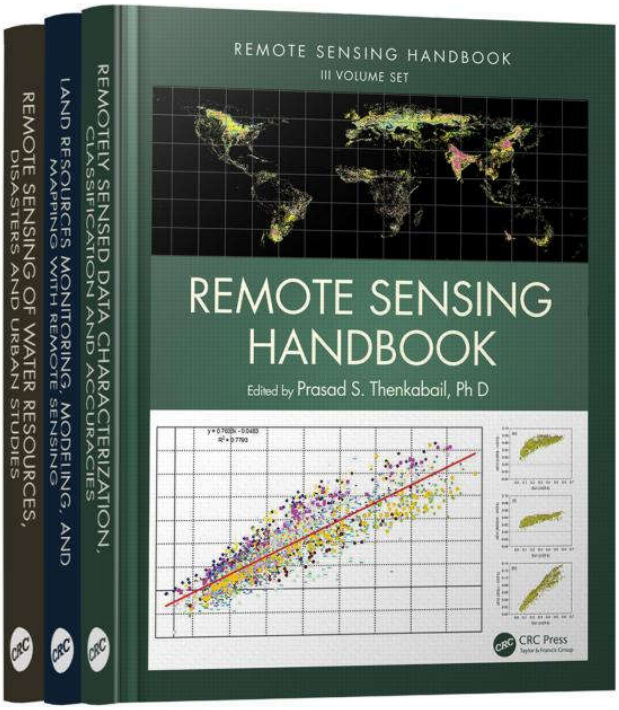
Book Review



Thenkabail, P.S. (Ed.) 2015. Remote Sensing Handbook - Three Volume Set. - 2200 pp., CRC Press, Taylor & Francis, Boca Raton, Florida. ISBN: 9781482218015. 409.00£ (Hardback).

GIS and remote-sensing form an integral part of our life these days. Beside everyday applications, such as navigation, smart phone applications relying on GIS technology, browsing the images provided by Google Earth or just checking the weather forecast, it is becoming more and more widely available for practical and scientific purposes, such as nature conservation and ecological uses. The substantial improvements regarding the technology and methodology of data acquisition and classification has resulted in an enormous amount of knowledge on remote sensing in the past decades. Given the fact that remote-sensing is getting to be widely used in nature conservation in recent years, exciting reviews have been published on the application possibilities of remote-sensing in habitat-mapping and monitoring (Vanden Borre et al. 2011; Nagendra et al. 2013). However there has been an urgent need for a synthesis of the most up-to-date developments and application possibilities in remote-sensing. The *Remote Sensing Handbook* can definitely fill this gap. The 82 chapters and 2200 pages, written by an international team of renowned leading experts in the field, provides a fully comprehensive reference material on the topic, from theory to practice. The book contains 942 colour and 321 black-and-white illustrations to support the readers in the visualisation of the methodology, the applied workflow and the results. This gigantic work has been coordinated and edited by Prasad S. Thenkabail (United States Geological Survey), an internationally acknowledged expert in the field of remote-sensing.

The three-volume *Remote Sensing Handbook* summarises the scientific and methodological evolution in remote-sensing during the past 50 years, and gives an overview on the state-of-the-art fundamental and practical knowledge on the topic.

The "*Remotely Sensed Data Characterization, Classification, and Accuracies*" volume introduces the existing remote-sensing platforms and sensors, as well as advances in data calibration, normalization, harmonization and synthesis. The chapters about image-processing methods and approaches, together with the detailed review on vegetation indices, can be particularly useful for phytosociological and ecological studies. Furthermore the volume provides theoretical and practical information on object-based image analysis and geo-spatial data integration; change detection techniques; geo-processing, GIS, and GIScience; GNSS applications; crowd-sourcing and cloud computing; Google Earth for Earth Sciences; map accuracies and up-to-date information on remote-sensing law and space law.

Maybe the "*Land Resources Monitoring, Modeling, and Mapping with Remote Sensing*" volume, dealing with several biodiversity, ecology and land-use related topics, is the most exciting for ecologists. Several chapters provide precise methodological descriptions and case studies about habitat mapping and monitoring, above ground biomass measurements and modelling, biodiversity detection, habitat quality measurements using remotely-sensed data. The chapter "Ecological characterisation of vegetation using multisensor remote sensing in the solar reflective spectrum" provides a brief history of key optical sensors applied in vegetation mapping and application possibilities of optical sensors in the detection of vegetation structure and function. The reader can find further information on land-use and land-cover mapping; application of remote-sensing in agricultural systems, food security analysis, soil studies and measuring photosynthesis from space.

The "*Remote Sensing of Water Resources, Disasters, and Urban Studies*" volume provides a fully comprehensive overview of the application of remote-sensing in the field of hydrology, water resources, floods, water use and water productivity; wetland modelling, mapping, and characterization; snow and ice studies; drought and dryland monitoring and mapping; volcanoes, coal fires, and greenhouse gas emissions; urban remote-sensing for disaster risk management and remote-sensing for the design of smart cities.

Actually, after reading this book I had the impression that the title of the book might be changed to "All you wanted to know about remote-sensing– a handbook for experts and practitioners". Given its breadth, depth, carefully constructed structure and easily readable style, the handbook is an indispensable reference for a wide audience interested in remote-sensing. On the one hand it provides very detailed and up-to-date information for professionals who would like to have an in-depth view of the present state-of-the-art of remote-sensing science and technology development. On the other hand, the self-contained thematic chapters of the handbook provide an essential reference for practitioners who would like to focus on a specific topic, about which they would like to find a basic theoretical knowledge and guidance on application possibilities. And last but not least, the volumes of the book can effectively be used for education purposes given the wide range of topics covered by the chapters and its clear and readable style. All volumes contain several chapters focusing on ecological problems, such as vegetation mapping, estimation of biomass and biodiversity, habitat quality assessment, habitat modelling and many other related topics. Advanced image-based algorithms and their applications described in the book have the potential to extend the spatial and temporal limits and resolution of ecological studies.

The applicability of remote-sensing to grassland ecosystems was demonstrated by several case studies from Pannonian alkali grasslands. Alkaline grasslands being one of the most complex grassland habitats in Europe, with a fine-scale mosaic of several plant associations, are suitable objects for testing remote-sensing applications (Török et al. 2012; Valkó et al. 2014). In their studies, Deák et al. (2014) differentiated eight typical alkali plant associations solely based on their vertical position along an elevation gradient in an alkaline landscape using digital terrain models derived from airborne laser-scanned (ALS) data. Another approach for vegetation mapping in grasslands characterised by elevation differences is to apply topographical indices, such as Topographic Wetness Index (TWI) and Topographic Position Indices (TPI), derived from ALS data (see Alexander et al. 2016). Multi-temporal full waveform ALS data has a high potential not only for mapping grassland habitats, but for mapping their nature conservation status even in a landscape level (Zlinszky et al. 2015). Beside ALS data, which provides fine resolution structural data from the studied area (such as plant height, elevation, vegetation cover and patterns), hyperspectral remote-sensing can also be a feasible tool for vegetation classification and mapping. Spectral attributes of the environment and the vegetation can be effectively used for differentiating vegetation groups with different photosynthetic activity and biomass (Burai et al. 2015).

An important advantage of the application of remotely sensed data is that it allows testing conventional hypotheses in a much broader scale and it also supports the testing of novel hypotheses related to e.g. changes in plant leaf traits or primary production on a regional level, which would not be possible without this technique. Besides that the chapters introduce a number of cutting-edge methodologies, this book also provides up-to-date examples of case studies, which can further contribute to the in-depth understanding of the work-flow, and support planning and implementation of one's own projects.

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