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GIS and Remote Sensing Applications in Natural Resources Management

Parveen Kumar*

M.A. Department of Geography, Panjab University, Chandigarh

Abstract – The socio-economic development of any country is based on natural resources. The natural resources are essential to the economy of the nation since they play a critical role in the provision of employment, they are a source of raw materials for various industries, act as the source of food and income, medicine as well as energy. Due to increase in population, these resources are over stretched often leading to resource depletion. Ultimately the depletion of natural resources has led to increase in the cost of living ,changes in weather pattern and decline in economic , social and cultural benefits that were accrued as a result of their utilisation .It is essential for nations to learn how to use these resources in sustainable manner to ensure that benefits are enjoyed in present as well as future generations There is need to prudently manage these delicate resources with the current trend in the advancement in the field of information technology, natural resources managers have now laid a lot of emphasis on the use of remote sensing and GIS technology in the management of natural resources,. These technologies provide a platform through which managers can generate informative data and the information that can be used to make sound decisions for sustainable development. This study is based on secondary data and information which includes research papers, reports, workshop outputs and information published in the websites of the related organizations .Thus, this paper presents an overview of the GIS and Remote Sensing applications in natural resources management and sustainable development.

Keywords: - GIS, Remote Sensing, Natural Resources and Management

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INTRODUCTION

Nature contains a plethora of resources right from the soil, water and land to various other forms and structures like forest, animals, minerals etc. With the ever increasing demand and exploitation of resources it is mandatory to use it sustainably. The topic “natural resource management” is selected due to the importance of natural resources in every sphere of life in both direct and indirect way right from the use of water to use of soil for food production for very basic need of survival. Remote sensing data is applied for mapping and monitoring of various natural resources related with Earth’s surface. Remote sensing has proved to be very effective means of developing and integrated GIS, which could meet the challengesof evaluating and managing natural resources. The extent and the amount of resources present , changes in resources, potential, strategy for resource protection and conservation; eco system studies, sustainable use and development practice of natural resources all can be effectively studied by integratedapproach with Remote Sensing and GIS. Studies on natural resource management have brought out the basic concept that methods of recovery and use of natural resource management are closely interrelated with human dimensions.

Remote Sensing data can be digitized and analysed by GIS tools to give precise outputs in different formats. The principal areas for application of GIS and RS are land-use planning and management, management of natural resources (land, water, agriculture and fishery); forestry and wildlife management, soil degradation studies and enumeration area mapping, environmental impact studies, natural hazard mapping, disaster forecasting and management, mineral exploration, etc. The application of GIS and RS is rapidly expanding worldwide for planning and management of natural as well as man-made resources. The present study was undertaken to explore the applications of GIS and RS in natural resource management in India.

RESEARCH METHODOLOGY

This study is based on secondary data and information mostly downloaded from the internet. The information materials from the internet include research papers, reports, workshop outputs, and information published in the websites of the related organizations. The information on the applications of GIS and RS in natural resource management were collected, sorted, compiled, and presented in this study. GIS/RS applications in meteorology, climate

change, disaster management, urban planning, health and transport are also included.

OBJECTIVE OF THE STUDY

This paper is basically just to give an overview of how Remote Sensing and GIS is already being used and applied or can be applied in different ways of natural resource management which may lead to sustainable development.

REMOTE SENSING IN INDIA

The National Remote Sensing Agency(NRSA), of the Dept. of Space (DOS), Govt. of India (GOI), is the focal point for distribution of Remote Sensing satellite data products in India. The Centre is responsible for remote sensing satellite data acquisition and processing, data dissemination, aerial remote sensing and decision support for disaster management and natural resources management. NRSC has set up data reception station at Shadnagar near Hyderabad for acquiring data from Indian remote sensing satellites as well as others. The Centre is also engaged in executing remote sensing application projects in collaboration with the users. Currently NRSC is supplying data from CartoSat - 1, 2, 2A & 2B, ResourceSat - 1 & 2, OceanSat, TES, IRS - 1D and IMS –1.

Satellites for remote sensing purpose in India working at present are listed as

Serial No.	Satellite	Date of Launch	Launch Vehicle	Status
1	IRS P6 (Resourcesat-1)	17 October 2003	PSLV-C5	In Service
2	IRS P5 (Cartosat 1)	5 May 2005	PSLV-C6	In Service
3	Cartosat 2 (IRS P7)	10 January 2007	PSLV-C7	In Service
4	Cartosat 2A	28 April 2008	PSLV-C9	In Service
5	IMS 1	28 April 2008	PSLV-C9	In Service
6	Oceansat-2	23 September 2009	PSLV-C14	In Service
7	Cartosat-2B	12 July 2010	PSLV-C15	In Service
8	Resourcesat-2	20 April 2011	PSLV-C16	In Service
9	Megha-Tropiques	12 October 2011	PSLV-C18	In Service
10	RISAT-1	26 April 2012	PSLV-C19	In Service
11	SARAL	25 Feb 2013	PSLV-C20	In Service
12	RESOURCESAT-2A	07 Dec 2016	PSLV-C36	In Service
13	Cartosat-2D	15 Feb 2017	PSLV-C37	In Service

Source: - National Remote Sensing Agency (NRSA), Indian Space Research Organisation.

Government and Semi Government Agencies/Organization Using Remote Sensing Data

- Space Applications Centre (SAC) - Ahmedabad
- National Centre for Human Settlements and Environment (NCHSE) - Bhopal
- M.P.Council of Science&Technology (MPCST - Bhopal
- NIOT - Chennai
- Survey of India - Dehradun
- U-SAC - Dehradun
- Indian Institute of Remote Sensing (IIRS) - Dehradun
- Bhaskaracharya Institute For Space Applications and Geo-Informatics - Gandhinagar
- Haryana Space and Applications Centre - Hissar
- The National Geophysical Research Institute (NGRI) - Hyderabad
- National Remote Sensing Centre - Hyderabad
- Telangana State Remote sensing Applications Centre - Hyderabad
- Safety Research Institute - Kalpakkam
- Institute of Environmental Studies & Wetland Management (IESWM) - Kolkata
- National Atlas And Thematic Mapping Organisation: - Kolkata
- Remote Sensing Application Centre - UP - Lucknow
- Punjab Remote Sensing Centre (PRSC) - Ludhiana
- Remote Sensing &Geoinformatics Division (MERI, Nasik) - Nasik
- Centre for Development of Advanced Computing (C-DAC) - Pune
- Science and Technology Park - Pune
- Jharkhand Space Application Centre - Ranchi
- North Eastern Space Applications Center (NESAC) - Shillong
- AryabhattaGeoinfo rmatics& Space Applicaion Centre - Shimla
- Soil Survey, Kerala - Thiruvananthapuram

The National Remote Sensing Centre (NRSC) at Hyderabad is the nodal agency for reception, archival, processing and dissemination of remote

sensing data in the country. NRSC acquires and processes data from all Indian remote sensing satellites like Cartosat-1,Cartosat-2, Resourcesat-1, IRS-1D, Oceansat-1 and Technology Experiment Satellite as well as foreign satellites like Terra, NOAA and ERS. This data from IRS are available to its users through NRSC Data Centre and also through Bhuvan Geoportal of ISRO. NRSC data centre provide data through its purchase process while Bhuvan Geoportal provides data in free and open domain.

National Natural Resources Management System (NNRMS) is a national level inter-agency system for integrated natural resources management in the country. NNRMS supports the optimal utilization of country's natural resources by providing for a proper and systematic inventory of natural resources available using remote sensing data in conjunction with conventional data/techniques. In doing so, NNRMS adopts various advanced technologies of satellite and aerial remote sensing; Geographical Information Systems (GIS); precise Positioning Systems; database and networking infrastructure and advanced ground-based survey techniques.

NNRMS was established in 1983 and was supported by the Planning Commission, Government of India. Department of Space (DOS) is the nodal agency for implementing NNRMS in the country and the Secretariat of NNRMS is housed in the ISRO Headquarters, Bangalore.

The Planning Committee of NNRMS (PC-NNRMS) is the apex-body that provides guidelines for implementation of the NNRMS and also oversees the progress of remote sensing applications for natural resources management in the country. The PC-NNRMS is chaired by Member (Science), Planning Commission and has Secretaries of various departments of Government of India as Members. The NNRMS activities are steered through nine NNRMS Standing Committees viz. (i) Agriculture & Soils, (ii) Bio-Resources, (iii) Geology and Mineral resources, (iv) Water Resources (v) Ocean Resources and Meteorology (vi) Cartography & Mapping, (vii) Urban Management (viii) Rural Development and (ix) Training & Technology. Each Standing Committee is chaired by Secretaries of the respective departments of the Government of India and consisting of experts from major user departments.

Table Major Fields and Areas of GIS/RS Applications

Major Fields	Areas of GIS/RS Applications
Land Resources	Land use planning, land inventories, land survey, land use and land cover mapping
Agricultural Resources	Agricultural planning and management, National Agro-Ecological Zone (AEZ) database, soil resources database, soil survey, soil data analysis, characterization of soil, soil erosion assessment and prediction, climate change impact on agriculture
Forest Resources	Planning and management, forest inventory, afforestation, climate change impact on forests
Water Resources	Water resources management, watershed analysis, fisheries resources development planning, river bank erosion and accretion, monitoring morphological changes and hydrology of rivers, navigation and dredging, construction and maintenance of embankments, flood forecasting and management, water pollution
Coastal zone resources	Management and development planning, land erosion, construction and maintenance of embankments, salinity, water logging, shrimp culture, marine fisheries, Sundarban mangrove forest, coastal afforestation, sea level rise

CONCLUSION

India faces many problems in management of natural and man-made resources. So the applications of GIS and Remote Sensing tools have become inevitable. Even International Development partners are encouraging the application of GIS and Remote Sensing in the applications in all spheres of natural resource management. Most of the organizations (government and private) are using GIS and Remote Sensing in the management of the resources from the past few years, and with the advancement of technology the application in the other fields is also going to increase with time.

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Corresponding Author

Parveen Kumar*

M.A. Department of Geography, Panjab University, Chandigarh

pkjanjara6030@gmail.com