

REMOTE SENSING OF MANGROVE FOREST STRUCTURE AND DYNAMICS

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ABSTRACT

On a mangrove peninsula in North Brazil suitable and transferable techniques for the remote sensing and airborne-based classification for the assessment of mangrove forest structures were developed within the framework of the MADAM (Mangrove Dynamics and Management) Project. Examples of this research are presented in this article. On local scale an object based classification rule network, which was developed and applied for airborne photo-transsects, was adapted to Ikonos sub-scene. The transfer of the object based rule network to the whole peninsula however, exposed crucial deficiencies in the overall technical performance. On this level, the rule network was redesigned to fuzzy sets instead of using training sets and nearest neighbour algorithms. The results provide an impressive insight into the structure of mangrove ecosystems and their hinterlands. Change Detection On the landscape level about 7 Landsat TM and ETM scenes ranging from 1986 to 2003 served as a remote sensing database to analyse the performance of several change detection techniques. These proved to be unstable and lead to the development of a new methodological approach based on land cover signature specific conditional queries. It was successfully applied to monitor the dynamics of coastal mangroves covered by four selected images from 1986 to 2001. These are currently compared with field data of the long-term beach profile monitoring programme. Moreover three Corona spy-satellite black & white photos with a resolution of about 4m from 1967-1969 were employed. As these scenes display the mangrove peninsula as an undisturbed ecosystem prior to the road construction in the 70ies, the detection of major changes compared to the Ikonos scene of 2003 were possible.

1. BACKGROUND & OBJECTIVES

The development of suitable and transferable techniques for the remote sensing and airborne-based classification for the assessment of mangrove forest structures, as well as the monitoring of their dynamics and the hinterland at multiples scales were a focal point of the research activities of the geographical research group in the 10-

year Mangrove Dynamics and Management (MADAM) project in North Brazil. The latter project is a long-term co-operation project between Brazil and Germany [2].

Several studies have aimed to determine types of mangrove structure patterns [5, 7, 20, 29]. In many cases mangrove species are not strongly large-scale zoned, nor randomly scattered, but often occur in small discrete mono-specific zones [4, 6, 13]. Conceptually, these landscapes may be characterised as a mosaic of habitat patches, which may change over time. However, little attention was given to the interactions between these different patches encompassing the entire landscape perspective, which is mainly due to difficulties of scale resolution of the information needed for such an attempt.

Despite modern technology, detailed geo-spatial information on this complex ecosystem, which would support such an assessment, is still lacking. This is due to the physical inaccessibility of most of the mangrove environments in the first place. Studies, such as in [8,10, 11, 12, 14, 22, 27] employed remote sensing techniques with high resolution satellites (e.g. Landsat, Spot) to determine the spatial composition of mangrove forest stands. Due to the heterogeneity of mangrove tree distributions, a detailed assessment of the mangrove structure according to species was not satisfactorily achieved so far. This is caused by the difficulties in generating sufficient spatial resolution by the use of satellite imagery in order to detect likely structural patterns. However, the problem emerges when dealing with spatially explicit data (e.g. mangrove structure plots of 30 x 30 m) that spatial patterns of mangrove individuals and/or mangrove species have to be quantified to a larger geographical dimension in order to allow recognition as a certain structure.

Only recently new very high-resolution (VHR) satellite data of the sensor systems Ikonos and Quickbird were tested for their applicability in mangrove research. WANG et al. [31] carried out a comparative analysis of both sensor systems, using the example of the Caribbean mangroves of Panama. In a further study [32] investigated, whether Quickbird-Data is capable of separating mangrove species and which classification

Remote Sensing Of Mangrove Forest Structure And Dynamics

Wenbin Ji



Remote Sensing Of Mangrove Forest Structure And Dynamics:

Assessing, Mapping and Modelling of Mangrove Ecosystem Services in the Asia-Pacific Region Rajarshi Dasgupta, Shizuka Hashimoto, Osamu Saito, 2022-09-13 This book presents the state of the art of knowledge in assessing mapping and modeling mangrove ecosystem services and outlines various scientific tools and techniques including environmental scenario building spatial and econometric modelling to understand the fluctuations and future availability of mangrove ecosystem services The book also highlights the current gaps and measures in policy planning and outlines the avenues for capacity building Through case studies and thematic reviews the book plans to cater to a wide range of audiences including students researchers and decision makers at various levels involved in mangrove conservation and land use optimization for sustainable and resilient development This book is particularly useful to researchers and students in the field of landscape and spatial ecology coastal zone management ecosystem services and resilience planning It is also a must read for policymakers conservators coastal zone managers foresters and general administrators in understanding the current and future roles of mangroves in ecosystem based adaptation through informed decision making

Satellite Remote Sensing for Forest and Environmental Monitoring Pablo Rodríguez González, Juan Guerra Hernández, Eduardo Manuel González Ferreiro, 2025-12-19 Satellite Remote Sensing for Forest and Environmental Monitoring provides a thorough examination of the applications and methods of satellite remote sensing for analyzing and managing forest environments From forest height mapping to biodiversity modeling the book explores a variety of Earth observation applications across cutting edge sensors and platforms The book addresses the ability of satellite technologies to observe and analyse ecological functions conditions and socioeconomic benefits for sustainable nature protection in the face of anthropogenic change offering practical tools and strategies for large scale forest inventories fire risk assessment and freshwater management Satellite Remote Sensing for Forest and Environmental Monitoring offers postgraduates researchers and academics in remote sensing and geospatial technologies particularly those focusing on forestry applications and related disciplines insights into environmental changes land use patterns vegetation mapping and climate indicators Covers a range of cutting edge sensors and platforms for advanced forest analyses and novel remote sensing methodologies Explore diverse global case studies utilizing consistent observations for effective geospatial monitoring strategies Provides insights into the management of forest dimensions through remote sensing technologies guiding readers through data acquisition and interpretation for decision making capabilities

GIScience & Remote Sensing, 2008

Modelling and Advanced Earth Observation Technologies for Coastal Zone Management Elham Mahmoud Ali, Islam Abou El-Magd, 2025-02-06 This volume provides readers with the tools to unlock the potential of Earth observation EO technologies to transform coastal zone management This comprehensive guide delves into how EO technologies can be used monitor and manage coastal areas emphasizing sustainable land use and development Designed for researchers decision makers and environmental planners

this book offers multi scale assessment approaches that provide actionable solutions and strategic plans for managing extensive environmental landscapes Readers will discover innovative management solutions for a variety of environmental challenges along with new methodologies aimed at sustainable development and the achievement of the United Nations Sustainable Development Goals SDGs and 2030 targets This volume showcases numerous multi tasked applications of satellite data from diverse sources validating the immense value of earth observations in environmental management By integrating this data into geographical databases the book provide an ideal framework for spatial planning at various scales Geospatial information is a crucial tool for creating interactive systems for spatial analysis merging real world data with forecasting models to support social and economic development Geospatial information guides where and when to act aiding in the development of strategic and implementation plans that promote sustainable development Embrace the future of coastal zone management with this volume and equip yourself with the knowledge and tools to make informed impactful decisions for a sustainable tomorrow

Drivers of Mangrove Forest Change and its Effects on Biodiversity and Ecosystem Services Jennifer Howard, Dominic A. Andradi-Brown, Valerie Hagger, Sigit Sasmito, Jared Bosire, 2022-08-25

Tsunamis and Earthquakes in Coastal Environments V. Santiago-Fandino, H. Tanaka, M. Spiske, 2016-04-14 This monograph is a compilation of a number of research studies presented in fourteen chapters dealing with the impact and restoration of coastal environments that have been affected by earthquakes and tsunamis The focus is mainly on rivers estuaries coastal lagoons beaches and related ecosystems In addition to direct impact and response due to flooding and subsequent abrasion this publication covers physical chemical and biological responses in coastal morphology water quality and ecosystems and includes also topics dealing with risk reduction and vulnerability This compilation mainly covers examples from large magnitude earthquake and tsunami events in the Indian and Pacific Ocean that are complemented with other events in Latin America and the Iberian Peninsula Comprehensive descriptions of multi scale impacts of tsunami and earthquake events both spatially and temporally will help the reader to understand the complicated interactions which occur in coastal zones in order to create a sustainable resilient environment and achieve a society with smart post event recovery planning This book is aimed at researchers and students in coastal science and engineering as well as at policy makers environmental planners and coastal managers

Seafloor Mapping along Continental Shelves Charles W. Finkl, Christopher Makowski, 2016-03-24 This university level reference work covers a range of remote sensing techniques that are useful for mapping and visualizing benthic environments on continental shelves Chapters focus on overviews of the history and future of seafloor mapping techniques cartographical visualisation and communication of seafloor mapping and practical applications of new technologies Seabed mapping is referenced by high resolution seismic methods sidescan sonar multibeam bathymetry satellite imagery LiDAR acoustic backscatter techniques and soundscape ecology monitoring use of autonomous underwater vehicles among other methods The wide breadth of subjects in this volume provides diversified

coverage of seafloor imaging This collection of modern seafloor mapping techniques summarizes the state of the art methods for mapping continental shelves **Belgian Journal of Botany** ,2006 *Object-based Methods for Individual Tree Identification and Tree Species Classification from High-spatial Resolution Imagery* Le Wang (Ph.D.),2003 **Forestry Research in Environmental Conservation, Improved Livelihoods, and Economic Development** Kenya Forestry Research Institute. Scientific Conference,2007 **ETFRN News** ,2000 Ecology Abstracts ,1998 Coverage 1982 current updated monthly This database covers current ecology research across a wide range of disciplines reflecting recent advances in light of growing evidence regarding global environmental change and destruction Major areas of subject coverage include Algae lichens Animals Annelids Aquatic ecosystems Arachnids Arid zones Birds Brackish water Bryophytes pteridophytes Coastal ecosystems Conifers Conservation Control Crustaceans Ecosystem studies Fungi Grasses Grasslands High altitude environments Human ecology Insects Legumes Mammals Management Microorganisms Molluscs Nematodes Paleo ecology Plants Pollution studies Reptiles River basins Soil TAiga tundra Terrestrial ecosystems Vertebrates Wetlands Woodlands

Proceedings of the ... International Symposium on Remote Sensing of Environment ,2003 **Tropical Forest Update** ,1993 Earth Resources ,1989 A selection of annotated references to unclassified reports and journal articles that were introduced into the NASA scientific and technical information system and announced in Scientific and technical aerospace reports STAR and International Aerospace Abstracts IAA **Australian Marine Research in Progress** ,1988 *Journal of Forest Planning* ,2002 *Earth Resources: A Continuing Bibliography with Indexes (issue 62)* ,1988 **Aquatic Sciences and Fisheries Abstracts** ,1995 **Remote-sensing Techniques for Assessment of Mangrove Forest Structure, Species Composition and Biomass, and Response to Environmental Change** Anthea Lauren Mitchell,2003

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