

Chapter 4 Protection From Coastal Erosion

Sea and Ocean Hazards, Risks and Disasters provides a scientific approach to those hazards and disasters related to the Earth's coasts and oceans. This is the first book to integrate scientific, social, and economic issues related to disasters such as hazard identification, risk analysis, and planning, relevant hazard process mechanics, discussions of preparedness, response, and recovery, and the economics of loss and remediation. Throughout the book cases studies are presented of historically relevant hazards and disasters as well as the many recent catastrophes. Contains contributions from experts in the field selected by a world-renowned editorial board Cutting-edge discussion of natural hazard topics that affect the lives and livelihoods of millions of humans worldwide Numerous full-color tables, GIS maps, diagrams, illustrations, and photographs of hazardous processes in action will be included

Close to one-half of all Americans live in coastal counties. The resulting flood of wastewater, stormwater, and pollutants discharged into coastal waters is a major concern. This book offers a well-delineated approach to integrated coastal management beginning with wastewater and stormwater control. The committee presents an overview of current management practices and problems. The core of the volume is a detailed model for integrated coastal management, offering basic principles and methods, a direction for moving from general concerns to day-to-day activities, specific steps from goal setting through monitoring performance, and a base of scientific and technical information. Success stories from the Chesapeake and Santa Monica bays are included. The volume discusses potential barriers to integrated coastal management and how they may be overcome and suggests steps for introducing this concept into current programs and legislation. This practical volume will be important to anyone concerned about management of coastal waters: policymakers, resource and municipal managers, environmental professionals, concerned community groups, and researchers, as well as faculty and students in environmental studies.

Working with nature - and not against it - is a global trend in coastal management. This ethnography of coastal protection follows the increasingly popular approach of "soft" protection to the Aotearoa New Zealand coast. Friederike Gesing analyses a political controversy over hard and soft protection measures, and introduces a growing community of practice involved in projects of working with nature. Dune restoration volunteers, coastal management experts, surfer-scientists, and Maori conservationists are engaged in projects ranging from do-it-yourself erosion control, to the reconstruction of native nature, and soft engineering "in concert with natural processes". With soft protection, Gesing argues, we can witness a new sociotechnical imaginary in the making.

This guidance note provides review and recommendations for how the protective services of mangroves and coral reefs can be measured and valued in a manner consistent with national economic accounts and included in other decision-making processes to support planning for development, disaster risk, and coastal zone management. It synthesizes evidence of the role mangroves (chapter 2) and coral reefs (chapter 3) play in coastal protection and risk reduction. It also reviews the tools and approaches commonly used by ecologists, economists, and engineers for estimating the coastal protection services of coastal habitats (chapter 4). Moreover, it examines how the valuations of these coastal protection services can be considered in the System of Environmental Economic Accounts (SEEA), the satellite accounts to the System of National Accounts (SNA) (chapter 5). In addition, the note examines where the coastal protection role of reefs and mangroves has been used in management decisions from local to national scales (chapter 6). Finally, it provides recommendations for advancing the assessment and the use of coastal protection values from coral reefs and mangroves in national and regional decisions (chapter 7).

Tide gauges show that global sea level has risen about 7 inches during the 20th century, and recent satellite data show that the rate of sea-level rise is accelerating. As Earth warms, sea levels are rising mainly because ocean water expands as it warms; and water from melting glaciers and ice sheets is flowing into the ocean. Sea-level rise poses enormous risks to the valuable infrastructure, development, and wetlands that line much of the 1,600 mile shoreline of California, Oregon, and Washington. As those states seek to incorporate projections of sea-level rise into coastal planning, they asked the National Research Council to make independent projections of sea-level rise along their coasts for the years 2030, 2050, and 2100, taking into account regional factors that affect sea level. Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future explains that sea level along the U.S. west coast is affected by a number of factors. These include: climate patterns such as the El Niño, effects from the melting of modern and ancient ice sheets, and geologic processes, such as plate tectonics. Regional projections for California, Oregon, and Washington show a sharp distinction at Cape Mendocino in northern California. South of that point, sea-level rise is expected to be very close to global projections. However, projections are lower north of Cape Mendocino because the land is being pushed upward as the ocean plate moves under the continental plate along the Cascadia Subduction Zone. However, an earthquake magnitude 8 or larger, which occurs in the region every few hundred to 1,000 years, would cause the land to drop and sea level to suddenly rise.

Living Shorelines: The Science and Management of Nature-based Coastal Protection compiles, synthesizes and interprets the current state of the knowledge on the science and practice of nature-based shoreline protection. This book will serve as a valuable reference to guide scientists, students, managers, planners, regulators, environmental and engineering consultants, and others engaged in the design and implementation of living shorelines. This volume provides a background and history of living shorelines, understandings on management, policy, and project designs, technical synthesis of the science related to living shorelines including insights from new studies, and the identification of research needs, lessons learned, and perspectives on future guidance. Makes recommendations on the correct usage of the term living shorelines Offers guidance for shoreline management in the future Includes lessons learned from the practice of shoreline restoration/conservation Synthesizes regional perspectives to identify strategies for the successful design and implementation of living shorelines Reviews specific design criteria for successful implementation of living shorelines Provides detailed discussions of social, regulatory, scientific and technical considerations to justify and design living shoreline projects International perspectives are presented from leading researchers and managers in the East, West and Gulf coasts of the United States, Europe, Canada, and Australia that are working on natural approaches to shoreline management. The broad geographic scope and interdisciplinary nature of contributing authors will help to facilitate dialogue and transfer knowledge among different disciplines and across different regions. This book provides coastal communities with the scientific foundation and practical guidance necessary to implement effective shoreline management that enhances ecosystem services and coastal resilience now and into the future.

Like ocean beaches, sheltered coastal areas experience land loss from erosion and sea level rise. In response, property owners often install hard structures such as bulkheads as a way to prevent further erosion, but these structures cause changes in the coastal environment that alter landscapes, reduce public access and recreational opportunities, diminish natural habitats, and harm species that depend on these habitats for shelter and food. Mitigating Shore Erosion Along Sheltered Coasts recommends coastal planning efforts and permitting policies to encourage landowners to use erosion control alternatives that help retain the natural features of coastal shorelines.

Prepared by the Hurricane Ike Field Assessment Team of the Coasts, Oceans, Ports, and Rivers Institute of ASCE.

Hurricane Ike Coastal Impact Assessment: Field Observations from October 3-6, 2008 describes the environmental and infrastructure impacts of Hurricane Ike on the upper Texas coast. Most important, the report identifies factors that appeared to provide protection from storm damage and presents some policy implications. After a general introduction to the area, its geology, historical storm events and rehabilitation, and coastal processes, the book describes Hurricane Ike,

including water levels, storm surge measurements, and comparisons with other storms. It portrays the physical impacts of the storm, such as geomorphic changes, erosion rates, shoreline position, and impact of winds on engineered structures. Damage to and survival of shoreline structures--piers, seawalls, geotextile tubes, groins, and inlet jetties--are also discussed. Subsequent chapters address structural damage to buildings, lifelines and infrastructure, and marinas from wind, flooding, waves, and erosion. Finally, the book raises policy issues and summarizes lessons learned. Civil engineers engaged in projects related to coasts, oceans, ports, and rivers, especially in hurricane-prone areas; facilities managers in coastal areas; government officials from agencies that participate in coastal zone management or manage emergency preparedness will find the observations and conclusions of this book valuable.

Advances in Coastal Structure Design presents a compendium of 10 papers addressing the state-of-the-art advances in Coastal Structure Design by internationally renowned authors. The papers focus on the tools and techniques used to analyze coastal processes and design engineering solutions to them. The first three chapters present multiple view points and policies regarding how the coastal-structure debate in the United States came to be and how policies are evolving to handle issues concerning the interactions of structures with shorelines. Including a paper on the global perspective surrounding the policy, design, construction and monitoring of coastal structures and the third demonstrating how a good knowledge of multi-disciplinary areas of geotechnical, geologic, and seismic conditions are essential to successful planning and design of coastal structures. The following chapter discusses a key aspect of coastal structure design, which is modeling. The remaining papers present insightful information on: wave distributions and probabilities; an overview of breakwater design and construction since the 18th century; and advances in structural design aspects on performance-based design. The final chapter demonstrates how sand, vegetation, cobbles, and small structures can be effectively utilized to provide coastal protection. CONTENTS INCLUDE: Coastal Structure Debate: Public and Policy Aspects; International Perspectives on Coastal Structure Uses; Geotechnical Consideration for Coastal Structure Design; Numerical Modeling as a Design Tool for Coastal Structures; Physical Modeling Considerations for Coastal Structures; Selection of a Design Wave Height for Coastal Engineering; Historical Overview of Rubble Mound Structure Design and Construction; Advances in Breakwater and Revetment Design; Design Aspects of Groins and Jetties; Application of Coastal Engineering in Coastal Zone Management.

Coastal communities depend on the marine environment for their livelihoods, but the common property nature of marine resources poses major challenges for the governance of such resources. Through detailed cases and consideration of broader global trends, this volume examines how coastal communities are adapting to environmental change, and the attributes of governance that foster deliberate transformations and help to build resilience of social and ecological systems. Governance here reflects how communities, societies and organisations (e.g. fisher cooperatives, government agencies) choose to organise themselves to make decisions about important issues, such as the use and protection of coastal commons (e.g. fishery resources). The book shows how a governance approach generates insights into the specific forms and arrangements that enable coastal communities to steer away from unsustainable pathways. It also provides an analytical lens to consider important questions of power, knowledge and legitimacy in linked social-ecological systems. Chapters highlight examples in which communities are engaging in deliberative transformations to build resilience and enhance their well-being. These transformations and efforts to build resilience are emerging through multi-level collaboration, shared learning, innovative policies and institutional arrangements (such as new property rights regimes and co-management), methodologies that engage with indigenous cultural practices, and entrepreneurial activities, including income and livelihood diversification. Case studies are included from a range of countries including Canada, Japan, Brazil, Indonesia, Mexico, South Africa, Thailand, the South Pacific and Europe. The authors integrate theory with practical examples to improve coastal marine policy and governance, and draw upon emerging concepts from social-ecological resilience and transformations, adaptive governance and the scholarship on the commons.

Existing coastal management and defense approaches are not well suited to meet the challenges of climate change and related uncertainties. Professionals in this field need a more dynamic, systematic and multidisciplinary approach. Written by an international group of experts, Coastal Risk Management in a Changing Climate provides innovative, multidisciplinary best practices for mitigating the effects of climate change on coastal structures. Based on the Theseus program, the book includes eight study sites across Europe, with specific attention to the most vulnerable coastal environments such as deltas, estuaries and wetlands, where many large cities and industrial areas are located.

Integrated risk assessment tools for considering the effects of climate change and related uncertainties Presents latest insights on coastal engineering defenses Provides integrated guidelines for setting up optimal mitigation measures Provides directly applicable tools for the design of mitigation measures Highlights socio-economic perspectives in coastal mitigation

More and more of the nation's vast coastlines are being filled with homes and vacation resorts. The result is an increasing number of structures built on erosion-prone shores--with many of these structures facing collapse or damage. In response to mounting property losses, Congress has given the Federal Emergency Management Agency responsibility for incorporating coastal erosion into its National Flood Insurance Program (NFIP). This book from the National Research Council addresses the immediate question of how to develop an erosion insurance program--as well as the larger issues raised by the continually changing face of our nation's shorelines. Managing Coastal Erosion explores major questions surrounding a national policy on coastal erosion: Should the federal government be in the business of protecting developers and individuals who build in erosion-prone coastal areas? How should such a program be implemented? Can it prompt more responsible management of coastal areas? The volume provides federal policymakers, state floodplain and resource managers, civil engineers, environmental groups, marine specialists, development companies, and researchers with invaluable information about the natural processes of coastal erosion and the effect of human activity on

those processes. The book also details the workings of the NFIP, lessons to be learned from numerous state coastal management programs, and much more.

The U.S. Army Corps of Engineers released the Louisiana Coastal Protection and Restoration (LACPR) draft final technical report in March, 2009. In response to federal legislation, the Corps had to analyze hurricane protection, and design and present a full range of measures to protect against a storm equivalent to a category 5 hurricane. The request included measures for flood control, coastal restoration, and hurricane protection, and stipulated close coordination with the State of Louisiana and its appropriate agencies. This is the second and final report from the National Research Council (NRC) Committee on the Review of the Louisiana Coastal Protection and Restoration (LACPR) Program. The committee was charged to review two draft reports from the LACPR team and to assess the hurricane risk reduction framework, alternatives for flood control, storm protection, coastal restoration, and risk analysis. This report presents this committee's review and advice for improvements of the LACPR March 2009 draft final technical report.

Hurricane- and coastal-storm-related losses have increased substantially during the past century, largely due to increases in population and development in the most susceptible coastal areas. Climate change poses additional threats to coastal communities from sea level rise and possible increases in strength of the largest hurricanes. Several large cities in the United States have extensive assets at risk to coastal storms, along with countless smaller cities and developed areas. The devastation from Superstorm Sandy has heightened the nation's awareness of these vulnerabilities. What can we do to better prepare for and respond to the increasing risks of loss? "Reducing Coastal Risk on the East and Gulf Coasts" reviews the coastal risk-reduction strategies and levels of protection that have been used along the United States East and Gulf Coasts to reduce the impacts of coastal flooding associated with storm surges. This report evaluates their effectiveness in terms of economic return, protection of life safety, and minimization of environmental effects. According to this report, the vast majority of the funding for coastal risk-related issues is provided only after a disaster occurs. This report calls for the development of a national vision for coastal risk management that includes a long-term view, regional solutions, and recognition of the full array of economic, social, environmental, and life-safety benefits that come from risk reduction efforts. To support this vision, "Reducing Coastal Risk" states that a national coastal risk assessment is needed to identify those areas with the greatest risks that are high priorities for risk reduction efforts. The report discusses the implications of expanding the extent and levels of coastal storm surge protection in terms of operation and maintenance costs and the availability of resources. "Reducing Coastal Risk" recommends that benefit-cost analysis, constrained by acceptable risk criteria and other important environmental and social factors, be used as a framework for evaluating national investments in coastal risk reduction. The recommendations of this report will assist engineers, planners and policy makers at national, regional, state, and local levels to move from a nation that is primarily reactive to coastal disasters to one that invests wisely in coastal risk reduction and builds resilience among coastal communities.

Accompanying CD-ROM in pocket at the back of book

Integrated coastal management (ICM) is widely accepted throughout the world as the best approach to dealing with coastal issues. The 1990s saw a proliferation of legislative reform processes worldwide. This aimed at supporting the implementation of ICM. Despite many international environmental treaties, declarations and other promises of action, the quality of coastal environments continues to deteriorate while the demand for coastal resources has increased in most of the world. This publication, in its practical guidance, will be especially valuable to anyone involved in the development, drafting or implementation of a legal or institutional framework to promote ICM. It is enhanced by illustrative examples from a range of countries that are at various stages of developing and implementing legislation to promote ICM.

Environmental and social impact assessment (ESIA) is an important and often obligatory part of proposing or launching any development project. Delivering a successful ESIA needs not only an understanding of the theory but also a detailed knowledge of the methods for carrying out the processes required. Riki Therivel and Graham Wood bring together the latest advice on best practice from experienced practitioners to ensure an ESIA is carried out effectively and efficiently. This new edition: • explains how an ESIA works and how it should be carried out • demonstrates the links between socio-economic, cultural, environmental and ecological systems and assessments • incorporates the World Bank's IFC performance standards, and best practice examples from developing as well as developed countries • includes new chapters on emerging ESIA topics such as climate change, ecosystem services, cultural impacts, resource efficiency, land acquisition and involuntary resettlement. Invaluable to undergraduate and MSc students of ESIA on planning, ecology, geography and environment courses, this internationally oriented fourth edition of *Methods of Environmental and Social Impact Assessment* is also of great use to planners, ESIA practitioners and professionals seeking to update their skills.

This book assesses the dimensions of our scientific knowledge as it applies to environmental problems in the coastal zone. The volume contains 10 papers that cover different aspects of science, management, and public policy concerning the coastal zone. A consensus is presented on several key issues confronting science for developing a more holistic approach in managing this region's intense human activities and important natural resources.

Many coastal communities have built structures at their beaches and added quantities of sand in contoured designs to combat erosion. Are such beach nourishment projects technically and economically sound? Or are they nothing more than building sand castles, as critics claim? *Beach Nourishment and Protection* provides a sound technical basis for decisionmaking, with recommendations regarding the utility of beach nourishment, the appropriate role of federal agencies, responsibility for cost, design methodology, and other issues. This volume Examines the economic and social role of beaches, the history of beach nourishment projects, and management strategies for shore protection. Discusses the role of the U.S. Army Corps of Engineers and other federal agencies, with a close-up look at the federal flood

insurance program. Explores the state of the art in project design and prediction of outcomes, including the controversy over the use of traditional and nontraditional shore protection devices. Addresses what is known about the environmental impacts of beach nourishment. Identifies what outcomes should be targeted for continued monitoring by project officials. Beach Nourishment and Protection provides insight into the technical, economic, environmental, and policy implications of beach nourishment and protection, with examples and suggested research directions.

This book describes critical environmental issues that face coastal ocean and Great Lakes areas, including eutrophication, habitat modification, hydrologic and hydrodynamic disruption, exploitation of resources, toxic effects on ecosystems and humans, introduction of nonindigenous species, global climate change and variability, and shoreline erosion and hazardous storms. These issues can be approached through science activities (including research, monitoring, and modeling) discussed in this book and through coordination among federal agencies.

Develops an analytical framework for water law reform, using case studies across four jurisdictions, for academics, students and policy makers.

"Provides an integrated approach to coastal dynamics and shoreline protection, aided by the use of specific case studies"
-- Back cover.

The U.S. Gulf Coast provides a valuable setting to study deeply connected natural and human interactions and feedbacks that have led to a complex, interconnected coastal system. The physical landscape in the region has changed significantly due to broad-scale, long-term processes such as coastal subsidence and river sediment deposition as well as short-term episodic events such as hurricanes. Modifications from human activities, including building levees and canals and constructing buildings and roads, have left their own imprint on the natural landscape. This coupled natural-human coastal system and the individual aspects within it (physical, ecological, and human) are under increased pressure from accelerating environmental stressors such as sea level rise, intensifying hurricanes, and continued population increase with its accompanying coastal development. Promoting the resilience and maintaining the habitability of the Gulf Coast into the future will need improved understanding of the coupled natural-human coastal system, as well as effective sharing of this understanding in support of decision-making and policies. Understanding the Long-term Evolution of the Coupled Natural-Human Coastal System presents a research agenda meant to enable a better understanding of the multiple and interconnected factors that influence long-term processes along the Gulf Coast. This report identifies scientific and technical gaps in understanding the interactions and feedbacks between human and natural processes, defines essential components of a research and development program in response to the identified gaps, and develops priorities for critical areas of research.

Fifty years ago Georgia chose how it would use the natural environment of its coast. The General Assembly passed the Coastal Marshlands Protection Act in 1970, and, surprisingly, Lester Maddox, a governor who had built a conservative reputation by defending segregation, signed it into law. With this book, Paul Bolster narrates the politics of the times and brings to life the political leaders and the coalition of advocates who led Georgia to pass the most comprehensive protection of marshlands along the Atlantic seaboard. Saving the Georgia Coast brings to light the intriguing and colorful characters who formed that coalition: wealthy island owners, hunters and fishermen, people who made their home on the coast, courageous political leaders, garden-club members, clean-water protectors, and journalists. It explores how that political coalition came together behind governmental leaders and traces the origins of environmental organizations that continue to impact policy today. Saving the Georgia Coast enhances the reader's understanding of the many steps it takes for a bill to become a law. Bolster's account reviews state policy toward the coast today, giving the reader an opportunity to compare yesterday to the present. Current demands on the coastal environment are different—including spaceports and sea rise from climate change—but the political pressures to generate new wealth and new jobs, or to perch a home on the edge of the sea, are no different than fifty years ago. Saving the Georgia Coast spotlights the past and present decisions needed to balance human desires with the limits of what nature has to offer.

?This book is an update of the first BACC assessment, published in 2008. It offers new and updated scientific findings in regional climate research for the Baltic Sea basin. These include climate changes since the last glaciation (approx. 12,000 years ago), changes in the recent past (the last 200 years), climate projections up until 2100 using state-of-the-art regional climate models and an assessment of climate-change impacts on terrestrial, freshwater and marine ecosystems. There are dedicated new chapters on sea-level rise, coastal erosion and impacts on urban areas. A new set of chapters deals with possible causes of regional climate change along with the global effects of increased greenhouse gas concentrations, namely atmospheric aerosols and land-cover change. The evidence collected and presented in this book shows that the regional climate has already started to change and this is expected to continue. Projections of potential future climates show that the region will probably become considerably warmer and wetter in some parts, but dryer in others. Terrestrial and aquatic ecosystems have already shown adjustments to increased temperatures and are expected to undergo further changes in the near future. The BACC II Author Team consists of 141 scientists from 12 countries, covering various disciplines related to climate research and related impacts. BACC II is a project of the Baltic Earth research network and contributes to the World Climate Research Programme.

More severe storms and rising seas will inexorably push the American coastline inland with profound impact on communities, infrastructure, and natural systems. In *A New Coast*, Jeffrey Peterson presents the science behind predictions for coastal impacts and explains how current policies fall short of what's needed to prepare for these changes. He outlines a framework of bold, new national policies and funding to support local and state governments. Peterson calls for engagement of citizens, the private sector, as well as local and national leaders in a "campaign for a new coast." This is a forward-looking volume offering new insights for policymakers, planners, business leaders preparing for the changes coming to America's coast.

Our coasts provide a home and livelihoods for millions of people; many of the world's biggest cities are along coastlines. Yet these precious areas face increasing threats from irresponsible development and the potential dangers of climate change. This volume explores the wide spectrum of coastal hazards, from high-magnitude, low-frequency events like tsunamis and hurricanes, to longer-term processes like urban regeneration and changing agricultural practices. International case studies range from mitigation measures in the Azores Archipelago to managing a coastal resort in South Wales, to tsunami early warning systems in the Indian Ocean Region. The resulting collection spans approaches from social science, engineering, planning, geology and biology and presents an integrated approach for assessing the impact of, and response to, coastal hazards. It will be of interest to all those involved in strategies for the environmental management of coastlines.

Climate change is occurring, is caused largely by human activities, and poses significant risks for--and in many cases is already affecting--a broad range of human and natural systems. The compelling case for these conclusions is provided in *Advancing the Science of Climate Change*, part of a congressionally requested suite of studies known as America's Climate Choices. While noting that there is always more to learn and that the scientific process is never closed, the book shows that hypotheses about climate change are supported by multiple lines of evidence and have stood firm in the face of serious debate and careful evaluation of alternative explanations. As decision makers respond to these risks, the nation's scientific enterprise can contribute through research that improves understanding of the causes and consequences of climate change and also is useful to decision makers at the local, regional, national, and international levels. The book identifies decisions being made in 12 sectors, ranging from agriculture to transportation, to identify decisions being made in response to climate change. *Advancing the Science of Climate Change* calls for a single federal entity or program to coordinate a national, multidisciplinary research effort aimed at improving both understanding and responses to climate change. Seven cross-cutting research themes are identified to support this scientific enterprise. In addition, leaders of federal climate research should redouble efforts to deploy a comprehensive climate observing system, improve climate models and other analytical tools, invest in human capital, and improve linkages between research and decisions by forming partnerships with action-oriented programs.

Estuaries and their surrounding wetland regions are among the most productive ecosystems in the world, with more than half of humanity inhabiting their shores. Anthropogenic factors make estuaries highly susceptible to ecosystem degradation. Coastal waters are closely connected with human activity, and their dynamic processes may greatly affect coastal environments. This book provides a compendium of studies on estuarine dynamics, river plumes, and coastal water dynamics, studies that have investigated the changes in estuarine and coastal zones in response to sea-level rise and other environmental factors, and policy and management strategies to ensure the health and economy of coastal zones. This book aims to display novel frontiers in these fields and may help to inspire in-depth studies in the future.

Europe has a long history of managing coastal erosion and protection, examples including the defences of the Venice lagoons, Mediterranean beaches and reclaimed land in The Netherlands. Climate change is now creating enhanced risks of coastal erosion through storms and rising sea levels, with many initiatives being developed to improve coastal protection. This book provides a comprehensive review of the entire coastline of Europe, from Scandinavia and the Baltic to the British Isles and north-west Europe, the Iberian Peninsula, Mediterranean...

This book focuses on the challenges people face in managing agricultural crops, aquaculture, fisheries and related ecosystems in inland areas of coastal zones in the tropics of Asia, Africa, Australia and South America. These challenges can create conflicts in the use of natural resources between different stakeholders. Through many case studies, the book discusses the nature of the conflicts and identifies what is known and not known about how to manage them. For example, some case studies relate to the trade-offs between enhancing agricultural production by constructing embankments to keep out saline water and maintaining not only the variety of rural livelihoods but also brackish aquatic biodiversity. Other case studies provide the lessons learnt from the conversion of mangrove forests to shrimp farms.

Mitigating Shore Erosion Along Sheltered Coasts National Academies Press

Coastal Management: Global Challenges and Innovations focuses on the resulting problems faced by coastal areas in developing countries with a goal of helping create updated management and tactical approaches for researchers, field practitioners, planners and policymakers. This book gathers, compiles and interprets recent developments, starting from paleo-coastal climatic conditions, to current climatic conditions that influence coastal resources. Chapters included cover almost all aspects of coastal area management, including sustainability, coastal communities, hazards, ocean currents and environmental monitoring. Contains contributions from a global pool of authors with a wide range of backgrounds and disciplines, making this an authoritative and compelling reference Presents the appropriate tools used in monitoring and controlling coastal management, including innovative approaches towards community participation and the implementation of bottom-up tactics Includes case studies from across the world, allowing for a thorough comparison of situations in both developing and developed countries

The world has witnessed extraordinary economic growth, poverty reduction and increased life expectancy and population since the end of WWII, but it has occurred at the expense of undermining life support systems on Earth and subjecting future generations to the real risk of destabilising the planet. This timely book exposes and explores this colossal environmental cost and the dangerous position the world is now in. *Standing up for a Sustainable World* is written by and about key individuals who have not only understood the threats to our planet, but also become witness to them and confronted them.

Numerical Models for Submerged Breakwaters: Coastal Hydrodynamics and Morphodynamics discusses the practice of submerged breakwaters, an increasingly popular tool used as a coastal defense system because of their amenity and aesthetics as compared to common emerged beach protection measures. The book is the perfect guide for experienced professionals who wish to keep abreast of the latest best practices or those who are entering the field and need a reference, explaining new and traditional numerical methodologies for designing submerged breakwaters and measuring their performance. In addition, the book provides case studies, examples, and practical methods for data selection and pre-processing, model setup, calibration, and analysis. Case studies and worked-out examples illustrate different concepts and methods Offers practical methods for Data Selection and Pre-Processing Provides simplified prediction tools for practical applications

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