

## SUB-THEME 8



Cross-Sectoral Issues in Management of the  
Mangroves and Wetlands



## **MANAGEMENT OF FOREST RESERVES AND PROTECTED AREAS IN NIGERIA USING SPACE TECHNOLOGY**

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### **Abstract**

This paper focuses on the Management of Forest Reserves and Protected Areas in Nigeria Using Space Technology. The paper further examined the concepts of science, technology, sustainable development as well as contributions of science and technology to sustainable forest development and the roles of forests. Though conservation efforts have a long history in the country, achievements are not encouraging. The implementation of the policy has not achieved the desired result of properly conserving the country's biodiversity; a variety of plants and animals in the country are seriously threatened today. Massive deforestation, desertification and large-scale erosion continue in various parts of the country. Various problems have been identified as obstacles to effective conservation in the country. These include the problems of inadequate data on the status of biodiversity, uncoordinated land-use policy and inadequate allocation of funds and manpower. There is also the problem of the high rate of rural and urban poverty in the country, which makes enforcement difficult. Various measures are suggested to promote better environmental forestry and wildlife conservation. These include improving the legal frameworks for conservation management in the country and expanding research into forest biology and economics. Other solutions proffered are the provision of basic education on conservation for the general population and the proper funding of protected areas and conservation programmes in the country. Furthermore, it is expedient to state that more than half of the world's forests perished before international concern mounted to where it is today.

**Keywords:** Protected areas, Forest Reserves, Geographic Information Systems, Space Technology.

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### **Introduction: Applications of Geographic Information Systems and Remote Sensing Technologies in Forestry**

Geographic Information Systems (GIS) can be defined as a multipurpose computer-based information system for retrieval, administration and processing of integrated analysis of geographic, cartographic and statistical information of any kind and combination of data that are geospatially referenced to the earth, and are defined in terms of time and space.

In addition, Ayeni (1998) underscored the usefulness of GIS for various purposes, some of which are monitoring, forecasting, service planning, resource management, network management, public protection/ security system, property development and investment as well as education. Remote sensing involves the capturing of data from a far place, and this is done via the use of aerial photography and satellite imageries.

Remote sensing techniques (including aerial photography and satellite imagery) have been used successfully for forest mapping and monitoring, thereby making it possible to cover large areas consistently and cost effectively. New technologies address technical challenges such as the variable height, structure, density and composition of forests. Airborne light detection and ranging using lasers can provide highly accurate estimates of tree cover and height, it can even assess the shape of individual trees. Space-borne radar (radio detection and ranging) is a promising new way to obtain estimates of stand volume and biomass and can penetrate clouds, overcoming some of the limitations of optical satellite sensors. New spectral sensing systems can measure a wide array of land and vegetation characteristics, making it possible to assess a range of forest attributes, helping to improve mapping of forest pests and diseases, for example.

### **The State of the Nigerian Forest**

Nigeria is covered by three types of vegetation namely forests (where there is significant tree cover), savannas (insignificant tree cover, with grasses and flowers located between trees), and montane land. Structurally, the tropical rainforest of Nigeria can be grouped into three, viz: tree layers, shrub layer and the undergrowth, which are all of economic value. The forests are dominated by tree species such as *Triplochiton scleroxylon* (African maple obeche), *Mansonia altissima* (mansonia), *Erioboma oblonga* (gum tree), *Milicia excelsia* (iroko), *Terminalia superba* (afara) and *Khaya grandifolia* (broad- leaf mahogany) among others (Oriola, 2009).

Nigeria's biodiversity of 899 species of birds, 274 mammals, 154 reptiles, 53 amphibians and 4,715 species of higher plants is strongly affected by the negative impacts of deforestation. The numbers of the rare Cross- River gorilla have decreased to around 300 individuals because of poaching by locals and mass destruction (Wikipedia, 2011). Other effects of deforestation include soil erosion, loss of biodiversity climate change, flooding and drought, disruption of the water cycle, etc.

For all practical purposes, there are very insignificant carbon sequestration strategies through afforestation activity in Nigeria as at now (Salami, 2011). It is against this background that the Federal Government of Nigeria directed the Ecological Fund Office (EFO) in 2009 to channel 60% of the Ecological Fund towards mass afforestation programme in Nigeria (a project in which the Forestry Research Institute of Nigeria, FRIN is a partaker, Badejo, 2011), in an attempt to combat the climate change crisis.

Forestry is one sector within the Clean Development Mechanism (CDM, which is a project created by the UN climate organizations so that developing countries can participate in combat against climate change). On account of the CDM project, Nigeria could become a major beneficiary of carbon finance through restoration of millions of hectares of forest cover on heavily degraded land where forest cover was previously found, and which has been left largely denuded.

From the foregoing, studies were carried out by Salami et al (2011) on climate change mitigation through reforestation. The study revealed climate and fiscal benefits. As regards the climate, it was observed that a 100% reforestation scenario would lower the projected increase in temperature by more than 0.8°C in North-Western Nigeria, and by more than 0.6°C over the entire country. In addition, rainfall would increase by more than 10% in the north, but decrease by 10 % in the South. The evapotranspiration and relative humidity would also increase over the entire country.

Many developing countries, like Nigeria, are suffering from serious environmental degradation primarily because of the rapid growth in population which has not only brought about gross encroachment and damage to natural forest, wildlife, land, water and even air but has also brought unacceptable quality of life conditions in the human community environment (Harvey, 1998).

Thousands of years of cutting and burning have so transformed the Nigerian vegetation that it bears little resemblance to its original forest state in which tree cover was probably denser than it is today (Husain, 1989). Concern is rising about the rapid rate of tropical deforestation, which is the temporary or permanent clearance of forest, for agriculture and other purposes.

The main cause of deforestation in tropical forests is clearing for agriculture to feed the growing population or (to a lesser degree) to earn foreign exchange from export of cash crops (Husain, 1989). Every year about 6.1 million hectares of tropical moist forests are destroyed (Husain, 1989). If the present rate of deforestation of 6.1 million hectares per year were to continue indefinitely, the tropical moist forests would be completely cleared in 170 years (Omiyale, 2001). Cote d'Ivoire and Nigeria annually lose about 5.2 per cent of their forests, while in Costa Rica, Sri Lanka and El Salvador the rates are 3.6 per cent, 3.5 per cent and 3.2 percent respectively (Omiyale, 2001). Out of the total land area of 923.768 km<sup>2</sup> in Nigeria, forests account for only 9.61%; 48.53% grassland; 1.05% fresh and inland wetlands; 0.3% tree crop plantations and 20.33% farmlands (Omiyale, 2001). Within the past 20 years, an estimated 43. 48% of the total forest ecosystem has been lost through human activities (Omiyale, 2001). Between 1980 and 1990, according to Omiyale (2001), the annual rate of deforestation averaged 3.5 % and the forest area declined from 14.9 million to 10.1 million hectares. This leads to the loss of not only the

wood and non wood forest products but also its vital functions in moderating local climate, controlling water and wind erosion and its insurance of a continuous flow of clean water in rivers and streams (Nwoboshi, 1989). Omiyale (2001) further stressed that this has led to soil degradation, water contamination, and microclimate change, drying up of rivers and lakes and the depletion of wildlife. For now, barely 5.34 % of the total land area of Nigerian is under forest as against the international requirement that 25 % of the total land area of each country should be under forest (Popoola and Akande, 2001).

Since prehistoric times, forest serves various purposes and will continue to do so as long as life continues on this planet (Abbiw, 1989). The forest houses and protects game, stabilizes the environment, prevents soil erosion and serves as a source of medicinal plants for curing diseases. Forests also provide the greatest diversity of plant life, yet they continue to be felled and burned and seldom replaced. The importance of forest and forestry in the development of our national economy has been widely reported in literature (e.g. Adeyoju, 1975, 2001 and Akindele 2001). In many parts of Nigeria, the forestry sector contributes significantly to the country's internally generated revenue (IGR) (Akindele, 2001). Between 1996 and 2001, this sector generated N608,460,455.78 from the sales of timber alone (Ajayi, 2001).

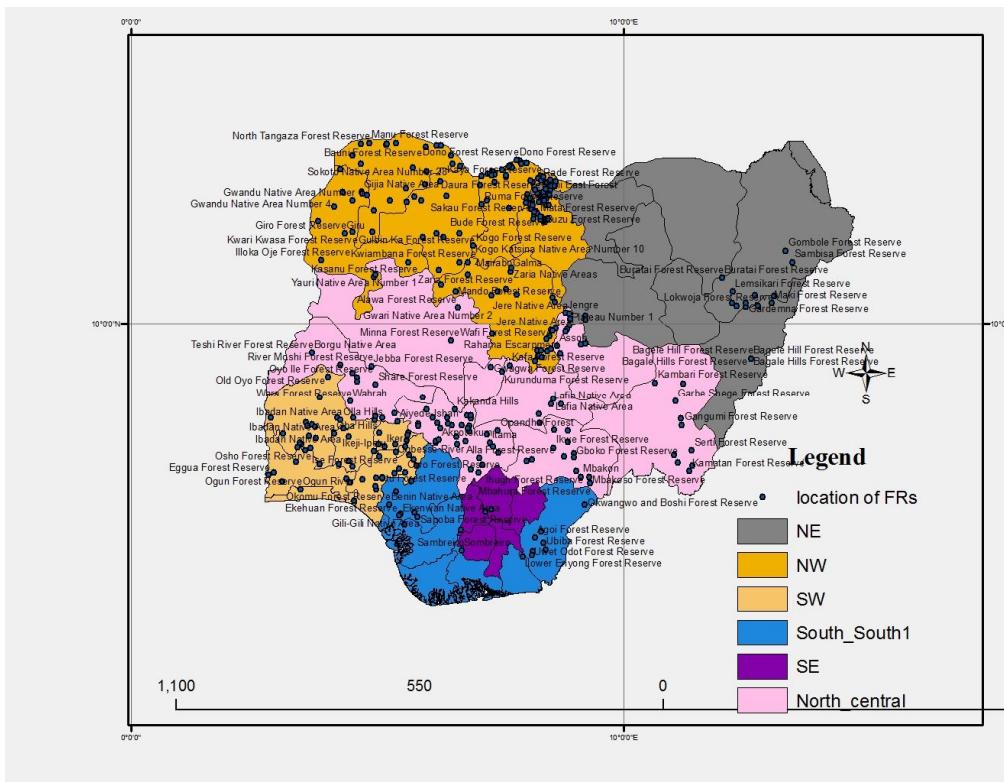
However, the resources inside the natural forest as well as those in the various plantation sites have been battered by de-reservation for tree crop plantations or large scale illegal farming operations, all of which the state forestry authorities have been unable to curtail or manage (Adeyoju, 2001).

### **The Study Area**

Nigeria covers a total area of 923,768 km square with a population of 140,431,790 in 2006 (NPC 2009). As a result of its large land area, the country covers different climatic and ecological zones. Nigeria is rich in biodiversity, with an array of fauna and flora. This includes about 20,000 species of insects, almost 1,000 species of birds, 247 species of mammals, 123 species of reptiles, about 1,000 species of fish and about 7,895 species of plants (Federal Government of Nigeria 2001). The policy on Forestry, Wildlife and Protected areas is part of the broad National Policy on the Environment was developed in 1989 (Federal Republic of Nigeria 1989) and later revised in 1999 (Federal Government of Nigeria 2001). The main goal of the policy is to achieve sustainable development in the country with particular emphasis on the following:

- Maintaining environmental quality adequate for the health and wellbeing of all Nigerians.
- Conserving the environment and natural resources to benefit present and future generation of Nigerians.

- Restoring, maintaining and enhancing the ecosystems and ecological processes which are necessary for proper functioning of the environment.
  - Raising public awareness and promoting public understanding of the important linkages between the environment and development.
  - Cooperating with other countries and international organizations to preserve the environment.



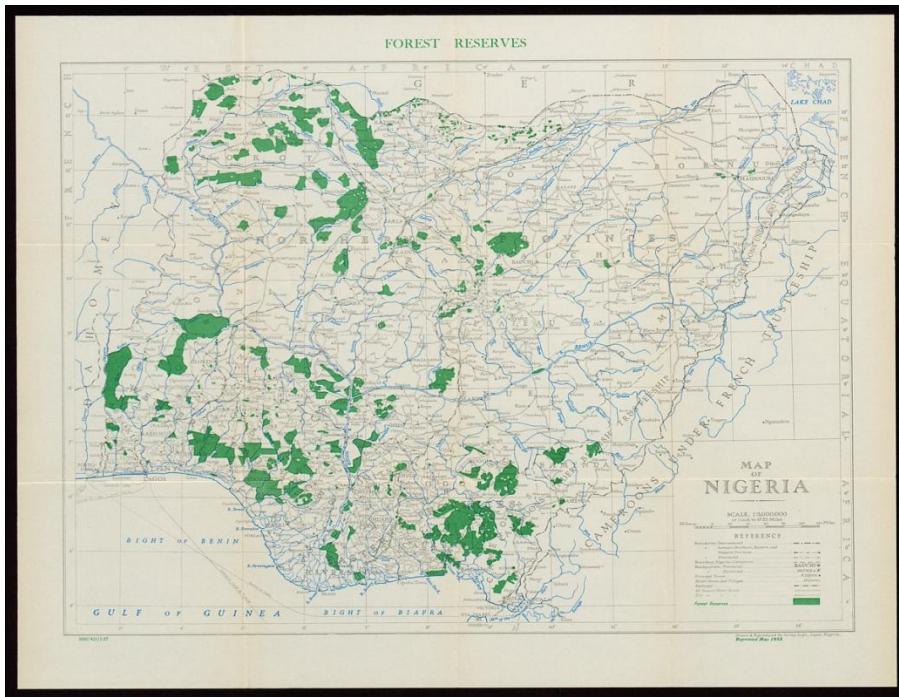
**Fig. 1: Digitized Map of Nigeria Showing the Forest Reserves**

Apart from the broad policy goals stated above, some specific strategies for achieving these goals in relation to the Policy on Forestry, Wildlife and Protected Areas include:

- To encourage “rational exploitation” of our forest resources to satisfy local consumption and attain a significant export level in the long term.
  - Regulation of forestry activities to ensure “conservation and environmentally sound management practices”.

- Strengthening of forest protection activities in marginal areas to prevent harmful changes in such areas.
  - Encouraging afforestation and reforestation programmes with the aim of reversing the effects of deforestation.
  - Supporting Non-Governmental Organizations (NGOs) and tree planting programmes of local communities.
  - Supporting the development of other alternative sources of energy while encouraging the development of more efficient way of wood energy utilization (Federal Republic of Nigeria 1989).

This is a regulatory policy aimed at protection and conservation. It came about because of the need to ensure the survival, protection and proper management of forests and wildlife for the use of the present and future generations.



**Fig. 2: Map of Nigeria Showing Protected Areas**

## **The Rational behind Conservation**

For a better understanding of the government's policy on forestry, wildlife and protected areas, it is important to consider the conditions that necessitated state intervention in this environmental issue.

First, there was the problem of increasing deforestation as a result of farming, construction and lumbering activities. There was therefore, the need to prevent the total destruction of forests in the country. Secondly, the rapid rate of soil degradation and desertification especially in marginal areas was another important reason for a positive action towards conserving the natural environment. Cultivation, cutting of firewood, and firing of the bush for farming and game was destroying the natural vegetation cover and exposing the soil to erosion. Thirdly, there was the need to control the rapid rate of destruction of wild animals especially with the increasing danger of extinction of some species. Finally, it was realized that creation of game reserves could turn such areas into tourist centres.

The categories of protected areas in Nigeria today are:

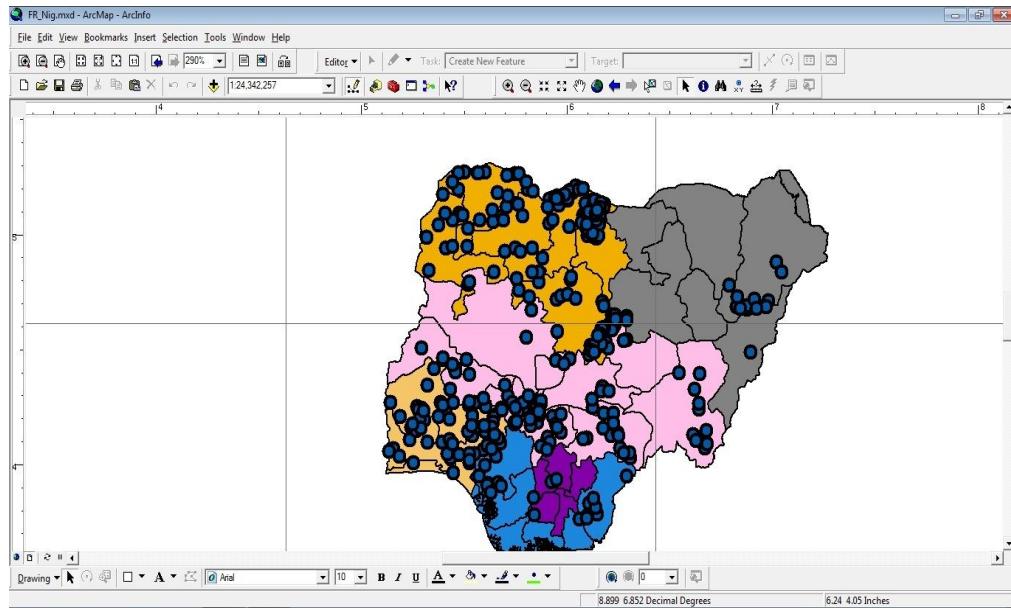
**National Parks:** These consist of areas of ecological and cultural importance where human habitation is not allowed but tourism is encouraged. Nigeria used to have eight National Parks but, this has been reduced to seven with the reversion of the Yankari National Park to a State game reserve. National Parks are managed by the Federal Ministry of Environment through the National Parks Service.

**Game Reserves:** These include Wildlife Parks and Wildlife Sanctuaries established by State Governments to protect wildlife. There are 15 game reserves in the country today, most of which are poorly managed.

**Forest Reserves:** Forest reserves are areas designated by state governments for the protection of timber and other forest resources. Harvesting of timber may be allowed under permit and under special concession to people in surrounding communities. Harvested timbers are mostly replaced with exotic tree species. Most of these forest reserves are also poorly managed by the various State Ministries of Agriculture and Natural Resources.

### **The Study Area**

The Federal Republic of Nigeria is located between latitudes 4°N and 14°N, and longitudes 3°E and 15°E. It lies wholly within the tropics along the Gulf of Guinea, on the west coast of Africa. It is bounded on the west by the Republic of Benin, on the north by the Republic of Niger and on the east by the Republic of Cameroon and on the south by the Atlantic Ocean. The country has a total length ( north-south) of about 853 km. Nigeria, which is the most populous black nation in the world, has a population of over 140 million (NPC, 2006) . With a total area of about 923,768.64 Sq kilometres (356,669 sq miles), the country occupies about 14% of West Africa, but supports more than 60% of the population of the region. Nigeria, one of the largest countries in Africa, has 36 states and 774 LGAs and Abuja as the Federal Capital city.



**Fig. 3: Map of Nigeria Showing Forest Reserves Produced with GIS Technology**

#### Some Selected Protected Areas in Nigeria

**Jos Wildlife Park:** The park at Jos, often also called the Jesse Aruku Wildlife Park, is relatively small, covering just 8 square kilometres / 3 square miles of land. Nevertheless, its wooded hills and forest streams make it an ideal place to spot many different sorts of animals and birds, including pigmy hippos, lions and buffalos. The well-kept facilities at the Jos Wildlife Park include picnic spots.

**Yankari National Park:** Yankari first opened its gates to the public in 1962, but it wasn't until the early 1990s that it officially became a national park. Over the years, the park has become one of the most popular in Nigeria, attracting thousands of annual visitors. The landscape includes woodland, rolling hills and savannah grassland. Animals that can be spotted include elephants, olive baboons, hippos, waterbuck, hartebeest and lions. Over 300 bird species also make Yankari their home, while the four thermal springs are an added visitor attraction. Facilities include Wikki Camp, a small museum and restaurant. The main entry point is in the village of Mainamaji, near Dindima.

**Cross River National Park:** The Cross River National Park is widely regarded as one of the richest areas of rainforest in the whole of West Africa. Created with the help of the World Wide Fund for Nature, the park is divided into two sections - the Oban Hills Division and the Okwangwo Division. The Cross River is known for its numerous

species of plants and birds, and is also home to over three-quarters of the primate species that can be found in Nigeria. These include western gorillas and chimpanzees. Other wild animals found in the park include African forest elephants, which are currently on the endangered animal list.

**Gashaka Gumti National Park:** Address: Adamawa State/Taraba State, Nigeria, NG, Africa.

Created after the combining of two existing reserves in the early 1990s, the Gashaka Gumti National Park currently ranks as the country's biggest, covering a vast area of just over 6,400 square kilometres/2,470 square miles. The southerly region comprises a particularly rugged and undulating terrain, being where you will find the Chappal Waddi – the tallest mountain in the whole of Nigeria, measuring in at around 2,419 metres/7,936 feet in height. Even during the West African dry season, the Gashaka Gumti sees a decent river flow, supporting an assortment of wildlife and some extremely colourful birds.

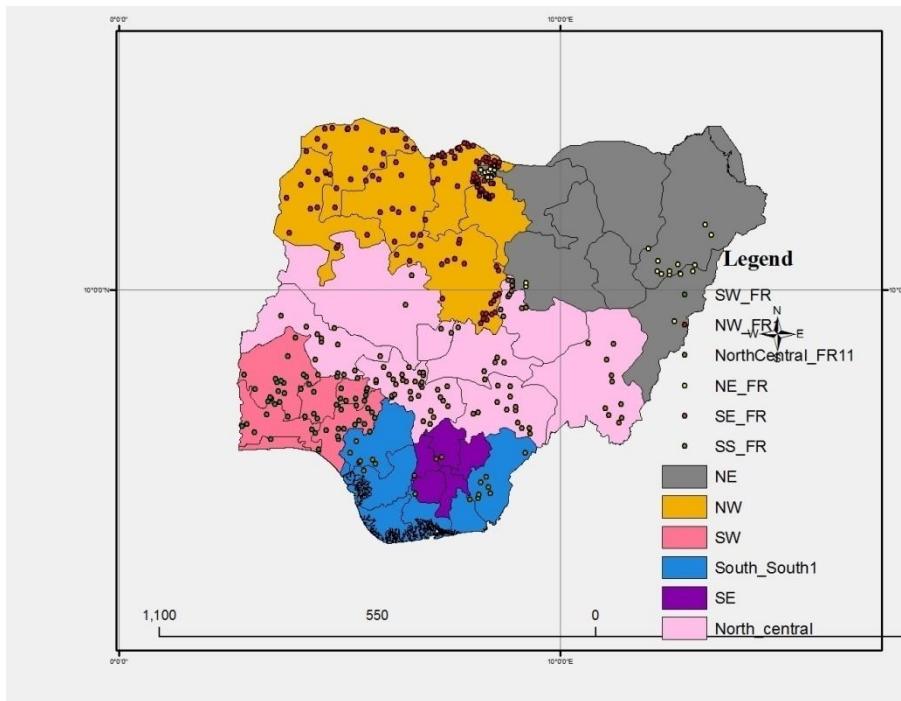
**Chad Basin National Park:** Located on the north-eastern side of Nigeria and covering areas in Borno and Yobe States, the Chad Basin National Park is spread over a little more than 2,250 square kilometres/870 square miles and is made up of a number of distinct regions, such as the Bade Nguru Wetlands and the Chingurmi Duguma area. Visitor numbers tend to be fairly low, since the animals here are considered relatively common and therefore rather unappealing to many.

**Kamuku National Park:** Encompassing roughly 1,100 square kilometres / 425 square miles, the Kamuku National Park is home to an archetypal Sudanian Savanna ecology and landscape, with large flat expanses sloping towards the easterly Birnin Gwari Ridge. Many attractions reside here, including the Dogon Ruwa Waterfalls and the Tsauuin Rema hill, as well as the isolated Goron Dutse rocky outcrop, which boasts distinctive black and white patterns. Wildlife is in good supply at the Kamuku, with particular highlights including antelope, baboons, elephants, hartebeest, monkeys and birds.

**Kainji Lake National Park:** The Kainji Lake National Park can be found some 560 km / 348 miles north of the city of Lagos and fairly near to Nigeria's border with Benin. The park has two sectors, the Borgu Game Reserve and the Kigera Sector, both of which surround Kainji Lake. Kainji is home to a rich variety of wildlife, such as baboons, hippos, hyenas and warthogs. There are plenty of activities to be found within the national park's boundaries, including boat cruises and wilderness treks.

**Old Oyo National Park:** This is located in Southern Kwara State / Northern Oyo State, Nigeria. Easily accessible and covering approximately 2,500 square kilometres / 965 square miles, the Old Oyo National Park is home to a large number of bushbuck antelope

and buffalos, together with countless bird species. Tourism is promoted in the surrounding tourist destinations of Igbedi, Igboho, Iseyin, Saki, Sepeteri and Tede, where many attractions await visitors. In the park itself are granite outcrops, large caves and several prominent rivers (Ogun, Owe, Owu and Tessi).



**Fig. 4: Geo-Political Distribution of Forest Reserves in the Study Area**

### Conclusion

The Nigerian national policy on Forestry, Wildlife and protected Areas, is aimed at the protection and sustainable management of the flora and fauna of the country. While Nigeria is rich in biodiversity, the reckless destruction of its forests and wild animals, which necessitated state intervention to protect the environment, still continues today. Indiscriminate destruction of the flora and fauna of the country continues in virtually every part of Nigeria. Today, many species of Nigerian plants and animals are either threatened or endangered and at the same time, soil degradation, erosion and desert encroachment continue in various parts of the country. Problems, such as inadequate data on the status of biodiversity, uncoordinated land use policy, absence of well-defined

programmes, inadequate funding and high poverty levels in the country remain the major constraints against the success of the policy.

Improving forestry and wildlife management in Nigeria must therefore begin with the development of a proper legal and political framework for conservation management. Other measures include providing basic education on conservation for the general population of Nigeria. There is also the need to address the issue of poverty by providing proper economic incentives to improve the well-being of people around protected areas. This should however, go on hand in hand with the provision of adequate funding and staffing of protected areas in the country.

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