similarly, Abere, et al (2018) confirmed that climate change will reduce biodiversity and wetland area, and lead to loss of trees and soil among other effects. Ecosystems are already often affected by human activities such as urbanization, deforestation, and the introduction of alien species. Poor and vulnerable communities are often relying the most on ecosystem services and are likely to be the most affected by the impacts of climate change.

According to Abere (2018) it is pertinent for cities to fashion out ways to co-exist with various fauna and flora of the wild which in an attempt for new area development for urban infrastructures and agriculture as well as associate land use, man has displaced several wild life species and thereby bringing man and wild life at close but conflicting proximity. The rehabilitation of these anthropogenic displaced wildlife species can be useful towards ecotourism development.

Urban and peri-urban forests in good condition perform various ecosystem functions. Through shading and evapotranspiration, for example, they can reduce summer and dry season daytime temperatures to bearable levels (FAO, 2016)

A large urban forest tree canopy can intercept up to 190 litres of water in a rain event, thereby reducing water run-off and the risk of urban flooding and landslides. Urban and peri-urban forests filter the air, thereby improving air quality by reducing air pollution, which is deposited on leaves. Hence the leaves of the trees act as passive sinks for particulate matter (Nowak, 1994).

This can be a wake up solution to the menace of Soot in Port Harcourt and environs.

Cities depend on a healthy natural environment that continuously provides a range of benefits, known as ecosystem services. Some examples of ecosystem services include drinking water, clean air, healthy food, and protection against floods. Healthy ecosystems are the foundation for sustainable cities, influencing and affecting human well-being and most economic activity (Abere, 2017)

Table 4.1: Types of Ecosystem Provision Services

Ecosystem Service	Service Icon	Service description	Example
Provisioning services: Ecosystem services that describe the material or energy outputs from ecosystems.			
Food		Ecosystems provide the conditions for growing food. Food comes principally from managed agro-ecosystems, but marine and freshwater systems, forests and urban horticulture also provide food for human consumption.	In Havana, Cuba (1996), a significant proportion of the urban population's food was produced within urban gardens, including 8,500 tons of agricultural produce, 7.5 million eggs and 3,650 tons of meat (according to a review by Altieri, 1999).
Raw materials		Ecosystems provide a great diversity of materials for construction and fuel including wood, biofuels and plant oils that are directly derived from wild and cultivated plant species.	Non-timber forest products such as rubber, latex, rattan and plant oils are very important in trade and subsistence – the annual global trade in such products is estimated to amount to US$11 billion (Roe et al. 2002).
Fresh water		Ecosystems play a vital role in providing cities with drinking water, as they ensure the flow, storage and purification of water. Vegetation and forests influence the quantity of water available locally.	Estimates of the value of the services of a South African mountain fynbos ecosystem with an area of only 4 km² indicated that water production was the biggest contributor to the total value of the system. The value was estimated to range from approximately US$4.2 million to 66.6 million in 1997, according to how well the system is managed (Higgens et al. 1997).
Medicinal resources		Biodiverse ecosystems provide many plants used as traditional medicines as well as providing raw materials for the pharmaceutical industry. All ecosystems are a potential source of medicinal resources.	80% of the world's people are still dependent on traditional herbal medicine (WHO 2002), while the sale of medicines derived from natural materials amounts to US$57 billion per year (Kaimowitz 2005).

Taken from TEEB, 2011

Tables 4.2: Types of Ecosystem Regulating Services

Regulating services: The services that ecosystems provide by regulating the quality of air and soil or providing flood and disease control, etc.			
Local climate and air quality regulation		Trees and green space lower the temperature in cities whilst forests influence rainfall and water availability both locally and regionally. Trees or other plants also play an important role in regulating air quality by removing pollutants from the atmosphere.	In Cascine Park in Florence, Italy, the urban park forest was shown to have retained its pollutant removal capability of about 72.4 kg per hectare per year (reducing by only 3.4 kg/ha to 69.0 kg/ha after 19 years, despite some losses due to cutting and extreme climate events) (Paoletti et al. 2011). Harmful pollutants removed included O_3, CO, SO_2, NO_2, and particulate pollutants as well as CO_2.
Carbon sequestration and storage		Ecosystems regulate the global climate by storing greenhouse gases. As trees and plants grow, they remove carbon dioxide from the atmosphere and effectively lock it away in their tissues; thus acting as carbon stores.	Urban trees too, are important in carbon sequestration: in the United States, their annual gross carbon sequestration amounts to 22.8 million tons of carbon per year (as calculated in 2002) (Nowak and Crane 2002). This is equivalent to the entire USA population's emissions in five days. This sequestration service is valued at US$460 million per year, and US$14,300 million in total.
Moderation of extreme events		Ecosystems and living organisms create buffers against natural disasters, thereby preventing or reducing damage from extreme weather events or natural hazards including floods, storms, tsunamis, avalanches and landslides. For example, plants stabilize slopes, while coral reefs and mangroves help protect coastlines from storm damage.	In the case of the Californian Napa City, USA, the Napa river basin was restored to its natural capacity by means of creating mudflats, marshes and wetlands around the city (TEEBcase by Almack 2010). This has effectively controlled flooding to such an extent that a significant amount of money, property, and human lives could be saved.
Waste-water treatment		Ecosystems such as wetlands filter effluents. Through the biological activity of microorganisms in the soil, most waste is broken down. Thereby pathogens (disease causing microbes) are eliminated, and the level of nutrients and pollution is reduced.	In Louisiana, USA, it was found that wetlands could function as alternatives to conventional wastewater treatment, at an estimated cost saving of between US$785 to 34,700 per hectare of wetland (in 1995) (Breaux et al. 1995).

Ecosystem Service	Service Icon	Service description	Example
Regulating services: Continued			
Erosion prevention and maintenance of soil fertility		Soil erosion is a key factor in the process of land degradation, desertification and hydroelectric capacity. Vegetation cover provides a vital regulating service by preventing soil erosion. Soil fertility is essential for plant growth and agriculture and well-functioning ecosystems supply soil with nutrients required to support plant growth.	A study estimated that the total required investment to slow erosion to acceptable rates in the USA would amount to US$8.4 billion, yet the damage caused by erosion amounted to US$44 billion per year. This translates into a US$5.24 saving for every US$1 invested (Pimentel et al. 1995).
Pollination		Insects and wind pollinate plants which is essential for the development of fruits, vegetables and seeds. Animal pollination is an ecosystem service mainly provided by insects but also by some birds and bats.	Some 87 out of the 115 leading global food crops depend upon animal pollination including important cash crops such as cocoa and coffee (Klein et al. 2007).
Biological control		Ecosystems are important for regulating pests and vector borne diseases that attack plants, animals and people. Ecosystems regulate pests and diseases through the activities of predators and parasites. Birds, bats, flies, wasps, frogs and fungi all act as natural controls.	Water hyacinth was brought under control in southern Benin using three natural enemies of that plant (De Groote et al. 2003). Whereas the biological control project cost only US$2.09 million in present value, its accumulated value is estimated to amount to US$260 million in present value (assuming the benefits stay constant over the following 20 years), representing a very favourable 124:1 benefit cost ratio.

Taken from TEEB, 2011

Table 4.3: Types of Ecosystem Supporting Services

Habitat or Supporting services: These services underpin almost all other services. Ecosystems provide living spaces for plants or animals: they also maintain a diversity of plants and animals.			
Habitats for species		Habitats provide everything that an individual plant or animal needs to survive: food, water, and shelter. Each ecosystem provides different habitats that can be essential for a species' lifecycle. Migratory species including birds, fish, mammals and insects all depend upon different ecosystems during their movements.	In a March 2010 article (IUCN 2010), IUCN reports that habitat loss is the single biggest threat to European butterflies, and may lead to the extinction of several species. Habitat loss was said to occur most often as a result of changes in agricultural practice, climate change, forest fires, and expansion of tourism.
Maintenance of genetic diversity		Genetic diversity (the variety of genes between, and within, species populations) distinguishes different breeds or races from each other, providing the basis for locally well-adapted cultivars and a gene pool for developing commercial crops and livestock. Some habitats have an exceptionally high number of species which makes them more genetically diverse than others and are known as 'biodiversity hotspots'.	In the Philippines, an initiative to conserve local varieties of rice aided in the development of rice strains that are better adapted to local conditions - giving greater yield, a quality seed supply, and decreasing dependence on plant breeders - at a much lower cost than that of formal plant breeding (SEARICE 2007).
Cultural services: These include the non-material benefits people obtain from contact with ecosystems. They include aesthetic, spiritual and psychological benefits.			
Recreation and mental and physical health		Walking and playing sports in green space is a good form of physical exercise and helps people to relax. The role that green space plays in maintaining mental and physical health is increasingly becoming recognized, despite difficulties of measurement.	A review article examined the monetary value of ecosystem services related to urban green space, based on 10 studies, including 9 cities from China and 1 from the USA (Elmqvist 2011). It reported that on average, 'Recreation and Amenity' and 'Health effects' contributed a value of US$5.882 and US$17.548 per hectare per year respectively to the total average of US$29.475 per hectare per year provided by the seven identified ecosystem services in the various studies.
Tourism		Ecosystems and biodiversity play an important role for many kinds of tourism which in turn provides considerable economic benefits and is a vital source of income for many countries. In 2008 global earnings from tourism summed up to US$944 billion. Cultural and eco-tourism can also educate people about the importance of biological diversity.	Based on the amounts of money people spent on travel and local expenditure in order to visit Coral reefs in Hawaii, it was estimated that the value associated with these reefs amounted to US$97 million per year (TEEBcase by van Beukering and Cesar 2010). This implies that reef tourism resulted in significant income generation for individuals, companies, and countries.
Aesthetic appreciation and inspiration for culture, art and design		Language, knowledge and the natural environment have been intimately related throughout human history. Biodiversity, ecosystems and natural landscapes have been the source of inspiration for much of our art, culture and increasingly for science.	Prehistoric rock art of southern Africa, Australia, and Europe, and other examples like them throughout the world, present evidence of how nature has inspired art and culture since very early in human history. Contemporary culture, art and design are similarly inspired by nature.
Spiritual experience and sense of place		In many parts of the world natural features such as specific forests, caves or mountains are considered sacred or have a religious meaning. Nature is a common element of all major religions and traditional knowledge, and associated customs are important for creating a sense of belonging.	In the example of the Maronite church of Lebanon, the church committed to protecting a hill in their possession, comprising rare remainders of intact Mediterranean forest, independent of scientific and legal arguments, because this was in line with Maronite culture, theology and religion (Palmer and Finlay 2003).

Taken from TEEB, 2011

4.2 WHY GIVE ATTENTION TO FOREST ECOSYSTEM SERVICES

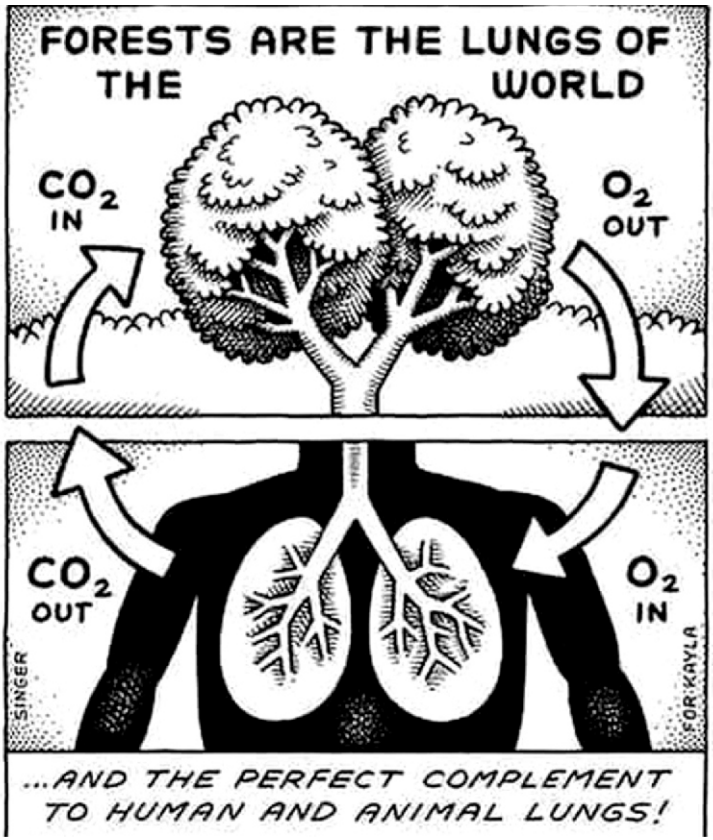


Figure 4.1.

4.2.1.: An assessment of the benefits of trees in urban areas can:

1. An assessment of the benefits of trees in urban areas can:

❖ Inform planning and budget allocations for several city departments, including green spaces, housing and sewage.

- Contribute to the provision of a healthy urban environment thereby increasing quality of life.
- Identify savings for the city (e.g. cut in energy use).

A typical case example can be traced to Canberra, Australia where local authorities plant and maintain trees resulting in a variety of benefits. The 400,000 trees within the city limits regulate the city climate, reducing air pollution as well as energy costs for air conditioning. Trees also sequester carbon and slow the run-off of precipitation. These benefits are estimated to amount to around US$4 million annually in terms of the value generated or savings incurred to the city (TEEB, 2011)

4.2.2. Assessing the health benefits of urban parks can:

- Facilitate alliances with the health sector, as a means of fostering preventive public health care.
- Also support the biodiversity conservation agenda of the environmental department and park authorities

A typical case study example can be traced to Melbourne, Australia: A world class network of regional parks, trails, foreshores and waterways support and contribute significantly to Melbourne's liveability and public health. Recognizing the health benefits of access to natural areas has recently led protected area authorities to take this up as a central theme. Parks Victoria, and the People and Parks Foundation, have forged a partnership with a major health insurer, investing over $1 million US$ in a program for health care professionals to encourage people to increase physical activity by visiting and engaging in activities in parks (Senior 2010).

4.2.3. *An ecosystem service approach to planning is useful to:*

- ❖ Prioritize areas for urban development.
- ❖ Make decision makers aware of the importance of nature conservation, previously perceived as a luxury.
- ❖ Motivate municipal leadership and local politicians to take a number of tough decisions to protect the environment.

A typical case study experience can be found in Durban, South Africa. Durban examined the role of open spaces, especially in terms of meeting the basic needs such as water, firewood and food of the poor, who did not have access to adequate infrastructure or municipal services. Thanks to an assessment of ecosystem services, it was possible to demonstrate that the city's open space system significantly improved their quality of life and enhanced their ability to meet their basic needs (TEEB, 2010).

4.2.4. *A focus on the benefits of green infrastructure can:*

- ❖ Support the effectiveness and efficiency of city efforts to regulate floods.
- ❖ Help the city to ensure the quality of air and water.
- ❖ Highlight the positive impact on property values.

We can trace a case study example in Miami, USA. The city has used the city green tool for systematically including 'green infrastructure' such as parks, urban forests and wetlands into urban planning. This is mainly for the purpose of storm water protection, enhancement of air- and water quality and climate regulation. As a result a riverine area was

rehabilitated which subsequently generated a range of positive side effects such as recreational and property values (TEEB, 2010).

In general, the forests ecosystems act as a source of food, medicine and fuel for more than a billion people. In addition to helping to respond to climate change and protect soils and water, forests hold more than three-quarters of the world's terrestrial biodiversity, provide many products and services that contribute to socio-economic development, and are particularly important for hundreds of millions of people in rural areas, including many of the world's poorest (FAO,2018).

4.3 GREEN CITIES AND URBAN FORESTS IN NIGERIA THAT REQUIRES PUBLIC PATRONAGE AND COMMENDATION

4.3.1 Port Harcourt Pleasure Park

My vice chancellor, in this inaugural lecture, I would like to commend the Rivers state government who have taken a bold step to start up what we can call the first modern urban green space project in Port Harcourt and Rivers State as a whole. This project can be replicated even in other parts of Rivers state. The benefits of this project- The Port Harcourt Pleasure Park to recreation, city aesthetics, and tourism and income generation are too many to mention. The efforts of the state governor are commended and we need to appreciate that project. Below are photographs showing the beauty of the Port Harcourt Pleasure park.

Plate 4.1.: Images for Port Harcourt Pleasure Park by Rivers state Government

Source: Google search

4.3.2. Port Harcourt Zoo Park

Another urban green space of note in Port Harcourt is the Port Harcourt Zoo Park. This is particularly important because it is the only space in Port Harcourt metropolis that attends to urban wild life support and range management. In this inaugural lecture, I would strongly support the upgrade and development of the zoo park to give it a modern out look that will enable both the government and the citizens and general public benefit from its usefulness. Below are photos of the Port Harcourt zoo park.

Plate 4.2.: Images of Port Harcourt Zoo Park
Source: Google search

4.3.3 Port Harcourt Tourist Beach

The Port Harcourt Tourist Beach is another ecotourism site in Rivers state that requires our attention for upgrade and infrastructural and facility development.

Plate 4.3.: Port Harcourt Tourist Beach

Source: Google search

4.3.4 The Lekki Conservation Centre, Lagos

Away from Port Harcourt, we can take a tour to the Lekki Conservation Centre which is managed by the National Conservation Foundation (NCF). This is another beautiful urban green space that showcases value derivable from urban wild life management and urban forest ecosystem conservation. Some pictures from the Lekki conservation Centre are shown below.

Plate 4.4. The Lekki Conservation Centre, Lagos
Source: Google Search

4.3.5 A Case From Finima Nature Park, Bonny, Rivers State

Finima Nature Park located in Bonny Island, Rivers state. The Finima Nature Park is a serene nature conservation park that has remained unnoticed to many. Finima Nature Park" represents a typical forest ecosystem and urban forest and green space with tremendous opportunities to benefit eco-tourism, urban wild life conservation and recreation (Abere, 2020)

The story of the kingdom of Bonny in Rivers state and my inaugural lecture theme discussion cannot be complete without discussing about the "Finima Nature

Park" considering the fact that I was a strong and leading voice that conceived the establishment of the "Finima Nature Park" in the mid-nineties (1996).

This idea was conceived and sold to the Bonny Kingdom. In 1997, the traditional council of Bonny Kingdom set up the Bonny Environment Consultants Committee (BECC) which was given the mandate to facilitate the establishment of the "Finima Nature Park". This dream was achieved and the 'Finima Nature Park' was set up.

Over the years (1999 – date), the Nigerian Liquefied Natural Gas (NLNG) company has been funding and sustaining the "Finima Nature Park". Similarly, the Nigeria Conservation Foundation (NCF) has also been engaged to manage this facility. In the coming days and for the future, the "Finima Nature Park" is gearing towards standing out as a self-financed institution thereby generating its own fund and sustaining itself (Catherine and Patricks, 2020)

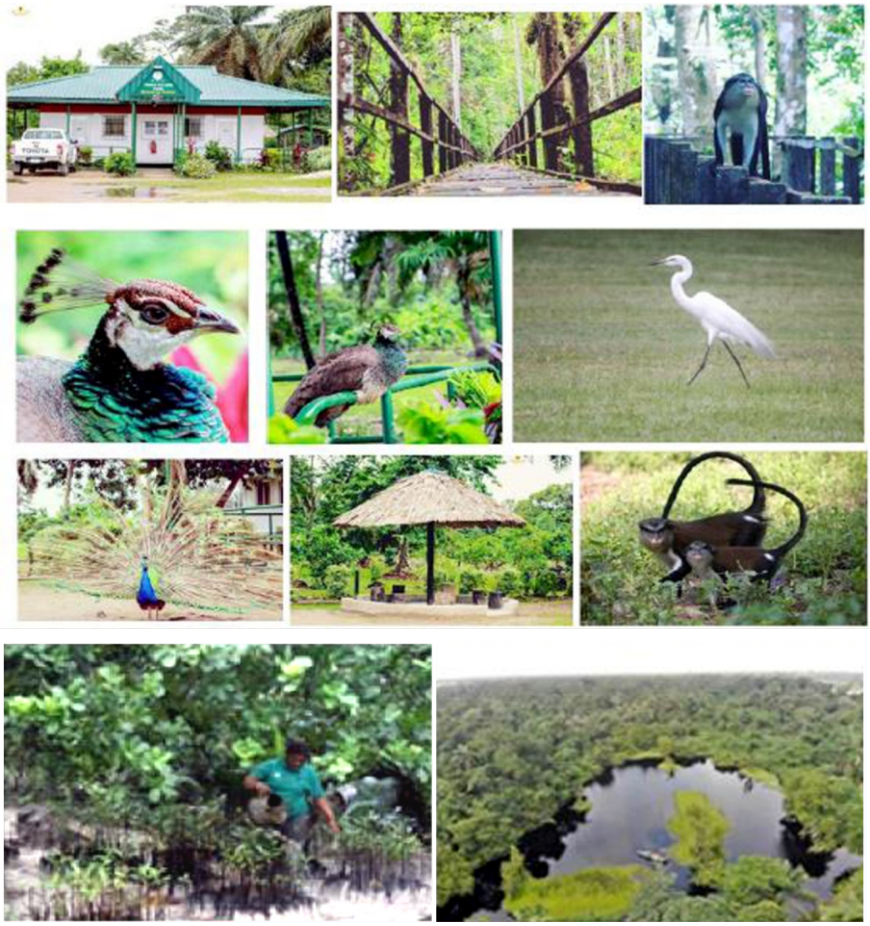
The Finima Nature Park has been selected as a real life case study to illustrate the importance of urban forest and green space towards eco-tourism in the region.

This inaugural lecture presents the Finima Nature Park' as a model for policy makers and decision makers to consider for future initiatives that can be made to further sustain its existence and for an opportunity to replicate it in other parts of the state including Port Harcourt city.

Finima Nature Park" further portrays the Bonny Kingdom as an Island known for its peaceful and beautiful serenity and adorned by beautiful water front which more than ever plays host to visitors and tourists

during major festive periods by drawing the attention of the people, the general public and the visiting tourists.

This Inaugural Lecture presents to this unique audience and to the global community that there is an urban forest and urban wild life colony that can be a model for tourist and city planners and development experts in urban forest and green space infrastructural development.



Plates 4.5: Images of Finima Nature Park, Bonny Island.

Source: Finima Natura Park on Google search

Photos of Finima Nature Park, Bonny Island.

4.4 HAPPENING ALREADY AROUND THE WORLD

In this inaugural lecture, I would like to take us on a journey around the world to introduce to us some city based green solutions. Perhaps, these could stimulate us to take sustainable local actions. We can borrow a leaf from some of these actions already embarked upon by cities to achieve needed resilience and sustainability in the face of climate change crisis.

4.4.1 Washington D.C, United States of America

Washington, D.C. has brought to scale one of the most innovative waste-to energy technologies by building the Walter F. Bailey Bioenergy Facility, the largest thermal hydrolysis installation in the world. The system produces 10 MW of electricity and supplies one-third of the power requirements of the connected Blue Plains wastewater facility. Washington, D.C. is affected by fluctuating energy prices. By investing in the thermal hydrolysis facility, the city provided itself a self-sufficient energy system that decreases its vulnerability to energy price fluctuations and increases its long-term resilience to climate change (Sustainia & C40 Cities, 2016)

4.4.2 Vancouver, USA

Vancouver has grown significantly and now uses more than 59.3 million gigajoules (GJ) of energy a year, resulting in 2.8 million tons of CO_2 emissions. By using innovative energy models to target the sectors most responsible for greenhouse gas emissions, buildings and transportation, the city is mitigating its carbon footprint and working toward its goal of using only renewable energy by 2050. Vancouver is the first city in North America to develop a Renewable City Strategy (RCS) to derive 100 % of the city's entire energy needs from renewable sources by 2050.

4.4.3 Istanbul, Turkey

Located in Istanbul, Turkey's largest landfill gas-to-energy project generates 50MWh, enough to provide electricity for 200,000 families. The project consists of two power plants, located close to the Kömürcüoda and the Odayeri landfills. Istanbul now boasts Turkey's largest landfill gas-toenergy facility, equipped with automated measuring and able to adjust to gas flows, which delivers energy for almost 200,000 families. In years past, half of Turkey's electricity generation is supplied by natural gas that has to be imported. By investing in its landfill gas-to-energy project, Istanbul is creating an affordable power source while decreasing its dependency on foreign gas.

4.4.4 Johannesburg, South Africa

Johannesburg is putting its wastewater and landfill methane emissions to productive use with a biogas-to energy project, at a minimal cost for the city. In 2011, Johannesburg launched a project to transform methane emissions from wastewater and landfill waste into energy. The project currently supplies 1.1 MW of electricity to the Northern Water Treatment plant, the largest in the city, which is equivalent to 12 % of the plant's operational needs. Let us recall that the procurement and use of energy is an expensive and often polluting endeavor for cities. Through its biogas-to-energy project, Johannesburg is mitigating those

4.4.5 Auckland, New Zealand

In a complete overhaul of the city's waste management system, Auckland's Waste to Resources project has put the city on track to achieve zero waste by 2040. In efforts to achieve zero waste by 2040, Auckland initiated the Waste to Resources project in 2012, diverting materials from the waste stream and improving resource efficiency throughout the city. In 2013, 9.3 % of Auckland's greenhouse gas emissions came from waste, with 1.2 million metrics tons sent to landfill in 2011. At the same time, around 65 % of curbside collected waste could be recovered, re-used, or recycled. The Auckland Waste to Resources project mitigates these issues and puts the city on track to achieve zero waste status by 2040.

4.4.6 The City of Quito, Ecuador

Quito is reducing emissions and changing the definition of waste by generating clean energy, creating compost, and recycling paper and cardboard as part of the Organic Waste and Climate Change project. Under its Development and Land Use Plan, in 2015 Quito launched an Integrated waste management project based on the concept of a circular economy, while encouraging social and environmental co-responsibility. In Quito, an average of 1,877 tons of waste is sent to the Inga landfill per year, accounting for 13 % of the city's carbon footprint. Sixty percent of waste in Inga landfill is organic, and its decomposition results in the generation of methane, contributing to climate change. By recycling, composting, and generating biogas through the Organic Waste and Climate Change project, Quito is reducing emissions and giving waste a new purpose.

4.4.7 City of Kolkata, India

In an effort to end waste burning, Kolkata is segregating its waste under the Solid Waste Management Project, creating a cleaner, healthier city while raising community awareness. The Kolkata Solid Waste Management Project encourages segregation of waste, a feat that had never been accomplished before in the city. Targeting 1 million people across six boroughs and covering over 65 km2 of land on the western bank of the River Ganges, the project focuses on recycling, composting organic waste, burying inert waste, and treating septic sludge. The project takes an engineering approach, through the development of infrastructure, but also incorporates a soft approach, including an

eight-year mass awareness program, ensuring community participation. Let us recall that for several years; mounds of waste at the Kolkata dumping site have measured up to 16 m high, causing land, water, air, and visual pollution. Furthermore, disposal of untreated sewage and waste dumping in the River Ganges has resulted in the extinction or endangerment of biodiversity in the area. The Kolkata Solid Waste Management Project has taken actions, through the segregation and appropriate management of waste, to reduce these hazards to the natural environment and the people of the city.

4.4.8 New York City, USA

New York City has conducted comprehensive studies over areas at risk of flooding due to climate change, increasing the resilience of buildings and livelihoods. New York City's Resilient Neighborhoods Study was launched in 2013 as a way to develop locally tailored strategies for land use and zoning changes that are responsive to the coastal hazards the city faces now and in the future. Ten studies were completed across a range of coastal neighborhoods in the city which analyzed damage from Hurricane Sandy; risks from coastal storms, including 10-, 50-, and 100-year storms; flood elevations; wave threats; future floodplains; and sea level rise. Information from these studies will help shape how and where development occurs on vulnerable coastal land and protect the 71,500 buildings currently located along these shorelines. Let us recall that Hurricane Sandy demonstrated that New York City is highly at risk from coastal storms, and climate change and sea level rise will only increase this risk in the future. To respond to

these concerns, the New York City Department of City Planning has completed a coastal risk assessment, taking into account the impact of flooding from sea level rise and changes in weather patterns, resulting in changes to zoning regulations, and securing resilient neighborhoods for the future.

4.4.9 City of Toronto, Canada,

Adaptation Report Informs Cross-Sector Collaboration. Toronto has published a policy report outlining an approach that will see climate change resilience integrated into decision-making and coordination across city agencies and with private sector partners. Toronto faces increased instances of heat waves, with modeling suggesting that by 2040- 2050 daily maximum temperatures could reach 44°C. To adapt to these pressing concerns, Toronto is laying the groundwork for action through the Resilient City report, ensuring that services and operations both in and outside the city's jurisdiction are coordinated. In 2014, Toronto unveiled Resilient City – Preparing for a Changing Climate, a policy paper that lays the groundwork for comprehensive adaptation action. The report outlines how climate change resilience can be integrated into decision-making and coordination of city operations and services. Furthermore, it proposes specific recommendations, such as the creation of a geospatial risk assessment tool that tracks data like heat vulnerability, locations of flood zones, locations of previously flooded areas and electrical outages, and areas of heavy tree damage from different departments and utilities, recognizing interdependencies between city departments.

4.4.10 Rio De Janeiro, Brazil

Rio de Janeiro engaged citizens, municipal employees, and private stakeholders in creating its resilience strategy, identifying climate shocks in the city, and creating targeted measures to reduce the impacts. The Rio Resilience Strategy was born in 2016 as a guide for Rio de Janeiro to become a global leader in resilience by 2035. Developed with the support of a group of sector-specific experts, interviews with 39 city departments, and workshops with private sector stakeholders, the strategy defines six key goals: understand and mitigate the impacts of severe weather; prepare the city to respond to extreme weather events; cultivate green, cool, and safe urban spaces; provide high-quality basic services to all citizens; promote a circular and low-carbon economy; and increase the overall resilience and cohesion of the city and its people. Climate impacts, such as strong winds and rain, sea level rise, and flooding, combined with increased heat waves and heat islands, threaten Rio de Janeiro's residents and infrastructure. The Rio Resilience Strategy serves as a guiding document for how, in both the short and long term, the city can protect itself from these challenges and transform into a global leader in urban resilience measures.

Chapter 5

MY CONTRIBUTIONS TO KNOWLEDGE

Vice Chancellor Sir, please permit that I share in brief some contributions I have made to knowledge and body of literature in my professional field of endeavor through years of experience and research works done.

5.1 WILDLIFE ECOLOGY AND ECOTOURISM

Wildlife in its diversity is inclusive of various life forms and the domestication of these life forms could be beneficial to humanity. In one of our studies Ekeke, et al (1993) elaborated that wildlife domestication with focus on Glasscutter rearing, Bee keeping and Snail culture can promote Eco farming and environmental Protection. Similarly in another study by Abere (1998), useful contributions evolved regarding how knowledge of wildlife status in the Bonny area of Niger Delta could be a useful tool that can aid the establishment of a nature park around NLNG, Bonny. This study paved way to the present day Finima Nature Park in Bonny. Abere, et al (2011) also pointed out that conservation of the mangrove will enhance wildlife development.

Abere and Nkasiobi (2012) conducted a study using aerial and ground surveys as a tool in game selection for domestication. This work proved to be a useful mechanism to map opportunities for ecotourism around the Kainji and other parts of Nigeria. In another work by Abere and Ukoima (2014), we attempted to introduce a new concept in wildlife management and urban wildlife in homestead habitats in Port Harcourt. This pointed out that it is possible to achieve urban wildlife management in Rivers State which can be a huge drive to ecotourism and income generation for the state. We

also adopted a checklist for identifying urban wildlife species in Rivers State using Obio/Akpor and Eleme Local Government Areas of Rivers State as case study locations. The findings showed that there are abundant wild life seen on daily basis around the city (>30%). Majority of these wildlife species were found near the homes (50%) and others near shops (30%) and offices (18%). This study corroborated with the study on status of tourism development in old Oyo National Park, Southern Nigeria by Abere et al (2014). It also aligned with finding in a study to identify the ecotourism potentials in Bayelsa State (Abere, et al., 2015). It also corresponded with the study done by Abere et al (2015) to assess the wildlife diversity in Bonny Island, and another to determine the tourism option for conservation of endangered species in Niger Delta, Nigeria with reference to Manatee of Itu Wetland (Abere et al., 2018). All these studies identified great potentials for ecotourism in the Niger Delta through detailed wild life assessment. This also gave rise to the assessment of Ecotourism operations in Ezeagu Tourist complex of Enugu State (Abere et al., 2018). Ijeomah et al (2018) confirmed that an evaluation of security situation and cultural components of Ecotourism in Okomu National Park was beneficial in driving further studies to determine the impact of security challenges and cultural diversities on ecotourism across Nigeria. This study proved a fact that security and cultural issues will always impact on the success or failure of ecotourism. These studies further brings to our knowledge that we can harness displaced wild life by re-accommodating them through a carefully planned urban wildlife management programme which will in turn bring about ecotourism dividends to our society.

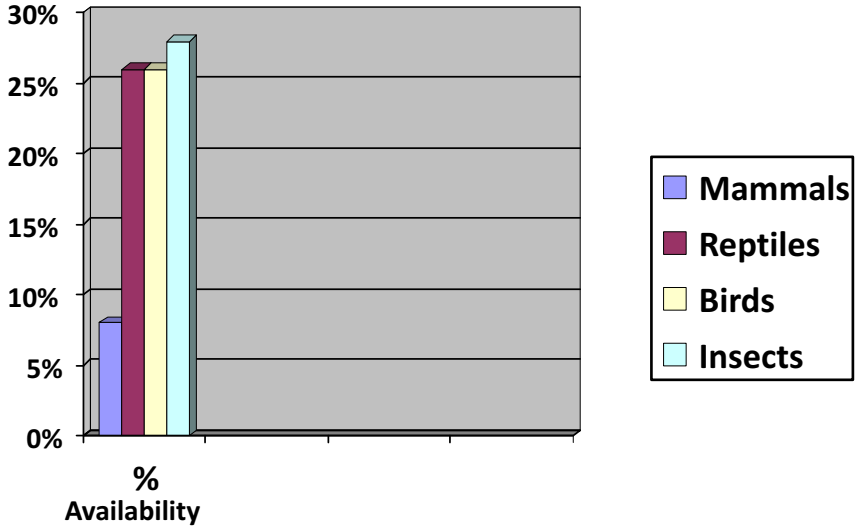


Figure 5.1: Percentage availability and abundance of wildlife species by respondents
Source: Abere and Ukoima (2014). Urban wildlife in homestead habitats in Port Harcourt

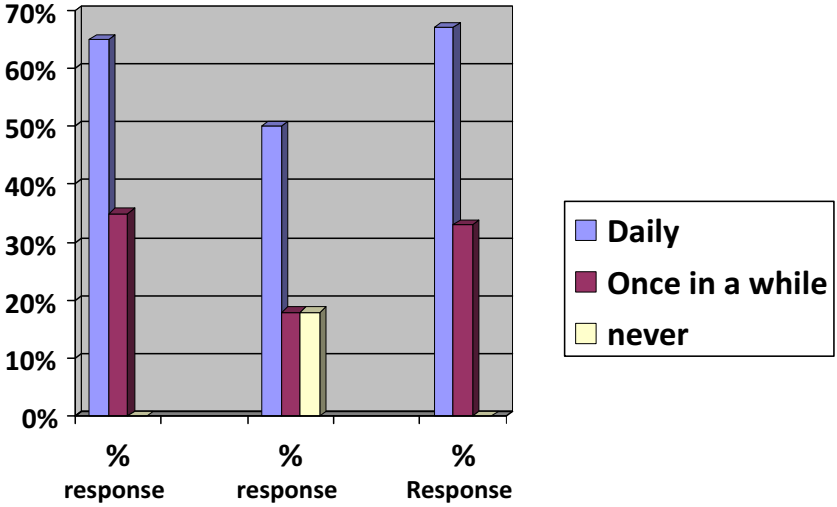


Figure 5.2: Percentage frequency of seeing wildlife species by respondents
Source: Abere and Ukoima (2014). Urban wildlife in homestead habitats in Port Harcourt

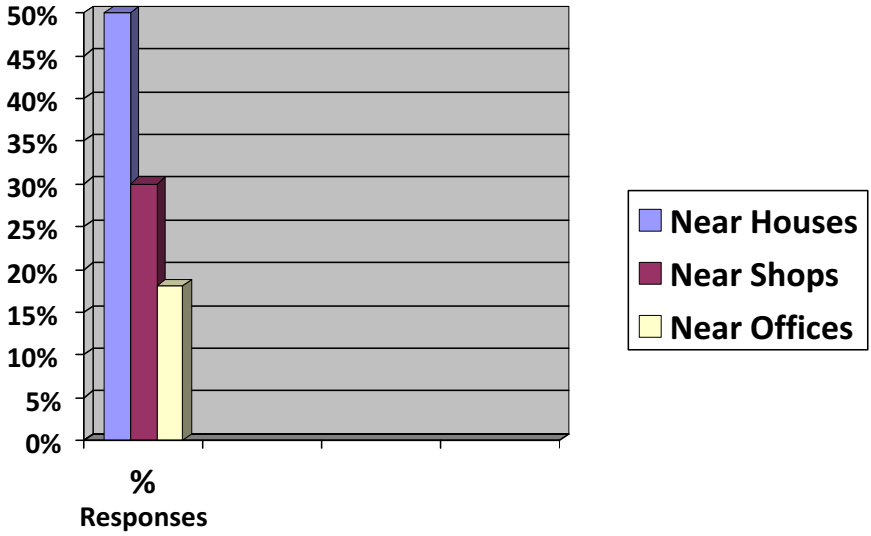


Figure 5.3: Percentage location distribution of cited wildlife species Source: Abere and Ukoima (2014). Urban wildlife in homestead habitats in Port Harcourt

5.2 DEFORESTATION AND SUSTAINABLE DEVELOPMENT

Sustainable development as we understand it today implies that we have to ensure both intergenerational and intra generational equity in resource utilization. In one of my studies Abere (2002), I was able to show case how deforestation in the Niger Delta using Akuku-Toru as a case study area could impact on environmental resource conservation and community development especially as it affects biodiversity and the forest ecosystem services in the mangrove forest of the Niger delta. This study showed that the mangrove forest which habours abundant biodiversity and plays critical role in climate change mitigation and sustainable development has been under threat due to deforestation. Almost 100% of the respondents engaged in cutting the mangroves stated that they do not re-plant new mangroves to

replace the once cut. This massive deforestation pose greater risk for this unique forest ecosystem and as such has huge implications for sustainable development in the future. Similarly, another study, Abere (2011) pointed out that forest protection can help to curb sustainable development challenges and implications of our time. Another study Abere, et al (2011) was able to pin-point the important role an evaluation of forest resources conservation laws in Nigeria will make on the prevention of deforestation. In similar studies Abere and Jacinta (2012) showed that the extent of deforestation has a visible relationship with sustainable development in the tropics. One of my studies Abere, (2017) which looked at the impact of Habitat destruction on livelihoods and vulnerability of the Forest dependent Communities in Rivers State was able to bring to knowledge that the destruction of natural habitats increased the vulnerability of communities whose livelihood is dependent on the forest ecosystem by reducing their livelihood opportunities, pushing them on the brink of hunger and poverty which are strong indices for measuring sustainable development

Table 5.2.1.: Percentage response on mangrove forest deforestation and re-planting

S/NO	Location	No. of Cutters	Do You Plant Mangrove as You Cut Some	
			YES	NO
	Abaji Okoloama	11	0	11
2.	Abissa	15	0	15
3.	Abonnema	36	0	16
4.	Arusun Kiri	8	0	8
5.	Boy-Boko	9	0	9
6.	Erisa Kiri	11	0	11
7.	Idama	7	0	7
8.	Kula	11	0	11
9.	Lele-Kiri	15	0	11
10.	Obonnoma	23	0	23
11.	Penny Penny Kiri	4	0	4
12.	Sagama	7	0	7
13.	Sika Kiri	8	0	8
14.	Soku	17	0	17
	Total	182	0	182
	Percentage Responses	%	0	100

5.3 CLIMATE CHANGE MITIGATION AND ADAPTATION

In an effort to further contribute to available knowledge on affordable ways to reduce greenhouse gas emission or increase its sinks in nature and also to identify beneficial adjustments that can be made in human and natural systems to increase resilience and reduce vulnerabilities to climate change, Abere et al (2018) conducted a study on *Niger Delta Biodiversity and the Contribution to Climate Change Mitigation and Sustainable Development*. From primary data obtained from interview and questionnaire survey methods administered to various respondents selected through purposive sampling technique, we found out that there is strong benefit derivable from ecosystem services to achieve climate change mitigation and adaptation through ecosystem based adaptation and conservation of biodiversity in the Niger Delta. The study assessed the contribution of the Niger Delta forest ecosystem to climate change mitigation and sustainable development by measuring thematic areas like: Carbon sequestration potential by Niger Delta forests, potentials to support food, food products and agriculture production and development, potentials to support domestic and commercial products production, contribution to vital ecosystem services and functions, potentials for job creation and occupation, research and scientific knowledge development, potentials for Climate Change Mitigation and Adaptation, potentials for tourism and aesthetic values and potentials for public health and traditional medicine, culture, heritage, arts and crafts. The various respondents were drawn from NGO's, civil societies, professional bodies in the Niger Delta, local community groups and farmers, and others drawn from government regulatory agencies and institutions.

Table 5.3.1: Percentage response from local community groups and farmers

Respondents	Thematic Area of Interest	Number Responding in the Positive	Number Responding in the Negative
Data from Local community groups and farmers	Carbon sequestration potential by Niger Delta forests	75%	25%
	Potentials to support food, food products and agriculture production and development	70%	30%
	Potentials to support domestic and commercial products production	65%	35%
	Contribution to vital ecosystem services and functions	85%	15%
	Potentials for job creation and occupation, research and scientific knowledge	75%	25%
	development		
	Potentials for Climate Change Mitigation and Adaptation	78%	22%
	Potentials for tourism and aesthetic values	95%	5%
	Potentials for public health and traditional medicine, culture, heritage, arts and crafts	72%	28%

Source: (*Abere et al.*, 2018)

Table 5.3.2: Percentage response from other stakeholders and government institutions

Respondents	Thematic Area of Interest	Number Responding in the Positive	Number Responding in the Negative
Other stakeholders including government sources	Carbon sequestration potential by Niger Delta forests	95%	5%
	Potentials to support food, food products and agriculture production and development	80%	20%
	Potentials to support domestic and commercial products production	75%	25%
	Contribution to vital ecosystem services and functions	90%	10%
	Potentials for job creation and occupation, research and scientific knowledge development	85%	15%
	Potentials for Climate Change Mitigation and Adaptation	95%	5%

Source: (*Abere et al.*, 2018)

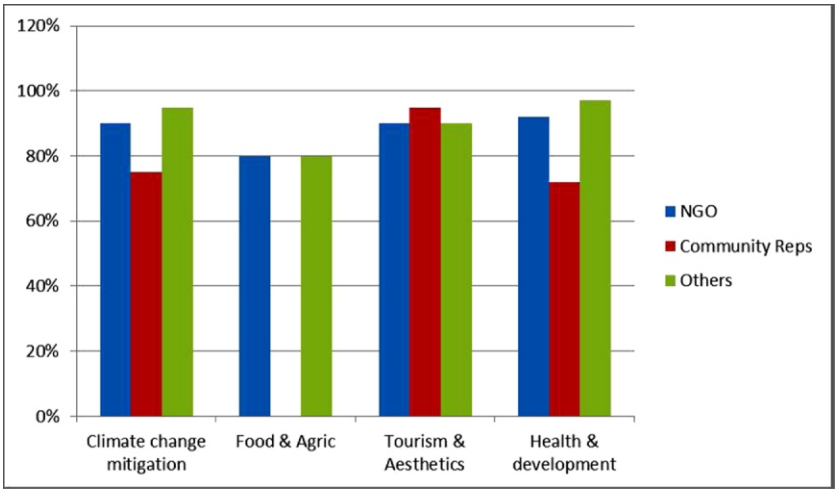


Figure 5.3.3: Percentage response from various respondents on the benefits of forest ecosystem and biodiversity

Source: (*Abere et al.,* 2018)

The results and findings showed that a greater percentage of the population sampled (>90%) understood the relevance of forest ecosystems and greater than (>85%) stated that the Niger Delta forests and biodiversity makes huge contribution to sustainable development through its function and role towards climate change mitigation. The results helped to provide evidences and proven knowledge on the ability of Niger Delta forests to support climate change mitigation, reduce vulnerabilities to climate change risks by providing abundant biodiversity and species that can support and have strong potential to support food, food products and agriculture production and development in the region. The evidences from the surveys also provided good knowledge on the potential of the forest ecosystems to support domestic and commercial products production, contribution to vital ecosystem services and functions, potentials for job creation and occupation, research and scientific knowledge development, potentials for tourism and aesthetic values, potentials for public health and traditional medicine, culture, heritage, arts and crafts. These thematic concerns which are supported by the forest biodiversity will in turn translate to net income, improved GDP and sustainable national Development.

Chapter 6

CONCLUSIONS AND RECOMMENDATIONS

6.1 FUTURE RESEARCH INTERESTS

It is my pleasure to bring also to our notice that for the future, these areas shall take my attention:

- ❖ To drive towards the establishment of a climate change solution and knowledge Centre for resilient and sustainable forest resource utilization and conservation.
- ❖ To actively promote the inclusion of an Urban wildlife management and Urban forest/greenspaces into present day city planning
- ❖ To further improve engagement towards sustainable municipal solid waste management
- ❖ Promoting projects and programmes aimed at resilient cities for tomorrow

6.2 RECOMMENDATIONS

Vice Chancellor, Sir, It is my pleasure that the following recommendations be considered after today

1. That a center for knowledge exchange and climate solutions be established within the department of Forestry and Environment to further build up on the issues raised during this inaugural lecture especially on conservation of our forest resources and climate change mitigation and adaptation.
2. That the university supports me to promote urban wildlife and urban forest conservation and management as a thematic concern for the future.

3. That the university mainstreams green and resilient city development in its advisory to government and policy makers of our great state
4. That we all take SMART personal actions to combat the climate crisis in our daily choices and decisions.
5. Bio-remediation practices must be enforced to check the degradation and pollution of our environment. Natural life forms should be used to treat organic and inorganic damages to the world.
6. Improved and clean agricultural practices must be encouraged to engage the rural communities and improve livelihood to avoid vandalization of infrastructures used for tapping natural wealth.
7. Government should take the lead for environmental protection by employing adequate political will to discourage defaulters. This can be done by enacting appropriate laws and developing adequate policies to achieve desired goals.

6.3 CONCLUDING REMARKS

My Vice Chancellor Sir, and distinguished guests, I would like to conclude with these proposals

We have to think global and act local. Supporting green cities and ecosystem services is a sure way to combat the climate change crises and achieve sustainable development.

Promoting urban wild life and urban forest management will create a win-win benefit for us regardless of the various wildlife forms and biological species we might have displaced during decades or city and urban infrastructural development.

We can still harness and tame them to provide opportunities for ecotourism.

Prof. S.A Abere

A CITATION ON THE INAUGURAL LECTURER

Vice-Chancellor Sir, I feel honored and privileged to be nominated as University Orator to introduce Professor S.A Abere, the 74th Inaugural Lecturer of the Rivers state University, Nkpolu, Port Harcourt, Rivers State, Nigeria.

In Brief:

Prof. S.A Abere is a distinguished Teacher and accomplished Research scientist in wildlife, ecotourism, waste management, forestry and environment. He is an academic Leader, a Mentor and a Great Scientist, who, on account of his widely published research findings is an internationally recognized Scholar.

Prof. Sodienye Austin Abere was at the Ahmadu Bello University Zaria in Nigeria from 1978-1981 where he had his undergraduate studies in Zoology. He then proceeded to work briefly at the Public Health Laboratory in the Rivers State Ministry of Health, Port Harcourt as a Scientific Officer in Parasitology and Epidemiology from 1984-1989. He earned an MSc degree in Wildlife and Range Management in 1986. Sodienye Abere moved into the University teaching profession as Assistant Lecturer in1989 and since then had taught at undergraduate and graduate levels in the Department of Crop Science/ Soil Science and Forestry in the Rivers State University (formerly Rivers State University of Science and Technology). Professor Abere is leading with an industrial experience spanning over 24 years as a Consultant to multinational corporations and Government parastatals in Nigeria. Prof. S.A Abere is the first professor of Wildlife Ecology and Ecotourism in the South East/South-South of Nigeria. He is the 13th professor of Wildlife management in Nigeria and first professor of Wildlife Ecology in Rivers State. He has served in various administrative positions including headship of Department of Forestry and Environment of the Rivers State University. He is a member of various Editorial Boards and has published in many internationally books and Research Journals. He is a very prominent executive of the Waste Management Society of Nigeria (WAMASON) and a Man that places strong value and respect for traditional cultures and authorities to promote sustainable community development. He initiated the first forest day celebration in the university community. He is an Ambassador of the Finima Nature Park and the Chairman of the Bonny Environment Consultants Committee (BECC). Abere S.A was elected Fellow of the African Scientific Institute in September 2018 and Fellow of the Nigerian Institute of Strategic Management in 2008.

Education

Our Inaugural lecturer, Prof. S.A Abere started his early education at age 4 at St. James Anglican Church Peterside in Bonny where he was also born. He was moved to Port Harcourt and introduced to the Salvation Army, a Charity and Evangelical International Authority that started in July 1865 by General William Booth. He had that impressive primary school education till Elementary 5 before moving to St. Cyprian's Primary School. He had his secondary school education from the Bonny National Grammar School and obtained the West African School Certificate (WASC) in 1973. He had to work for some time and later went in for a pre-degree at College of Science and Technology (CST) in 1976. He had to go to the Civil Aviation Training Center, Zaria on employment because he was an indigent student to obtain Full-Tech. Certificate on Aeronautical Electronics and Telecommunications (AET9) class. During his over one year stay at Civil Aviation training Centre; he picked interest in the flying school to train as a standard pilot.

Armed with an A 'level qualification from CST, he was still bent on getting a degree so on admission to Ahmadu Bello University ABU, he was so happy to bag a B.Sc. (Hons) in Zoology having studied between 1978-1981. He did the compulsory National Youth Service corps (NYSC) programme at the Military Hospital Enugu and later at Park lane General Hospital, Enugu between 1981-1982. He got admitted to the Standard Pilots (SP18) course just after the NYSC programme and had to rush it for the love he had in flying and the fact that he would be sponsored by the Training Centre to be a flying instructor on completion.

Work Experience:

His joy was cut short when his mother threatened to die if he continued flying – she said air accident never left any remains to be buried. He had to come back to Port Harcourt to seek employment with the Rivers state Government. Still interested in flying, he had to write a proposal for taking healthcare to the villages and hamlets as in

agriculture, the light aircraft is used for spraying plantations and vast farmlands. The proposal paid off in what was called the FLYING DOCTORS SCHEME. He took up appointment with the State Ministry of Health and worked as Scientific Officer in the Public Health Laboratory and became the Team Lead for the National Onchocerciasis and Schistosomiasis Control Project. He left the Ministry in 1989 to join the Rivers State University of Science and Technology as an Asst. Lecturer and have risen to the rank of Professor in October 2019.

As a Lecturer II and an active ASUU Executive Member, he was called up to serve the Nation as Deputy Chairman and Supervisor for Agriculture and Rural Development for Bonny Local Government between 1994-1996. He proposed the establishment of a Biodiversity Conservation Project in 1995 that became the Finima Nature Park in 1999. As an environmentalist he called for the stoppage of burying solid, industrial and hazardous wastes in the soil of the Bonny Island because the water table is very shallow and to prevent ground water contamination.

Public Experience in Industry and Non-teaching/ Research Institution

(i) Pathologist in charge: Epidemiological survey of disease. Pathogens in Rivers State under the State Ministry of Health – 1985-1989.

(ii) State facilitator, National Schistosmiasis Control Programme Rivers State.

(iii) Resource person on wildlife ecology to the Nigeria Agip Oil Company (N.A.O.C) Green Rivers project – 1992.

(iv) Consultant, Ecologist – NLNG/NCF Conservation project at Bonny, February 1997 to date.

(v) Consultant, Bonny Environment Consultants Committee: Bonny Kingdom – 1997-date

(vi) Consultant to the Federal Ministry of Environment: Nigeria – 1995 – Date

(vii) Consultant of the Rivers State Ministry of Environment – 1997 – Date

(viii) Formulation and establishment of waste to wealth project in Bonny municipality.

(ix) Participation in the world conference and exhibition on waste to wealth initiative in Malaysia Nov. 2007.

(x) Forest and wildlife conservation efforts and studies in Bonny – Finima Nature Park. Sponsored by NLNG 2001-Date

(xi) E.I.A Study execution on sand sourcing in the Bonny River and hydraulic land fill project of a plant site proposed for gas business in Bonny by Dredging international (DI)

(xii) Design, plan and execution of crude oil spills management in mangrove and swamp forest ecosystems by Bonny Environment Consultants Committee (BECC) 2006.

(xiii) Clean-up of multiple oil spills in Bonny, Ogoni, Kalabari and Ijaw lands in the Niger Delta region of Nigeria- 2005 to Date.

(xiv) Expert team member on effect of environmental pollution on Health in Rivers State (2019)

In the University system he has served in the following academic and administrative positions.

1. Transport and Logistics Officer 1990-1994 Faculty of Agriculture.
2. Faculty SIWES Coordinator and Department as well 1991-94 & 1997-2000
3. Faculty Exam Officer 1996-2001
4. Faculty PG, Coordinator 2003-2006

5. Faculty and Department: Board of Examiners 1990 - date
6. Member of the University Ceremonial Committee 1996-2007
7. Member of the University Library Committee 2010 - date
8. Chairman ICTC Development Committee 2019 - date
9. Member Rivers State Environmental Action Plan SEAP 1991 - 94
10. Faculty and Dept. Convocation Exhibition Committee 2010-
11. Permanent member of Senate 2019 - date
12. NUC accreditation Committee Member 2012 – date.
13. PG and Undergraduate Co-coordinator 2010 - 2015
14. Faculty Exams Officer 1997 – 2000
15. Ag Head of Dept of Forestry & Environment 2015 - 2018
    - ❖ Membership of University/Faculty/Departmental Committees in this University with dates
16. University Ceremonial Committee 1990 - 1994
17. Faculty Exams Officer 1997 – 2000
18. University Library Committee 2013 – 2015 and 2017 - Date Curriculum and Programme Committee for the department 2011 – Date
19. Member Disciplinary Committee 2010 - 2014
20. Member PG Internal Examination Panel (Msc) 2017- Date
21. Member Faculty of Agriculture Developmental Committee 2018 – Date
22. Member Faculty of Agriculture Representative in Senate 2018 – Date

Membership of Professional Bodies

He belongs to many professional societies because of his interest in community development service. Some of these are:

1.	Nigeria Institute of Management	- 1986
2.	National Geographic Society	- 1998
3.	Nigerian Institute of Strategic Management	- 2004
4.	Waste Management Society of Nigeria	- 2008
5.	Solid Waste Association of North America	
6.	International Association for Impact Assessment	- 2013
7.	Forestry Association of Nigeria	- 2015
8.	Wildlife Society of Nigeria	- 2018
9.	Bonny Environment Consultant Committee	- 1997
10.	Nigerian Environmental Society	- 1986
11.	International Solid Waste Association (ISWA)	- 2015

Awards & Recognitions

In the community, He has been recognized and appointed to high and sensitive positions of the Bonny land such as:

1.	Warisenibo Allison Major House	- 1997- date
2.	Amasenibo of Grand Bonny Kingdom	- 2006- 2016
3.	AmaOpusenibo of Grand Bonny Kingdom	- 2016- date
4.	Captian of the Allison Ogbokroma	- 2004- 2019
5.	Caretaker Oputumbie in the Allison Group of Houses	- 1997- date
6.	President Bonny Improvement Association PHC	- 1997- date

7. Provost and later Secretary Allison Family Union PHC - 1987-2017

Religious And Social Life

Professor Augustine Abere has served the Salvation Army in various capacities.

1. Quarter Master Port Harcourt Central Corps - 1983-1987
2. Recruiting Sergeant Port Harcourt Central Corps - 1980-2000
3. Corps Sergeant Major - 2001- date
4. Divisional Envoy - 2015- date
5. Territorial Advisory Council - 2004-2020
6. Member Board of Trustees, Salvation Army Nigeria Territory - 2021- date
7. Founding Member of Scripture Union Bonny National Grammar School 1970 and President - 1972- 73
8. Member S. U Pilgrims Group PHC - 1974-1976
9. President Christian Union UST - 1974-1976
10. President Christian Union ABU Zaria - 1977-1979
11. Asst. Squad Commander ANAMCORP Enugu - 1981-1982
12. Secretary Police Officers Mess PHC - 1983-1993
13. Board of Trustee Member, United Christian Prisons Ministry - 2010- date
14. Welfare Officer Christian Council of Nigeria (CCN) - 2010- 2015
15. General Secretary CCN Rivers State Chapter - 2015- 2018

16. Director for Women and Youths Affairs of Christian Association of Nigeria (CAN) - 2012- 2015

17. Bar and Kitchen Secretary, Port Harcourt Club (1928) - 2003- 2005

18. Captain Billiards and Snooker Section – PH Club (1928) - 2006- 2009

Community Services

1. Professor Abere Augustine proposed and defended at Abuja Federal Environmental Protection Agency organized session on the Nigerian Liquefied Natural Gas (NLNG) EIA the need for the establishment of a Nature Reserve (Park) in Bonny as a mitigation measure for the massive land take to house the NLNG plant in 1995. It is now known as a functional FINIMA NATURE PARK.

2. He made out a working document to the Bonny Chiefs Council and defended same to give birth to the Bonny Environment Consultants committee (BECC) of which I He is a founding member and current chairman since 2004 but BECC started 1997.

3. He was appointed to serve his community in the capacity of a vice chairman and supervisor for Agriculture and Rural Development in the Caretaker Committee of Bonny Local Government Council – 1994-1996.

4. He pointed out that the water table in Bonny Island is shallow and will facilitate surface and ground water contamination by indiscriminate dumping of wastes or any form of landfill. So the kingdom ordered that all wastes from the industries be carried out of Bonny Island for disposal. This is the practice till Date.

5. He initiated the need for carrying capacity studies to the effect of Bonny; housing the expansion project of SPDC, Mobil and NLNG – 2006, ongoing.

6. Prof. S.A. Abere initiated and established the annual tree planting and Forest Resources Conservation Day 2018 in the Rivers State University in August 2018

7. He started the waste to wealth initiative of NLNG that all the multinationals are invited to buy into in 2008.

8. He has been a member since 1969 and a captain (Head) since 2004 of the Bonny Allison Ogbokroma Cultural and Dance Group.

9. He has been talking on Television and Radio on World Environmental Day, EarthDay and a resource person to Rivers State House on waste management laws etc.

10. Prof. Abere Sodienye became member 1984, Secretary 1993 and Vice President 1997 of the Bonny Improvement Association, Port Harcourt and its President since 2000.

11. He seeks the welfare of Bonny people outside Bonny and gives recognition to other Branches opened up outside Port Harcourt eg. Lagos, Abuja, Ibadan, Kano etc.

12. Prof. Abere Sodienye is the elder of Allison Major House 1997 and titled citizen of Grand Bonny Kingdom 2006 by His Majesty the King.

13. He became the International Awardee of the General of the Salvation Army in 2005.

14. He was a director of Education, Youth & Women Development in Christian Association of Nigeria (CAN) 2010.

15. He was the General Secretary of Christian Council of Nigeria. 2015.

16. He is an envoy of the Salvation Army 2015 — date.
17. He is Member Board of Trustees United Christian Prison Ministry (UCPM)
18. He has awards by the Salvation Army Church, Rivers/ Bayelsa Division for Technical assistance. January 2018.

Research Supervisions and Publications

Our Inaugural lecturer, Prof. S.A Abere has published more than 91 academic papers in National and International Journals, a written text book and has contributed to chapters in six books.

He has supervised 23 PhD Thesis, 5 are currently ongoing, 15 M.Sc. dissertations and 7 are ongoing as well as 12 B.Sc. projects.

Family Life and Hobbies

Prof. S.A Abere is a lover of sports. He introduced basketball to CST, participated in long distance races and triple jump for CST and ABU. He swims very well and still plays billiards and snooker till date.

He is happily married with 5 children, 4 girls and a boy who are all graduates in various fields.

He has as sibling 4 sisters and 2 brothers all married and managing their separate families.

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Vice Chancellor Sir, in the preparation of this lecture, I am greatly indebted to Dr. (Sir) Chinemerem Patricks who assisted in no small measure to the production and formatting of this work. My special thanks go to Dr. Werisuo Simbi-wellington my own student and staff who had given me no rest in charging for the preparation of this work.

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Vice Chancellor sir and chairman of this August gathering, I would not be here today addressing this distinguished audience if I was not employed in the then Rivers State University of Science and Technology (RSUST), now Rivers State University. Therefore, my profound gratitude goes to the Rivers State Government and the second Vice Chancellor of this great Institution and first professor from Bonny, Rtd. Professor Edward I.O. Banigo for counting me worthy of excellence and creativity to keep in motion the wheel of truth. I also remember the transparency and warm welcome the then Head of the Department of Crop/Soil Science and Forestry Dr. Douglas meted out to me as the second Forestry staff. I cannot forget the way my senior friend Rtd. Professor Victor Omuaru a former Vice Chancellor of this University cherished and encouraged my every move in this community to belong these 32 years, I thank him.

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Vice chancellor Sir, in concluding this segment permit me to introduce to you and all, those apart from God and my Parents who are in the great beyond, have kept me going and are giving me reason to live on. These are my wife and children they are all here and I thank them openly. May God bless and reward them all. Amen.

Professor Sodienye Augustine Abere

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APPENDICES

1. GLOSSARY AND DEFINITIONS

Wildlife and wildlife Ecology

Wildlife is better simply described as all life forms existing in their natural environment. Wildlife are all species of living things that have not undergone complete domestication. This is a process where humans intentionally or unavoidably interfere with the natural or wild traits of the life form leading them to gradually drop such traits as they get accustomed to the condition introduced to them by man. Feeding habit and search, social organization and health care etc (Abere, 1998)

Wildlife Ecology

This is the study and understanding of the environment which has direct and indirect influence on the life forms existing in that setting. These elements of environment generally include: Air, precipitation, temperature, topography, relative humidity, solar radiation. These also determine the climate of an area which gives rise to the recorded zones of the world such as equatorial tropical temperate, tundra, desert and so on. Wildlife exists in all the zones (Abere et al., 2011)

Climate Change: A change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings, or to persistent anthropogenic changes in the composition of the atmosphere or in land use (IPCC, 2012).

Climate Extreme (extreme weather or climate event): The occurrence of a value of a weather or climate variable above (or below) a threshold value near the upper (or lower) ends of the range

of observed values of the variable. For simplicity, both extreme weather events and extreme climate events are referred to collectively as 'climate extremes (IPCC, 2012).

Exposure: The presence of people; livelihoods; environmental services and resources; infrastructure; or economic, social, or cultural assets in places that could be adversely affected (IPCC, 2012).

Vulnerability: The propensity or predisposition to be adversely affected.

Disaster: Severe alterations in the normal functioning of a community or a society due to hazardous physical events interacting with vulnerable social conditions, leading to widespread adverse human, material, economic, or environmental effects that require immediate emergency response to satisfy critical human needs and that may require external support for recovery (IPCC, 2012).

Disaster Risk: The likelihood over a specified time period of severe alterations in the normal functioning of a community or a society due to hazardous physical events interacting with vulnerable social conditions, leading to widespread adverse human, material, economic, or environmental effects that require immediate emergency response to satisfy critical human needs and that may require external support for recovery (IPCC, 2012).

Disaster Risk Management: Processes for designing, implementing, and evaluating strategies, policies, and measures to improve the understanding of disaster risk, foster disaster risk reduction and transfer, and promote continuous improvement in disaster preparedness, response, and recovery practices, with the explicit purpose of increasing human security, well-being, quality of life, resilience, and sustainable development (IPCC, 2012).

Adaptation: In human systems, the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities. In natural systems, the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate (IPCC, 2012).

Resilience: The ability of a system and its component parts to anticipate, absorb, accommodate, or recover from the effects of a hazardous event in a timely and efficient manner, including through ensuring the preservation, restoration, or improvement of its essential basic structures and functions (IPCC, 2012).

Transformation: The altering of fundamental attributes of a system including value systems; regulatory, legislative, or bureaucratic regimes; financial institutions; and technological or biological systems (IPCC, 2012).

Mitigation: This is a human intervention to reduce the sources or enhance the sinks of greenhouse gases. Mitigation, together with adaptation to climate change, contributes to the objective expressed in Article 2 of the United Nations Framework Convention on Climate Change-UNFCCC (IPCC, 2012).

1. LIST OF ACRONYMS & ABBREVIATIONS

ABU	Ahmadu Bello University
ACRP	African Climate Reality Project
AET	Aeronautical Electronics & Telecom
AfDB	African Development Bank
AR5	Fifth Assessment Report
ASUU	Academic Staff Union of University
BECC	Bonny Environmental Consultants Committee

BRT	Bus Rapid Transport
C	Carbon
CCE	Climate Change Economics
CDKN	Climate development and Knowledge Network
CH4	Methane
CO2	Carbon Dioxide
COP	Conference of Parties
CST	College of Science and Technology
EIA	Environmental Impact Assessment
EMT	Environment & Millennium Targets
FAO	Food and Agriculture Organization
FAO	Food and Agriculture Organization of the United Nations
FMEnv	Federal Ministry of Environment
FRIN	Forestry Research Institute of Nigeria
FWMSON	Fellow Waste Management Society of Nigeria
GHG	Green House Gas
GHGs	Greenhouse Gases
GWP	Global Warming Potential
HFC	Hydro-Fluoro Chloride
IPCC	Inter-Governmental Panel on Climate Change
LUCF	Land Use Change and Forestry
LULUC	Land Use and Land Use Change
MDG	Millennium Development Goals
N2O	Nitrous oxide
NAOC	Nigeria Agip Oil Company
NCF	Nigeria Conservation Foundation

NF	Nitrogen fluoride
NGO'S	Non-Governmental Organizations
NLNG	Nigerian Liquefied Natural Gas
NUA	New Urban Agenda
NYSC	National Youth Service Corps
PFC	Per Fluoro Chloride
PHC	Port Harcourt
RCP	Representative Concentration Pathway
REDD+	Reduced Emissions from Deforestation and Forest Degradation
RSU	Rivers State University
SDG's	Sustainable Development Goals
SF	Sulfur Fluoride
SIWES	Students Industrial Work Experience Scheme
SPM	Summary for policy Makers
TEEB	The Economics of Ecosystem & Biodiversity
UI	University of Ibadan
UNCC	United Nations Climate Change
UNCED	United Nations Conference on Environment and Development
UNEP	United Nations Environment Programme
UNEP	United Nations Environment Programmes
UNESCO	United Nations Educational, Scientific and Cultural Organization
UNFCC	United Nations Framework Convention on Climate Change
UN	United Nations
WAMASON	Waste Management Society of Nigeria
WASC	West African School Certificate


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