

# Geospatial Information For Sustainable Forest Management In Ekiti State

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## ABSTRACT

Environmental resources management is becoming a burning issue in local, regional and global discourse. Similarly, the power and influence of the masses in attitudinal change are appreciated especially in this era of globalization. It then follows logically that Geospatial Information technique is a powerful tool for addressing the issue of forest management sustainability in Ekiti State. Both primary and secondary sources of data were adopted for carrying out this research using random sampling techniques. This paper evaluates the environmental and management problems associated with natural resources use in developing countries. It identifies greed and ignorance as mutually reinforcing factors that have exacerbated resources degradation, and contends for the forest resources to be effectively managed for sustainable economic development and environmentally friendly. The proposed attitudinal change must be in place; and mixture of both traditional and modern Geospatial information technique be utilized. The credibility of information dissemination through Science and Technology must be boosted, research-based, legally backed and logically presented. These would facilitate effective management through preservation and conservation of forest reserves, eliminate sharp practices that cart away the resources, degrade the environment and thus allow promotion of sustainable forest management and development in Ekiti State in this twenty first century.

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## 1.0 INTRODUCTION

Forest is the next most important resource of nature on earth after air and water. It is one of the world's most abundant resources dominated by trees, predominantly plant community, occupying an extensive area of land and it is home to at least two-third of the world's living organisms. Forest resources do essentially support life on earth by absorbing carbon dioxide and releasing oxygen thereby maintaining a delicately balanced ecosystem. Forests are sources of food, medicine, timber and many other products. They play protective roles against soil erosion, drought, flood and intensive radiation. However, clearing of forest trees for agriculture, overgrazing, wildlife charcoal production and over exploitation of wood resources for timber and pole is at alarming rate (Zaku et al,2013). Akande (1994) reveals that in the last 10,000 years, human beings have significantly influenced land surface characteristics by altering forest vegetation because they are highly susceptible to man's interference and could easily be destroyed by man. Popoola (2016) lamented that Nigeria had lost 21% of its forest reserves because man is an 'Homo vandalus' species. Forest resources, among others, are invaluable resources with enormous advantages socially, economically and environmentally being valuable to man and his environment. Ekiti State's economy is hinged on the natural resource within her environment and because of this, forest is at greater risk because of over exploitation in which the resource is prone to. The over-exploitation comes as a result of greed and ignorance, especially, the rate of illegal exploitation, which this forest resource is subjected to in most part of Ekiti land and in her forest reserves called for sustainable management because of the ripple effect on man and his environment in time like this (WCED,1987). Tropical rainforest contributes a lot to housing global biodiversity and accommodate 50% of all species in the world while occupying only 10% of the surface land of the earth (Myres,1992; Ogirigiri, 1998). Ekiti State, being in a tropical rain forest, has been under serious threat due to over-exploitation because of man's need and quest for food, shelter and other socio-economic requirements available which are often in the increase. Thus, appear to be at the risk of serious depletion. Information about the total forest area, forest types, age, classes, volume, number of trees and biodiversity are needed to properly manage forest resources, identify problems associated with it, suggest solutions and select appropriate areas for different management purposes. Such cannot be obtained unless through Geospatial information techniques which are timely and detailed and should be employed for proper gathering of such information, bearing in mind that information is power. It must be truly used to harness forest resources, and be properly coordinated, for better management in Ekiti State. Geospatial information technique is a method by which information is associated with a definite point that is, spatial data are got at any given time (Onyeka, 2007).

The spatial data on the forest resource is captured, geo-referenced using satellite system, remote sensing imagery in Geographic Information System (GIS). It is a tool for capturing and monitoring the impact of forest resource depletion in Ekiti State (Adegboyega, 2014). The information

obtained through this Geospatial technique is an important tool for recreational planning, tourism attraction, forest plan development and monitoring requiring spatial analysis of data for environmental assessment. (Oyebade et al, 2008).

### **1.1 AIM AND OBJECTIVES**

The paper evaluates the environmental impacts and management problems associated with forest resources in Ekiti State for the purpose of sustainability.

The specific objectives are to:

- i identify the reasons why forest resources are being depleted and degraded in Ekiti State.
- ii evaluate the impacts of forest resources exploitation
- iii contend for forest resources sustainability in Ekiti State
- iv proffer solutions to forest depletion through forest management system.

## **2.0 MATERIAL AND METHODS**

### **2.1 THE STUDY AREA**

Ekiti State is located in the south western part of Nigeria. It lies between latitudes  $07^{\circ}15'$  and  $08^{\circ}5'$  north of the Equator and between longitudes  $04^{\circ}45'$  and  $05^{\circ}45'$  east of the Greenwich Meridian. The state is bounded in the north by Kwara State, in the north east by Kogi State, in the west by Osun State and in the south and south east by Ondo State ( Fig 1). Ekiti State has sixteen Local Government Areas ( Fig 2).

The relief of Ekiti State is most gently undulating landscape rock outcrops that are part of Yoruba hills referred to as Western upland of Nigeria. This major landform characterized the whole Ekiti land and oftentimes serve as determinant factor for its use whether for economic activities such as forest exploitation or agriculture (Oguntuyi, 1979; Fasuan, 2002). Ekiti State enjoys the humid tropical climate of distinct wet and dry seasons. The seasons are determined by the movement of the Inter-Tropical Discontinuity (ITD). The wet season spreads between April and October with the tropical maritime (mT) air mass originating from the Atlantic Ocean. The dry season spread between November and March with the Tropical Continental (cT) air mass originating from the Sahara desert. The temperature ranges from  $26^{\circ}\text{C}$  to  $30^{\circ}\text{C}$  with the annual temperature of  $27^{\circ}\text{C}$  owing to the climate change experienced in the recent time.

The vegetation of Ekiti State shows that its spatial distribution varies with fascinating scenery. It is classified into two viz: the north and the south vegetation. The south falls in to the tropical low land rainforest zone of Nigeria and it is characterized by the assemblage of plant species arranged in distinctive complex vertical structure of forest canopies with a peculiar physiognomy. The zone

contains both deciduous and evergreen plants with scattered savannah forest. The vegetation is rich in biodiversity with forest characterised by abundance of tree species such as *Iroko*, *African Walnut*, *Mahogany*, *Obeche*, *Black and white Afara*, *Iron wood* and *Masonia*, that are being used as timbers for commerce, fibre, fire wood and ornament spices. The northern vegetation of Ekiti State can be described as the Guinea savannah woodland forming fairly close canopies like *Galbanum* species and *Andropogon spp*, *Hyporpace spp*. The trees include locust beans, shear butter trees (Olorode, 2002; Adebayo, 2004).

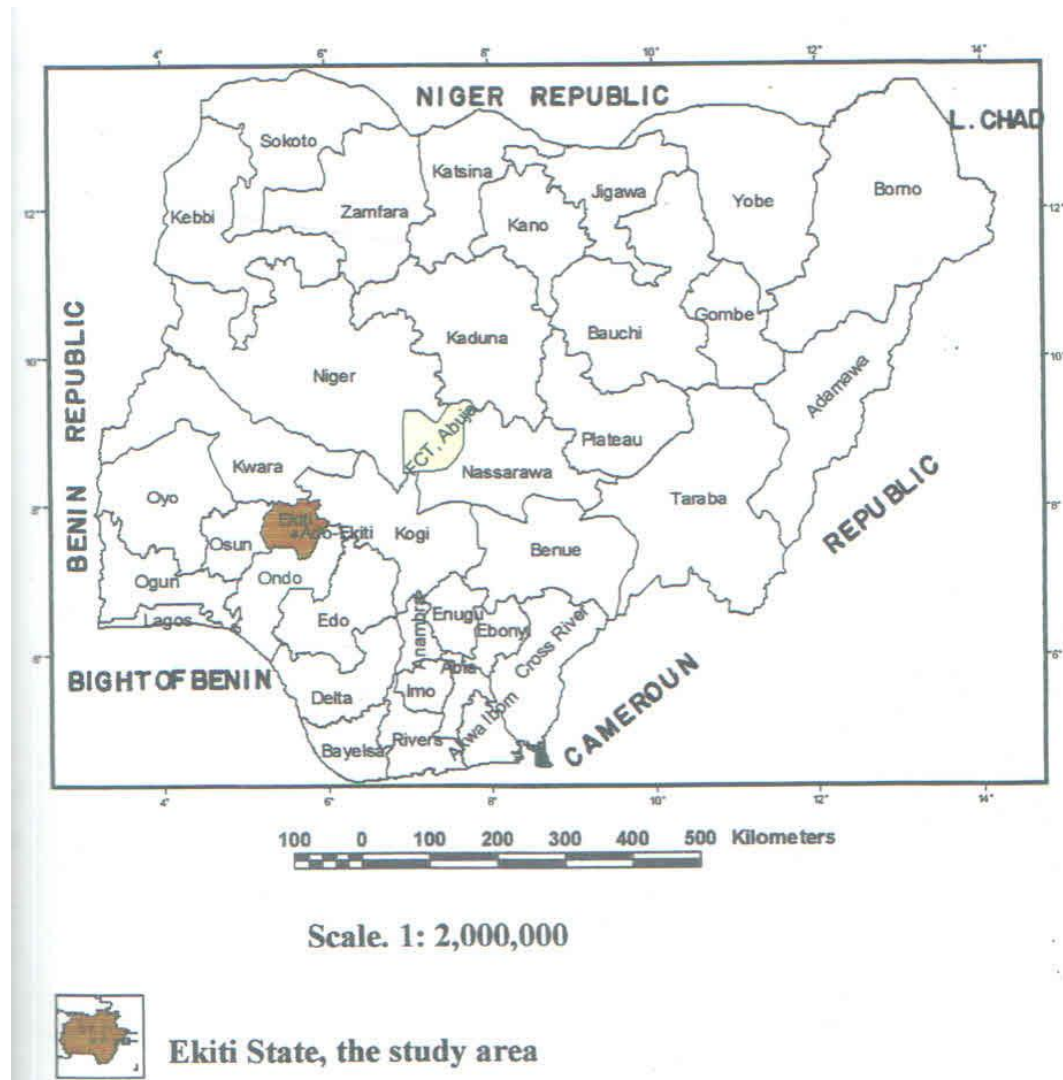


Fig 1: Ekiti State within Nigeria (Office of Surveyor General, Ekiti State, 2016)

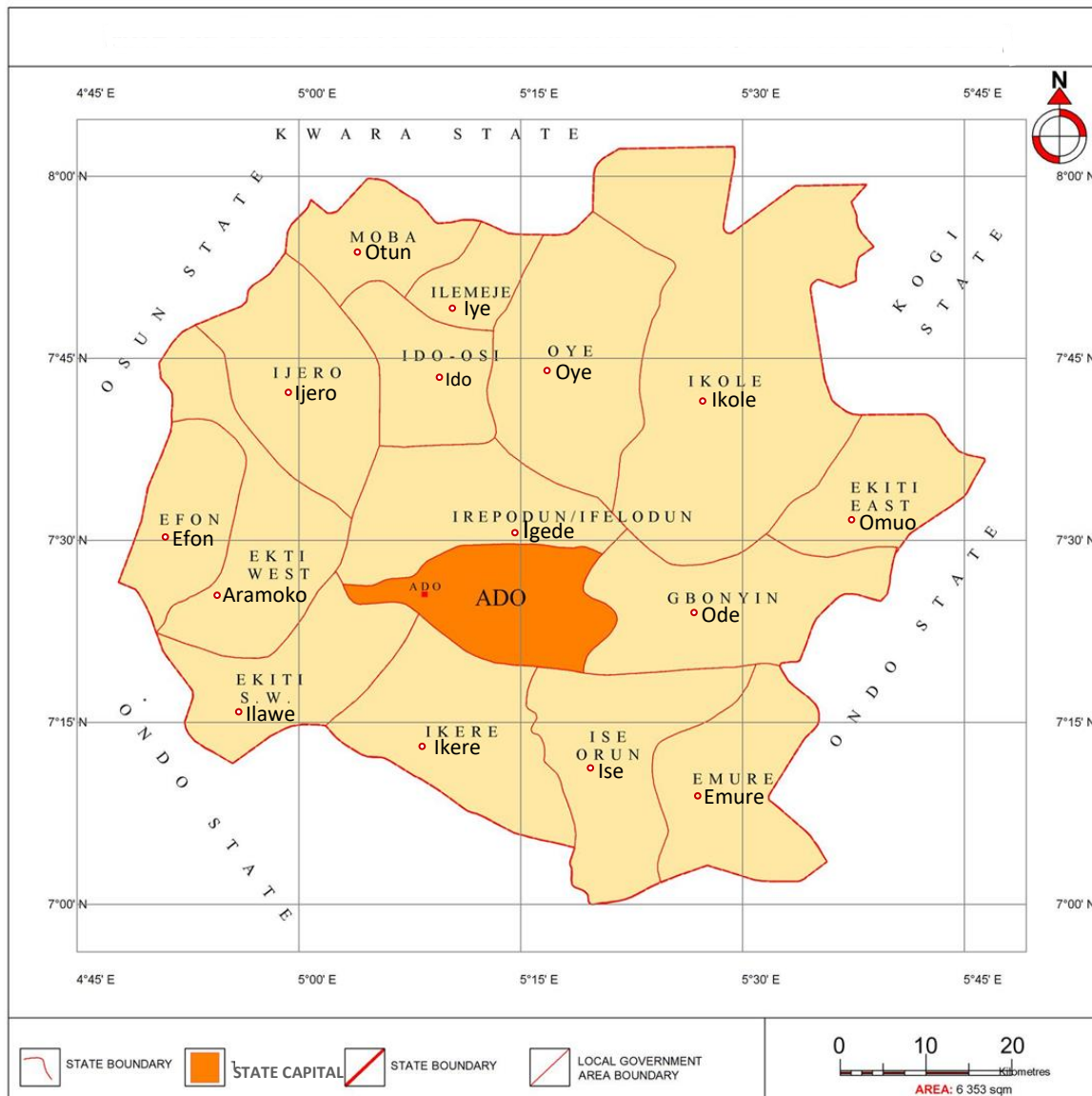


Fig. 2: Map of Ekiti State and its Local Government Areas (Office of Surveyor-General, Ekiti State, 2016)

## **2.2 DATA COLLECTION**

Data was collected through both primary and secondary sources. The primary data includes data on the numbers of forest reserves in Ekiti State and their locations, the significance of the forest resources in Ekiti State, possible reasons for the wanton destructions and the consequences of forest over-exploitation in the state. These data were obtained through the administration of questionnaire. A total of 578 copies of questionnaire were distributed within the state. This was randomly done with the sample populations consisting of men, women, youth and the aged ones using purposive sampling techniques. Furthermore, tables, frequency and percentage were used to bring the study to a clear perspective, while Analysis of variance (Anova) was used to bring the impact of the forest resources on man and his environment for the purpose of sustainability in the state. The secondary source of data was by satellite remote sensing imported into the GIS environment to map out the locations of the forest reserves in the state.

## **2.3 DATA PRESENTATION AND ANALYSIS**

Table 1 shows that there are eleven renown forest reserves in the study area and their respective locations are listed according to their senatorial districts in Ekiti State. Approximately 18.2% of the forest reserves were located in Ekiti Central and Ekiti North Senatorial Districts respectively and 63.6% of the forest reserves were located in Ekiti South Senatorial Districts. These are major forest reserves asides the natural forests in various towns in the state where illegal felling and spot logging are practised.

Table 2 shows the significance of forest resources to the inhabitants of Ekiti land. The data revealed that forests are beneficial to them because they derive from the forest sources of food/farming (14%), fuel wood for energy consumption (4%), herbal medicine (11%), bush meat (2.6%) and fresh water protection (48%) and all the purposes (63.4%). These quests and needs have resulted to wanton destruction witnessed in the study area as we have nearly four hundred sawmills in the state. The analysis revealed that 99.8% of the needs spelt out above are beneficial and of significant value to the people of Ekiti State.

Table 1. Renown Forest Reserves in Ekiti State

| S/No | Town               | Senatorial District | Frequency | Percentage | Remarks |
|------|--------------------|---------------------|-----------|------------|---------|
| 1    | Ado-Ekiti          | Ekiti Central       | 1         | 9.09       | 18.18%  |
| 2    | Aramoko            | Ekiti Central       | 1         | 9.09       |         |
| 3    | Eda oniyo          | Ekiti North         | 1         | 9.09       | 18.18%  |
| 4    | Ayede/ Isan        | Ekiti North         | 1         | 9.09       |         |
| 5    | Emure (Little Ose) | Ekiti South         | 1         | 9.09       | 63.64%  |
| 6    | Eporo-Ekiti        | Ekiti South         | 1         | 9.09       |         |
| 7    | Ogbese Ise-Ekiti   | Ekiti South         | 1         | 9.09       |         |
| 8    | Ise-Ekiti          | Ekiti South         | 1         | 9.09       |         |
| 9    | Ikere-Ekiti        | Ekiti South         | 1         | 9.09       |         |
| 10   | Ogotun-Ekiti       | Ekiti South         | 1         | 9.09       |         |
| 11   | Egbe-Ekiti         | Ekiti South         | 1         | 9.09       |         |
|      | Total              |                     | 11        | 100        | 100     |

Source: Federal Ministry of Environment, Afforestation Division, Abuja 2010 and field survey, 2014.

Table 2. Significance of Forest Resources in Ekiti State.

| S/N | Options                    | Frequency | Percentage |
|-----|----------------------------|-----------|------------|
| 1   | Sources of food/ farming   | 81        | 14         |
| 2   | Sources of fuel wood       | 23        | 4          |
| 3   | Sources of herbal medicine | 64        | 11         |
| 4   | Sources of bush meat       | 15        | 2.6        |
| 5   | Fresh water protection     | 28        | 4.8        |
| 6   | Others                     | 1         | 0.2        |
| 7   | All of the above           | 366       | 63.4       |
|     | Total                      | 578       | 100        |

Source: Authors' field survey, 2014

Table 3. Reasons for Wanton Destruction of Forest in Ekiti State.

| S/N | Options                     | Frequency | Percentage |
|-----|-----------------------------|-----------|------------|
| 1   | Infrastructural development | 15        | 2.6        |
| 2   | Urban & rural exploitation  | 40        | 6.9        |
| 3   | Timber exploitation         | 44        | 7.6        |
| 4   | Agricultural activities     | 184       | 31.8       |

|   |                  |     |     |
|---|------------------|-----|-----|
| 5 | Wood collection  | 53  | 9.2 |
| 6 | Others           | 34  | 5.9 |
| 7 | All of the above | 208 | 36  |
|   | Total            | 578 | 100 |

Source: Authors' field survey, 2014.

Table 4: Environmental Consequences of Forest Exploitation in Ekiti State

| S/N | Options                   | Frequency | Percentage |
|-----|---------------------------|-----------|------------|
| 1   | Loss of Biodiversity      | 68        | 11.8       |
| 2   | Loss of fresh water       | 94        | 16.2       |
| 3   | Increase in soil erosion  | 62        | 10.8       |
| 4   | Increase in heat          | 39        | 6.8        |
| 5   | Pollution of water bodies | 24        | 4.1        |
| 6   | Others                    | 46        | 8          |
| 7   | All of the above          | 245       | 42.3       |
|     | Total                     | 578       | 100        |

Source: Authors' field survey, 2014.

The result revealed that the dominant causes of the destruction are urbanization which takes 6.9%, infrastructural development takes 2.6%, agricultural activities such as farming takes 31.8%, timber exploitation and wood collection takes 7.6% and 9.2% respectively. Those who agreed to all these aforementioned development are made up of 36%.

Table 4 shows the consequences of over exploitation of the forest resources in Ekiti State. The results revealed that loss of biodiversity constituted (11.8%), loss of fresh water (16.2%), increase in soil erosion (10.8%), temperature changes within the built up area(16.8%), pollution of water bodies(4.1%),and all the factors (42.3%). This is indicated that 92% of the respondents could perceive the after math of the consequences of over-exploitation of the forest resources. Only 8% of the respondents could not state clearly the impacts of forest exploitation.

## 2.4 GEOSPATIAL INFORMATION FOR FOREST MANAGEMENT

The spot 5 image of 2008 with spatial resolution of 5m and Google earth imagery were used to provide useful Geospatial information for the forest management in the study area. The digital imagery created tree canopy models by using LIDAR data processed to GIS to compute and map the relationship of the distance between vegetation and other man made attributes such as trees and power line for decision making processes for the forest management. Spots satellites gave repetitive views of large areas in several spectral bands. Data from Spot 5 satellite were geocoded and the



terrain corrected was used for forest assessment detection of change, state-wide inventories and for monitoring.

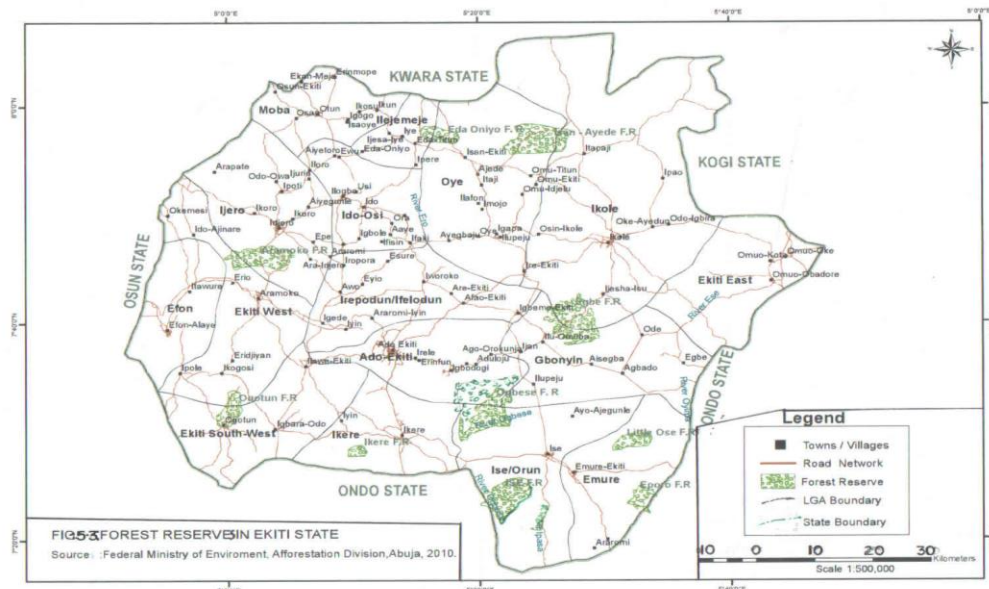


Fig 3: Forest Reserves in Ekiti State Source: Extracted from Spot 5, 2008 and modified by the Author, 2014

### 3.0 RESULTS AND DISCUSSION

Findings from the study revealed that forest plays a major role in food production, fuel wood, herbal medicine, bush meat, fresh water protection, wind breakers, source of employment and recreation centres in the state. There were eleven developed forest reserves in Ekiti State, there are few others belonging to private individuals that are springing up in different parts of the state (fig.3). This is an indication that Ekiti State depends heavily on the available forest resources in the state for sustainable development. The over-dependence of the people on spot logging through over-exploitation of trees had caused forest depletion as a result of urbanization, settlement expansion and timber exploitation because the study revealed that there were over three hundred and sixty five (365) Sawmills in the study area where they take the log to for further processing (Adegboyega, 2014). Many of the sawmills have just sprung up to show the extent of economic development in the area. This indicated that much more forests were destroyed for timber and commerce in the state with some environmental consequences (Adebayo, 2010). The present study is in agreement with Kayode (2004), Gbadebo (2006) and Zaku et al, (2013) who revealed that uncontrolled bush burning, unplanned human interference with soil, changing land

tenure system in the agricultural activities and infrastructural developments have caused loss of biodiversity in the state and the depletion of the native species of flora and fauna inclusive. The result showed further that a significant contribution of Geospatial Information technique used for forest resources management made it capable of being monitored in the study area. Fig. 4 below showed the cumulative effects of management programmes as were observed and analyzed. The conversion of forest to settlement area led to loss of fresh water which implied that deforestation had a lot of impacts on the environment which subsequently, could negatively affect the socio-economic sustainability of the study area.

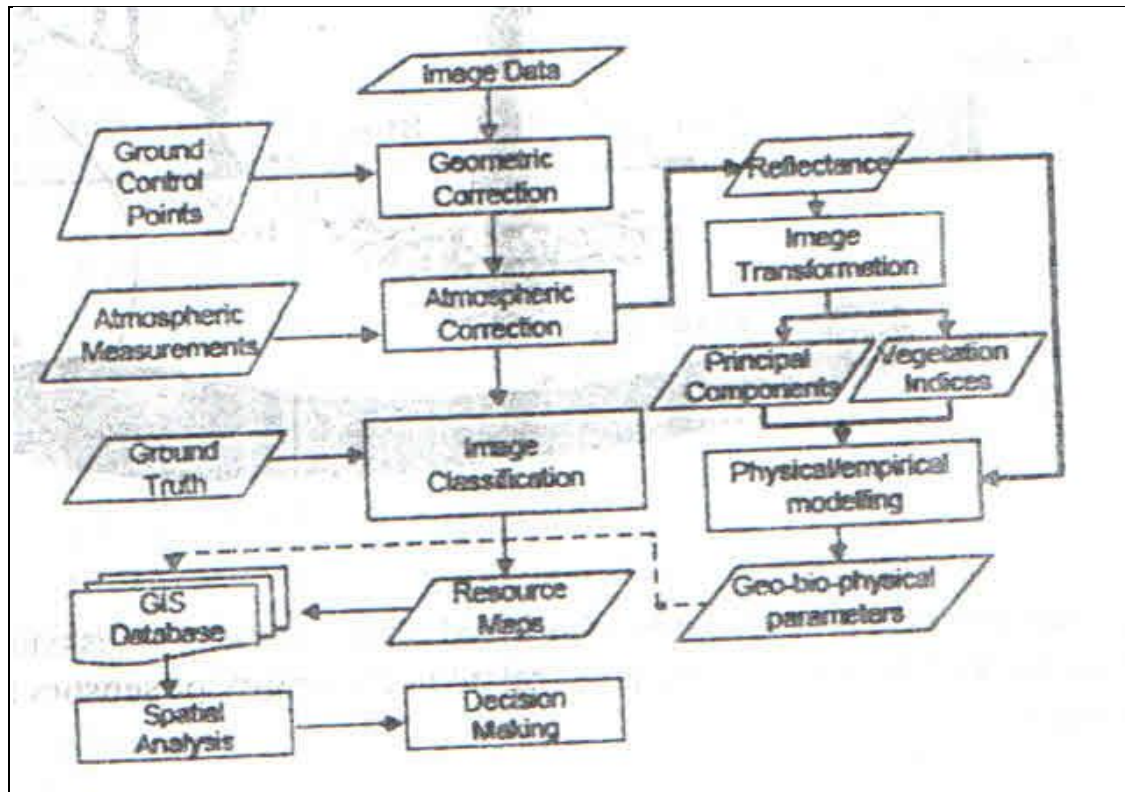


Fig 4: Schematic diagram of general image processing procedures. Source: Adapted from Navalgulid et al, 1991.

It was found that the Geospatial Information techniques integrated with the remotely sensed information into GIS environment using Arc GIS 3.2a was a unique method that had been used to

revolutionize the collection and manipulation of resources data for planning and conservation in its various types ranging from aerial photographs to multi-spectral scanner. Foresters were primarily concerned with vertical photograph which were taken to give 3-dimensional study with stereoscope. Other types were the use of RADAR, Landsat multi-spectral scanner, Landsat Thematic Mapper and spot 5 which were used in the study. Geospatial information techniques was found to be a very concomitant tool for forest management assessment. The technique could be used for planning, monitoring and conservation of the forest resources. This was evidenced in the estimation of the amount of distribution of vegetation, and knowing the vegetation monthly permits for vegetation yield to be estimated. Applying the technique to forest growth, produced yield that can be predicted.

The benefits of the Geospatial technique information for global sustainable development as applicable to Ekiti State are:

1. Inventory of forest resources, that is, identification and classification of tree species.
2. Monitoring of logging and reforestation.
3. Assessment of area of land covers by different types of forest and forest mensuration which further determines the volume of transfer for harvest and density.
4. Timber law appraisal for taxation and compensation.
5. Evaluation of forest land for recreation resources.
6. Monitoring of forest exploitation and forest burns/fire.
7. Measuring inaccessible sites.

#### **4.0 RECOMMENDATIONS**

There should be extensive education and information for the citizen of Ekiti State and the world at large that over-exploitation of resources (timber felling) is not good for environmental sustainability.

Secondly, there should be legislation made to ban illegal felling of timbers and trees in our forests in a quest for survival.

Thirdly, the Government at all levels, that is, Federal, State and Locals should set up awareness and campaign team to mobilize the policy makers, private groups, Non Governmental Organisations (NGO's) and individuals about the importance of tree planting for reforestation and afforestation to combat soil erosion, land degradation and global warming in Nigeria.

## 5.0 CONCLUSION

The quest for meeting the needs of millions of people globally especially in Ekiti State, has negatively impacted the environment, particularly, attempts by people to achieve seemingly endless wants and greed for food, shelter and infrastructure development worldwide have resulted to deforestation and urbanization. Also, the influx of people into Ekiti State that was created nearly two decades ago, ignorance and lack of skill to handle resources management in the time past have resulted to the menace being witnessed in both temperate and tropical rainforest resulting to loss of forest areas, habitat fragmentation, increasing risk of fire and decrease resilience in the face of climate change. The effectiveness of Geospatial information technique in forest management for monitoring, planning, conservation, prioritizing and analysing information remain unparalleled. The information obtained using the technique for forest resources management has really helped in quantitative appraisal of recent environmental degradation and changes. It has given the professionals such as resources managers, data analysts and image processors the ability to simulate the impacts of changes in the forest management policy. It is therefore pertinent that adequate funding should be given for the acquisition and integration of remote sensed tools to GIS environment for adequate environmental assessment and forest degradation control.

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