

MAHESH GAUR  
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# REMOTE SENSING

FOR NATURAL RESOURCES  
MANAGEMENT  
& MONITORING





# **Remote Sensing for Natural Resources Monitoring & Management**

**Mahesh Gaur**

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#### Foreword

The field of Geospatial Technologies, i.e., *Remote Sensing and GIS*, is very wide, both in the data acquisition methods, data processing procedures and techniques and the applications it is used for. It is a fast developing field, in all the themes. It opens the frontiers of data dissemination and distribution in effective and convenient way. In contrast with *in-situ* measurements, remote sensing acquires information about properties of an object from a sensor platform without making any physical contact with the object that is being sensed. Satellites are the most commonly used platforms, although aircraft are also used, and recently unmanned aerial vehicles (*drones*) have become more common. With the growth of remote sensing in second half of the 20th century, it has been one of the most exhilarating techno-scientific developments for monitoring and mapping of resources. However, Remote Sensing technology had been well established now and is thriving in various areas.

This present book, *Remote Sensing for Natural Resources Management & Monitoring* is therefore intended to give an extensive coverage about several thematic applications, and I hope, covering all the important topics regarding Remote Sensing of the surface of the Earth. The book starts with explanations about the science behind remote sensing; describing what it is, how it works, and how it can be used in real life applications. It being a multi-author book, presents state-of-the-art techniques for estimating land surface variables from a variety of data types, including optical sensors. Detailed thematic case studies of Remote Sensing applications has been given which have direct importance for resource mapping, management and monitoring.

I have known Dr. Mahesh Gaur for many years who has been associated with many NRSC projects. I am happy that he has compiled and edited a book entitled *Remote Sensing for Natural Resources Management & Monitoring*. Considering his enquiring cognizance and wide-ranging academic-scientific network across the globe, this book is not an unexpected one from him. It covers an eclectic selection of topic presented in 27 chapters. As the application of geo-spatial technologies is increasing and the globe becomes more integrated, these papers will provide a valuable component of the reference covering an array of topics. Dr. Gaur and his team deserves to be thanked and congratulated for this endeavour.

भारतीय अन्तरिक्ष अनुसंधान संगठन



Indian Space Research Organisation

Researchers and scientists in a number of different fields including geography, geology, ecology and environmental science will have access to critically-important data extraction techniques and their virtually unlimited applications. These techniques are well designed and integrated, making the book's content intuitive, clearly presented, and practical in its implementation. The book also attempts to give the reader an understanding of the capabilities and limitations of Remote Sensing. I truly hope that this collection will lead to the valuable additions to our knowledge.



(V.K. Dadhwal)

**May 30, 2016**

# Preface

The Remote Sensing (RS), Geographic Information System (GIS) and Global Positioning System (GPS) are reliable, precise and efficient technologies used for the mapping, management, assessment and monitoring of natural resources. These technologies give a visual impression of the landscape that helps to make quick decision in resource planning and management. These technologies deal with the local spatial context and the global spatial referencing issues as well. These referencing issues are related to the compatibility and uniformity of the geographic data produced.

These also open the frontiers of data dissemination and distribution in effective and convenient way i.e. digital data using web technologies. This will allow the institution to be active node of the common place of data sharing system i.e. National Spatial Data Infrastructure. This kind of development will benefit end user having access over data or metadata of the geographic products.

The field of remote sensing is fast evolving, with new satellites being launched and new sensors developed every year. Remote sensing technology allow us to observe the earth feature from the space fundamentally and there are several techniques to differentiate the information collected from RS of our interest i.e. forest or vegetation (resource), hydrographic, agricultural, land and others. The remote sensing product (satellite imageries) support us to analyze the real earth situation of the resources that may be by type of the resources, by stock level of the resources, or by other spatial extent of the resources. Demographic changes and economic development have increased pressures on resources. More people than ever are generating at least part of a livelihood from activities which directly affect, or are affected by, changes in the natural environment. The absence of effective monitoring systems to generate baseline data against which the impacts of natural and anthropogenic changes can be measured has been a significant constraint to effective decentralized planning and e-governance.

In this age of twenty first century with advancement in the fields of computer and geographic systems, the resource management issues are to be dealt more efficiently, effectively and convincing way by applying those technologies rather than the traditional methods of management. These systems and technologies make countable effort to identify and assess the threats and difficulties of resources management. The present book covers chapters on application of RS & GIS technologies in natural resource planning; management and monitoring, Decision Support System (DSS) and some case studies related to the natural resource management.

This book is one of the outcome of a Ministry of Agriculture, Government of India sponsored successful model training course. It attempts to match user

need to the level of technology required for management, planning and monitoring of natural resources. It provides clear guidance on the reliability, accuracy and cost of applications. We believe that this endeavour shall provide a valuable scientific basis to students and researchers to address the future challenges in natural resources monitoring and management. We further hope this book will be a valuable reference and provide practical guidance for all who work towards the goal of the sustainable and judicious use of resources. The editors gratefully acknowledge the sincere efforts made by different authors in accomplishing their thoughts and permitting to publish their articles. The editors also expresses their sincere thanks to M/s Scientific Publishers, Jodhpur for timely publication of the book. The book has been written in individual capacity and does not reflect the views of any institution with which authors/editors belongs or have been associated.

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