Chapter 1
Application of Remote Sensing and GIS in Environmental Monitoring and Management

Jayashri Dutta
https://orcid.org/0009-0006-5303-1654
Gauhati University, India

Smitakshi Medhi
https://orcid.org/0009-0004-6106-1111
Gauhati University, India

Mayurakshi Gogoi
https://orcid.org/0009-0000-3706-1606
Gauhati University, India

Lisha Borgohain
https://orcid.org/0009-0007-5763-5583
Gauhati University, India

Nourhan Gamal Abdel Maboud
GIS Community Academy, Egypt

Hanaa Mustafa Muhameed
GIS Community Academy, Egypt

ABSTRACT

Remote sensing (RS) and geographical information system (GIS) have been extensively used for their ability to provide better scope for decision making in terms of monitoring and managing various natural resources: water, land, forest, agriculture, natural hazards, climate change, etc. In this chapter, the authors precisely discuss in detail about the various applications of remote sensing and GIS in numerous fields such as monitoring water quality, crop modelling, monitoring wildlife habitat and forest management, application in agriculture and soil science, water resource, as well as natural disaster management. This chapter will also incorporate several case

DOI: 10.4018/979-8-3693-9651-3.ch001

studies where GIS and remote sensing were used as a powerful tool to delineate and monitor environmental changes and take the necessary steps to manage the same. This chapter will thus focus on the importance of remote sensing and GIS and its impact in sound decision-making, which in turn will secure the sustainable utilization of natural resources to reach the requirements of present as well as future generations.

1. INTRODUCTION

Remote sensing and Geographical Information Systems (GIS) become a means of utmost importance in recent days for various disciplines. In the sixties, non-spatial mathematical models had developed for the decision-making process which has been changed to a displayable spatial model with the help of GIS in the last years. With the advent of Remote Sensing and GIS techniques, it has become easier to an extent to monitor natural resources with multi-spectral, multi-spatial and multi-temporal resolution (Kumar et al., 2015). Remote sensing provides a remarkable insight into the field of applied sciences with a greater extent of geospatial information that is useful in environmental change detection studies (Chamine et al., 2021). The remote sensing data of a wide range of resolutions from space-borne and air-borne platforms help government organizations, industries and public sector organizations to prepare their planning of the management of natural resources and decision-making process. However, GIS is such a powerful tool that it can collect, process, reacquire and transform a large set of data into a displayable form that can be used as a decision support system in environmental resource supervision and impact assessment in various disciplines i.e. agriculture, water, soil, mineral resources etc. (Droj, 2012).

Some satellites such as Landsat, and MODIS provide historical data also that help to carry out trend analysis in an uninterrupted manner (Parra, 2022). For the trend analysis of various meteorological parameters and change detection studies of land use land cover, satellite data products are used. With the aforementioned advantages, Remote Sensing and GIS have now become a very effective robust technique over many traditional methods of decision-making.

2. BACKGROUND

With the advancement of technology, GIS combined with remote sensing data provide a cost-effective and efficient approach for acquiring data in earth and environmental sciences. Remote sensing data can be collected using passive (e.g. spectral imaging) and active sensors (e.g. radar). The most used satellite sources for remote sensing images are the Landsat, followed by MODIS, SPOT 5 and Sen-