

Review Article

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Application of Geo-informatics in Natural Resource Management

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ABSTRACT

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Over exploitation and mismanagement of natural resources have resulted in adverse effects such as degradation, biomass deterioration and siltation of tanks. Increasing food needs of growing population demands the efficient use of natural resources in a comprehensive manner. In addition, the low per capita availability of land, erratic and uneven distribution of rains, undulating topography, improper resource management, traditional cropping programmes and recurrence of droughts having cumulative effect leading to lower productivity and higher risk particularly in dryland farming. This calls for optimum utilization of natural resources by scientific planning and action oriented approach. In this connection, taking the present day importance of watershed development and capabilities of Remote sensing, GIS and GPS technologies is important.

Introduction

The socio-economic development of any country is based on land resources and water resources. Due to increase in population, these resources are over stretched often leading to resource depletion. There is therefore need to prudently manage these delicate resources. Remote Sensing and GIS techniques can be applied effective measure to generate data and information for sustainable development. After more than twenty five years of satellite-based land remote sensing experimentation and development, these technologies reached almost all sectors of Earth science application. The use of remote sensing data and derivative information has ever promise

of entering into mainstream of governing at local and regional level. The article enumerates the mapping and management of natural resource using Remote Sensing and GIS Techniques.

Use of remote sensing and GIS in natural resource management

In natural resource management, remote sensing and GIS is mainly used in the mapping process. These technologies can be used to develop a variety of maps. Examples include: Land cover maps, Vegetation maps, Soil maps, Geology maps.

However, before these maps are developed, there are a variety of data that need to be collected and analysed. Most of this data is collected with the help of remote sensing technology. Data can be collected using either ground photographs, aerial photographs or satellite photographs of the area of study. The choice of the photograph usually depends on the topography of the area of study and the aim of the study. Satellite photographs can also be used to collect relevant data for the study. These types of photographs are however superior to aerial photographs in the sense that they have higher spectral, spatial, radiometric and temporal resolutions. Thus, satellite images are more detailed hence a lot of data can be generated from them. However, for remote sensing data to be effective, it needs to be incorporated together with topographical maps that show the variation of climate, soils, and other factors.

The data that is collected on the ground is geo-referenced with the help of a GPS to ensure that its corresponding location can be accurately identified in the images that were collected earlier.

Application of GIS data in forest management

Over the last century, the forest cover of the world has declined at an alarming rate. Being a renewable resource, forest cover can be regenerated through sustainable management. Hence, with the help of remote sensing and GIS data, a forest manager can generate information with regards to forest cover, types of forest present within the area of the study, human encroachment into forest land/protected areas, encroachment of desert like conditions and so on. This information is critical in the development of forest management plans and in the process of decision making to ensure that effective policies have been put in place to control

and govern the manner in which forest resources is utilized.

Application of GIS data in watershed management

Water as a resource has been diminishing over the years. In Africa and other developing nations, the availability of clean water has been always scarce. Water management has therefore been a challenge in developing nations. However, with the use of satellite data, water bodies such as rivers, lakes, dams and reservoirs can be mapped in 3D with the help of GIS technology. This data can be used in the sustainable management of water bodies since respective authorities can decide which regions need effective protection and management. At the same time, decisions regarding the most effective means of utilization of these regions can always be arrived at.

Application of GIS data to combat desertification

Geospatial data can be used to determine the soil types present in a given area and nutrient availability. Negative change can always be identified once this data is collected over a long period of time. GIS data can also be used to determine the land use practices within a given area and vegetation constitution and the impact that they have on the environment. Consequently, slope information of a region can also be determined with the use of GIS data. With all this information, an individual can easily determine whether desert like conditions are encroaching in an area. If desert like conditions have been identified, its impacts and intensity shall be analysed in order to decide on whether artificial or natural methods shall be used to combat the situation.

Application of GIS data in biodiversity management

Geospatial data can also be used in the management of flora and fauna within protected areas. Ground and aerial photographs, for instance, are essential in this practice. Aerial and satellite photographs can be used to determine the presence and distribution of vegetation within a protected area. These photos can also be used to determine the presence and distribution of invasive species within an ecosystem. This information is essential as it determines the amount of cover and food that is present, particularly for herbivores during various seasons of the year. Aerial photographs can be used to ease the process of counting during animal census activities. The stop capability of photographs eases this process. It is always essential for protected area managers to determine the population and distribution of various animal species within a protected area to ensure that they have enough food and water, to eliminate the chances of overstocking that might lead to soil erosion and to ensure that a balance within the ecosystem is arrived at. Geospatial data can also be used to show human encroachment into protected areas as well as animal activities outside protected areas. This data critical especially in the process of resolving human/wildlife conflicts. Finally, the use of GPS technology can be applied to monitor the movement of endangered species as well as newly introduced species to determine their progress as well as protecting them from poachers. Finally, geospatial data can be used to carry out environmental impact assessment (EIA) of various projects carried

out within protected areas. Projects such as building of roads, buildings, pipe ways, dams, and so on might have various effects on the flora and fauna of the ecosystem. Thus, geospatial data has become essential in biodiversity management.

It can be concluded with the increasing pressure on natural resources due to the rising human population, remote sensing and GIS can be used to manage these limited resources in an effective and efficient manner. Geospatial data are effective in the analysis and determination of factors that affect the utilization of these resources. Thus, with the understanding of these factors, sound decisions can be arrived at that will ensure the sustainable use of natural resources to meet the needs of the present generation as well as future generations.

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