

## Ecosystem Services Of Mangrove Forests Global Nature

This is the first comprehensive science-based primer to highlight the unique ecosystem services provided by mangrove forests, and discuss how these services preserve the livelihoods of coastal populations. The book presents three decades of real-time data on Sundarbans and Bhitarkanika mangroves in India measuring carbon and nitrogen sequestration, as well as case studies that demonstrate the utility provided by mangroves for reducing the impact of storms and erosion, providing nutrient retention for complex habitats, and housing a vast reservoir of plant, animal and microbial biodiversity. Also addressed is the function of mangroves as natural ecosystems of cultural convergence, offering the resources and products necessary for thriving coastal communities. The book will be of interest to students, academics and researchers in the fields of oceanography, marine biology, botany, climate science, ecology and environmental geography, as well as consultants and policy makers working in coastal zone management and coastal biodiversity conservation.

Mangrove forests are among the most sensitive and also the most threatened ecosystems on Earth. At the same time, nearly all of them are located in regions where food security is fragile and smallholder families are desperate to find additional sources of income. As a result, the local population views them as a resource for enhancing their livelihoods; and as there are significant differences between the private profitability of converting mangroves into farm land and the social cost-benefit-balance of such actions, conflicts between the protection of mangrove forests on the one hand and their use for agricultural production on the other hand are prevalent. This study was conducted to estimate the economic value of the Wunbaike Mangrove and to evaluate the benefits of the alternative mangrove uses from the private and social point of view to assist in the improvement of mangrove management strategies and policies. The study focused on the Wunbaike Mangrove users in the Yanbye Township. The economic value of mangroves was estimated in terms of local direct use of mangrove forest products and users' willingness to pay for the conservation of mangroves for its non-use value. Financial and economic cost-benefit analyses were conducted to evaluate the rice and shrimp farms in the mangroves.

Mangroves provide essential ecosystem functions and services that support coastal communities. Despite their importance, they have been degraded and removed globally resulting in loss of resilience of coastlines, their communities, and economies. Myanmar in particular has suffered from high levels of mangrove loss and has the highest current rate of mangrove loss among mangrove holding nations. The role of mangroves in protecting coastlines and communities from storms and flooding, regulating carbon and nutrient cycles, and supporting fisheries has been well established. Yet, the effects of deforestation have resulted in lowering the capacity of mangrove forests to effectively act as a buffer against waves and storm surges. With the development goal of enhancing economic and environmental conditions, in 2016 the government launched the Myanmar Reforestation and Rehabilitation Program (MRRP 2017- 2026). The MRRP aims to create impact through a shift from degraded forests to better quality forests and income improvement of local communities. This study comprises intensive data collection, including mapping and on-ground assessment of mangrove resources, detailed household surveys on how community members use mangroves and what incomes they receive, accumulation of knowledge of costs for restoration, and management activities by governments and non-government organizations.

Sundarbans, a UNESCO heritage site, is the world's largest single chunk of mangroves distributed on the Indian and Bangladesh coasts. The mangroves and associated ecosystems are one of the most fertile ecosystems of the earth. Sundarbans Mangrove Systems: A Geo-Informatics Approach portrays different perspectives of studying Sundarbans and mangroves using geospatial analysis. This book highlights the major issues with the Sundarbans

mangrove forest, its future conservation strategies and its ecological importance using geoinformatics technology. It explains the usage of remote sensing data for providing information about the present state of mangroves and their tropic status, including assessment in terms of extent, density of community, condition, diversity, identifying potential habitats and heterogeneity. Furthermore, it discusses the use of hyperspectral remote sensing data for species level classification of mangroves, community zonation for biodiversity assessment and for preparing management plans for conservation. KEY FEATURES Exclusively covers the ecological state of Sundarbans (mangrove systems) through geo-informatic studies Describes the application of a combination of geomorphological, biogeochemical and remote sensing methods to the analysis of temporal changes Includes environmental factors affecting the health and decline of mangroves Covers biodiversity and ecological controls in mangroves ecosystems Discusses a remote sensing approach for tropical forested island and mangroves mapping This book is aimed at graduate students and researchers in environmental sciences, ecology, marine sciences, biology, geosciences and GIS/remote sensing areas.

Protection of the environment has nowadays become a major challenge and a condition for survival of future human generations and life on Earth in general. Yet it is still far too much of a dream or hope rather than a reality in the policy of our societies. Presently we are experiencing an unprecedented exponential growth of demography combined with a race for profit, resulting in excessive consumption particularly of energy, and a serious impact on the world ecosystems. Various types of pollutants and emerging new diseases not only disrupt the normal course of life, but also above this some of the atmospheric pollutants are most likely involved in the changing climate. We fear and literally shiver at the thought that the "changing climate" would ultimately disrupt the fragile thermodynamic equilibrium between the atmosphere and the oceans. Are we insensitive to these facts to the point of pushing our descendants, some generations ahead, into a new glacial period after a first period of warming up, at least, in northern Europe, like the one that took place 13 to 14 millennia ago? Surely the planet's nature is not prepared to be dominated by man and will go its way, whether humanity will be alive or dead.

Sustainable management of natural resources is an urgent need, given the changing climatic conditions of Earth systems. The ability to monitor natural resources precisely and accurately is increasingly important. New and advanced remote sensing tools and techniques are continually being developed to monitor and manage natural resources in an effective way. Remote sensing technology uses electromagnetic sensors to record, measure and monitor even small variations in natural resources. The addition of new remote sensing datasets, processing techniques and software makes remote sensing an exact and cost-effective tool and technology for natural resource monitoring and management. Advances in Remote Sensing for Natural Resources Monitoring provides a detailed overview of the potential applications of advanced satellite data in natural resource monitoring. The book determines how environmental and - ecological knowledge and satellite-based information can be effectively combined to address a wide array of current natural resource management needs. Each chapter covers different aspects of remote sensing approach to monitor the natural resources effectively, to provide a platform for decision and policy. This important work: Provides comprehensive coverage of advances and applications of remote sensing in natural resources monitoring Includes new and emerging approaches for resource monitoring with case studies Covers different aspects of forest, water, soil- land resources, and agriculture Provides exemplary illustration of themes such as glaciers, surface runoff, ground water potential and soil moisture content with temporal analysis Covers blue carbon, seawater intrusion, playa wetlands, and wetland inundation with case studies Showcases disaster studies such as floods, tsunami, showing where remote sensing technologies have been used This edited book is the first volume of the book series Advances in Remote Sensing for Earth

Observation.

Ecosystems as Natural Assets explores this literature and related modeling to show explicitly how the concept of ecosystems as natural assets translates into the traditional "natural capital" approach of resource economics.

This publication provides a timely synthesis of the importance of mangroves to people. It highlights that in spite of the mounting evidence in support of the multitude of benefits derived from mangroves, they remain one of the most threatened ecosystems on the planet, being lost at a rate greater than coral reefs and tropical rain forests. This has potentially devastating effects to mangrove biodiversity and in turn, the food security, protection and livelihoods of some of the most marginalized coastal communities in developing countries, where more than 90 percent of the world's mangroves are found.

Mangrove Forests in India Exploring Ecosystem Services Springer

A major challenge in trading ecosystem services is the need to quantify and commoditise services, for monitoring and verification as well as for trade. This is relatively straightforward for goods such as forest honey or shade-grown coffee, but potentially complex for services such as water purification, reducing risk from floods or other disasters or carbon sequestration. Developing certification systems for forest ecosystem services is one potential way to define, quantify and verify these services in a way that buyers can trust, and this is why certification of ecosystem services is promoted by a number of environmental and forestry NGOs. Certification of ecosystem services is a useful concept, but many practical and theoretical obstacles must be addressed before it can be put into practice. This paper is a review of existing development in certification of ecosystem services, with information useful for designing and implementing projects to evaluate the efficacy of new systems. We discuss the potential use of more holistic concepts for measuring management sustainability, which are to date undeveloped and untested, and recommend developing pilot projects that are specifically designed to address a number of challenges inherent to ecosystem service certification.

This book provides recent environmental, ecological and hydrodynamic information for the major estuaries and the coastal marine systems of the Western Indian Ocean Region. It covers various functions and values of the region's estuarine ecosystems and their respective habitats, including the land/ocean interactions that define and impact ecosystem services. The Western Indian Ocean region covered by this volume consists of the continental coastal states of Kenya, Mozambique, South Africa and Tanzania and the island states of Madagascar, Mauritius, Seychelles and Comoros. "The investigation of socio-ecological interactions involving mangrove ecosystem services (ES) illustrates the complexity of the relationships between functional ecosystems, market integration and the ability to maintain human well-being. The Belosur-Mer system of mangrove forests, located on the west coast of Madagascar, provides a range of ES to the communities of Antanamanimbo and Marofihitsy. Mangrove fisheries provide the majority of monetary incomes in both communities, representing 53.53 % of total annual incomes for Antanamanimbo and 59.76 % for Marofihitsy. Greater market integration in Antanamanimbo corresponds with larger material, energy and monetary throughputs. The role of mangrove ES in generating incomes is complemented by their importance as key components in local diets, communities' reliance on the mangrove as a safety-net for incomes and food production, for harvesting fuelwood and lumber, and in supporting cultural identities.

Despite large differences in the size of household incomes and scale of mangrove resource extraction between these communities, their levels of human well-being are very similar. This suggests that the relationship between human well-being and natural systems is multi-dimensional and relies heavily on components that are not accounted for by the market system. Considering the role of mangrove ES in this local socio-economic context provides an invaluable tool to be used in guiding local decision making and establishing an effective balance between conservation and development."

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This book outlines the performance and management of mangroves in the changing climatic scenario of the Asia-Pacific region and draws examples and lessons from the national and community-driven mangrove conservation programs of relevant countries including Pakistan, India, Bangladesh, Sri Lanka, Myanmar, Thailand, Cambodia, Indonesia, the Philippines, and Japan as well as the Pacific islands. By highlighting the major drawbacks that hinder effective mangrove conservation, the book contributes towards enhancing climate resilience of communities through proposition of corrective methods and ameliorative approaches of mangrove conservation. Mangroves play an important role in adapting to climate change and provide a plethora of ecosystem services that are fundamental to human survival. Yet these ecosystems are exceptionally prone to extinction due to increased human interventions and changes in environmental boundary conditions. Especially in the Asia-Pacific region, mangroves have dwindled at an exceptional high rate over the past three decades. As the threat of climate change hovers over millions of people in this region, particularly those who crowd the low-lying coastal areas, conservation/restoration of mangroves through appropriate policies and practices remain highly imperative. The primary target readers for this book are students and researchers in the fields of conservation and management of mangroves, especially from the developing tropical countries of the Asia-Pacific region. Other target groups comprise policy planners, practitioners, and NGO workers, who will be able to apply the collective knowledge from this work towards proactive mangrove conservation through effective mediation in local communities.

This book focuses on the worldwide threats to mangrove forests and the management solutions currently being used to counteract those hazards. Designed for the professional or specialist in marine science, coastal zone management, biology, and related disciplines, this work will appeal to those not only working to protect mangrove forests, but also the surrounding coastal areas of all types. Examples are drawn from many different geographic areas, including North and South America, India, and Southeast Asia. Subject areas covered include both human-induced and natural impacts to mangroves, intended or otherwise, as well as the efforts being made by coastal researchers to promote restoration of these coastal fringing forests.

Mangrove Ecosystem Ecology and Function deals with several aspects of mangrove science, as well as conservation, management, and related policies. The book is divided into six sections and structured into 10 chapters. The first section discusses mangrove ecology, structure, and function; the second section explains mangrove physiology related to salt accumulation; the third section focuses on mangrove polychaetes; the fourth section talks about the bioprospect of mangrove microbes; the fifth section discusses soil geochemistry; and the sixth section elucidates mangrove

management and conservation. Researchers from different countries and fields of mangrove ecosystem exploration have contributed their findings. This book would be an ideal source of scientific information to graduate students, advanced students, researchers, scientists, and stakeholders involved in mangrove ecosystem research. This book aims to give a holistic overview of the pond ecosystem of Indian Sundarbans. Due to climate change, the Indian Sundarbans faces several challenges. With rising sea levels, islands are disappearing and the increasing salinity in the water and soil has severely threatened the health of mangrove forests and the quality of fresh water, soil and crops. Additionally, there have been serious disturbances to hydrological parameters in the lotic as well lentic ecosystems. This book provides new insights into lentic ecosystem-oriented research in the deltaic ecosystem of GBM-I (Ganga-Brahmaputra-Meghna, Indian Delta). The major findings from various research works are brought together, and the gaps and future possible ways forward are outlined. The book addresses the SDG 6 (Clean Water and Sanitation), SDG 13 (Climate Action) and SDG 14 (Life below Water), with a focus on the ecosystem services of ponds in the Indian Sundarbans. Despite there being many studies on riverine water, ground water and mangrove ecosystems of the Indian Sundarbans, this book offers new insights into the pond ecosystem of the Indian Sundarbans. The outcomes from this book can be utilized by researchers from the inland fisheries sector, environmental managers, professionals, and those who seek to develop ways for making pond ecosystems sustainable.

Agroforestry, the word coined in early seventies, has made its place in all the developed and the developing countries of the world and is now recognized as an important approach to ensuring food security and rebuilding resilient rural environments. India has been an all-time leader in agroforestry. The South and Southeast Asia region comprising India is often described as the cradle of agroforestry. Almost all forms of agroforestry systems exist across India in ecozones ranging from humid tropical lowlands to high-altitude and temperate biomes, and perhumid rainforest zones to parched drylands. The country ranks foremost among the community of nations not only in terms of this enormous diversity and long tradition of the practice of agroforestry, but also in fostering scientific developments in the subject. Agroforestry applies to private agricultural and forest lands and communities that also include highly erodible, flood-prone, economically marginal and environmentally sensitive lands. The typical situation is agricultural, where trees are added to create desired benefits. Agroforestry allows for the diversification of farm activities and makes better use of environmental resources. Owing to an increase in the population of human and cattle, there is increasing demand of food as well as fodder, particularly in developing countries like India. So far, there is no policy that deals with specifics in agroforestry in India. But, the Indian Council of Agricultural Research has been discussing on the scope of having a National Agroforestry Policy in appropriate platforms. However, evolving a policy requires good and reliable datasets from different corners of the country on the subject matter. This synthesis volume containing 13 chapters is an attempt to collate available information in a classified manner into different system ecologies, problems and solutions, and converging them into a policy support. Policy and management decisions are often made on financial grounds. However, the economic value of the benefits that people derive from ecosystems, that is, ecosystem

services, may not be fully recognised and hence ecosystem considerations may not be incorporated adequately into decision-making processes. This is particularly true for regulating services, the benefits obtained from the regulation of ecosystem processes, the valuation of which requires an interdisciplinary approach. In essence, valuation is a problem solving strategy and a problem is a problem, it does not respect the boundary of any particular discipline. The valuation of regulating services is an evolving field of ecological economics. In this book, Professor Pushpam Kumar and Professor Michael D. Wood have invited some of the foremost international experts in the field of ecosystem services valuation to contribute chapters on the valuation of regulating services and highlight some of the main obstacles to the implementation and acceptance of these methodologies in the context of decision-making. The contributors explore the theoretical underpinning of valuation of ecosystem services and demonstrate ways in which these theories can be applied to case-specific problems in order to inform decision-making processes. This collection clarifies some of the doubt and uncertainty regarding the valuation of regulating services. Innovative methodologies in this field have started to emerge and in coming years there may be much further discussion on this topic as methodologies and understanding continue to evolve. This is a highly active area of interdisciplinary research with far reaching social and environmental implications, and this book should be of interest to those who are new to the field, as well as established experts, in moving both theory and practice forward.

'Should be essential reading for all those who wish to realize truly sustainable development in this new millennium.' From the foreword by Achim Steiner UN Under-Secretary General and Executive Director United Nations Environment Programme

'Fills a much needed gap in the literature ... The chapters include contributions by leading academics and policy experts which make for one of the most authoritative books in this field.' Andreas Kontoleon University Lecturer and Director of MPhil in Environmental Policy University of Cambridge This is the most comprehensive book to address the economic soci.

A major part of the mangrove forests in the Gulf of Guayaquil (Ecuador) was converted to shrimp aquaculture throughout the 20th century. The remaining forests are crucial for supporting the livelihoods of local communities, coastal protection and carbon sequestration. What are the decisive ecological and social barriers that restoration efforts have to overcome to restore mangrove forests and their ecosystem services? How relevant are social barriers compared to ecological ones? To investigate these questions we analyzed restoration trajectories within a community-managed area that is part of the Ramsar site.

The book provides an up-to-date account of mangrove forests from Asia, together with restoration techniques, and the management requirements of these ecosystems to ensure their sustainability and conservation. All aspects of mangroves and their conservation are critically re-examined. The book is divided into three sections presenting the distribution and status of mangrove ecosystems in Asia, the challenges they are facing, their issues and opportunities, and the management strategies for their conservation.

The 15th Franco-Japanese Symposium of Oceanography "Marine Productivity, Perturbations and Resilience of Socio-Ecosystems," organized by the long-standing

partners Société franco-japonaise d'Océanographie de France and Société franco-japonaise d'Océanographie du Japon, reviewed the impacts of natural (storms, typhoons, earthquakes, tsunamis, etc.) and man-made (pollution, buildings in coastal areas, aquaculture, tourism, sports, diving, etc.) perturbations inflicted on coastal and marine environments. The Symposium examined the resilience of affected socio-ecosystems along with governance responses for these global/local environments. This book collects 43 selected papers, written by experts from numerous universities and research institutes in both countries. It addresses the needs of marine sciences researchers (natural and social sciences), decision-makers and coastal zone managers, and other stakeholders involved in coastal and marine socio-ecosystems. Mangroves are one of the most productive and biologically important blue-carbon ecosystems across the coastal intertidal zone of earth. In the current scenario of serious environmental changes like global warming, climate change, extreme natural disasters, mangrove forests play a vital role in mitigating greenhouse gas emissions and maintaining ecosystem balance. Mangroves are unique ecosystems with rich biological diversity of different taxonomic groups exhibiting great ecological and commercial importance. The book consolidates existing and emerging information on ecology of mangroves, with a special reference to their biodiversity and management. It emphasizes on the role of mangroves in providing various ecological services. The book is a comprehensive compilation covering all aspects of mangrove ecology. It is useful for students and researchers in ecology, plants sciences and environmental sciences.

Carbon sequestration is one of the most important ecosystem services provided by mangrove forests and seagrass beds that helps with climate change adaptation. Mangrove forests and seagrass beds are important ecosystems in tropical and subtropical locations that sequester significant greater amounts of carbon within their living biomass as well as in their sediments compared to terrestrial ecosystems. Ecosystems that exchange energy, organisms and materials are considered connected. This dissertation, however, will focus on connectivity as the specific exchange of particulate organic matter (POM). Connectivity across coastal vegetated ecosystems could have an important impact for ecosystem services across the seascape. Although mangrove forests and seagrass beds usually occur adjacent to each other they are frequently evaluated independently without taking into account how connectivity between these coastal vegetated ecosystems can influence carbon accumulation. Therefore, a comparison of connected with isolated mangrove forests and seagrass beds will help to understand the effect of connectivity on carbon accumulation at the seascape scale. Five field studies in Singapore (Asia), Adelaide (Oceania), Zanzibar (Africa), Florida and Bonaire (Americas), were chosen to evaluate the influence of connectivity. Sampling for sediment carbon content analysis was conducted across all places in different locations with connected mangrove forests and seagrass beds and/or isolated ecosystems. The general hypothesis was that mangrove forests and seagrass beds that are connected with each other would have greater quantities of carbon in the sediment, compared to those that are isolated from each other. Furthermore, other aspects such as connectivity with other ecosystems (i.e. salt marsh, macroalgal beds), community characteristics, sediment nutrient concentration and geomorphic settings were tested and compared separately in each place. Results of

this dissertation in Singapore and Zanzibar showed that no significant differences were observed between mangrove forests connected with seagrasses beds and mangrove forests isolated from seagrass beds. Connectivity between mangrove forests and seagrass beds for carbon accumulation only increased sediment carbon accumulation in South Australia's mangrove forests, where the sediment carbon content was higher in connected forests compared with an isolated mangrove patch. In general, sediment in seagrass beds have higher inorganic carbon indicating that mangrove forests are not the main allochthonous carbon source. Contrary to the general hypothesis, isolated seagrass beds had up to double sediment carbon content compared with connected beds. This was mainly driven by higher amounts of inorganic carbon in isolated beds since sediment organic carbon quantity was similar across the sampled beds. Thus, autochthonous production of inorganic carbon and connectivity with carbonate rich ecosystems (i.e. coral reefs) could be important for seagrass beds carbon accumulation. Although connected seagrass beds did not have higher sediment carbon content compared with isolated beds, results of this dissertation showed that mangrove forests are crucial donors of organic carbon to adjacent ecosystems such as seagrass beds and mud flats. The contributions to POM in the coastal water body of the main primary producers across all coastal vegetated ecosystems were measured in Singapore and South Australia. In both places, mangrove trees contributed between 10 to 70% and significantly more compared with other ecosystems with respect to the area occupied in the seascape by mangrove forests. Additionally, in Singapore and Bonaire it was observed that the export of dissolved organic carbon is an important pathway of exchanging carbon from mangroves forests to adjacent ecosystems. Besides mangrove trees, macroalgae thalli were with 10-50% the main contributors to the POM stocks in Singapore and South Australia. These results highlight the importance of mangrove forests as well as other coastal vegetated ecosystems, such as macroalgal beds, for carbon exchange and potential carbon accumulation across the seascape. Interactions between community composition and environmental parameters (i.e. water particle transportation or sediment nutrient concentration) could enhance the sediment carbon content. In Zanzibar, although functional diversity indices were not associated with higher sediment organic or inorganic carbon content, community species composition associated with prop roots in mangrove forests and large-leaved seagrass plants were correlated with higher sediment carbon content. In both ecosystems the area of tidal channels was also an important predictor of sediment carbon content although there were differences in the influence on sediment organic and inorganic carbon content. Additionally, in Florida the gradient of physical traits of mangrove roots and seagrass plants were compared against different carbon content type (organic and carbonate). A negative correlation was found between the sediment organic carbon content and the root complexity index, whilst higher sediment organic carbon levels were found in areas with higher shoot density and coverage. Besides connectivity other factors at the seascape level such as geomorphic settings or anthropogenic induced changes in the seascape settings could influence the connectivity and the sediment carbon content. In Zanzibar the area of tidal channels as well as the area covered by mangrove forest were positively correlated with sediment organic carbon content in mangrove forests. Anthropogenic induced changes such as changing freshwater fluxes and reduction of mangrove forest area in Singapore as well as reduction of area of healthy mangrove

trees in Bonaire could affected carbon accumulation dynamics not only in mangrove forests but also in adjacent coastal ecosystems such as seagrass beds. In both places the same underlying mechanism was discussed, the reduction of mangrove forest area could reduce the exported amount of POM and decrease the amount of carbon accumulated in the adjacent ecosystems. I conclude that connectivity between mangrove forests and seagrass beds is affected by different localized factors and that degrees of connectedness between those two ecosystems and other adjacent ecosystems should be further study. Factors such as mangrove forests cover area, community composition and health state of mangrove communities influence both the sediment carbon accumulation in mangrove forests and their exportation of carbon to adjacent ecosystems. Additionally, including sediment inorganic carbon content in blue carbon studies concerning seagrass beds is critical, since sediment inorganic carbon content was an important component of their sediment carbon content. Geomorphic settings such as presence of low energy streams or rivers as well as presence of macroalgal beds can also enhance sediment carbon accumulation in mangrove forests and seagrass beds. Results of this dissertation in connectivity between different coastal vegetated ecosystems as well as terrestrial ecosystems highlight the importance of the conservation of all interconnected ecosystems (i.e. mangrove forests, seagrass beds, salt marches, macroalgae beds, coral reefs as well as connected terrestrial ecosystems) for carbon accumulation ecosystem service.

The five-volume set LNCS 7971-7975 constitutes the refereed proceedings of the 13th International Conference on Computational Science and Its Applications, ICCSA 2013, held in Ho Chi Minh City, Vietnam, in June 2013. Apart from the general track, ICCSA 2013 also include 33 special sessions and workshops, in various areas of computational sciences, ranging from computational science technologies, to specific areas of computational sciences, such as computer graphics and virtual reality. There are 46 papers from the general track, and 202 in special sessions and workshops.

The aim of this manual is to enhance understanding of ecosystem services and their valuation. The specific target group comprises governmental officers in planning units and field-level officers and practitioners in key government departments in Bangladesh responsible for project development, including the Ministry of Environment and Forests and its agencies. Most of the examples and case studies presented herein, therefore, are tailored to the Bangladesh context, but the general concepts, approaches and methods can be applied to a broad spectrum of situations. This manual focuses on valuing forest-related ecosystem services, including those provided by trees outside forests. It is expected to improve valuation efforts and help ensure the better use of such values in policymaking and decision making.

This book presents a comprehensive overview and analysis of mangrove ecological processes, structure, and function at the local, biogeographic, and global scales and how these properties interact to provide key ecosystem services to society. The analysis is based on an international collaborative effort that focuses on regions and countries holding the largest mangrove resources

and encompasses the major biogeographic and socio-economic settings of mangrove distribution. Given the economic and ecological importance of mangrove wetlands at the global scale, the chapters aim to integrate ecological and socio-economic perspectives on mangrove function and management using a system-level hierarchical analysis framework. The book explores the nexus between mangrove ecology and the capacity for ecosystem services, with an emphasis on thresholds, multiple stressors, and local conditions that determine this capacity. The interdisciplinary approach and illustrative study cases included in the book will provide valuable resources in data, information, and knowledge about the current status of one of the most productive coastal ecosystem in the world.

Soil and water salinity is a major challenge for the agricultural community and policy makers in terms of meeting the burgeoning population's demand for food and other agricultural commodities. In coastal regions, climate change and sea level rise will aggravate the problem with more and more areas becoming saline due to intrusion of sea water. As such there is a pressing need for modern tools and innovative techniques for the identification of salty soils and poor-quality waters, crop production, soil reclamation and lowering the water table in waterlogged areas. Tackling next-generation problems such as contamination of soil and underground water due to fluoride and arsenic, as well as developing multi-stress tolerant crops is also a high priority. Further, techniques for domesticating halophytes, mangrove-based aquacultures, using seaweed cultures as agricultural crops and integrated farming systems need to be perfected. This book addresses all these aspects in detail, highlighting the diverse solutions to tackle the complex problem of salinity and waterlogging and safer management of poor-quality waters. With chapters written by leading experts, it is a valuable resource for researchers planning future investigations, policy makers, farmers and other stakeholders, and for students wanting insights into vital issues of environment.

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Dynamic Sedimentary Environments of Mangrove Coasts provides knowledge on the importance of sedimentary dynamics in managing mangrove forests. In the first part of the book, the editors seamlessly offer a general introduction of mangrove sedimentary dynamics. This leads into more in-depth information on soil surface elevation change, sea level rise, and the importance of sedimentary dynamics in the loss or gain of blue carbon. The book concludes the discussion of mangrove sedimentary dynamics by addressing the issues of climate change (e.g. sea level rise and blue carbon) on mangrove restoration and sediment. This

book will assist coastal managers and academics in addressing the gaps in mangrove restoration and coastal management. As such, it will be a valuable reference for advanced undergraduate students, graduate students, researchers, academics in the field of coastal restoration, and coastal management practitioners. Provides a state-of-the-art summary of research into sedimentary dynamics in mangrove forests Includes updates on issues of climate change-relevant to mangroves, such as blue carbon and sea level rise Presents scientific background and successful case studies for mangrove restoration that can solve problems relating to mangrove management

Byram mangrove forest with a land area of 240 ha is considered as a degraded mangrove forest. However, the union of different elements, both man-made and natural – the rubbish dump, effluent ponds, intermittent semi-submerged skeletal trees, a mangrove estuary – somehow works in harmony to attract a number of bird species to such a small area. Famously known to avid bird watcher as the Pulau Burung Landfill Site, this semi-aerobic landfill is located in the Byram mangrove forest. Byram mangrove forest is part and parcel of this unique ecosystem. The Pictorial Guide to the Plant and Bird Life of Byram Mangrove Forest, Penang illustrates photos of plant and bird species thriving within the Byram mangrove. Thus, it is a recommended reading for educators, policy makers, academicians, researchers, students and land managers. Key features include: § more than 100 full-colour photos covering major plumage variation, § accurate and latest text describing the habitat, behaviour and status of birds visiting Byram mangrove forest, and § a magnificent guide that successfully captures the richness and biodiversity of the Byram mangrove, in an accessible form. This work should be considered as a continuity of another collaborative effort between Universiti Sains Malaysia and the Penang State Forestry Department on the mangrove ecosystem, from which a book, namely the Ecological Survey on Mangrove Forests: A Case Study of Balik Pulau and Pantai Acheh was published in 2006 by Penerbit Universiti Sains Malaysia. Universiti Sains Malaysia, Penerbit Universiti Sains Malaysia

With the expansion of the world aquaculture industry, there has been increasing concern over sustainability and environmental impact. This book addresses this topical issue, concentrating on marine aquaculture.

"Mangroves are highly productive and biodiversity-rich socio-ecological ecosystems that provide vital goods and services to millions of people, including wood, a renewable natural capital, which is the primary source of energy and construction material for several coastal communities in developing countries. Unfortunately, mangrove loss and degradation occur at alarming rates. In some regions, unregulated and unsustainable mangrove wood harvesting are important causes of degradation. Community-based harvesting is a common practice but few successful case studies are known and studies evaluating its sustainability, and effect on different ecosystem services are lacking. Therefore, my research explores the sustainability of regulated community-based small-scale mangrove timber production by assessing its effect on multiple forest structure attributes, such as tree density, natural regeneration, and wood volume. For this study, I identified and selected the most intensively and recently harvested

and the most conserved mangrove natural stands within a Management Unit for Wildlife Conservation in West Mexico, where local communities have been managing mangroves for decades for both domestic and commercial purposes. In contrast to mangrove over-harvesting, industrial and illegal logging scenarios elsewhere authorized community-based forestry activities in the area follow a unique approach including four management units: conservation, wood production, protection, and restoration. Average tree density and number of shared diameter size classes were not significantly different between harvested and non-harvested stands. Diameter-size class analysis revealed a good representation of different tree development stages from young to mature trees in both conditions. Height class-analysis showed that average natural regeneration of seedlings was similar in both forest conditions suggesting that regulated selective harvesting does not hinder the natural regeneration of mangrove forests in the Management Unit. Although average wood volume between conditions was significantly different, high volumes of wood were recorded in both harvested and non-harvested stands. These results indicate that community-based mangrove wood harvesting may contribute to enhancing the establishment of seedlings, securing wood stocks in the long-term and preserving landscape connectivity. Mangroves in the studied area are likely to be resilient to wood harvesting and hurricanes, as average tree densities and natural regeneration estimated were comparable to well-managed mangrove forests in other regions of the world. Consequently, the spatial and temporal trade-offs of mangrove harvesting and the provision of multiple ecosystem services may be minimal, as selective tree harvesting is conducted only in small production areas allowing the maintenance of canopy cover, along with roots, soil, and biodiversity conservation. Overall, my research findings suggest that community-based mangrove forestry through Management Units for Wildlife Conservation could be a cost-effective scheme to manage and conserve mangrove forests and their ecosystem services within and beyond protected areas, while providing local livelihoods and helping reduce illegal logging. If implemented with a multidisciplinary perspective that incorporates scientific assessments this win-win strategy may contribute to achieving national and international environmental and sustainable development agreements that could provide multiple social, ecological and economic benefits from local to global scales. Including the protection of traditional knowledge, biodiversity, and renewable natural capital, as well as forest-based climate change mitigation and adaptation." --

This book informs readers on the ecology, ecosystem services, and management of Sundaland wetland ecosystems, discussing the concepts and tools necessary to conserve these imperiled habitats. Sundaland is a biogeographically defined area of South East Asia characterised by an exceptional concentration of endemic species. The unprecedented loss of wetland habitats within Sundaland warrants urgency in implementing conservation actions. The authors are both researchers who have witnessed the ongoing losses of wetland habitats in Sundaland. The first chapter introduces fundamental concepts of ecosystems, ecological processes and ecosystem services of coastal and inland wetlands. The second chapter provides an overview of the global and regional conservation status of these ecosystems. The third chapter advances the importance of wetlands management at the landscape level (drainage basins), and proposes to adopt the concept of Ecotonal Networks (ENTs) as a sustainable management method, within the theoretical framework of Resilience Theory. The fourth chapter showcases potential flagship species that can aid in raising awareness on these endangered but poorly-known ecosystems. The fifth chapter discusses sustainable ecotourism as a viable and profitable industry to manage non-urban wetland areas of Sundaland, while providing specific suggestions for future developments. The book is written for ecosystem managers, conservation scientists, ecologists, and nature enthusiasts. It consists of a coherently arranged set of scientifically accurate tools that consider societal, cultural, and economic factors to succeed in the conservation of the Sundaland wetlands, as well as other

wetland habitats in the world.

Changing Ecosystems and their Services provides a very interesting account of the frontiers of biodiversity and ecological research. It consists of seven chapters covering mass extinctions: the "Big Five" and "The Sixth", which are recent global ecological crises, Caribbean biodiversity, acoustic habitat degradation due to shipping in the world's oceans, methane production of microbes in Amazonian floodplains, African mangrove forests, pollination as ecosystem services in Ethiopia, and climate change management. I am sure that this book will be very useful for everybody—researchers, teachers, students, or others interested in the field—who would benefit from insight into biodiversity research.

The degradation of ecosystems, including forests, and the associated loss of biodiversity, particularly due to human-induced threats and climate change, has gained increased attention from scientists and policymakers. The Millennium Ecosystem Assessment presented a new conceptual framework that puts ecosystem services at the centre and links human well-being to the impacts on ecosystems of changes in natural resources. The Economics of Ecosystems and Biodiversity initiative drew further attention to the economic benefits of conserving ecosystems and biodiversity, supporting the idea that economic instruments – if appropriately applied, developed and interpreted – can inform policy- and decision-making processes. Only a few ecosystem services, however, have explicit market value and are traded in open markets: many – especially those categorized as having “passive-use” value – remain invisible and are rarely accounted for in traditional economic systems. The failure to appropriately consider the full economic value of ecosystem services in decision making enables the continued degradation and loss of ecosystems and biodiversity. Most ecosystem services are considered public goods and tend to be overexploited by society. Many methods have been applied to the economic valuation of ecosystem services. The use of these methods, as well as the interpretation of their results, requires familiarity with the ecological, political, normative and socio-economic context and the science of economics. Recognizing, demonstrating and capturing the value of ecosystem services can play an important role in setting policy directions for ecosystem management and conservation and thus in increasing the provision of ecosystem services and their contributions to human well-being. The aim of this manual is to enhance understanding of ecosystem services and their valuation. The specific target group comprises governmental officers in planning units and field-level officers and practitioners in key government departments in Bangladesh responsible for project development, including the Ministry of Environment and Forests and its agencies. Most of the examples and case studies presented herein, therefore, are tailored to the Bangladesh context, but the general concepts, approaches and methods can be applied to a broad spectrum of situations. This manual focuses on valuing forest-related ecosystem services, including those provided by trees outside forests. It is expected to improve valuation efforts and help ensure the better use of such values in policymaking and decision making. Among other things, the manual explores the basics of financial mathematics (e.g. the time value of money; discounting; cost–benefit analysis; and profitability and risk indicators); the main methods of economic valuation; examples of the valuation of selected ecosystem services; and inputs for considering values in decision making.

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