

**KAUNAS UNIVERSITY OF TECHNOLOGY  
SCHOOL OF ECONOMICS AND BUSINESS**

**Osahon Osazee Ighodaro**

**THE ECONOMIC IMPORTANCE of BIODIVERSITY in NIGERIA**

**MASTER'S THESIS**

**Supervisor:** Prof. Dr. Vytautas Snieška

**KAUNAS 2015**

KAUNAS UNIVERSITY OF TECHNOLOGY  
SCHOOL OF ECONOMICS AND BUSINESS

**THE ECONOMIC IMPORTANCE OF BIODIVERSITY IN NIGERIA**

BUSINESS ECONOMICS

**MASTER'S THESIS**

**Student**.....  
(signature)

Osahon Osazee Ighodaro  
VMVEen - 4

December, 2015

**Supervisor**.....  
(signature)

Prof. dr. Vytautas Snieška..

21 December, 2015

**Reviewer**.....  
(signature)

Prof. Dr., Jadvyga Čiburienė

21 December, 2015

**KAUNAS, 2015**



KAUNAS UNIVERSITY OF TECHNOLOGY  
School of Economics and Business

School of Economics and Business

---

(Faculty)

OsahonOsazeeIghodaro

---

(Student name and surname)

Business Economics 62L17001

---

(Title and code of study programme)

## **THE ECONOMIC IMPORTANCE OF BIODIVERSITY IN NIGERIA**

"Title" of final master's thesis

### **DECLARATION OF ACADEMIC INTEGRITY**

21 December, 2015  
Kaunas

I, Osahon Osazee Ighodaro, hereby confirm that Master's Thesis entitled **The Economic Importance of Biodiversity in Nigeria** is solely my own work and all the data and research findings presented are true and obtained fairly. None of the thesis parts contain plagiarised material from printed or internet sources, all direct or indirect quotes of other sources are fully and properly acknowledged. I have not made illegal payments for this work to anyone.

I understand that in case of dishonesty I will be subject to penalties in accordance with the procedure established by Kaunas University of Technology.

---

*(Write your name and surname by hand)*

---

*(Signature)*

Ighodaro, O (2015). The Economic Importance of Biodiversity in Nigeria. Master's Final Thesis in Business Economics, 62L17001. Supervisor: Prof. Dr. Vytautas Snieška. Kaunas: School of Economics and Business, Kaunas University of Technology

## SUMMARY

Biodiversity is understood to be the variability among all life on Earth, it includes all organisms, species, and populations, the genetic variation and also all ecological complexes of which they coexist. It also involves the variety of all life form on earth, which provides the building blocks for human existence and our ability to adapt to environmental changes in the future (ESA 2012). Nigeria is a country with plenty of unexplored development potentials, with a population of over 160 million people and rich with environmental diversity. The GDP growth rate of Nigeria is currently 6.4 percent, higher than most countries but this artificial growth has obscured the effect of the country's growing wealth on the poor and ill-educated populace. According to Munang, R (2013) sustainable development has to include environmental, political, economic, technological, and psychological aspects, all of which are interlinked in various crucial ways in one complex total system. An argument that seems too difficult to comprehend for Nigeria and most countries in the world. This paper analyses the major challenges Nigeria face as a country in the current globalized world we live in. Issues such as agriculture related problems, deforestation, pollution, high rate of poverty and mass migration have in recent times been the most damaging factors limiting social and sustainable development in the country. Environmental degradation, climate change and lack of proper policies are usually blamed for the continuous increase of biodiversity loss, Nigeria data on Forest loss and Natural resource indicated that the rate of depletion is excessive compared to data's from selected countries: Germany, Ghana, Turkey, South Africa, USA and China. Meanwhile with such depletion rates in Nigeria the economy grows continuously in financial terms. The use of education in sustainable development and promotion of sustainable development policies are considered as an important tool in mitigating biodiversity loss. The analysis of scholarly articles, important socio-economic and environmental statistics, was vital in observing and concluding that economic growth in Nigeria has only led to worsening environmental conditions, whereby the most affected are usually the poor people.

**Key Words:** Biodiversity, Nigeria, Economic Development, Sustainability, Education

# Contents

.....	1
<b>SUMMARY</b> .....	4
<b>List of Figures:</b> .....	6
<b>List of Tables:</b> .....	7
<b>LIST OF ACRONYMS</b> .....	8
<b>INTRODUCTION</b> .....	9
<b>1. BIODIVERSITY IN NIGERIA</b> .....	10
<b>1.1 Biodiversity Problems in Nigeria</b> .....	11
<b>1.2 Deforestation</b> .....	11
<b>1.3 Refugee migration/mass migration</b> .....	13
<b>1.4 Agriculture Importance</b> .....	14
<b>1.5 High Population Growth Rate and Poverty</b> .....	15
<b>1.6 Pollution</b> .....	16
<b>2. THEORITICAL SOLUTIONS FOR BIODIVERSITY LOSS</b> .....	18
<b>2.1 Implementation of Sustainable Development for limiting Biodiversity loss</b> .....	18
<b>2.2 Education as a Tool for Promoting Sustainable Development</b> .....	24
<b>2.3. Eco-system Valuation</b> .....	29
<b>2.4 Ecosystem Based Adaptation</b> .....	33
<b>2.5 Technology as a tool for the mitigation of biodiversity loss</b> .....	36
<b>2.6 Mass Media as a Tool for Environmental Protection</b> .....	40
<b>3. RESEARCH METHODOLOGY ON ECONOMIC GROWTH AND BIODIVERSITY LOSS IN NIGERIA</b> .....	42
<b>4. RESEARCH FINDINGS AND DISCUSSION OF ECONOMIC, SOCIAL AND ENVIRONMENTAL INDICATORS</b> .....	44
<b>4.1 Economic Sector Overview</b> .....	44
<b>4.2 Socio-Economic Overview</b> .....	47
<b>4.3 Human Development Trends and GDP Growth</b> .....	48
<b>4.4 Land Use Classification in Nigeria</b> .....	56
<b>4.5 Discussion</b> .....	61
<b>CONCLUSION</b> .....	64
<b>RECOMMENDATIONS</b> .....	66
<b>References</b> .....	67

## **List of Figures:**

1. Figure 1.2.1 Map of Nigeria showing vegetation zones and important sites (Fifth Nigeria Biodiversity Report (2014))
2. Figure 1.5.1 Nigeria Ecological Footprint (Global footprint Network (2015))
3. Figure 2.1.1 Aspects of Sustainable Development Adapted from Jain, A (2015)
4. Figure 2.2.1 The whole school approach Adapted from: Buckler, C., & Creech, H. (2014)
5. Figure 2.2.2 Integrated Context of ESD (Adapted from UNESCO 2010)
6. Figure 2.3.1 Total Economic Value (TEV) Adapted from Pascal, U (2010)
7. Figure 2.4.1 Ecosystem- based Adaptation, Source: Adapted from Munang, R (2013)
8. Figure 2.4.2 Typical emissions sources in cities including those that flow in and out of city's boundaries (Adapted from Rogers, H (2014))
9. Figure 2.5.1: Technology as a tool for the mitigation of biodiversity loss. Conceptual frame work
10. Figure 2.5.2 Main Methods of Preserving Plant Diversity (Belokurova, V. B. (2010))
11. Figure 4.1.1 Contribution to GDP by Sector (Designed According to (NBS GDP Report 2014, World Bank 2015))
12. Figure 4.3.1 Nigeria HDI Trends (Designed According to (Nigeria HDR 2015, World Bank 2015))
13. Figure 4.4.1 Land Distribution in Nigeria (NIGERIA FRA 2015)
14. Figure 4.4.2 land use in Nigeria (Designed According to FRA Nigeria 2015)
15. Figure 4.4.3 Illustration of Forest Statistics in Nigeria (Designed According to FRA Nigeria 2015)
16. Figure 4.5.1 Environmental Sustainability IHDI Loss and GDP Growth Rate (Designed According to UNDP HDR 2015, World Bank 2015)

### **List of Tables:**

1. Table 3 .1.1 Economic and Social and Environmental Indicators of Nigeria (UNDP HDR 2015, NBS 2014)
2. Table: 4.1.1 Nigeria GDP from 2010 to 2015 (IMF 2015)
3. Table: 4.1.2 Contribution Rate by Sector to GDP (NBS GDP Report 2014, World Bank 2015)
4. Table: 4.2.1 Social Indicator 2015 Estimates (UNDP HDR Nigeria 2015)
5. Table 4.3.1 Nigeria's HDI Trends and GDP Growth (Nigeria HDR 2015, World Bank 2015)
6. Table: 4.3.2 Environmental sustainability table (UNDP HDR 2015)
7. Table 4.3.4 Human Development Index with other countries and Sub-region (UNDP HDR 2015)
8. Table 4.3.5 Inequality Adjusted Human Development Index (UNDP HDR 2015)
9. Table: 4.3.6 Multi-dimensional poverty for Nigeria relative to selected countries 2014 (Nigeria HDR 2015)
10. Table 4.3.7 Population Trend for Nigeria and Selected Countries (UNDP HDR 2015)
11. Table 4.3.8 Impelled Migration (Adapted from Ogbonnaya, U. M 2013)
12. Table: 4.4.1 Nigeria LAND Classification and Distribution (NIGERIA FRA 2015)
13. Table: 4.4.2 Forest Land Use in Nigeria (FRA Nigeria 2015)
14. Table 4.4.3 Forests statistics of Nigeria (Nigeria FRA 2015)
15. Figure 4.4.3 Illustration of Forest Statistics in Nigeria (Designed According to FRA Nigeria 2015)

## **LIST OF ACRONYMS**

CBD- Convention on Biodiversity

UNEP - United Nations Environmental Program

ESA- Ecological Society of America

WWF- World Wildlife Fund

FAO-Food and Agriculture Organization

GDP- Gross Domestic Product

REDD-Reducing Emissions from Deforestation and Forest Degradation

UN- United Nations

GBO- Global Biodiversity Outlook

ESD- Education for Sustainable Development

UNFPA -United Nations Population Fund

TEV -Total Eco-system Valuation

PES -Payments for Eco-system Services

SEEA-System of Economic Environmental Accounting

GHG – Green House Gas

UNDP - United Nations Development Program

HDR – Human Development Report

HDI- Hyman Development Index

MDGS-Millennium Development Goals Report



## INTRODUCTION

Nigeria is located at longitudes 3<sup>0</sup> and 14<sup>0</sup> East of the Greenwich Meridian and latitudes 4<sup>0</sup> and 14<sup>0</sup> North of the Equator with an estimated area of 923,768 square km, occupying a unique geographic position in Africa and a population of over 160 million people, it therefore stands out as the most populous country in Africa, also with variable climate and geographic features, it provides her with one of the richest biodiversity in the continent (CBD 2010).

This paper raises the discussion of how the loss of biodiversity in the country has limited the economic development of Nigeria, basically focused on the major problems affecting the economic growth of the country. Problems such as growing population mixed with poverty and deepening corruption and ill-educated populace who earn majority of their income from agricultural related activities. This research also analyses the importance of this dilemma and how ethnic conflicts displacing people and oil exploration in the Niger-delta region of Nigeria has created an unsuitable living condition for the locals with stagnating development, destruction to the mangrove forests and marine life of the region. The objective of this paper is to show the intrinsic connection between biodiversity loss and socio-economic downslide in Nigeria, through the analysis of related articles and citation of statistics from developed countries, on how primary-tertiary education on sustainable development and proper management of natural resources can aid in the rapid development of the country. Chapter one defines biodiversity in the country also identifying some of the major biodiversity problems in Nigeria, ranging from pollution, poverty/ increasing population to agriculture related activities. Chapter two analyses related articles and theories that can be applicable in the mitigation of biodiversity loss and economic development. Chapter three explains the research data and survey methodology used, the methodology rests upon qualitative analysis and the interpretation of primary and secondary sources, this research covers from the year period of 2000 to 2015 due to limited availability of information. Chapter 4 discusses the results from analyzed data and qualitative survey analysis. The concluding chapter breaks down recommendations and overall conclusion of the research on biodiversity and its economic importance in Nigeria.

## 1. BIODIVERSITY IN NIGERIA

Biodiversity is understood to be the variability among all life on Earth, it includes all organisms, species, and populations, the genetic variation and also all ecological complexes of which they coexist. It involves the variety of all life form on earth, which provides the building blocks for human existence and our ability to adapt to environmental changes in the future (ESA 2012). It also includes the Ecosystem <sup>1</sup>diversity which is all the different habitats, biological communities and ecological processes, as well as variation within individual ecosystems (UNEP 2010). Nigeria is the largest economy in Africa, with a GDP of over 500billion USD it operates a mixed<sup>2</sup> economy a developing market, with expanding financial, service, communications, and technology and entertainment sectors. Fundamentally two reasons for conserving biodiversity. The first is the moral justification and the second is the value to human existence. Biodiversity is essential to human development because of the goods and services it provides according to Meduna, 2009. An estimated 40 percent of the global economy is based on biological products and processes (Christ, 2003)

The acquaintance of the Nigerian people with biodiversity can be well placed below average, due to the depleting nature of biodiversity in the country. Biodiversity is vital to the preservation of a good and healthy environment. Biodiversity plays a very important role in meeting the basic need of humans which is (healthy environment, clean water, food, clean air and natural resource etc.) Our dependence on these natural resources is colossal. Biodiversity does not only provide these resources it also affords us a “life support system.” Its benefits also include; recycling of essential elements (oxygen, carbon, nitrogen). It is also responsible for moderating pollution, protecting watersheds, and combating soil erosion. Biodiversity’s intervention against excessive variations in weather and climate, helps to protect us from disastrous events beyond human control (Hails, WWF International 2006).

Nigeria being a very diverse country inhabits more than 250 ethnic groups, which exemplifies the dynamism of the socio-political and cultural background of the country. Nigeria possesses more than 5,000-recorded species of plants, 22,090 species of animals, including

---

<sup>1</sup>Ecosystems is any geographic area with all of the living organisms present and the non-living parts of their physical environment. Involves the movement and storage of energy and matter through living things and activities ESA 2012

<sup>2</sup> Mixed economy is an economic system that features characteristics of both capitalism and socialism, a system combining both private and state enterprises.

insects and 889 species of birds, and 1,489 species of microorganisms. (CBD REPORT 2010) Nigeria is well famous for being a global hotspot for primate species, with a great diversity found especially in the Gulf of Guinea forests of Cross River State. There are nine distinct ecological zones which can be rationalized into five, namely Sahel/Sudan savanna, guinea savanna, derived savanna, lowland rainforest/montane forest and freshwater swamp forest/mangrove forest and coastal vegetation. The physical and climatic diversity of Nigeria permits the growth of a wide variety of crops (FAO 2008).

Nigeria habitation consists of some of the globally threatened species according to the IUCN Red List of Threatened Species, among the 148 animals and 146 plant species, 26 animals and 18 plant species are classified as endangered, with only three of these animals and fifteen plants classified as critically endangered. The most endangered gorilla subspecies on earth, the Cross River gorilla (*Gorilla diehli*) with an estimated population of less than 250 individuals is found only in a couple of protected areas in Cross-River State, south eastern Nigeria (CBD report 2010). According to Nigeria CBD report (2014) records show that 70-80% of Nigeria's original forest has disappeared and presently the area occupied by forests is reduced to 12%. In the period between 2000 and 2005, Nigeria lost about 2, 048 thousand hectares of forest (FAO 2005).

### **1.1 Biodiversity Problems in Nigeria**

Environmental degradation through deforestation, pollution, high population rate, refugee migration/mass migration and ethnic conflict are all major threats to the earth's biodiversity and socio stability. The influence these human factors have on biodiversity loss in the country is impeccable, below are analysis of these factors and related concerns of biodiversity conservation in Nigeria.

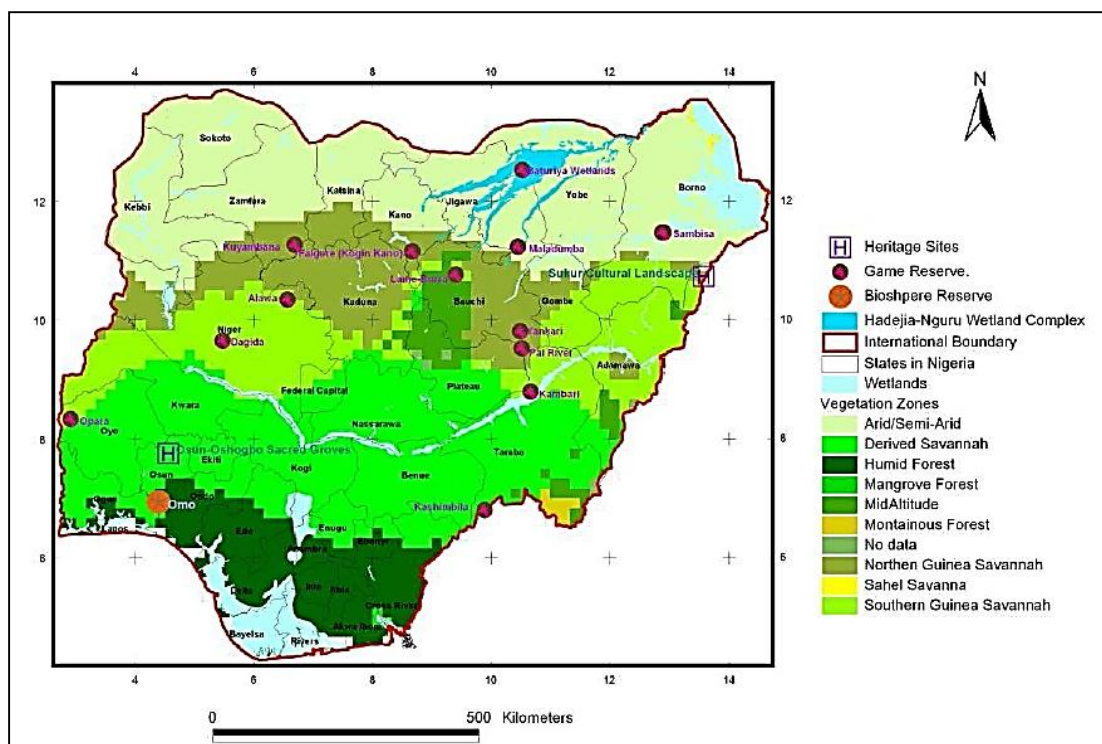
#### **1.2 Deforestation**

(WWF 2015) defines deforestation as the conversion of forest to another land use or the long-term reduction of the tree canopy cover. This includes conversion of natural forest to tree plantations, agriculture, pasture, water reservoirs and urban areas but excludes timber production areas managed to ensure the forest regenerates after logging. (FAO 2008) A Nigerian report "On The State Of Plant Genetic Resources For Food And Agriculture" determined that deforestation in Nigeria is estimated to be about 3.5% per annum resulting to a loss of 350,000 –400,000

hectares of forest land per annum. Furthermore it explains that 10 percent (92,377 km<sup>2</sup>) of Nigeria's land area is occupied by forests, this which is lower than the twenty-five percent mark recommended by Food and Agriculture Organization of the United Nations (FAO).

Poaching is well known to be one of the biggest threats to large mammals and habitat loss (mainly due to farming) in Nigeria. Increasing environmental degradation and deforestation is estimated to cost Nigeria over 6 billion USD a year, and with only 6% of forest areas protected, the monetary and biodiversity loss is substantial. Nigeria forests has declined immensely from 24 million hectares in 1976 to about 9.6 million hectares in 2011 according to Nigeria CBD report (2014). With such damage to the country's biodiversity and economic revenue, it is obvious Nigeria is ignorant of the economic and natural benefits of biodiversity.

Chivian, E. (2010) states the benefits of forests and the conservation to human wellbeing, they include the breakdown and decomposition of dead organisms and wastes; the recycling of nutrients for new life on land, in rivers, lakes, and streams, and in the oceans; and the regulation of climate. There are numerous ways biodiversity contributes to human development and it's a continuous need for the survival of the human race and earth. Forests in general and tropical forests in particular, have been drawing the increasing attention of the world community Adeoye, N. O (2011). Figure 1.2.1 below indicates important sites and biodiversity forestry in Nigeria, as shown on the map, Nigeria is richly endowed with biodiversity, but the poor maintenance of this resource has been detrimental to the nation from every perspective and with the continuous negative impact it has had on the country and it can only get worse on the long run.



**Figure 1.2.1 Map of Nigeria showing vegetation zones and important sites (Fifth Nigeria Biodiversity Report (2014))**

The continuous development of major community projects, oil exploration and solid mineral exploration has resulted in Nigeria's loss of major forest areas. Nigeria has one of the highest rate of deforestation in Africa and loss of primary forest in the world (CBD 2010). A country report on sustainability and development specified that the remaining forest area in Nigeria will possibly fade from view by 2020 if the current rate of deforestation remains unaffected.

### **1.3 Refugee migration/mass migration**

National Geographic society 2005 refers to impelled/imposed/reluctant migration as one which occurs when Individuals are not forced out of their country, but leave because of adverse situations such as warfare, political problems, or religious persecution. According to IOM (2015), mounting violence by the Boko Haram insurgency in Nigeria have displaced close to a million people in the country. The migrations that occurred in Nigeria due to conflict has had major influence on the environment, Major conflicts such as the Niger Delta militancy and the

Boko-haram insurgency, has and is currently damaging the ecosystem of the northeast region of the country according to Ogbonnaya, U. M, (2013)

According to Akintunde, E. A. (2014), conflicts in the Jos area of Nigeria have led to the unprecedented erection of residential structures and the emergence of new settlements in the area furthermore explaining that the dispersion of people, establishment and growth of communities have led to environment alteration in recent years. Deforestation has gradually transformed thick vegetation into plain fields and residential houses in Nigeria, these new fields and structures are mostly set up on farmlands and animal kingdoms where biodiversity is known to thrive. Continuing Ogbonnaya, U. M (2013) explained that the Jos crisis, the Tiv/Jukun crisis of Benue and Taraba States, the Fulani Herdsmen/Tiv crises of Benue and the Aguleri/Umuleri crisis in Eastern Nigeria are in one way or the other associated with biodiversity and natural resource access and use. With mass migration and resettlement being the top priority of people torn apart because of ethnic conflicts, the environment tends to be the one who writhes the impact of this problem in the country.

### **1.4 Agriculture Importance**

Nigeria can be described as a society heavily dependent on agriculture due to availability of rich ecosystem, high rate of poverty and poor economic structure. About 70% of the Nigerian populace manage their existence and income from agriculture and agro-allied activities. Agricultural sector in Nigeria totals 5% of all export and provides 88% of non-oil earnings and also contributes about 41% of the Gross Domestic Product. Crops contribute 85% of the agricultural GDP, livestock 10%, fisheries 4% and forestry 1% and also more than 60.0% of total employment is provided by the agricultural sector in Nigeria (CBD 2010).

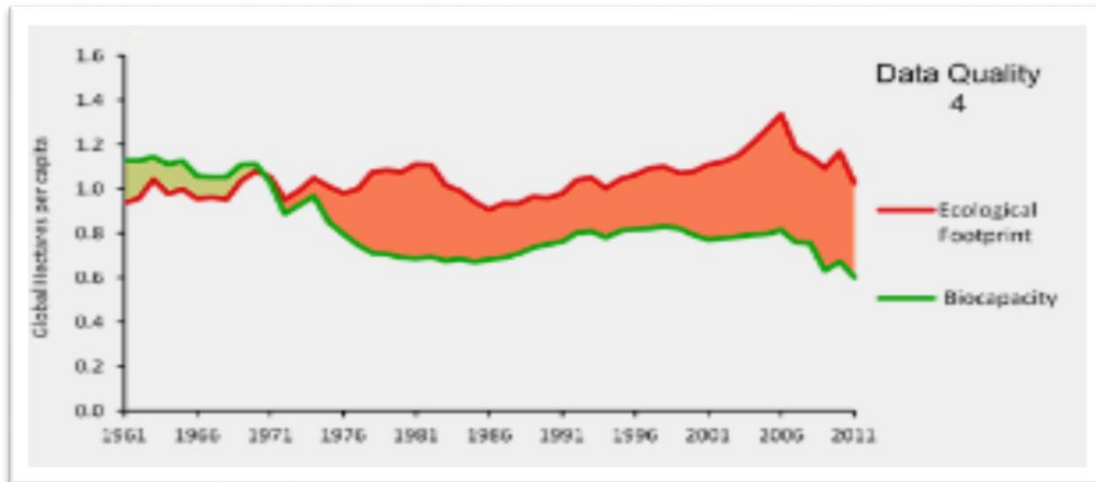
Nwajiuba, C. (2012) argues that the dependency of Nigeria on the oil sector and lack of diversity of the agricultural sector has hampered the success of agricultural development in the country therefore threatening the agricultural and food security in the near future. Furthermore suggesting that a two-track approach is needed in reviving and improving the argic/economic diversity of the country by fostering Agricultural business and continued support to smallholders through utilization of the population advantage and reducing poverty rate substantially. (FAO 2015) It is estimated that Nigeria has lost USD 10 billion in annual export opportunities from

groundnut, palm oil, cocoa and cotton alone due to continuous decline in the production of those commodities.

Merely a fraction of the rich natural endowment of plant genetic resources are properly documented and profitably exploited for food and agriculture in Nigeria. Medical research has always relied on other animal species, plants, and microbes, to help us understand human physiology and treat human disease (Chivian, E.A (2010). A country blessed with diversity and also plagued with slow development, the rich biodiversity of Nigeria provides plentiful advantage in all aspects of human development.

### **1.5 High Population Growth Rate and Poverty**

Nigeria is the most populated country in Africa and the 7<sup>th</sup> most populous country in the world with a population of over 160 million people and has one of the highest growth rates in the world. A country report from the Harmonized Nigerian Living Standard Survey (2010), indicated a 62.60% poverty rate in the country, which points out that in Nigeria alone there are over a 100 million people living in out-right poverty. Literacy in Nigeria according to the CIA World Fact Book stands at 69.2% for male: 49.7% for female and the total population 59.6% (2015 est.). A very poor statistics considering the vast amount of natural resource, ethnical diversity and economic standpoint of Nigeria in Africa. This which is an underlying factor hindering the development of the country as the few literate and educate populous takes advantage of the majority of the population. Transparency International 2015, identified that Nigeria sits at 136 out of 176 countries, scoring 27 out of 100 on the 2014 Corruption Perception Index Corruption. It further explains that the hardest hit by this fact are the poor in Nigeria who make up more than 40 per cent of the 179 million people. With alarming rate of corruption and poverty in Nigeria and growing population, little can, and has be done in the conservation of the environment and preservation of the country's biodiversity resource.



**Figure 1.5.1 Nigeria Ecological Footprint (Global footprint Network (2015))**

Figure 1.5.1 above shows Nigeria's ecological footprint between the periods of 1960 to 2011, from the above figure it is well established that the consumption level of Nigeria has increased over the years which has had negative impact on biodiversity in the country. Nwajiuba, C. (2012) explains that the increasing number of the country's population which is expected to grow up to between 230 and 430 million by 2050. Therefore making Nigeria the 3rd most populous country in the world only behind China, India and the USA, can only pressurise the availability of food and agricultural produce in the near future.

## 1.6 Pollution

Evelyn, M. I. (2013) describes pollution to be any disorder within an environment and is a result of energy conversion and the use of resources by people, pollution is among the major significant reasons for biodiversity loss in Nigeria, Adeyemo, O. K. (2003) explains that the lack of adequate technology and skilled manpower with required technical and managerial training and skills to effectively dispose wastes in an environmentally conducive routine has resulted in pollution becoming one of the most serious problems of our generation. Nigeria's problem with pollution ranges from different areas of industrialization and poor economic & social setup. Pollution of water, land and air comes from numerous sources, in Nigeria pollution from extractive industries precisely the oil industry has been very damaging to the economy as a



whole. Virtually all aspects of oil and gas exploration and exploitation have deleterious effects on the ecosystem and local biodiversity in Nigeria according to Nenibarini (2004)

Pyagbara, L. S. (2007) indicates Oil spills, Gas Flares, Effluent and waste discharge as the three major sources of pollution in Ogoni, Niger Delta region of Nigeria furthermore explaining some drastic effects the exploration of oil has caused by completely destroying ecosystems in the region, Mangrove <sup>3</sup>forests dying away due to toxicity of oil spills and are being replaced by noxious nipa palms, the rainforest heavily being destroyed by Oil companies and destruction of the traditional means of livelihood due to farmlands rendered infertile causing limited access to adequate food in the region. Oil pollution and contamination of the Niger-Delta region of the country has consequently left mangroves shedding leaves and stems, leaving roots coated in a bitumen-like substance sometimes 1 cm or more thick (Nigeria Biodiversity Report 2014). An Amnesty International report in 2015 highlighted the amount of spills by two multinational Oil companies in Nigeria recording 550 Oil spillage in 2014 alone, compared to an average of 10 oil spills recorded in Europe over the period of 40 years (1971-2011). This therefore identifies the poor commitment of the Nigeria government to tackle the destruction caused by multinational companies and pollution in the country 'oil spills on land and marine combined with fire out-break, which damages vegetation and forms a crust over the land therefore making regeneration or revegetation difficult'. (UNEP2011) stressed that it could take Nigeria up to 30 years and a round up cost of over 5 billion dollars for the first five years to clean up the pollution caused by the activities of oil companies in the Niger-delta area for the past 50 years. With numerous damaging effect associated with these pollutions, there seems to be little or anything being done to limit the impact on the environment as a whole.

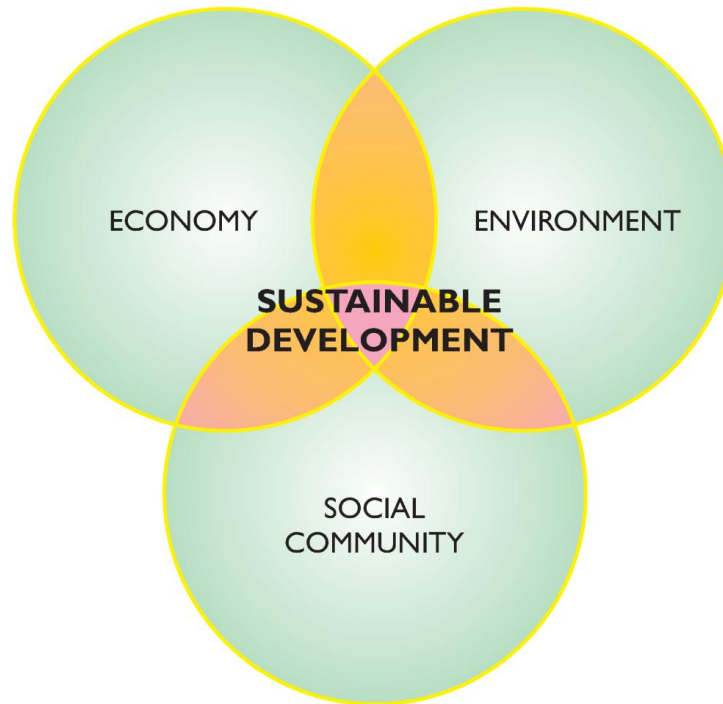
---

<sup>3</sup>Mangroves are spawning areas for fish and nurseries for juvenile fish and the extensive pollution of these areas is impacting on the fish life-cycle

## 2. THEORITICAL SOLUTIONS FOR BIODIVERSITY LOSS

### 2.1 Implementation of Sustainable Development for limiting Biodiversity loss

Sustainable development according the International Institute of sustainable development is generally accepted to be *'development that meets the need of the present without compromising the ability of the future generation to meet their own needs'*. Harris, J. M. (2000) argued that the concept of sustainable development is extremely normative in nature and therefore makes it hectic to pin down analytically, a fact some scholars agree on, take for instance Nigeria as a country with so much resource but practically slow in implementing and management of biodiversity conservation. (Mehta 2010) Explains true sustainable development as not only the ability of the society to manage potential growth from human capital, trade boosting and regulation of structural and manmade market failures but also the equitable distribution of revenues from such growth for fulfilment of human welfare and innovation through robust social accountability system and reliable governance. Soaga J. A (2014) argues that Nigeria's heavy reliance on oil can be blamed for the corruption, civil instability, environmental degradation and economic exploitation. The question of what other issues arise from biodiversity loss, rarely causes distress for people as there's little or no information about environmental importance, compared to the capitalistic driven advertisement all over the media, the future is not the only aspect of biodiversity loss altered, there are numerous challenges including the depletion of cultural heritages, social unification and mental growth is all affected with this loss. Biodiversity loss and the abilities of sustainable development to mitigate this loss is undebatable, since majority of the environmental problems on the planet is associated with human activities and asymmetric information seems to have civilians clueless about the impacts on human survival. Harris, J. M. (2000) explains a concept of sustainable development must remedy social inequities and environmental damage, while maintaining a sound economic base.



**Figure2.1.1 Aspects of Sustainable Development Adapted from Jain, A (2015)**

The diagram above depicts the interlinkages between sustainable development and human development, also showing how sustainable development can be a major tool for coordinating growth in all three aspects of human development (economic, environmental and social). Mehta 2010 argues that the irreversibility of human development rests on the undiminished satisfaction of all three needs (economic, social stability and environmental). Example is drawn from the interlinkage between human needs, environment and socio-economic development “economic progress depends on the capacity of the natural resource base to support it. Access to food, clothing and shelter is constrained by the availability of material inputs (water, wood, chemicals and minerals etc.) while the generation of human capabilities is dependent on the availability of environmental services such as clean water and air, with their effects for human health and productivity, and that of energy inputs which expedite the speedy dissemination of knowledge and development.” Furthermore adding that “at the same time, the level of economic activity, which provides the economic means for satisfaction of these needs and capabilities, is crucially dependent on social capital needed to maintain peace and order and the coordination of diverse economic actors” meaning that if long term and established progress

in the quality of human life is to be irreversible then growth has to be accompanied with the absence of deterioration in the economic, environmental and social scopes, given the interrelationships amongst these factors. Munang, R (2013) sustainable development has to include environmental, political, economic, technological, and psychological aspects, all of which are interlinked in various crucial ways in one complex total system. Kopnina, H. (2013) argues that Anthropocentrism rooted in sustainable development discourse infers that humans are fundamentally in control of the world around us, climate change, pollution, and environmental degradation are all as a result human/economic development. Furthermore explaining that problems arising from modern living can be taken care of through technological development.

The international communities such as United Nations and countries in the world has in the past and still currently trying to find new ways to limit biodiversity loss, with summits and conventions held around the world to reach important and viable targets such as the Nagoya Protocol, convention on biodiversity and a host of others.

Global biodiversity outlook 4 Aichi Biodiversity Targets (Solutions for the mitigation of biodiversity loss)

- ✓ Identifying at the national level the direct and indirect causes of habitat loss with the greatest impact on biodiversity, to inform policies and measures to reduce loss
- ✓ Developing a clear legal or policy framework for land use or spatial planning that reflects national biodiversity objectives
- ✓ Aligning existing incentives to national objectives for land use and spatial planning, and, the use of further incentives to reduce habitat loss, degradation and fragmentation, including as appropriate, payments for ecosystem services and REDD+ mechanisms
- ✓ Facilitating a sustainable increase or intensification in the productivity of existing agricultural land and rangeland, within a land use or spatial planning framework, combined with more moderate meat consumption and reduced waste from food systems, with a view to reducing the demand for conversion of natural habitats
- ✓ Engaging with and supporting indigenous and local communities, landowners, other stakeholders and the general public in activities to conserve biodiversity, to reduce illegal and unplanned land use change to prevent access to products produced from illegally

sourced commodities and illegally cleared land, including by addressing issues related to commodity supply chains

- ✓ Developing effectively-managed protected area networks and other area based conservation measures, identified as being among the most effective instruments for conserving forests and other habitats
- ✓ Monitoring land use and land-cover, including, where possible, near-real-time monitoring to inform enforcement actions, as well as regular comprehensive assessments of land use and land-cover change
- ✓ Making greater use of innovative fisheries management systems, such as community co-management, that provide fishers and local communities with a greater stake in the long-term health of fish stocks
- ✓ Eliminating, reforming or phasing out those subsidies which are contributing to excess fishing capacity
- ✓ Phasing out fishing practices and gear which cause serious adverse impacts to the seafloor or to non-target species •• Further developing marine protected area networks and other effective area based conservation measures, including the protection of areas particularly important for fisheries, such as spawning grounds, and vulnerable areas
- ✓ Developing and enforcing national water and air quality guidelines and/or concentration thresholds for different pollutants, for example by reducing the level of emissions per unit of combustion<sup>125</sup>
- ✓ Eliminating phosphates from detergents to reduce nutrient loss to water bodies.. Enhancing treatment and recycling of sewage and industrial waste water Conserving and restoring wetlands and other ecosystems which play an essential role in nutrient cycling, to reduce nutrient losses to the environment promoting the reuse and recycling of plastics

and the use of biodegradable alternatives to reduce marine debris<sup>1</sup>

- ✓ Sustainably managing fisheries on coral
- ✓ Managing coastal zones and inland watersheds in an integrated manner in order to reduce pollution and other land-based activities that threaten coral reefs
- ✓ Maintaining sustainable livelihoods and food security in reef-dependent coastal communities and provide for viable alternative livelihoods, where appropriate
- ✓ Convention on International trade in Endangered Species (CITES), and taking measures to prevent and deter illegal killing and trade and reducing demand for products derived from such actions
- ✓ Removal of perverse subsidies and other forms of public support for infrastructure that destroys, fragments or degrades ecosystems
- ✓ Putting in place, by 2015, legislative, administrative or policy measures and institutional structures for implementing the Nagoya Protocol<sup>4</sup>
- ✓ Raising awareness of the importance of traditional knowledge to conservation and sustainable use of biodiversity
- ✓ Developing national guidelines or action plans, aligned with relevant guidance under the CBD, on recognizing and safeguarding the rights of indigenous and local communities over their knowledge
- ✓ Ensuring that relevant biodiversity information is made available in a way that it can be easily accessed and improving national, regional and international Clearing House

---

<sup>4</sup>The *Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization (ABS) to the Convention on Biological Diversity* is a supplementary agreement to the Convention on Biological Diversity. It provides a transparent legal framework for the effective implementation of one of the three objectives of the CBD: the fair and equitable sharing of benefits arising out of the utilization of genetic resources (CBD 2015)

Mechanisms, strengthening thematic information-based services and establishing interconnections in order to contribute to the development of a global biodiversity knowledge network

- ✓ Engaging indigenous and local communities as well as relevant stakeholders in information collection and use, including through support for community-based monitoring and information systems\
- ✓ Promoting effective participation of indigenous and local communities, at all levels, in issues related to biodiversity and of interest to them
- ✓ Strengthening and promoting the further mobilization of and access to data by, for example, encouraging the use of common informatics standards and protocols, promoting a culture of data sharing (for example, requirements for publicly-funded research and recognition for the publication of datasets), investing in digitization of natural history collections and promoting citizen scientists' contributions to the body of biodiversity observations

Although there is great potential among the listed solutions above purposed by international organizations and national governments, some key instruments being used by the United-Nations such as the REDD + (Reducing Emissions from Deforestation and Forest Degradation) a frame work set up to create financial value for the carbon stored in forests, by offering incentives for developing countries to moderate emissions from forests vegetation's through investment in sustainable development and also includes conservation and enrichment of forest carbon stocks<sup>5</sup> (UN 2015). REDD+ is galvanized by profit interests according to Cabello (2012), furthermore arguing that the framework and agreements governing the REDD+ is structured to tolerate polluters to continue polluting while maximizing profits and encircling lands. One major criticism of the GBO 4 is that governments and international institutions, have been quite vocal about biodiversity loss but relatively inefficient in their actions towards

---

<sup>5</sup> (FAO Terms and definition 2015)The quantity of carbon in a “pool”, meaning a reservoir or system which has the capacity to accumulate or release carbon

mitigation and improvements, example of the ineffectiveness is drawn from the development pace of Aichi targets, with only five of the twenty targets from the GBO4 being on track for the year 2020 according to Vaughan (2014).

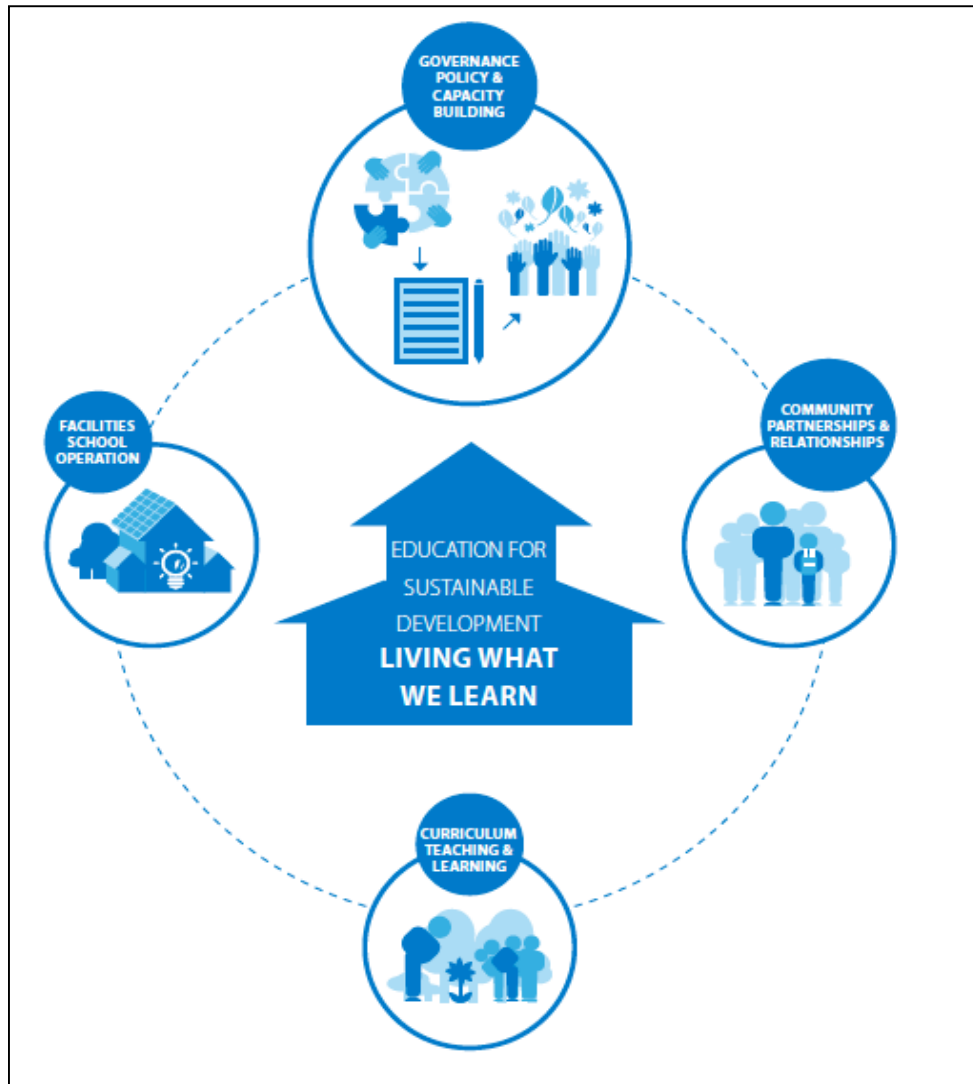
The thought of *‘How international negotiations, instead of sourcing new ways of reducing emissions at root source, end up focusing on ways of measuring, owning, governing, and compensating for the liabilities of carbon commodities Cabello, J (2012)’* pinpoints the argument of the poor effective roles International organizations and national governments has played in limiting biodiversity loss.

Rayber J (2010), added that with many good examples of effective policies existing in the world, the international community is limited by ineffective cohesion of policies that aid in forest management, furthermore highlighting that although this problem has long been identified by international forest institutions and stakeholders and has also been repeatedly asked for review, the endorsement of effective inter-sectoral management and collaboration policies remains a problem.

## **2.2 Education as a Tool for Promoting Sustainable Development**

According to Anderson, A. (2012), *‘Education for Sustainable Development (ESD) is an approach to teaching and learning based on the ideals and principles that underlie sustainability’*. According to UNESCO 2010, Education for Sustainable Development (ESD) empowers everyone to make informed decisions for environmental integrity, economic viability and a just society for present and future generations, while respecting cultural diversity The growing rate of population seem to pose diverse risk for the world and with youth population estimated to be about 1.8 billion and expected to double over time there’s great and potential risk of the younger generation’s resource of time, energy and knowledge being misdirected towards vices such as violence, terrorism, war, drug and alcohol abuse. This which in-turn might possibly lead to economic, political and social instability (UNFPA 2014). The above fact raises the question of how the minds of the growing young generation can be shaped into innovative and productive outcomes, thereby leaving education as the most influential tool for mitigating this potential risk.





**Figure 2.2.1**The whole school approach Adapted from: Buckler, C., & Creech, H. (2014)

The diagram above highlights the interaction of our everyday life and education for sustainable development “living what we learn”. Anderson, A. (2012) argues that the education sector comprises of unique opportunities that are left unexploited, current problems such as climate change and green innovation, can be mitigated with this untapped resource in the educational sector. Furthermore explaining that with education the skill set, knowledge and

behavior can be instilled to mitigate<sup>6</sup> these global issues. The educational sector in many developing countries are rather inefficient compared to the developed world, according to data sourced from World Bank, developing countries in Africa are way behind compared to Europe, Asia and North America on research and development, a clear indication of the poor investment in education. Kassas, M. (2002) Clarifies environmental literacy as the gaining of basic knowledge on how the society and the environment interact in the process of resource development and human habitat management. Development in any possible thought can only come about through research, and the education sector is entwined with research and development. The higher the educational level of a country the higher the social and institutional capacity of the country for environmental performance, meaning that an educated mass of a country will have a good understanding of how human wellbeing with the environment is dependent on one another Peng Y.S (2009). According to Kassas, M. (2002) biodiversity education is based on five pivots: scale of boundaries, perspectives, goals, themes and assimilation, furthermore highlighting the relationship between all five pivots and their significance in the integration of biodiversity in the educational system.

Kopnina, H. (2012) Talks about how academic relativism about education on sustainable development might be limiting the efforts of educating citizens on the value significance of environmental protection, furthermore explaining how the diverse socio-economic factors of different countries practicing Education for sustainable development (ESD) has been influenced. An argument directly pointing out the facts that the method of educating the populace has to be reviewed and properly utilized for the benefits of the people. According Armstrong, C. M. (2011) Constructivism gives definition to the ESD Educator through the utilization of a different strategy such as asking the learner to investigate a sustainability issue with the students which therefore removes the instructor from an omniscient authoritarian role. The introduction of learners to emerging problems related to sustainability, focusing on problems that are of personal significance to the learner, such understandings of sustainable development are useful in transforming discipline-specific content. Furthermore suggesting that the ESD theme 'Reframing Knowledge and Reality Modelling' could be delivered with the use of constructivist approaches

---

<sup>6</sup>Mitigation: Reducing greenhouse gas emissions through sustainable consumption patterns in lifestyles, livelihoods, economies, and social structures that are currently based on excessive greenhouse gas production. (Anderson, A., &Strecker, M. (2012)

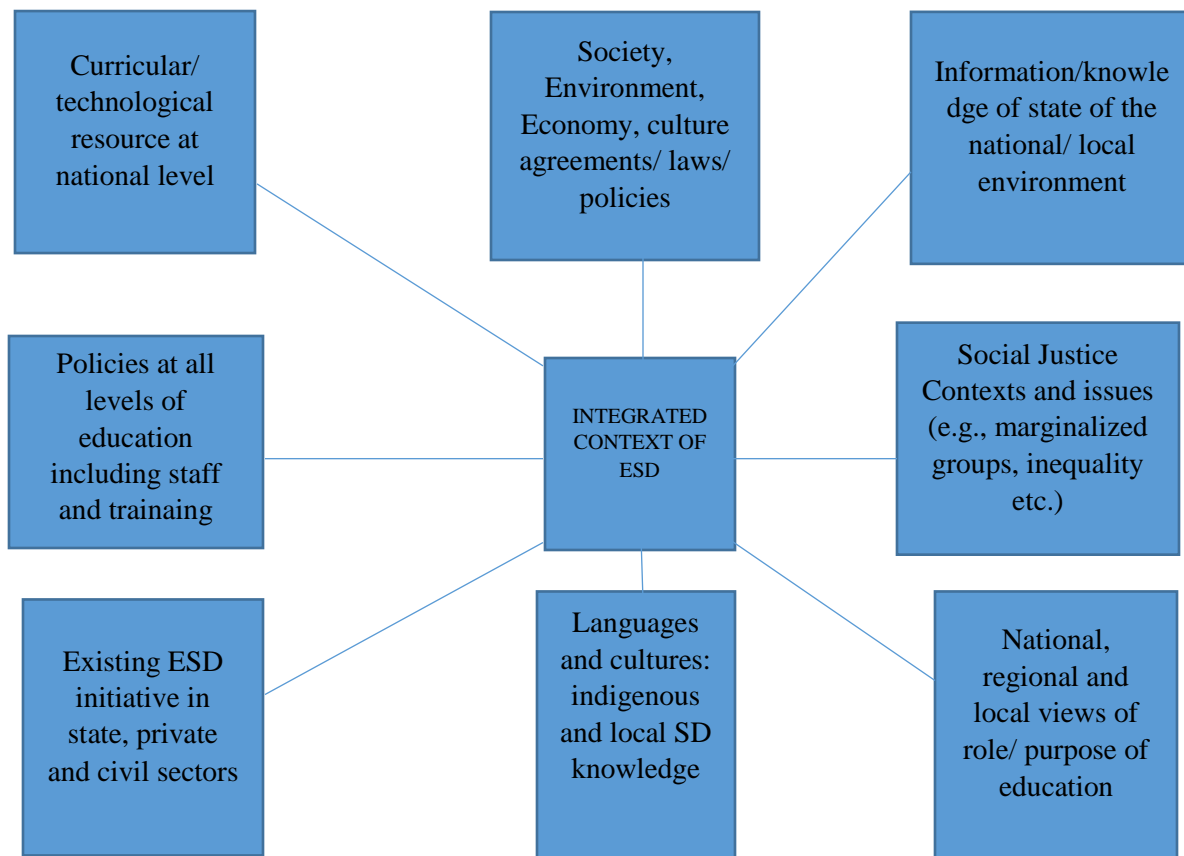
like focusing on emerging problems, emphasizing broad concepts, and using supplemental materials. In this context Kassas, M. (2002) was able to explain ‘determining perspectives’ in education, specifying that planners of education programs must be able to determine perspectives that aid them in navigating the course of their steps, due to the broad scopes of the area concerning biodiversity and wide range of learning goals (related to different groups of learners). The learners: Their motivation, skills, and cultural background; the teachers: The quality of their training, motivation, the support staff, and the institutional support.

Three perspectives may be considered according to Kassas, M (2002)

- (i) Understand ecology. Ecological literacy implies the understanding of the relationships amongst different species (plants, animals, etc.) that share the ecosystem.
- (ii) Intimacy with nature: Working with biodiversity it is vital to develop a personal association with nature, the conservation and sustainable use.
- (iii) Supportive society. Societal support requires dissemination of information nation-wide on the values involved. These relate to local and national interests and responsibilities to regional and international conventions to which the nation is committed.

According to Fiebelkorn, F. (2013), the concept of biodiversity hotspot should be introduced and debated in teacher education programs as it provides abundant learning opportunities to mirror on socioeconomic and ecological concerns for the conservation of the world’s biodiversity.

Evolving through the influence of education brings about arguments and suggestions of what and how can this leaning process be properly utilized. UNESCO’s decade for education for sustainable development 2010, is reasoned as a stride towards improvement, however one of the review tools purposed in the UNDESD project provided the ESD lens; a framework of different tools, setup to initiate ESD within national education systems, policies and programs, ESD lens is built on a holistic approach towards education. According to (UNESCO 2010) the whole-system view and the integrated context of ESD is essential for every person, at any stage of life and in any kind of context.



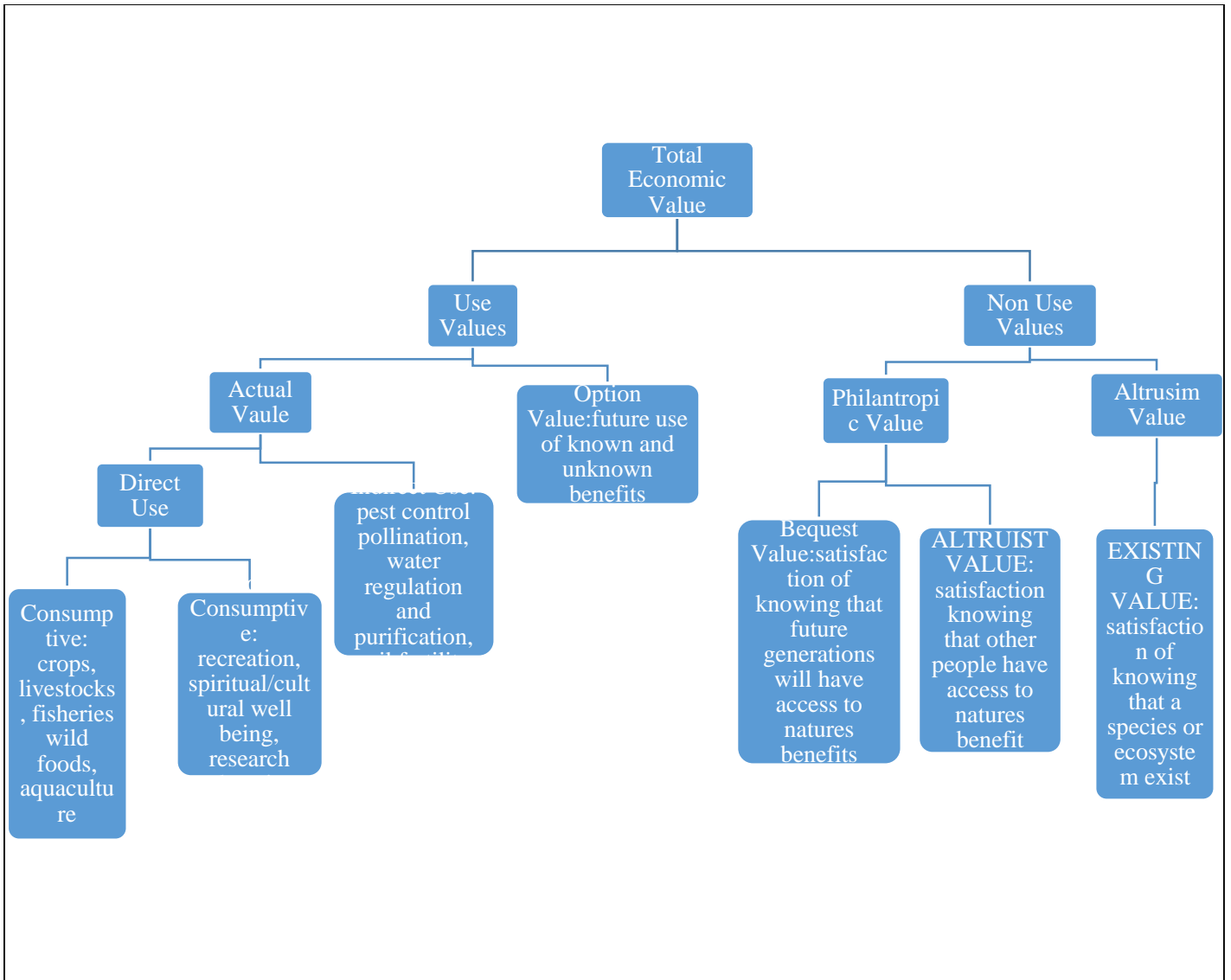
**Figure 2.2.2 Integrated Context of ESD (Adapted from UNESCO 2010)**

According to UNESCO 2010, ESD is an integral part of human wellbeing, encompassing all forms of learning (formal and informal) from childhood to adult life, the figure 2.2.2 above illustrates the scope of influence ESD perpetuates within the broad span of economic, social, environmental and cultural policies for sustainable development.

### **2.3. Eco-system Valuation**

Ecosystem valuation and biodiversity reflects what the society is willing to trade off in order to conserve natural resources, comprehensively the economic valuation of ecosystem provides every society with useful understanding of natural resource limitations, cost and benefits Pascal, U (2010), further more suggesting that the inability of society to input these cost will result in misguided policies, therefore leaving society worse off due to misallocation of resources. Sokari-George, E. (1987) added that the element of an effective policy measure is therefore, one that seeks a balanced and unified growth orientation, further more explaining that soon the world with its multiplying population and declining food reserves will comprehend the fact that life cannot only depend on non-renewable resources. Su, T. (2007) indicated that the main aim of ecosystem valuation is to strengthen the prominence of ecosystems and integrate ecosystem services into traditional cost-benefit analysis of land use policy.

The Total Eco-system valuation (TEV) concept that categorizes values into ‘use and non-use values’ is defined according to Pascal, U (2010) as the discounted value-sum of all service flows generated by natural capital both of now and the future. The TEV framework comprises of any utility or disutility derived from ecosystem related services using a predominant unit of account (money or other unit of measurements) that permits comparison of the cost and benefits of various goods. Ludwig, D. (2000) argues that economic valuations are of mostly tertiary importance (personal and social values) ignoring the environment and public opinion) furthermore questioning the survey measures used in analyzing the perceived values. Additionally Su, T (2007) stated that the underestimation of biodiversity has resulted in what is called “the tragedy of public goods’ endangered by “external effect”. The development of existing valuation database is a necessity for all stakeholders involved in sustainable development and the ability to combine this available resource with scientific evidence, will aid in the development of appropriate analytical tools Markandya (2008).



**Figure 2.3.1 Total Economic Value (TEV) Adapted from Pascal, U (2010)**

Bossel, H. (1999), pointed out the use of a single indicator to analyze economic and national development has rather been ineffective over the years, further more explaining that the use of the GDP (Gross Domestic Product)<sup>7</sup> indicator only focuses on how natural resource wealth is being depleted rather than the improvement of human well-being. He argues that human well-being can be better measured with three basic systems:

- human system = social system + individual development + government

<sup>7</sup> GDP indicator (gross domestic product) : The total money value of the annual flow of goods and services produced in an economy (Bossel H 1999)

- support system = infrastructure + economic system
- natural system = resources + environment

These three systems according to Bossel H (1999) concur with the three categories of capital that are regularly used in analyses of the total system: human capital, structural (built) capital and natural capital. In order to reduce poverty and unemployment, economic progress must outpace demographic expansion in a progressive manner (Mdgs 2013). Human survival will always depend on the availability of natural resource and its management, only then can development be borne in any system, growing technology and improving analysis tools offer copious alternative means to initiate economic development and environmental conservation

The development of existing valuation database is a necessity for all stakeholders involved in sustainable development and the ability to combine this available resource with scientific evidence, will aid in the development of appropriate analytical tools according to Markandya (2008).

Reliable information supports better policies according to OECD (2012), furthermore explaining that the use of GDP alone to measure and capture elements of improved human welfare and progress is colossal, with numerous areas in-which economic valuation should be improved.

Sukhdev, P (2014) analyzed approach by pointing out three important areas of optimizing the benefits of biodiversity:

- Recognizing value: Recognizing value' is a capability of all human societies and communities, and can easily influence societal norms and regulations, often without any recourse to monetization or even economics example. Changes in land management and planning strategies in recognition of ecologically important areas are also examples of value recognition.
- Demonstrating value: Focuses on using economic tools to make the services of nature economically discernible so as to support decision makers wanting to assess all costs and benefits of land-use change.
- Capturing value: This is about incorporating biodiversity benefits into decision making by the use of incentives and price signals 'Capturing value' is attainable through a variety of economic mechanisms. (Example: eco-labelling, eco-certification, and 'payments for ecosystem services' (PES)).

Helm, D (2012), explains a viable approach towards biodiversity economics is by incorporating biodiversity assets into national accounts, setting of intergenerational rules and then mainstreaming biodiversity with natural capital, therefore instilling this integration into the core of economics. Additionally an alternative of this approach is to oblige developers to procure eco-credits so as to offset the impact of their development on biodiversity. Specific threats can be identified, valuation techniques can be used to estimate their values, furthermore stressing that that for success to be achieved in biodiversity economics, assimilation of natural environment into the economic calculations, and into the primary accounts of government is of utmost importance. Conniff, R. (2012), argues that the PES scheme which involves pricing nature in a capitalistic world is rather too risky when analyzed in a broader concept. An argument supported by Rodríguez-Labajos, B (2013), insisting that more attention should be placed on the driving forces rather than on the price pattern, in addition Helm, D (2012) pointed out that although the tools of economics can help in mitigating biodiversity loss they are also very primitive in analysis of the diverse biodiversity systems over long periods, therefore creating the assumption of unstable equilibria “nature imbalance”. The perception that policy mix just needs to be integrated and properly regulated seems a lot easier to imply but in-reality political and economic difference always makes it rather challenging to implement according to Munang, R (2013)

A System of Economic Environmental Accounting (SEEA) is suggested by Teeb T, (2009) SEEA system, encompasses all aspects of biodiversity (land, water, environmental) expenditures and social issues in both monetary and physical terms. Furthermore explaining that the value of society’s natural capital is better reflected in decision making if largely considered from national accounting, regulation and fiscal policy, to public and private procurement and government spending.

Meijaard, E. (2013) argues that if forest perception patterns could be translated into spatial maps with continuous coverage, spatial representations of forests important for communities, this could facilitate informed land use planning and zoning in areas of high social or cultural importance. Furthermore suggesting that by pointing out areas where forest dependence and perceived values are highest, government decision makers can optimize the balance between revenue generation and forest exploitation. The poor living in rural areas depend on forests and trees as their source of food also these natural resources serve as



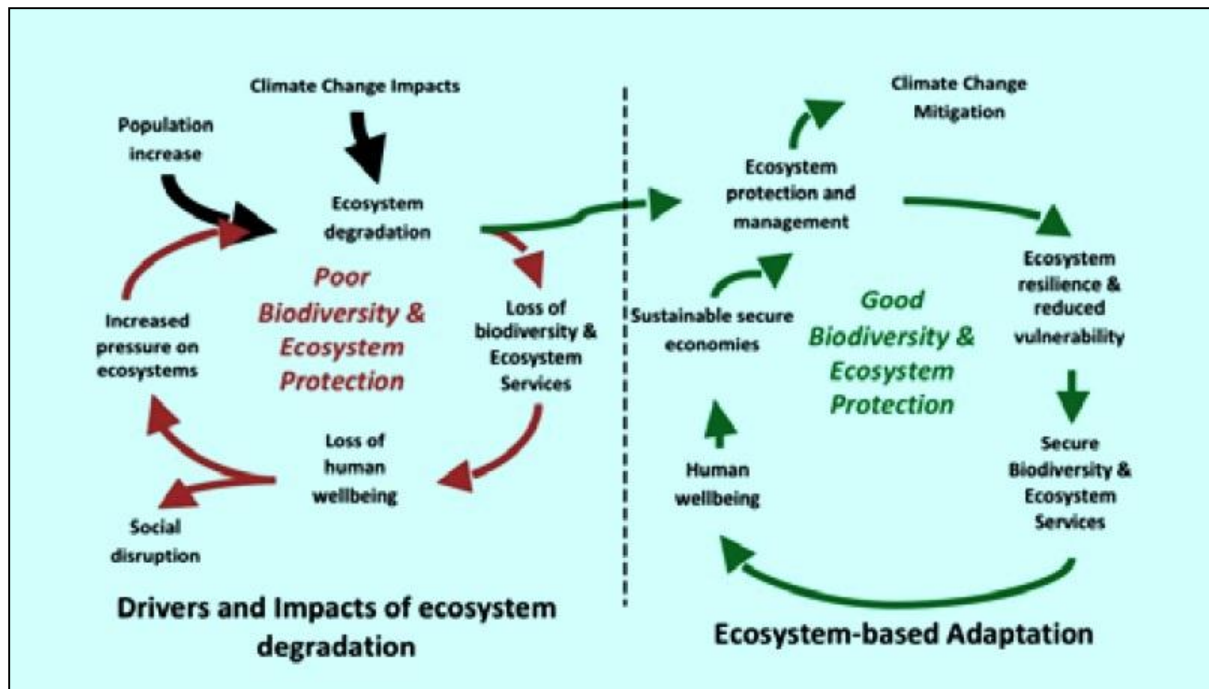
medicines, fuel and building materials and also cash income, fuelwood as a resource meets about 90% of the energy requirements in many developing countries in the world. (FAO 2015)

## **2.4 Ecosystem Based Adaptation**

According to Travers, A (2012), Ecosystem-based Adaptation (EBA) uses biodiversity and ecosystem services as part of a global adaptation strategy to help every society adapt to the adverse effects of climate change at local and international levels. EBA comprises of numerous schemes operating at many levels, with the aim of harmonizing environment and society within the EBA framework. The replacement of our obsolete economic scope, could aid in development of economic tools that can bring solutions to reverse global climate change and biodiversity loss according to Munang, R (2013). Such perception requires requisite shift in the structure of the world's economic systems, whereby the consumption of resource for human development is the primary driver for environmental degradation and biodiversity loss. In addition Munang, R (2013) suggests, the development of economic models that can help reverse the market failures of the existing system by totally valuing the environment. One major issue that arises when discussing human development and its damaging activities, is that societies will rather prefer to use technology to adapt to biodiversity loss and climate change than reduce its consumptive behavior (Blench, R. 1998).

The diagram below illustrates how good biodiversity and ecosystem protection under the EBA framework can aid in the general improvement in every aspect of society. According to Travers, A 2012 the EBA framework is delivered through three main primary components:

1. Assessments and knowledge support
2. Capacity building and demonstration
3. Integration of EBA options into national development and adaptation plans



**Fig 2.4.1 Ecosystem- based Adaptation**

**Source: Adapted from Munang, R (2013)**

In combating climate change and biodiversity loss, there is need for appropriate adherence to international standards agreed upon such as the UNFCCC COP21 2015 recently agreed in Paris. The COP21 is a deal signed by over 200 countries to limit the rise in global temperatures to less than 2C, an agreement that is partly legally binding and partly voluntary in respect to targets set by individual countries (BBC News 2015).

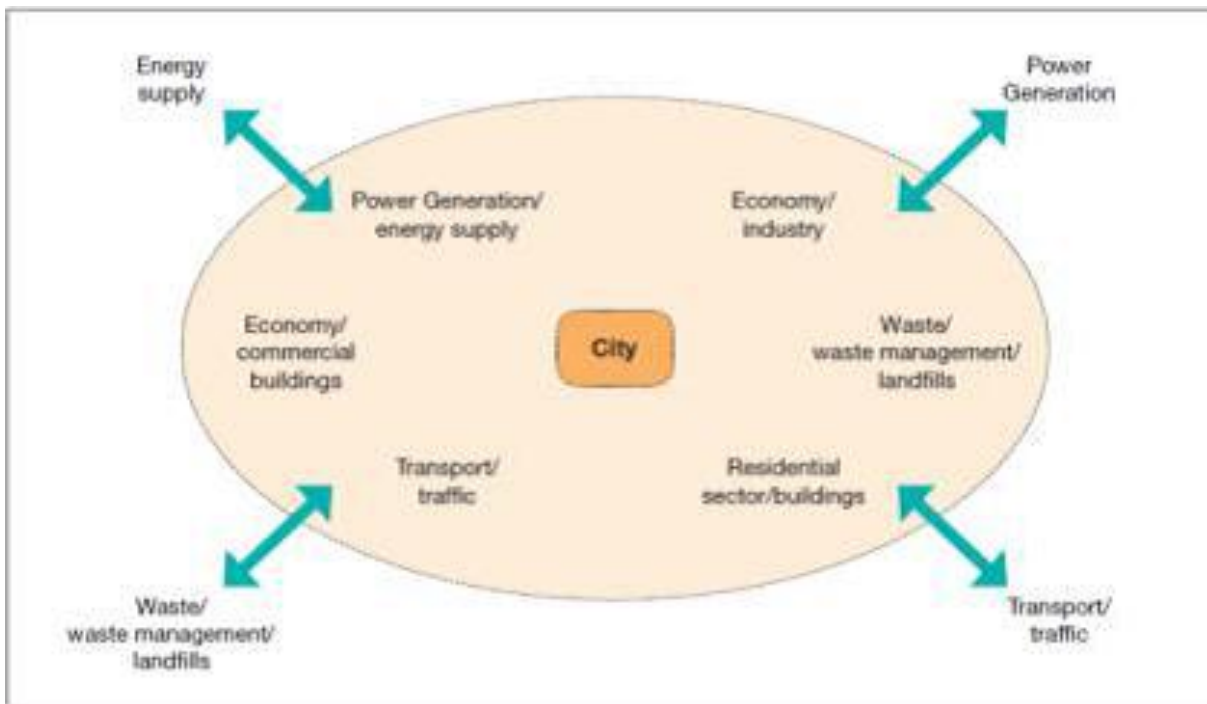
The key features of the summit include:

- To peak greenhouse gas emissions as soon as possible and achieve a balance between sources and sinks of greenhouse gases in the second half of this century
- keeping global temperature increase well below 2C (3.6F) and to pursue determinations in limiting it to 1.5C
- Review of progress every five years
- \$100 billion a year in climate finance for developing countries by 2020, with a pledge to further finance in the future so as to cut the gap in green technology innovation .(BBC News 2015)

Although there is huge cheer amongst nations concerning the COP21, arguments such as the undermining of the rights of the world's most vulnerable communities which has contributed the

least of GHG emissions, additionally there's little hope that the effect of this summit will be diverse as the non-binding policies makes the entire program vague Dearden (2015).

Rogers, H (2014) highlighted that the urban population increases at about one million inhabitants every week, and with human activity being the most contributing sectors of greenhouse gas emissions, activities such as buildings, waste, transport, industry and electricity production are the most contributors of green-house gas emissions (GHG) and opportunities for decreasing the GHG emissions from these different sectors are usually related with broader sustainable development goals. Tools such as Clean Development Mechanism, Carbon and climate finance mechanisms has proven to be instrumental in mitigating climate change in some areas of the world.



**Figure 2.4.2 Typical emissions sources in cities including those that flow in and out of a city's boundaries (Adapted from Rogers, H (2014))**

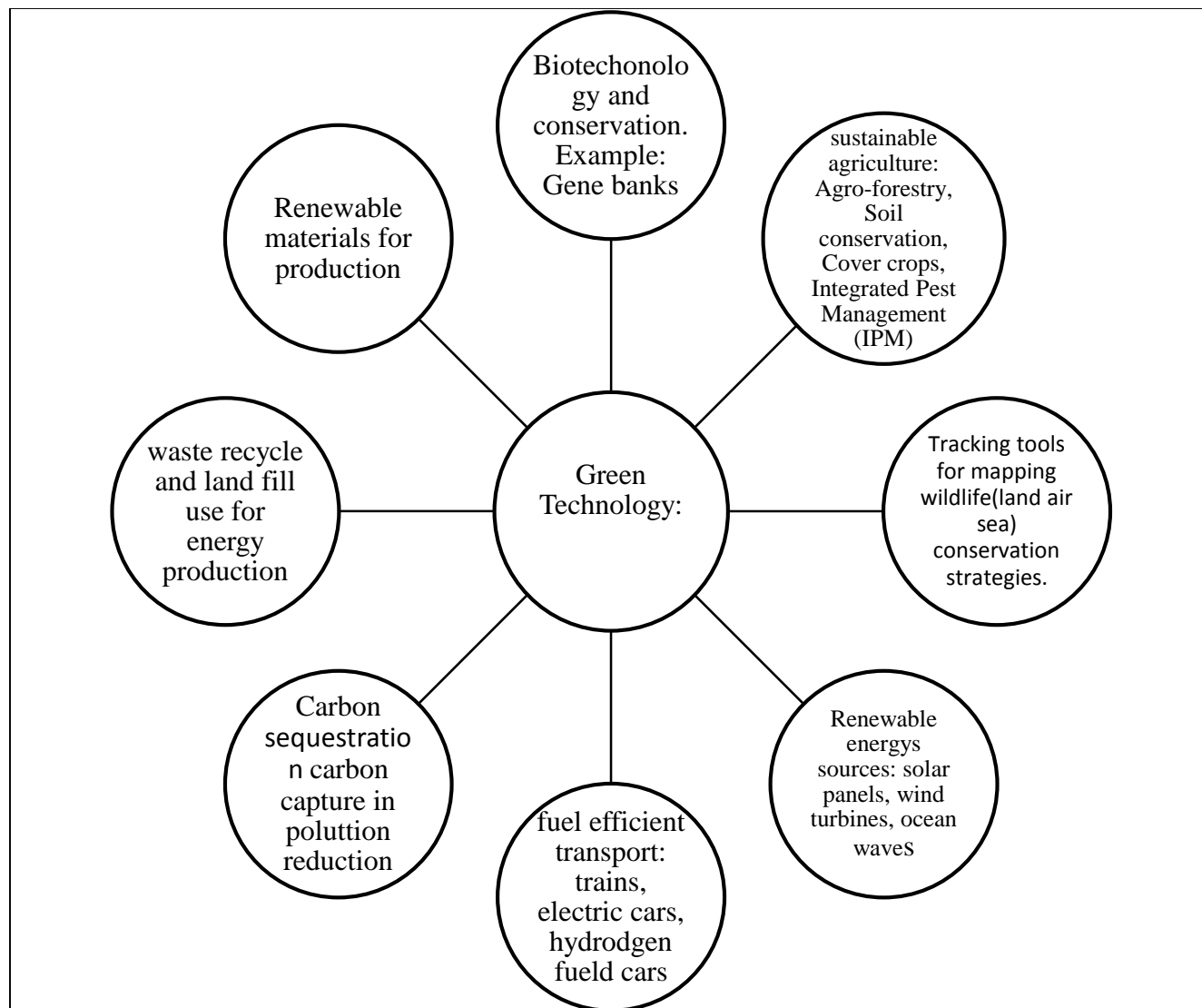
Rogers, H. 2014 measuring, reporting and verification (MRV) is the chain of processes required to calculate a vigorous GHG emissions baseline (i.e. the amount of GHGs being emitted from a given source) and measure how it changes over time. Furthermore explaining that although some of the problems of MRV framework includes, time consumption and poor policy

integration, MRV is thought to be of significance to the UN as it is used for monitoring progress of nations towards limiting global warming to 2<sup>0</sup>C.

## **2.5 Technology as a tool for the mitigation of biodiversity loss**

According to Pyakuryal, B (2009) Technology simply means applying knowledge for practical purpose furthermore defining green technology as the innovation that reduces waste generated from human activities by shifting production and consumption patterns.

Science and technology advancement has aided in the development of new green technologies that might be key to solving the environmental issues of the present day Show, K. Y. (2010). With diverse natural sources of energy and available means of extraction, it is rather absurd that the rate of pollution and environmental damage is still a lingering problem for the world. McNeely, J. A. (1994) explains that the rapid change of technological trend, as it has often been gives way for over exploitation as humans develop new ways of exploitation due to the breakdown of traditional controls. An argument that exemplifies innovative trends such as (ship building, cars, internet). Technology can be used in many ways to produce different possible outcomes Schewe, R. L (2015). Continuing advancement in technology, has so far proven to be significant in combating climate change by means of numerous alternative energy sources: solar, wind, hydro and many others that encourage biodiversity conservation. Grillo, R (2014) explains that Landfill heat is generated from degradation of different waste types due to result of chemical and biological processes furthermore suggesting that if the concept of geothermal heating systems is used in landfills, sustainability can be improved. Although Li, L (2014) argues that the exorbitant cost of new technologies and its immaturity in the global market makes the wide spread application of alternative and transitional energy difficult. Furthermore stating that limitation of these technology in urban transportation can be blamed on the industrial commercialization of energy sources, usually requiring the backing of government policy.



**Figure 2.5.1: Technology as a tool for the mitigation of biodiversity loss Conceptual framework**

The figure above gives and insight of how far technology has reached in terms of biodiversity loss mitigation and conservation. McNeely, J. A. (1994) Globalization and growth in technological trend enables the global consumer society to exploit resources from alternative sources and locations when local resources are depleted. To promote innovation, policy instruments needs to be tweaked to the conditions of sociotechnical change, which can be done

through societal deliberations, technological foresight and experimenting with new technologies at local the local level Kemp, R. (2000).

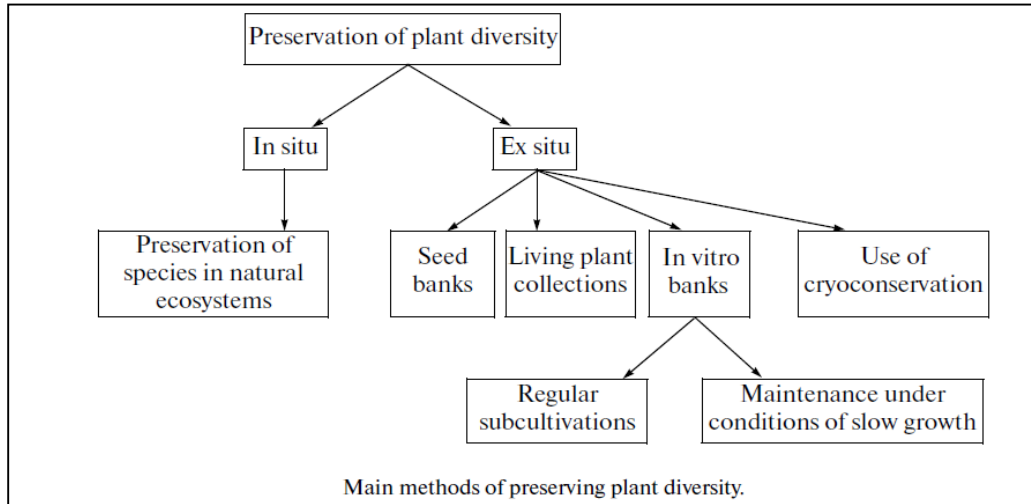
According to Czech, B. (2003), biodiversity conservation in respect to advancing technology is poised to decline, since research and development which gives rise to innovative technology always requires finance, the only option for improvement is based on the efficient integration of biodiversity conservation into the economy, an argument furthermore expanded by Zainutdinova, K. K (2011) explaining that achieving millennium development goals and climate summits which aims to reduce poverty and improve sustainability, is unrealistic, except through the use of modern forms of energy in the diverse improvised areas. In addition, the use of proper marketing strategies by energy companies will aid in integrating the available renewable technology into rural communities

Olajire, A. A. (2013), suggests the use of ‘chemical sequestration’ where by using aqueous ammonia process (AAP) which provides clean low carbon technology for the efficient conversion of captured CO<sub>2</sub> into clean CO<sub>2</sub>, and also can be injected into oil fields for enhanced oil recovery or fertilizer source. Furthermore stressing that the UN clean development mechanism CDM-CCS (carbon capture and storage) project with AAP holds huge potential for improving sustainable livelihood development as well limiting global pollution. But Tambo, J. A (2012) argues that the availability of information on climate change increases farmer’s awareness about the threats they face from destructive climate change, therefore influencing their choice of technology use. A CBD report on Nigeria 2014, explains that although research is usually carried out by different institutions in the country, the information presented are limited and usually not accessible by the public.

Nigeria’s poor record on applied research and development, has left the country way behind in the global technology trend. Additionally the absence of functioning database in the country, has so far had negative impacts on biodiversity data collection and application, as explained in Nigeria CBD report (2014). Siddiqi, A. (2015) highlighted that it is essential for synergies and trade-offs between water end-use, energy consumption, economic effects, and environmental impacts, be holistically imbedded in policy decision making.

Belokurova, V. B. (2010) explained that the use of In-situ and ex-situ conservation techniques has aided in plant species preservation and management. Furthermore highlighting the main purpose of the framework, is to gather, maintain, assess and distribute plant material

and information. The figure 2.5.2 below shows the two main methods of plant diversity preservation, with the rate of biodiversity loss in the world, brilliant ideas and national economic polices has been able improve efficient techniques and provide adequate technologies that complement one another in biodiversity conservation.



**Figure 2.5.2 Main Methods of Preserving Plant Diversity (Belokurova, V. B. (2010))**

In a world where development and growth is heavily dependent on research and development, there's little expectation from African countries in terms of speedy development due to the current world systems that relies on finance for everything. Ultimately humans will come to the understanding that the environment is the source of all things, as we humans and our societal frame work or policies are set up by people and governments and not by an invisible hand. Radzi, A. (2014) explained that although there has been substantial rise in technological development and awareness that the connection, and integration of all aspects of the society is vital in the transition to renewable energy, implementation of projects is still based on government intervention. Furthermore highlighting the different obstacles government face in renewable energy policies: (high direct costs, low investment, lack of incentives, poor technical knowhow and capacity, and strain between central and local policies) which is as a result of bad politics.

## **2.6 Mass Media as a Tool for Environmental Protection**

Mass media according to Viswanath, K (2007) is an influential tool for policy cohesion, integration of society and culture. The media comprises of information flow in terms of entertainment, persuasion, and cultural transmission. Furthermore the media helps in defining people's perceptions and knowledge both globally and locally. According to Dorji, T. (2007) communication is a fundamental component of society development. Mass-Media comes in different forms, from television, radio, print media like newspapers and magazines, to internet media and also other forms of mass media outlets which maintain a World Wide Web presence to take advantage of the readily available internet users in many regions of the world. Sypsas, A (2013) Identified two significant roles digital media plays in the enhancement of environmental awareness and eco-friendly lifestyles: firstly they create a flexible environment for the decomposition and explanation of complex issues, through different types of information, text, pictures, multi –media presentation and other smart technology systems that aid people in managing their resource use. Secondly they stimulate and enhance the adoption of ecological philosophy, by contribution to eco-tourism, energy use management other eco-friendly activities. Furthermore suggesting the use of digital media to capture the attention of young people since they are more digitally inclined.

Shabir, G. (2013) explains society to be a group of people who share a common dwelling and who are dependent on each other for their survival and well-being, furthermore highlighting cultural alteration through globalization as one of the limitations of mass media. According to OECD (2012) Better information supports better policies, therefore our knowledge base needs to be expanded, so as to accommodate the diverse choices and options available to us. People need access to information continuously to enhance development, and in this current world the media is a major game changer for information flow, as more people connect to the internet for diverse reasons. Viglianisi, F. M (2011) pointed out that the use of information technology can assist in the expansion of awareness and emotions, transforming the method of construction of knowledges and training processes, more precisely people need to enhance their environmental awareness . The development of information technology 'satellite communication' over the year's dictates the fact that mass media is now a part of human experience and survival. Additionally communication enables society to share experience, knowledge and generate collective astuteness (Dorji, T. 2007). According to Van Dijk, T. A. (1995), if we talk about the



influence of media messages, we should begin with an explicit and systematic analysis of text and talk, and exceeding superficial content analysis. Furthermore explaining that to understand media effects and uses, there's a need to study detailed Cognitive procedures and representations involved, so that a proper understanding of 'changes' in public ideologies, and how these changes are, in turn, related to the social practices of media users. Chan, K.K. (1998) article illustrated the relationship between mass media and the environmental knowledge of students, furthermore suggesting that the news coverage on environmental concerns should be enhanced in the mass media so as to cultivate an environmentally informed public, the reach of mass media is undebatable as it goes beyond boundaries and great distance. The use of internet and World Wide Web with other diverse technological means of communication can literally be a driving force for environmental conservation as explained in Dorji, T (2007).

A Nigeria country report on Rio summit (2012) identifies the weakness of the country's data collection process, furthermore suggesting the proper Utilization of Global System for Sustainable Development (GSSD) an adaptive, interactive system for knowledge networking, knowledge management, and knowledge sharing for use and combining with Internet resources so as to ease social and environmental sustainability, and further raise public awareness using all forms of media channels. Olukunle, O. T. (2013) stressed that due to the poor structural information system in Nigeria the main techniques of agriculture improvements developed by research institutes remain un-adopted. Furthermore suggesting that the marketing system in Nigeria needs a dynamic information system in which both the buyer and sellers are linked together. The current available technology in the world is very much reliable in the collection of economic, environmental and social data according to ECA I. (2012). Furthermore explaining that the information gathered can be shared through the web so as to enable ease of access for the populace. An argument Kushwaha, V. S. (2015) supported by identifying that, media play an important role in the formation of positive attitudes towards the environment, a fact also supported by ECA I (2012). One way of regulating divisive pressures in multi-ethnic societies such as Nigeria is the adoption of a collective policy based on mutual respect and tolerance for cultural differences. Known as multiculturalism, which asserts the value of diverse cultures co-existing within a country, and stresses the equal responsibility of all people to consent the rights of others, to freely express their views and values wherever appropriate (Shabir, 2013).

### 3. RESEARCH METHODOLOGY ON ECONOMIC GROWTH AND BIODIVERSITY LOSS IN NIGERIA

**Table 3 .1.1Economic and Social and Environmental Indicators of Nigeria (UNDP HDR 2015, NBS 2014)**

Indicators	Years		
	2010	2012	2014
Gross domestic product, current prices in (Billion\$)	373.839	467.119	573.652
Unemployment rate(%) of total Labor force	21.1	23.9	-
Agriculture (%) of Contribution to GDP	29.89	39.21	22.90
Poverty Rate (%)	69.0	60.9	50.9
Human Development Index (HDI)	0.493	0.505	0.514
Life expectancy at birth %	51.3	52.1	52.8
Adult Literacy %	51.1	51.1	-
Natural Resource Depletion %	-	-	8.1
Income Inequality	-	-	28.4
Research and Development (% of GDP)	0.2	0.2	0.2
Forests (thousand Hectares) percentage change			-52.3

Table 3.1.1 above highlights the different social economic and environmental indicators of Nigeria, as shown on table 3.1.1 Nigeria is growing rapidly in the economic sector according to the GDP data, while every other sector of the country is being depleted or left stagnant.

David Suzuki said that *‘If we pollute the air, water and soil that keep us alive and well, and destroy the biodiversity that allows natural systems to function, no amount of money will save us’*. Biodiversity is as important as economic growth, but this fact is majorly ignored by most countries until recent years. This chapter describes and explains the research methodology used in this paper through the analysis of related literature and the indication of different statistical data on tables and figures.

The data's were analyzed using Microsoft excel spread sheet program with indicated statistics on the listed tables. This research method was chosen because it gives precise insight of socio economic indicators and their growth rate. In addition the analysis of different data on the listed table was able to pinpoint the intrinsic connection between economic growth rate and biodiversity loss in the country. The use of economic social and environmental indicators in this research was effective in highlighting the difference in percentage change within the time period specified. The main aim of using different statistical tables was important in showing the rapid change in the different socio economic sectors of Nigeria and selected countries. The research paper is limited by availability of related articles concerning Nigeria and insufficient data provided by national governments. Additionally proximity to Nigeria, and insufficient data on biodiversity, limited the comprehensive research of this paper.

UNDP human development report 2015 was used for gathering data on Nigeria, related counties and Sub-Regions in the world, according to (UNDP 2015) the report was designed to emphasize that evolving human choices should be the ultimate criteria for assessing development outcomes. Furthermore the HDI index which analyses human development achievements in the three basic dimensions: a long and healthy life, knowledge and a decent standard of living, is limited by discrepancies in human development through the population within a country. An example of such disparity can be seen from two countries with different distributions of achievements can still have the same average HDI value. Although such disparities can influence data and decisions the inequality adjusted human development index (IHDI) takes into account such discrepancies by “discounting each dimension’s average value according to its level of inequality” but this approach is limited by overlapping inequalities not taken into consideration UNDP (2015).

The forest country report was prepared to show the forests land use system used by Nigeria according to FRA (2015), the report is limited by insufficient data and inaccessibility of some area of the country. Nigeria Bureau of Statistics (NBS), World Bank data and International Monetary Funds were used as secondary source for data collection. The data and survey methodology used in this research rests upon qualitative analysis and the interpretation of primary and secondary sources, this research covers from the period of year 2000 to 2015, due to limited availability of information and timeframe needed for the development of environmental and socio-economic trends.

## 4. RESEARCH FINDINGS AND DISCUSSION OF ECONOMIC, SOCIAL AND ENVIRONMENTAL INDICATORS

### 4.1 Economic Sector Overview

**Table: 4.1.1 Nigeria GDP from 2010 to 2015 (IMF 2015)**

Indicators	Years					
	2010	2011	2012	2013	2014	2015
Gross domestic product, current prices in (Billion\$)	373.839	418.834	467.119	521.812	573.652	515.431
Gross domestic product per capita, current prices (\$)	2,395.624	2,612.124	2,835.290	3,082.492	3,298.034	2,883.998
Inflation, average consumer prices (%)	13.720	10.841	12.217	8.476	8.057	9.594
Unemployment rate(%) of total Labor force	21.100	23.900	-	-	-	-

The table 4.1.1 above highlights the economic indicators of Nigeria between the periods of 2010-2015, GDP has steadily increased over the 5 year period with 2015 recording 515.43 billion dollars, while unemployment has remained high, with an increase between the two year data available, from 21.1 percent to 23.9 percent. Inflation on the above table 4.1.1 has decreased over the period with 2014 recording the lowest at 8.057 percent and the highest rate coming in 2010 at 10.720 percent. Gross domestic product per capita from table 4.1.1 above recorded the highest in 2014 with \$3,298.034, with the lowest recorded GDP per capita 2015 being 2,395.624, a decrease from the previous year.

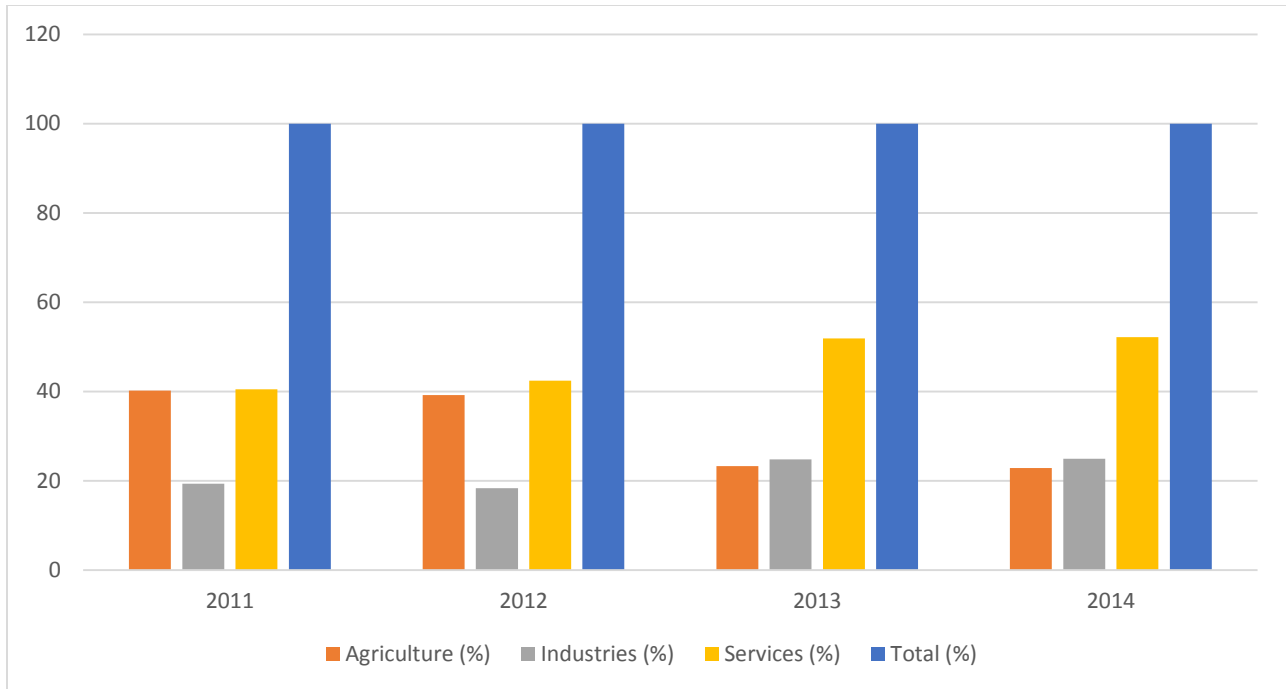
**Table: 4.1.2 Contribution Rate by Sector to GDP (NBS GDP Report 2014, World Bank 2015)**

Sectors	Years			
	2011	2012	2013	2014
GDP Annual Growth (%)	4.9	4.3	5.4	6.3
Agriculture (%)	40.19	39.21	23.33	22.90
Industries (%)	19.32	18.34	24.81	24.93
Services (%)	40.50	42.46	51.86	52.16
Total (%)	100.00	100.00	100.00	100.00

Table 4.1.2 above shows the annual growth rate of Nigeria's GDP and contribution of GDP by sector between the periods of 2011 to 2014. GDP growth has increased over the years with 2012 recording the lowest at 4.3 percent majorly due to the world economic recession and the highest growth rate of GDP recorded in 2014 at 6.3 percent.

The services sector records the most contribution to GDP over the years, with 2014 contributing 52.16 percent more than half of the country's total GDP majorly due to the telecommunication sector and real estate development in the country NBS 2014, the year 2011 recorded the lowest services, averaging just 40.50 percent but added the most among the different sectors of the economy for that year as shown in table 4.1.2.

Agriculture sector is made up of four sub-activities: Forestry, Crop Production, Livestock, and Fishing recorded the highest in 2011 at 40.19 percent, the contribution of agriculture over the period decreased from 39.21 percent in 2012 to 22.90 percent in 2014, an alarming drop in agriculture production which highlights Nwajiuba, C. (2012) argument that Nigeria's lack of diversity in the sector is threatening the food and agricultural security of the country. Industries which include all extraction and production industries recorded the highest contribution rate in 2014, adding 24.93 percent and recording the lowest in 2012 at 18.34 percent a drop from the previous year which was 19.32 percent.



**Figure 4.1.1 Contribution to GDP by Sector (Designed According to (NBS GDP Report 2014, World Bank 2015))**

Figure 4.1.1 above illustrates the different contribution to GDP by sector, it shows the steady drop in agriculture production, also indicating the sharp fall of industries in 2012 which was mainly due to the economic down turn in the world. Services sector as illustrated above improved over the years, contributing the most to GDP every year over the four year period.

## 4.2 Socio-Economic Overview

**Table: 4.2.1 Social Indicator 2015 Estimates (UNDP HDR Nigeria 2015)**

Indicators	Nigeria	Low HDI	Developing countries	Sub-Sahara Africa
Total unemployment (% of labor force)	23.9	9.7	5.6	11.9
Employment to population ratio (% ages 15 and older)	51.8	63.9	60.7	65.7
Labor force participation rate (% ages 15 and older)	56.1	68.1	64.3	70.9
Child labor (% ages 5-14 years)	24.7	23.8	14.5	24.7
Internet users (% of population)	42.7	16.0	31.9	19.3
Research and Development Expenditure (% of GDP)	0.2	-	1.1	0.4

Table 4.2.1 highlights the major socio-economic indicators in Nigeria and other regions and sub group. Countries with low human development, developing countries and Sub-Sahara African countries were included so as to compare with Nigeria.

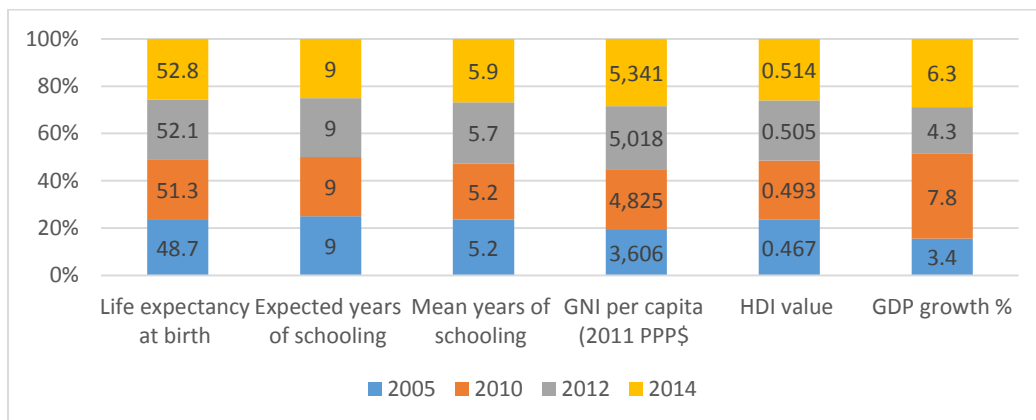
Table 4.2.1 shows that majority of the Nigeria population uses internet at 42.7 percent compared to other developing countries rate of 31.9. Child labor rate on table 4.2.1 is 24.7 percent for Nigeria higher than countries with Lower human development at 23.8 percent and developing countries 14.5 percent. Also the table 4.2.1 shows research and development for Nigeria is averaged 0.2 percent lower than the rate of developing countries 1.1 percent and Sub-Sahara Africa's 0.4 percent. Unemployment is very high in Nigeria at 23.9 percent, in comparison with most developing countries which averaged 5.6 percent, Sub-Sahara Africa 11.9 percent and Low Human Development countries 9.7 percent as shown in the table 4.2.1 above. The table 4.2.1 above presents data that pinpoints the poor socio-economic structure and conflicts hampering development in the region.

### 4.3 Human Development Trends and GDP Growth

**Table 4.3.1 Nigeria’s HDI Trends and GDP Growth (Nigeria HDR 2015, World Bank 2015)**

Years	Life expectancy at birth	Expected years of schooling	Mean years of schooling	GNI per capita (2011 PPP\$)	HDI value	GDP growth %
2005	48.7	9.0	5.2	3,606	0.467	3.4
2010	51.3	9.0	5.2	4,825	0.493	7.8
2012	52.1	9.0	5.7	5,018	0.505	4.3
2014	52.8	9.0	5.9	5,341	0.514	6.3

Human Development Index according to UNDP is a composite index that measures the average achievement in three different basic scopes of human development: a long and healthy life, knowledge and a decent standard of living. The table 4.3.1 above highlights the trends in human development index of Nigeria and the GDP growth percentage in the periods of 2005 to 2014. Figure 4.3.1 below indicates that there has been steady increases over the period for all indicators, with life expectancy rate barely improving from 48.7 percent in 2005 to 53.8 percent in 2014, years of schooling for the Nigerian populace increased from the stagnant 5.2 years average in 2010 to 5.9 in 2014. Whereas GNI per capita increased rapidly from \$3,606 in 2005 to \$5,341 in 2014, also Nigeria HDI value improved from 0.467 in 2005 to 0.514 in 2014 as indicated on the chart below. GDP growth recorded the highest between the periods listed in 2010 with an annual growth rate of 7.8 percent, basically due to the rise in oil prices that year as the Nigerian economy is dependent on oil.



**Figure 4.3.1 Nigeria HDI Trends (Designed According to (Nigeria HDR 2015, World Bank 2015))**



**Table: 4.3.2 Environmental sustainability table (UNDP HDR 2015)**

Countries	Primary energy supply		Electrification rate		Emissions	Resources				Effects of Environmental Threats				
	Fossil fuels	Renewable sources	Total	Rural		Carbon dioxide emissions per capita	Natural resource depletion	Forest area	Fresh water withdrawals	Population living on degraded land	Deaths of children under age 5 due to: (per 100,000 children under age 5)			Natural disasters
	(2012)	(2012)	(% of Population (2012))	(% of rural Population (2012))	Tons (2011)	(% of GNI) (2008–2013)	% of total land area 2012	% change (1990/2012)	% of total renewable water resources (2005–2014)	2010	Outdoor air pollution(2008)	Indoor air pollution(2004)	Poor water, sanitation or hygiene (2004)	(2005/2012)
Nigeria	17.4	82.6	55.6	34.4	0.5	8.1	9.0	-52.3	4.6	11.5	14	370	559	5,667
Ghana	37.4	63.1	64.1	41.0	0.4	12.6	20.7	-36.8	--	1.4	3	152	226	3,055
Turkey	89.5	10.3	100.0	100.0	4.4	0.3	15.0	19.5	--	5.5	2	11	85	217
Germany	80.2	20.4	100.0	100.0	8.9	0.1	31.8	3.3	21.0	8.1	0	0	0	10
South Africa	87.2	12.9	85.4	66.9	9.3	4.8	7.6	0.0	--	17.5	2	23	104	860
USA	83.6	16.3	100.0	100.0	17.0	1.0	33.3	3.0	15.5	1.1	0	0	0	5,074
China	88.3	11.7	100.0	100.0	6.7	4.2	22.6	35.2	19.5	8.6	2	10	55	73,314

The table 4.3.2 above highlights the sustainability statistics of Nigeria and key countries such as USA, Germany, Turkey, Ghana South Africa and China. Nigeria and most African countries as shown above is basically dependent on renewable resources with major energy supply for renewable resource fixated at 82.6 percent and fossil fuels 17.4 percent. Ghana a developing country like Nigeria is dependent on renewable resource at 63.1 percent but compared to South Africa 12.9 percent, USA 16.3 percent and Turkey's 10.3 percent. . As shown above in table 4.3.2 most African countries lack basic electricity, with Nigeria total electrification rate set at 55.6 percent and Ghana at 64.1 percent, compared to developed countries where there electrification rate is 100 percent, Germany, USA, Turkey and China.

Most Green House gas emissions in the world is usually recorded by developed countries, the table 4.3.2 above indicates that Nigeria per capita carbon emission is merely 0.5 tons compared to that of the USA and China which stands at 17.0 tons emission and 6.7 tons emission respectively. The carbon emission statistics highlights the diverse consumption lifestyle of developed countries like Germany 8.9 percent, USA 17.0 and China 6.7 percent. The rate at which Nigeria and other African countries are depleting their natural resources is observed to be excessive compared to developed countries, with Nigeria resource depletion standing at 8.1 percent only second to Ghana's 12.6 percent, while compared to developed countries like the USA 1.0 percent and Germany 0.1 percent, a critical resource management crisis that needs to be tackled. The Depletion rate of natural resource in African countries is replete, a rate that also explains how poor conservation in these countries has resulted in forest loss, with forest area loss between the periods of 1990-2012 showing a -52.3 percentage change in Nigeria and -36.8 in Ghana compared to Germany 3.3 percent and USA 3.0 percent, pointing out the poor conservation schemes of African countries against the proper conservation strategies of developed countries. The effects of environmental threat indicator on the table 4.3.2 shows that most African countries are more affected than developed countries in terms of indoor air pollution with Nigeria 370, Ghana 152 and for poor water sanitation hygiene 559 and 226 respectively, while developed countries like the USA and Germany both recorded 0 in each sections. Natural disasters which can be somehow blamed on poor conservation and demographic set up has affected China the most, recording an estimated 73,314 disaster within the periods of 2005 to 2012, while Nigeria recorded over 5,667 and USA 5,074 as shown on the table 4.3.2 above, while Germany 10 recorded the lowest among the listed country.

**Table 4.3.4 Human Development Index with other countries and Sub-region (UNDP HDR 2015)**

Countries and Sub-Region	Human Development Index (HDI)2014	Life expectancy at birth 2014	Expected years of schooling 2014	Mean years of schooling 2014	Gross national income (GNI) per capita2014
Nigeria	0.514	52.8	9.01	5.9	5,341
Ghana	0.579	61.4	11.5	7.0	3,852
Germany	0.916	80.9	16.5	13.1	43,919
Turkey	0.761	75.3	14.5	7.6	18,677
South Africa	0.666	57.4	13.6	9.9	12,122
Europe and Central Asia	0.748	72.3	13.6	10.0	12,791
Sub-Saharan Africa	0.518	58.5	9.6	5.2	3,363

From table 4.3.4 above it can be seen that Nigeria and Ghana perform the worst with and HDI value of 0.514 and 0.579 respectively while Germany and Turkey had values of 0.916 and 0.716 respectively. Among all countries and Sub-Region, Nigeria performs the worst in most indicators except in GNI per capita where the value was \$5,341 compared to Ghana's \$3,852. Germany performed the best with mean years of schooling at 13.1 percent compared to Nigeria's 5.9 percent, Europe and Central Asia 10 percent and Sub-Saharan Africa 5.2 percent respectively. The table 4.3.4 above shows Nigeria to have an average of 52.8 years life expectancy at birth and South Africa 57.4 compared to Germany 80.9 and Turkey 75.3 years life expectancy at birth.

**Table 4.3.5 Inequality Adjusted Human Development Index (UNDP HDR 2015)**

Country and Sub-Regions	Human Development Index (HDI)2014	Inequality-adjusted HDI (IHDI)	Inequality-adjusted HDI (IHDI) Overall Loss (%)	Inequality life expectancy index	Inequality adjusted life expectancy index	Inequality in education	Inequality adjusted education index	Inequality in income	Inequality adjusted income index
Nigeria	0.514	0.320	37.8	40.8	0.299	43.3	0.254	28.4	0.430
Europe and Central Asia	0.748	0.651	13.0	14.3	0.690	7.9	0.655	16.6	0.611
Sub-Saharan Africa	0.518	0.345	33.3	36.6	0.375	35.3	0.285	27.5	0.385

Table 4.3.5 above shows the inequality adjusted human development index in 2014, Nigeria recorded the highest loss among selected regions with IHDI being 0.320 and an overall HDI (IHDI) loss of 37.8 percent compared to Europe and Central Asia 13.0 percent and Sub Saharan Africa’s 33.3 percent. Inequality in education is shown on the above table 4.3.5 as 43.3 percent and adjusted inequality education index was 0.254.

**Table: 4.3.6 Multi-dimensional poverty for Nigeria relative to selected countries 2014  
(Nigeria HDR 2015)**

Country	Head count percentage	Intensity of deprivation percentage	Population share			Contribution to overall poverty deprivation		
			Near poverty	In severe poverty	Below income poverty line	Health	education	Living standard
Nigeria	50.9	54.8	18.4	30.0	62.0	29.8	29.8	40.4
Congo (DR)	72.5	50.8	18.5	36.7	87.7	31.0	15.6	53.4

Multi-Dimensional poverty is the population that is multi-dimensionally poor adjusted by the intensity of deprivation in a region (UNDP 2015), the table 4.3.6 above shows the percentage of poor in the population of Nigeria to Congo Democratic Republic. Head count percentage shows that Nigeria has over 50.9 percent multi-dimensional poor people compared to Congo (DR) 72.5 percent. Furthermore indicating that the poor living standards in both countries, where Nigeria 40.4 percent and Congo 53.4 percent have been the biggest contributors to overall poverty deprivation. With health and education for Nigeria being 29.8 percent respectively compared to Congo (DR) health and education contributors being 31.0 percent and 15.6 percent as indicated in table 4.3.6 above.

**Table 4.3.7 Population Trend for Nigeria and Selected Countries (UNDP HDR 2015)**

Countries and years	Total Population (millions)		Population Average annual growth		Urban	Median age	Total fertility rate 2010/2015	
	2014	2030	2000/2005	2010/2015	2014	2015	2000/2005	2010/2015
Nigeria	178.5	273.1	2.6	2.8	51.5	17.7	6.1	6.0
Ghana	26.4	35.3	2.5	2.1	53.9	20.9	4.6	3.9
Germany	82.7	79.6	0.1	-0.1	74.3	46.3	1.4	1.4
Turkey	75.8	86.8	1.4	1.2	74.3	30.1	2.3	2.1
South Africa	53.1	58.1	1.5	0.8	63.3	26.5	2.8	2.4

The table 4.3.7 above shows the total population of Nigeria relative to selected countries, Germany in the above diagram has the worst population growth rate at – 0.1 between 2010/2015 compared to Turkey’s average annual population growth of 1.2 percent in the same period, while Nigeria and Ghana both recorded 2.8 percent and 2.1 percent respectively. Nigeria high fertility rate is shown on the table 4.3.7 above, with a record of 6.0 percent in 2010/2015 periods, a 0.1 percent decrease from the previous period of 2000/2005 which was 6.1 percent. Compared to other countries, Germany remained at 1.4 in both periods of 2000/2005 and 2010/2015, while the fertility rate of Ghana and Turkey both decreased between the years 2000/2005 and 2010/2015.

**Table 4.3.8 Impelled Migration (Adapted from Ogbonnaya, U. M 2013)**

Forced Migration	Years			
	2001	2002	2008	2010
Number of people displaced (Thousands)	60,000	3,000	25,000	1000

Table 4.3.8 above shows the number of people displaced as a result of conflicts in the Jos region of Nigeria between the periods of 2001 to 2010. The conflict year 2001 recorded the highest number of displaced people while 2002 recorded the lowest among the 4 years data presented in table 4.3.8.

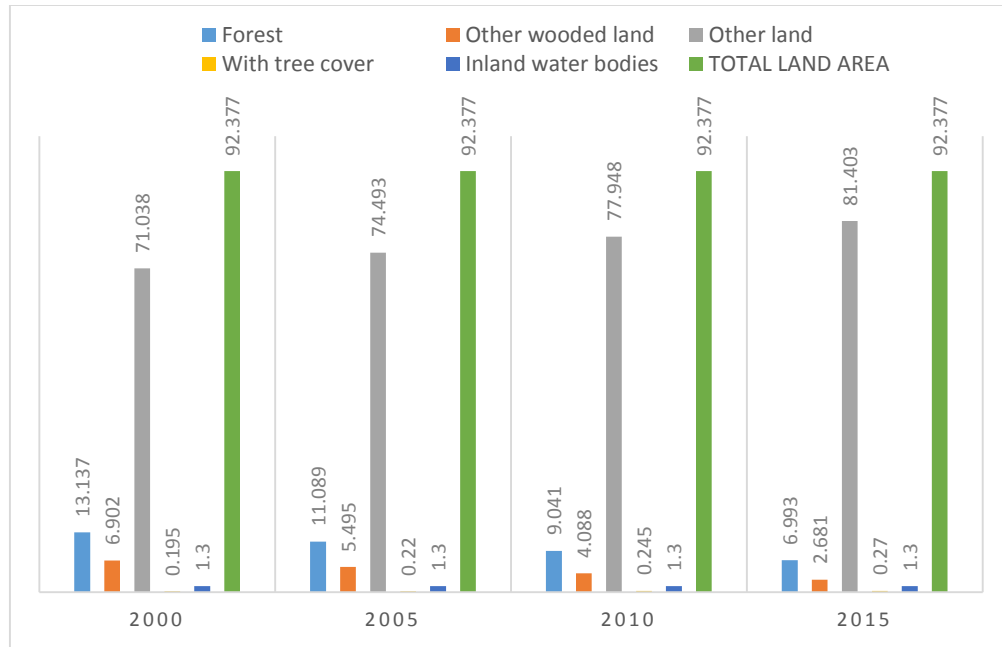
## 4.4 Land Use Classification in Nigeria

**Table: 4.4.1 Nigeria LAND Classification and Distribution (NIGERIA FRA 2015)**

Area (1000 hectares)	Years			
	2000	2005	2010	2015
Forest	13,137	11,089	9,041	6,993
Other wooded land	6,902	5,495	4,088	2,681
Other land	71,038	74,493	77,948	81,403
With tree cover	195	220	245	270
Inland water bodies	1,300	1,300	1,300	1,300
<b>TOTAL LAND AREA</b>	<b>92,377</b>	<b>92,377</b>	<b>92,377</b>	<b>92,377</b>

Nigeria land area is estimated to be 92,377 km<sup>2</sup> miles, rich with biodiversity and natural resource. The table 4.4.1 above highlights the changes in land use over the years from 2000 to 2015, with forest losing over 6,144 thousand hectares, about half of the forest total in just 15 years, an obvious statistics that raises interesting questions concerning the poor management of forests in Nigeria. Most Nigeria lands has been lost mainly due to increasing deforestation; which is thought to be as a result of growing population and also natural resource explorations. In land water bodies remained constant at 1300 over the years, as shown on the table 4.4.1 above





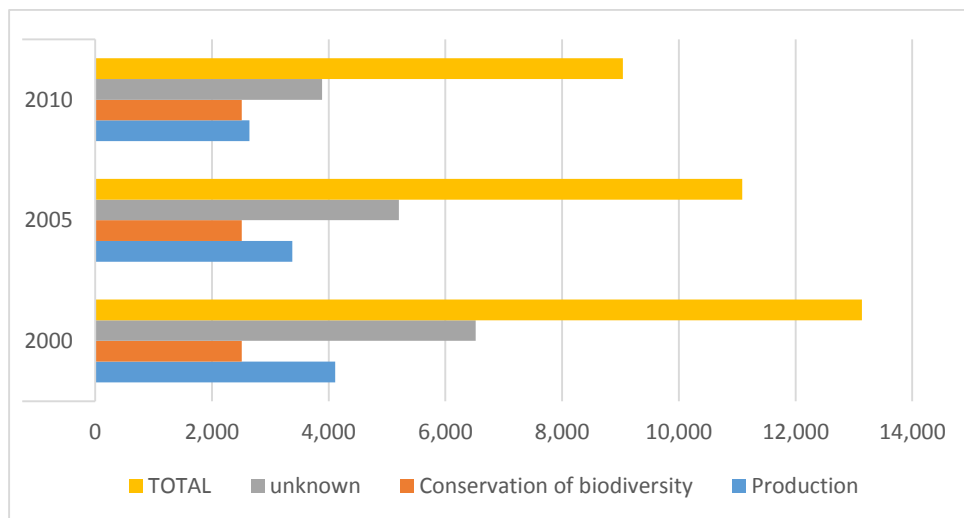
**Figure 4.4.1 Land Distribution in Nigeria (NIGERIA FRA 2015)**

The figure 4.4.1 above illustrates the Total land area relative to Forests and inland water body and other land use. As shown on figure 4.4.1 above, forest which was 17,324 in 1990 decreased gradually to merely 6,993 hectares in 2015, while there was substantial increase in other land use as shown on table 4.4.1 and illustrated on the above figure 4.4.1, from 64,126 hectares in 1990 to 81,403 hectares in 2015. From the figure above it is shown that OWL had also decreased uncontrollably from 9,717 hectares in 1990 to 2,661 in 2015. Basically the loss in forest resource is due to the uncontrolled resource depletion in Nigeria from forest areas to marine bodies, and also increase in Gross domestic product seems to undervalue the severity of this issue, as cited by Bossel, H. (1999) in an article criticizing the use of GDP indicator as it only focuses on how natural resource wealth is being depleted rather than the improvement of human and environmental well-being.

**Table: 4.4.2 Forest Land Use in Nigeria (FRA Nigeria 2015)**

Forest area (1000 hectares)	Years		
	2000	2005	2010
Production	4,110	3,377	2,645
Conservation of biodiversity	2,509	2,509	2,509
unknown	6,518	5,203	3887
<b>TOTAL</b>	<b>13,137</b>	<b>11,089</b>	<b>9041</b>

Table 4.4.2 above provides information on forest land used for production, conservation and other functions between the periods of 2000 to 2010. Conservation in table 4.4.2 has remained constant at 2,509 hectares only despite the increase in forest loss over the years as illustrated in figure 4.4.2 below. Unknown land dropped from 5,203 hectares in 2005 to 3,887 hectares in 2010. Figure 4.4.2 below illustrates the loss of total forest area in comparison with conservation of biodiversity in the same time period from 2000 to 2010. The decrease in total forest land over the period of years listed is catastrophic for any country to manage on the long run, with stagnant conservation and continuous environmental degradation mixed with rising population as indicated in table 4.4.2 above, there's urgent need for the Nigeria government and international community to improve conservation of forests and proper management of forest activities.

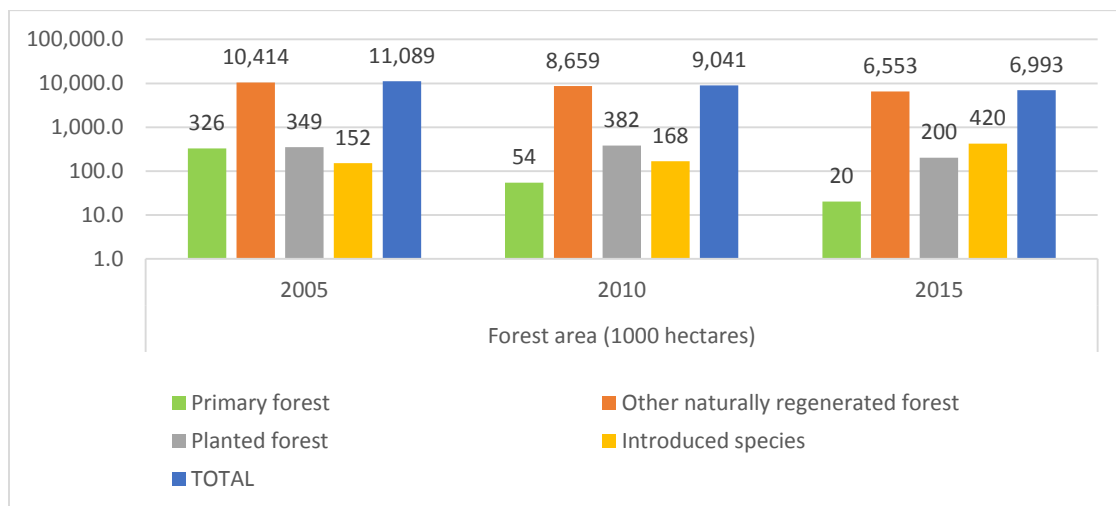


**Figure 4.4.2 land use in Nigeria (Designed According to FRA Nigeria 2015)**

**Table 4.4.3 Forests statistics of Nigeria (Nigeria FRA 2015)**

Forest area (1000 hectares)	Years		
	2005	2010	2015
Primary forest	326	54	20
Other naturally regenerated forest	10 414	8 659	6553
Planted forest	349	382	200
Introduced species	152	168	420
<b>TOTAL</b>	<b>11 089</b>	<b>9 041</b>	<b>6993</b>

Table 4.4.3 shows the primary forest in Nigeria decreased from 326 thousand hectares in 2005 to merely 20 thousand hectares in 2015. Other naturally generated forests decreased gradually in the space of 10 years from 10,414 in 2010 hectares to 6,553 hectares in 2015, planted forest also lost some proportion of its forest area, with 2015 statistics being 200, while the previous year 2010 recorded a higher data of 382 thousand hectares.



**Figure 4.4.3 Illustration of Forest Statistics in Nigeria (Designed According to FRA Nigeria 2015)**

Figure 4.4.3 highlights Nigeria’s forest statistics including number of introduced species, between the periods of 2005 to 2015. Nigeria lost about 306 thousand hectares of primary forest

between the years 2005 to 2015, an insufferable data that generally affected the total loss of forest area as shown in figure 4.4.3 above. The loss of forest area indicated above in figure 4.4.3 shows the damage of poor environmental management in the country and also the effect of over population, of which the majority is dependent on fuel wood for survival. (FRA 2015).

## 4.5 Discussion

The data's and figures above highlights the most influential indicators of biodiversity and economic growth. Nigeria in table 4.1.1 above experienced a substantial growth in gross domestic product with an increase of over 141.592 billion us dollars between the periods of 2005 to 2015, but unemployment remained high at 23.1 percent as indicated in table 4.1.1. The table 4.1.2 and figure 4.1.1 indicated that the services sector contributed the most to GDP between 2011 to 2014 periods with 52.16 percent in 2014 the most contributed over the years, while agriculture was the least contributor in 2014, adding just 22.90 percent to the total GDP, table 4.1.2 Showed that agricultural contribution to GDP has been on a downslide losing over 17.29 percent contribution rate between the periods of 2011 to 2014. Industry sector which includes oil exploration and refining contributed 24.93 percent in 2014, an increase from the previous year data presented on table 4.1.2.

Table 4.3.2 Analyses the environmental sustainability of Nigeria in relation to selected countries and sub-regions, with Nigeria recording the highest in percentage change of forest loss period of 2014. Natural resource depletion is shown to be very high in table 4.3.2 with a rate of 8.1 percent, compared to statistics of selected countries in the table 4.3.2. Poverty rate in Nigeria remained high at 50.9 percent as indicated in table 4.3.6, the data's presented in 4.3.2 and 4.3.6 respectively criticizes the increase in the growth rate of GDP (a measurement for economic growth) over the years from 2011 to 2014. A clear indication of how the economic growth of the country, has alienated natural resource conservation and sustainable development in the nation. Nigeria recorded the lowest in the human development index at 0.514 HDI compared to selected countries who averaged a higher value, life expectancy at birth which gives a deeper insight into the survival rate of babies, recorded Nigeria at 52.8 years, a very poor result compared to selected countries and sub region in table 4.3.4. Mean years of schooling for Nigeria was at 5.9 years, the lowest recorded among the selected countries in the table 4.3.4.

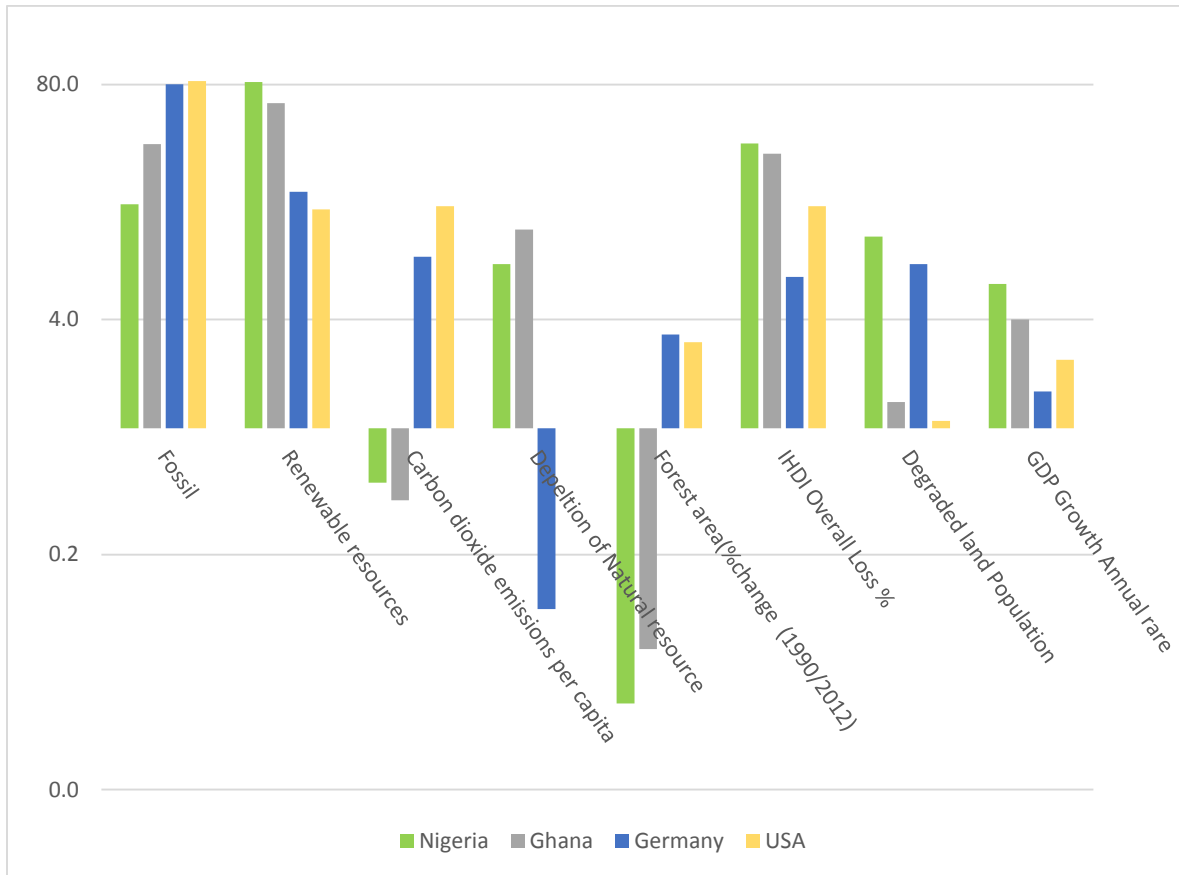
Population statistics in Nigeria was 178.5 million in 2014 and an estimated increase of 273.1 million people in 2030 as shown in table 4.3.7, an estimate that raises questions of how such growth rate of 2.8 percent in population can be harmonized in the long run considering the high rate of natural resource loss and poverty. Table 4.3.8 highlights the number of displaced people due to ethnic conflicts in the Jos region of Nigeria, the table further highlights the trend within

the conflict period from 2001 to 2010, with the highest statistics being 60,000 displaced people in 2001 and 1000 people displaced in 2010 the lowest among the listed years in table 4.3.8.

Table 4.4.1 and figure 4.4.1 indicates the loss of forest area between a 15 year period, figure 4.4 shows how forest area has gradually declined from 13,137 thousand hectares to just 6,993 thousand hectares, while other wood areas gradually declined in the 15 year period, an observation that explains the continuous loss of biodiversity in the country. Table 4.4.2 and figure 4.4.2 shows the rate of biodiversity conservation remained constant at 2,509 thousand hectares within the periods of 2000 to 2015 and forest area used for production reduced from 4,110 thousand hectares in the year 2000 to 2,645 in 2010 as shown in table 4.4.3. Primary forests according to FRA 2015 are forests that naturally regenerate and are of native species where the ecological process are rarely disturbed. Data from table 4.4.3 indicated the loss in primary forests sits at 20 thousand hectares in 2015 compared to 326 thousand hectares in 2005, figure 4.4.3 furthermore showed the increase in new specie introduction between the 10 year period and also the loss in naturally regenerated forests, dropping from 10,414 thousand hectares in 2005 to 6553 thousand hectares in 2015, the resulting statistics listed in table 4.4.3 comprehensively totals up to the forest area loss in Nigeria. Soaga J. A (2014) explained that the lack of proper management and Nigeria's inability to move away from its oil dependency has resulted in major losses for the country as a whole, from human wellbeing to environmental degradation.

Figure 4.7 below highlights the major economic and biodiversity indicators in Nigeria and relative to selected countries (Germany, USA, Ghana), from the figure below it is observed that the economic growth rate of Nigeria was the highest among the selected countries while in the category of natural resource depletion and forest change, Nigeria performed the worst as shown on the figure 4.7 below. Emissions from the below figure 4.7 shows that the USA and Germany contributed the most GHG emissions by performing the worst. A statistic usually blamed on the consumption lifestyles of western countries. Although most of the emissions can also be as a result of energy supply, the figure 4.5.1 below indicated that Germany and the USA energy source is mostly from fossil fuels, with only a fraction of the energy supply coming from renewable resources. While Nigeria and Ghana were mostly dependent on renewable resources. Inequality adjusted human development index (IHDI) loss percentage showed that Nigeria

performed the worst among selected countries, with Germany and USA recording a lower loss percentage of IHDI.



**Figure 4.5.1 Environmental Sustainability IHDI Loss and GDP Growth Rate (Designed According to UNDP HDR 2015, World Bank 2015)**

## CONCLUSION

1. Biodiversity plays a very important role in meeting the basic need of humans which is (healthy environment, clean water, food, clean air and natural resource etc.) Nigeria Occupies a unique geographic position in Africa, with a population of over 160 million people, it therefore stands out as the most populous country in Africa, also with variable climate and geographic features, it provides her with one of the richest biodiversity in the continent (CBD 2010).
2. Nigeria boasts of having the largest economy in Africa with a GDP of over 500 billion dollars at an annual growth rate of 6.4 percent (2014 est). The biggest contributor to Nigeria's GDP was service sector, and industry sector mainly because of oil exploration. Agriculture contributed the least to GDP even considering the fact that about 70% of the Nigerian populace manage their existence and income from agriculture and agro-allied activities. More than 60.0% of total employment is provided by the agricultural sector in Nigeria (CBD 2010).
3. The loss of biodiversity in Nigeria has limited the economic development, basically focused on the major problems affecting the economic growth of the country. Problems such as growing population mixed with poverty and deepening corruption and ill-educated populace. Ethnic conflicts displacing people and oil exploration in the Niger-delta region of Nigeria has created an unsuitable living condition for the locals with stagnating development, destruction to the mangrove forests and marine life of the region.
4. Deforestation in Nigeria is estimated to be about 3.5% per annum resulting to a loss of 350,000 –400,000 hectares of forest land per annum. Only 10 percent (92,377 km<sup>2</sup>) of Nigeria's land area is occupied by forests, this which is lower than the twenty-five percent mark recommended by Food and Agriculture Organization of the United Nations (FAO).
5. Nigeria's displaced population may be close to a million according to (IOM 2015). Major conflicts such as the Niger delta militancy, Jos crisis, and Boko-haram insurgency are one way or the other associated with biodiversity, natural resource access and use (Ogbonnaya, U. M (2013).



6. A country report from the Harmonized Nigerian Living Standard Survey (2010), indicated a 62.60% poverty rate in the country, which points out that in Nigeria alone there are over a 100 million people living in out-right poverty. Literacy in Nigeria according to the CIA World Fact Book stands at 69.2% for male: 49.7% for female and the total population 59.6% (2015 est.).
7. According to UNESCO 2010, Education for Sustainable Development (ESD) empowers everyone to make informed decisions for environmental integrity, economic viability and a just society for present and future generations, while respecting cultural diversity. Furthermore stressing that, ESD is an integral part of human wellbeing, encompassing all forms of learning (formal and informal) from childhood to adult life.
8. Suggested theoretical solutions for the mitigation of biodiversity loss in Nigeria includes, the implementation of sustainable development, education for sustainable development (ESD), ecosystem valuation, ecosystem based adaptation, use of technology and mass media.
9. The data and survey methodology used in this research rests upon qualitative analysis and the interpretation of primary and secondary sources, this research covers from the period of year 2000 to 2015, due to insufficient information, limited availability of information, proximity and timeframe needed for the development of environmental and socio-economic trends in Nigeria.
10. The analysis of GDP data, environmental sustainability data and human development index, indicated that Nigeria is losing biodiversity at an alarming rate while the economy is booming. Nigeria experienced a substantial growth in gross domestic product with an increase of over 141.592 billion us dollars between the periods of 2005 to 2015, but unemployment remained high at 23.1 percent.
11. Analysis of the environmental sustainability of Nigeria in relation to selected countries and sub-regions, indicated that natural resource is depleting at a rate of 8.1 percent and forest loss at -51.2 percent, Nigeria had the worst statistics compared to selected

countries: Germany, Ghana, USA, Turkey and South Africa. Sub-regions include Sub Saharan Africa and Europe and Central Asia

12. Human development index for Nigeria was 0.514 index ratio in 2014 a very low ratio compared to selected countries which averaged higher ratios, life expectancy at birth, which gives a deeper insight into the living condition of people in a society, increased sluggishly from 48.7 years in 2005 to 52.8 years in 2014.

## **RECOMMENDATIONS**

This research paper has been able to identify the problems of biodiversity loss in Nigeria, analyze the economic, social and environmental indicators influencing economic development and human well-being in the country. The suggested solutions in this research is recommended for implementation as it encompasses global and local strategies that can be easily implemented. There's need for further research in the valuation of biodiversity in Nigeria and also research on the role of mass media in biodiversity conservation, as it will provide greater insight into the economic importance of biodiversity.

## References

1. Adeoye, N. O., & Ayeni, B. (2011). Assessment of deforestation, biodiversity loss and the associated factors: case study of Ijesa-Ekiti region of Southwestern Nigeria. *GeoJournal*, 76(3), 229-243.  
Retrieved from: <http://link.springer.com/article/10.1007/s10708-009-9336-z>
2. Adeyemo, O. K. (2003). Consequences of pollution and degradation of Nigerian aquatic environment on fisheries resources. *Environmentalist*, 23(4), 297-306. Retrieved from: <http://link.springer.com/article/10.1023%2FB%3AENVR.0000031357.89548.fb>
3. Akintunde, E. A., & Jambol, R. A. (2014). Conflict Induced Migration and its Impact on Land Resources in Plateau State, Nigeria. *Journal of Environment and Earth Science*, 4(18), 43-54.  
Retrieved from: <http://www.iiste.org/Journals/index.php/JEES/article/view/15910>
4. Anderson, A., & Strecker, M. (2012). Sustainable development: A case for education. *Environment: Science and Policy for Sustainable Development*, 54(6), 3-16.  
Retrieved from: <http://www.environmentmagazine.org/Archives/Back%20Issues/2012/November-December%202012/sustainable-full.html>
5. Armstrong, C. M. (2011). Implementing education for sustainable development: The potential use of time-honored pedagogical practice from the progressive era of education. *Journal of Sustainability Education*, 2.  
Retrieved from: <http://www.jsedimensions.org/wordpress/wp-content/uploads/2011/03/CosetteArmstrongEditedTABLESFIXED.pdf>
6. BBC News (2015) Science & Environment, *COP21 climate change summit reaches deal in Paris*. Retrieved from: <http://unesdoc.unesco.org/images/0019/001908/190898e.pdf>

7. Belokurova, V. B. (2010). Methods of biotechnology in system of efforts aimed at plant biodiversity preservation (Review). *Cytology and Genetics*, 44(3), 174-185.  
Retrieved from: <http://link.springer.com/article/10.3103/S0095452710030096>
8. Blench, R. (1998). *Biodiversity conservation and its opponents*. Overseas Development Institute.  
Retrieved from: <https://dlc.dlib.indiana.edu/dlc/bitstream/handle/10535/4162/32-biodiversity-conservation-opponents.pdf?sequence=1&isAllowed=y>
9. Bossel, H. (1999). *Indicators for sustainable development: theory, method, applications* (p. 138). Winnipeg: International Institute for Sustainable Development.  
Retrieved from: <https://www.iisd.org/pdf/balatonreport.pdf>
10. Chan, K. K. (1998). Mass media and environmental knowledge of secondary school students in Hong Kong. *Environmentalist*, 19(2), 85-97.  
Retrieved from: <http://link.springer.com/article/10.1023/A%3A1006636832732>
11. Chivian, E., & Bernstein, A. (2010). *How our health depends on biodiversity*. Boston, MA: Center of Health and the Global Environment, Harvard Medical School. Retrieved from:  
<http://www.plumblinestudio.com/chge/sites/default/files/resources/182945%20HMS%20Biodiversity%20booklet.pdf>
12. Christ, C. (2003). *Tourism and biodiversity: Mapping tourism's global footprint*. Conservation International (CI). Retrieved from:  
[http://www.jsdafrica.com/Jsda/V10N4\\_Spring2009/PDF/BiodiversityConservationProblems.pdf](http://www.jsdafrica.com/Jsda/V10N4_Spring2009/PDF/BiodiversityConservationProblems.pdf)
13. Central Intelligence Agency (CIA) (2015) *The World Factbook Nigeria*

Retrieved from: <https://www.cia.gov/library/publications/the-world-factbook/geos/ni.html>

14. Conniff, R. (2012). What's wrong with putting a price on nature? The Guardian.  
Retrieved from: <http://www.theguardian.com/environment/2012/oct/18/what-wrong-price-on-nature>.
15. Czech, B. (2003). Technological progress and biodiversity conservation: a dollar spent, a dollar burned. *Conservation Biology*, 1455-1457.  
Retrieved from: [http://www.jstor.org/stable/3588972?seq=1#page\\_scan\\_tab\\_contents](http://www.jstor.org/stable/3588972?seq=1#page_scan_tab_contents)
16. Dorji, T. (2007). Attitude towards Mass Media and its role in promoting Environmental Consciousness: An Empirical Investigation. Retrieved from:  
<http://www.bhutanstudies.org.bt/publicationFiles/ConferenceProceedings/MediaAndPublicCulture/M-19.pdf>
17. ECA, I., UNCTAD, U., & UNICEF. (2012). Social protection: a development priority in the post-2015 UN development agenda—thematic think piece. In UN System Task Team on the Post-2015 UN Development Agenda. Economic Commission for Africa, International Labour Organization, UN Conference on Trade and Development, UN Department for Economic and Social Affairs, and UNICEF. Retrieved from:  
<http://arabpost2015.org/system/USB/Reference%20documents/UN%20Task%20Team%20on%20the%20post2015%20Development%20Agenda/Thematic%20think%20pieces/16-Thematic%20think%20piece-social%20protection.pdf>
18. Ecological society of America (2012) Biodiversity  
Retrieved from: <http://www.esa.org/esa/wp-content/uploads/2012/12/biodiversity.pdf>
19. Evelyn, M. I., & Tyav, T. T. (2013). Environmental pollution in Nigeria: The need for awareness creation for sustainable development. *Journal of Research in Forestry, Wildlife and Environment*, 4(2), 92-105.

Retrieved from: <http://www.ajol.info/index.php/jrfwe/article/view/84726>

20. Federal Republic of Nigeria (2010) Fourth National Biodiversity Report, (CBD (2010)).  
Retrieved from: <https://www.cbd.int/doc/world/ng/ng-nr-04-en.pdf>
21. Fiebelkorn, F., & Menzel, S. (2013). Student teachers' understanding of the terminology, distribution, and loss of biodiversity: Perspectives from a biodiversity hotspot and an industrialized country. *Research in Science Education*, 43(4), 1593-1615. Retrieved from: <http://link.springer.com/article/10.1007/s11165-012-9323-0>
22. Food and Agriculture Organization of the United Nations (2015) Forests and poverty reduction (FAO (2015)). Retrieved from: <http://www.fao.org/forestry/livelihoods/en/>
23. Food and Agriculture Organization of the United Nations (2005) Global Forest Resources Assessment, Country reports, Nigeria (FAO (2005)).  
Retrieved from: <ftp://ftp.fao.org/docrep/fao/010/ai919E/ai919E00.pdf>
24. Food and Agriculture Organization of the United Nations (2008) State of plant genetic resources for food and agriculture in Nigeria (FAO (2008)). Retrieved from:  
<http://webcache.googleusercontent.com/search?q=cache:mlrav8ag8iwJ:www.fao.org/docrep/013/i1500e/nigeria.pdf+&cd=1&hl=lt&ct=clnk&gl=lt>
25. Global Footprint Network (2015) Nigeria. Picture retrieved from:  
<http://www.footprintnetwork.org/en/index.php/GFN/page/trends/nigeria/>
26. Global Forest Resources Assessment (2015) Nigeria (FRA (2015)).  
Retrieved from: <http://www.fao.org/3/a-az293e.pdf>
27. Grillo, R. J. (2014). Energy Recycling—Landfill Waste Heat Generation and Recovery. *Current Sustainable/Renewable Energy Reports*, 1(4), 150-156.

Retrieved from: <http://link.springer.com/article/10.1007/s40518-014-0017-2>

28. Hails, C. (2006) WWF's approach to conservation from its inception to 2006. WWF Global. Retrieved from:  
[http://wwf.panda.org/who\\_we\\_are/history/wwf\\_conservation\\_1961\\_2006/](http://wwf.panda.org/who_we_are/history/wwf_conservation_1961_2006/)
29. Harris, J. M. (2000). *Basic principles of sustainable development*. Medford, MA: Tufts University.  
Retrieved from: <http://econwpa.repec.org/eps/dev/papers/0106/0106006.pdf>
30. Helm, D., & Hepburn, C. (2012). The economic analysis of biodiversity: an assessment. *Oxford Review of Economic Policy*, 28(1), 1-21. Retrieved from:  
<http://oxrep.oxfordjournals.org/content/28/1/1.short>
31. Human Development Report (2015) Briefing note for countries on the 2015 Human Development Report, Nigeria Retrieved from:  
[http://hdr.undp.org/sites/all/themes/hdr\\_theme/country-notes/NGA.pdf](http://hdr.undp.org/sites/all/themes/hdr_theme/country-notes/NGA.pdf)
32. Human Development Report (2015) United Nations Development Program (HDR 2015)). Retrieved from: [http://hdr.undp.org/sites/default/files/hdr\\_2015\\_statistical\\_annex.pdf](http://hdr.undp.org/sites/default/files/hdr_2015_statistical_annex.pdf)
33. International Monetary Fund (2015) Nigeria economic statistics, (IMF (2015)). Retrieved from:  
<https://www.imf.org/external/pubs/ft/weo/2015/01/weodata/weoselgr.aspx>
34. International organisation for migration (2015) *Boko Haram May Have Displaced Over a Million in Nigeria: IOM* (IOM (2015)). Retrieved from: <https://www.iom.int/news/boko-haram-may-have-displaced-over-million-nigeria-iom>

35. Kassas, M. (2002). Environmental education: biodiversity. *Environmentalist*, 22(4), 345-351  
Retrieved from: <http://link.springer.com/article/10.1023/A:1020766914456>
36. Kemp, R. (2000). Technology and Environmental Policy—Innovation effects of past policies and suggestions for improvement. *Innovation and the Environment*, 35-61.  
Retrieved from:  
[https://books.google.lt/books?hl=lt&lr=&id=5YIHp5F\\_LWoC&oi=fnd&pg=PA35&dq=Kemp,+R.+%282000%29.+Technology+and+Environmental+Policy%E2%80%94Innovation+effects+of+past+policies+and+suggestions+for+improvement.+Innovation+and+the+Environment,+35-61.&ots=rJMHIQYv40&sig=t2EJOIaUL0URxDtrDsK3H5liqD0&redir\\_esc=y#v=onepage&q&f=false](https://books.google.lt/books?hl=lt&lr=&id=5YIHp5F_LWoC&oi=fnd&pg=PA35&dq=Kemp,+R.+%282000%29.+Technology+and+Environmental+Policy%E2%80%94Innovation+effects+of+past+policies+and+suggestions+for+improvement.+Innovation+and+the+Environment,+35-61.&ots=rJMHIQYv40&sig=t2EJOIaUL0URxDtrDsK3H5liqD0&redir_esc=y#v=onepage&q&f=false)
37. Kopnina, H. (2012). Education for sustainable development (ESD): the turn away from ‘environment’ in environmental education? *Environmental Education Research*, 18(5), 699-717. Retrieved from:  
<http://www.tandfonline.com/doi/full/10.1080/13504622.2012.658028>
38. Kopnina, H. (2013). Evaluating education for sustainable development (ESD): Using ecocentric and anthropocentric attitudes toward the sustainable development (EAATSD) scale. *Environment, development and sustainability*, 15 (3), 607-623.  
Retrieved from: <http://link.springer.com/article/10.1007/s10668-012-9395-z>
39. Kushwaha, V. S. 2015 MASS MEDIA IN DISSEMINATING ENVIRONMENTAL AWARENESS. Retrieved from:  
[http://granthaalayah.com/Articles/Vol3Iss9SE/71\\_IJRG15\\_S09\\_118.pdf](http://granthaalayah.com/Articles/Vol3Iss9SE/71_IJRG15_S09_118.pdf)
40. Li, L., & Loo, B. P. (2014). Alternative and transitional energy sources for urban transportation. *Current Sustainable/Renewable Energy Reports*, 1(1), 19-26.



Retrieved from:<https://www.ashgate.com/pdf/SamplePages/Sustainable-Railway-Futures-Ch1.pdf>

41. Ludwig, D. (2000). Limitations of economic valuation of ecosystems. *Ecosystems*, 3(1), 31-35. Retrieved from:  
<http://link.springer.com/article/10.1007%2Fs100210000007?LI=true>
42. Munang, R., Thiaw, I., Alverson, K., Mumba, M., Liu, J., & Rivington, M. (2013). Climate change and Ecosystem-based Adaptation: a new pragmatic approach to buffering climate change impacts. *Current Opinion in Environmental Sustainability*, 5(1), 67-71. Retrieved from:  
<http://www.sciencedirect.com/science/article/pii/S1877343512001881>
43. Markandya, A., Taylor, T., Longo, A., Murty, M. N., Murty, S., & Dhavala, K. (2008). Counting the cost of vulture decline—An appraisal of the human health and other benefits of vultures in India. *Ecological economics*, 67(2), 194-204.  
Retrieved from:  
<http://www.sciencedirect.com/science/article/pii/S092180090800178X?np=y>
44. McNeely, J. A. (1994). Lessons from the past: forests and biodiversity. *Biodiversity & Conservation*, 3(1), 3-20.  
Retrieved from: <http://link.springer.com/article/10.1007/BF00115329>
45. Meduna, A. J., Ogunjinmi, A. A., & Onadeko, S. A. (2009). Biodiversity conservation problems and their implications on ecotourism in Kainji Lake National Park, Nigeria. *Journal of Sustainable Development in Africa*, 10(4), 59-73.  
Retrieved from:  
<http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.504.9130&rep=rep1&type=pdf>
46. Meijaard, E. (2013) People's Perceptions about the Importance of Forests on Borneo.  
Retrieved from: <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3767661/>

47. National Bureau Of Statistics (2015) Nigeria- Harmonised Nigeria Living Standards Survey 2010. Retrieved from: <http://www.nigerianstat.gov.ng/>
48. National geographic (2005) Human migration guide 6-8. *What is human migration?* Retrieved from:  
<http://www.nationalgeographic.com/xpeditions/lessons/09/g68/migrationguidestudent.pdf>
49. Nigerian Fifth National Biodiversity report (2014) (CBD (2014)). Retrieved from:  
<https://www.cbd.int/doc/world/ng/ng-nr-05-en.pdf>
50. Nigeria Millennium Development Goals Report (2013) (MDGS)  
Retrieved from:  
[http://www.ng.undp.org/content/dam/nigeria/docs/MDGs/UNDP\\_NG\\_MDGsReport2013.pdf](http://www.ng.undp.org/content/dam/nigeria/docs/MDGs/UNDP_NG_MDGsReport2013.pdf)
51. Nwajiuba, C. (2012). Nigeria's agriculture and food security challenges.  
Retrieved from:  
[http://us.boell.org/sites/default/files/downloads/4\\_Green\\_Deal\\_Nigeria\\_AGRICULTURE.pdf](http://us.boell.org/sites/default/files/downloads/4_Green_Deal_Nigeria_AGRICULTURE.pdf)
52. United Nations Decade of Education for Sustainable Development 2005-2014 (2010) Education for Sustainable Development Lens: A Policy and Practice Review Tool (UNESCO (2010)).  
Retrieved from: <http://unesdoc.unesco.org/images/0019/001908/190898e.pdf>
53. *OECD (2012) Environmental Outlook to 2050. The Consequences of Inaction*, OECD Publishing.  
Retrieved from: [http://www.oecd-ilibrary.org/environment/oecd-environmental-outlook-to-2050\\_9789264122246-en](http://www.oecd-ilibrary.org/environment/oecd-environmental-outlook-to-2050_9789264122246-en)

54. Ogbonnaya, U. M., & Ehigiamusoe, U. K. (2013). Niger Delta Militancy and Boko Haram Insurgency: National Security in Nigeria. *Global Security Studies*, 4(3), 1-14.  
Retrieved from: <http://globalsecuritystudies.com/Ogbannaya%20Niger-AG.pdf>
55. Olukunle, O. T. (2013). Challenges and Prospects of Agriculture in Nigeria: The Way Forward. *Journal of Economics and Sustainable Development*, 4(16), 37-45.  
Retrieved from: <http://www.iiste.org/Journals/index.php/JEDS/article/view/8461>
56. Olajire, A. A. (2013). CO<sub>2</sub> capture by aqueous ammonia process in the clean development mechanism for Nigerian oil industry. *Frontiers of Chemical Science and Engineering*, 7(3), 366-380.  
Retrieved from: <http://link.springer.com/article/10.1007/s11705-013-1340-7>
57. Pascal, U., Muradian, R., Brander, L., Gomez-Baggethun, E., Martin-Lopez, B., Berma, M., & Christie, M. (2010). TEEB Chapter 5 The Economics of Valuing Ecosystem Services and Biodiversity. *The Economics of Ecosystems and Biodiversity*. Retrieved from: <http://teebweb.org/wp-content/uploads/2013/04/D0-Chapter-5-The-economics-of-valuing-ecosystem-services-and-biodiversity.pdf>
58. Peng, Y. S., & Lin, S. S. (2009). National culture, economic development, population growth and environmental performance: The mediating role of education. *Journal of Business Ethics*, 90(2), 203-219.  
Retrieved from: <http://link.springer.com/article/10.1007/s10551-009-0036-x>
59. Pradeep, S. M. (2010) Facilitating Sustainable Development in the Developing World  
Retrieved from: [http://www.cuts-citee.org/pdf/Briefing\\_Paper10-Facilitating\\_Sustainable\\_Development\\_in\\_the\\_Developing\\_World.pdf](http://www.cuts-citee.org/pdf/Briefing_Paper10-Facilitating_Sustainable_Development_in_the_Developing_World.pdf)

60. Pyagbara, L. S. (2007). The adverse impacts of oil pollution on the environment and wellbeing of a local indigenous community: the experience of the Ogoni people of Nigeria. In International Expert Group Meeting On Indigenous Peoples And Protection Of The Environment. Document retrieved from:  
[http://www.un.org/esa/socdev/unpfii/documents/workshop\\_IPPE\\_pyagbara](http://www.un.org/esa/socdev/unpfii/documents/workshop_IPPE_pyagbara)
61. Pyakuryal, B. (2009) Submitted to. Fourth Session of the Technical Committee of APCAEM. Retrieved from:  
<http://www.unapcaem.org/activities%20files/a0902/studyongreentech.pdf>
62. Radzi, A., & Droege, P. (2014). Latest Perspectives on Global Renewable Energy Policies. *Current Sustainable/Renewable Energy Reports*, 1(3), 85-93.  
Retrieved from: <http://link.springer.com/article/10.1007/s40518-014-0014-5>
63. Rodríguez-Labajos, B., & Martínez-Alier, J. (2013). The economics of ecosystems and biodiversity: recent instances for debate. *Conservation and Society*, 11(4), 326.  
Retrieved from: <http://www.conservationandsociety.org/article.asp?issn=0972-4923;year=2013;volume=11;issue=4;spage=326;epage=342;aulast=Rodr%EDguez-Labajos>
64. Rogers, H., & Pouffary, S. (2014). Climate finance for cities and buildings: a handbook for local governments.  
Retrieved from: <http://bibliotecavirtual.minam.gob.pe/biam/handle/minam/1909>
65. Shabir, G., Farooq, U., Amin, R. U., & Chaudhry, A. W. (2013). MASS MEDIA, CULTURE & SOCIETY WITH THE PERSPECTIVE OF GLOBALIZATION, MODERNIZATION AND GLOBAL CULTURE. *Asian journal of social sciences & humanities*, 2(3), 479-484. Retrieved from:  
<http://www.ajssh.leena-luna.co.jp/AJSSHPDFs/Vol.2%283%29/AJSSH2013%282.3-52%29.pdf>

66. Schewe, R. L., & Stuart, D. (2015). Diversity in agricultural technology adoption: How are automatic milking systems used and to what end?. *Agriculture and Human Values*, 32(2), 199-213.  
Retrieved from: <http://link.springer.com/article/10.1007/s10460-014-9542-2>
67. Show, K. Y. (2010). Green Technology. Department of Environmental Engineering.  
Retrieved from: <http://www.eolss.net/sample-chapters/c05/e6-35-55-00.pdf>
68. Siddiqi, A., & Fletcher, S. (2015). Energy Intensity of Water End-Uses. *Current Sustainable/Renewable Energy Reports*, 2(1), 25-31.  
Retrieved from: <http://link.springer.com/article/10.1007/s40518-014-0024-3>
69. Soaga, J. A., Adegbenjo, A. E. H., & Oladejo, A. D. (2014). Economic inequality and biodiversity loss in eriti community forest wetlands, Ogun State, Nigeria. *Advances in Forestry Science*, 1(3), 89-93.  
Retrieved from: <http://200.129.241.78/index.php/afor/article/view/1733>
70. Sokari-George, E. (1987). Planning in Nigeria: The agricultural base 1962-1985. *GeoJournal*, 14(1), 97-108. Retrieved from:  
<http://link.springer.com/article/10.1007/BF02484702>
71. Su, T., & Zhang, E. (2007). Ecosystem valuation and the conservation of wild lands in vigorous economic regions: A case study in Jiuduansha Wetland, Shanghai. *Chinese Science Bulletin*, 52(19), 2664-2674.  
Retrieved from: <http://link.springer.com/article/10.1007/s11434-007-0414-7>
72. Sukhdev, P., Wittmer, H., & Miller, D. (2014). The Economics of Ecosystems and Biodiversity-TEEB: Challenges and Responses. *Nature in the Balance: The Economics of Biodiversity.* Oxford University Press, Oxford. Retrieved from:  
<http://img.teebweb.org/wp-content/uploads/2014/09/TEEB-Challenges-and-Responses.pdf>

73. Suzuki, D. (2015) (authors quote).  
Retrieved from: [http://www.brainyquote.com/quotes/authors/d/david\\_suzuki.html](http://www.brainyquote.com/quotes/authors/d/david_suzuki.html)
74. Sypsas, A., Tsitsanoudis–Mallidis, N., Dromantiene, L., & Pange, J. (2013). The role of the media in the enhancement of the environmental awareness. In *Innovative Practices in Biotourism, Prespa–Conference Proceedings* (pp. 66-72). Retrieved from:  
[http://www.academia.edu/6853467/The\\_role\\_of\\_the\\_media\\_in\\_the\\_enhancement\\_of\\_environmental\\_awareness](http://www.academia.edu/6853467/The_role_of_the_media_in_the_enhancement_of_environmental_awareness)
75. Tambo, J. A., & Abdoulaye, T. (2012). Climate change and agricultural technology adoption: the case of drought tolerant maize in rural Nigeria. *Mitigation and Adaptation Strategies for Global Change*, 17(3), 277-292.  
Retrieved from: <http://link.springer.com/article/10.1007/s11027-011-9325-7>
76. TEEB, T. (2009). *The Economics of Ecosystems and Biodiversity for National and International Policy Makers—Summary: Responding to the Value of Nature 2009*. Retrieved from: [http://www.teebweb.org/media/2009/11/National-Executive-Summary\\_English.pdf](http://www.teebweb.org/media/2009/11/National-Executive-Summary_English.pdf)
77. The World Bank (2014) Nigeria GDP Annual Growth. Retrieved from:  
<http://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG/countries/NG?display=graph>
78. Travers, A., Elrick, C., Kay, R., Vestergaard, O., Olhoff, A., Mills, A. & Dews, G. (2012). *Ecosystem-based Adaptation Guidance: Moving from Principles to Practice*, working document: April 2012. Retrieved from:  
[http://www.unep.org/climatechange/adaptation/Portals/133/documents/Ecosystem-Based%20Adaptation/Decision%20Support%20Framework/EBA%20Guidance\\_WORKING%20DOCUMENT%2030032012.pdf](http://www.unep.org/climatechange/adaptation/Portals/133/documents/Ecosystem-Based%20Adaptation/Decision%20Support%20Framework/EBA%20Guidance_WORKING%20DOCUMENT%2030032012.pdf)
79. UNFPA 2014, *The State of World Population 2014, The Power of 1.8 Billion: Adolescents, Youth and the Transformation of the Future* Retrieved from:  
<http://eeca.unfpa.org/news/power-18-billion>

80. Van Dijk, T. A. (1995). The mass media today: Discourses of domination or diversity?. *Javnost-The Public*, 2(2), 27-45. Retrieved from:  
<http://www.discourses.org/OldArticles/The%20mass%20media%20today.pdf>
81. Viglianisi, F. M., & Sabella, G. Biodiversity, Environmental Education and Social Media. Retrieved from:  
[http://www.biodiversityjournal.com/pdf/2%284%29\\_195-200.pdf](http://www.biodiversityjournal.com/pdf/2%284%29_195-200.pdf)
82. Viswanath, K., Ramanadhan, S., & Kontos, E. Z. (2007). Mass media. In *Macrosocial determinants of population health* (pp. 275-294). Springer New York. Retrieved from:  
[http://link.springer.com/chapter/10.1007/978-0-387-70812-6\\_13](http://link.springer.com/chapter/10.1007/978-0-387-70812-6_13)
83. Zabbey, N. E. N. I. B. A. R. I. N. I. (2004, September). Impacts of extractive industries on the biodiversity of the Niger Delta region, Nigeria. In *Conference Proceedings: National Workshop on Coastal and Marine Biodiversity Management*, Pyramid Hotel, Calabar, Nigeria (pp. 7-9). Retrieved from:  
<https://scholar.google.lt/scholar?hl=lt&q=Zabbey%2C+N.+E.+N.+I.+B.+A.+R.+I.+N.+I.+%282004%2C+September%29.+Impacts+of+extractive+industries+on+the+biodiversity+of+the+Niger+Delta+region%2C+Nigeria.+In+Conference+Proceedings%3A+National+Workshop+on+Coastal+and+Marine+Biodiversity+Management%2C+Pyramid+Hotel%2C+Cal&btnG=>
84. Zainutdinova, K. K., & Lutpullaev, S. L. (2011). Solar power and the possibility of socio-economic development in the remote and mountainous areas of Uzbekistan. *Applied Solar Energy*, 47(4), 327-335.  
Retrieved from: <http://link.springer.com/article/10.3103/S0003701X11040153>