Chapter 15

Trends in Management of Tropical Forests: Application of Remote Sensing and Geographic Information System

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ABSTRACT

Forests are important plant communities that consist of trees and other woody vegetation that performs life-supporting functions on Earth. This chapter presents the application concepts necessary to link remote sensing data and geographic information system to conservation, restoration, and sustainable management of tropical forests. Despite the rising global concern, there is still continuous destruction of tropical forests at an alarming rate. This chapter assessed various approaches for conservation, restoration, and sustainable management of tropical forests using remote sensed data and geographic information system. This involves their applications to biodiversity conservation, forest ecophysiology, forest trees’ disease and insect interactions, forest mensuration, forest resources monitoring and evaluation, forest fires, land use and land cover dynamics, and vegetation cover.

INTRODUCTION

Forests play dynamic roles in providing shelter and food for wildlife, purifying the air, regulating climate and controlling water runoff (Cunningham et al., 2005). Tropical dry forests are distinctive ecosystems with extraordinary stages containing many unique flora and fauna. They are forests categorized by prominent dry season throughout some parts of the year, which aggravates a diversity of adaptations in plants and animals. Various plant species of these forests are deciduous; shedding their leaves at the beginning of...
Trends in Management of Tropical Forests

There are also other plants adaptations which are designed for water conservation such as spines leaves, waxy leaves, photosynthetic bark and swelling of tissues for water storage during the raining season. Forests in Nigeria are within the tropics, spanning from the tropical rain forests in the southern part to the tropical dry forests towards the north. The dry forests in the northern part of Nigeria are characterised by prolonged dry season and provide unique ecosystems which are under threat. These forests are steadily converted to grassland due to anthropogenic activities; more prominently are cattle pasture and felling of trees for fuel wood. The conversion has caused fragmentation and loss of large scale of wildlife habitat (Ali et al., 2014).

Despite the rising global environmental concern, there is still continuous destruction of tropical forest at an alarming rate. Forest like any other natural resources is of immense value to man. The constant exploitations of these forests have resulted in serious reservations for their sustainability. The demands for conservation and management methods could help these forests meet the need of future generations. Many species of trees are currently faced with extinction while some are at different phases of risk. The interference of man into forests for different purposes have resulted in loss of biodiversity, deforestation, reduction in the available forest, loss and extinction of plant and animal species resulting to predictable long term effect from climate change. The prevailing interdependent association amid man and his regular environment requires an equilibrium system on the activities that impose the nature in demand to certify the sustainability of the environment. Forest ecosystems provide variety of services that help in maintaining the status of life support systems. Conservation and proper management strategies are of vast concern if the needs of future generations are to be met in a sustainable way.

Forest resources are one of the most key renewable natural resources aimed for timber production, raw material for pulp and paper and other forest resources as well as genetic resources. It is progressively documented that the loss of forest generates some amount of serious environmental and conservation problems such as: soil erosion, flood, sedimentation, and loss of valued materials which aid to ensure the peoples’ lifespan (Agbelade and Akindele, 2013). It is a matter of worry that tropical dry forests are constantly disappearing at disturbing speed due to the increasing demand over ecosystem services and natural resources. In whichever zone, forest is a true indicator of ecological system dominant.

Remote sensing (RS) is an indispensible tool for providing dependable data and precise information about natural resources such as forest. Geographic information system (GIS) on the other hand, is a system for capturing, storing, analysing and managing data and associated attributes, which are spatially referenced to the earth. They can be used for scientific investigations, resource management, and asset management to mention but few. Forest managers in Nigeria and the world at large are whirling progressively to digital forest inventories and geographic information systems to help in the management of forest resources. In meeting the numerous information desires for forest conservation, restoration and management, different data sources, such as field survey, aerial photography and satellite imagery are used.

This chapter therefore, aimed at exploring the various areas of application of remote sensing and GIS in forest management such as species composition (biodiversity), forest ecophysiology, forest trees’ disease and insect interactions, forest mensuration, forest resources monitoring and evaluation, forest fires, land use and land cover dynamics and vegetation cover.

**Geographic Information System (GIS)**

Geographic information systems are used to collect, store, analyze, distribute and control information that can be referenced to a geographical position. GIS is a tool capable of integrating, storing, editing, analys-
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