BEACH AND DUNE RESTORATION

This new edition – now with Nancy L. Jackson as a coauthor – continues the themes of the first edition: the need to restore the biodiversity, ecosystem health, and ecosystem services provided by coastal landforms and habitats, especially in the light of climate change. The second edition reports on progress made on practices identified in the first edition, presents additional case studies, and addresses new and emerging issues. It analyzes the trade-offs involved in restoring beaches and dunes – especially on developed coasts – the most effective approaches to use, and how stakeholders can play an active role. The concept of restoration is broad, and includes physical, ecological, economic, social, and ethical principles and ideals. The book will be valuable for coastal scientists, engineers, planners, and managers, as well as shorefront residents. It will also serve as a useful supplementary reference textbook in courses dealing with issues of coastal management and ecology.

KARL F. NORDSTROM is Distinguished Professor Emeritus in the Department of Marine and Coastal Sciences at Rutgers University. He has 45 years of experience in conducting coastal research. He is a fellow of the American Association for the Advancement of Science and the Geological Society of America. His books include *Estuarine Beaches* (1992), *Beaches and Dunes of Developed Coasts* (2000), and *Beach and Dune Restoration* (2008). He has published more than 160 scholarly articles.

NANCY L. JACKSON is Professor Emerita in the Department of Chemistry and Environmental Science at New Jersey Institute of Technology. She has 30 years of research experience on beach and dune systems. She is a fellow of the American Association for the Advancement of Science and the Geological Society of America and was Fulbright Distinguished Chair and Scholar. She has published more than 100 scholarly articles.

From reviews of the first edition:

'… informs and educates stakeholders about potential viable alternative methods of managing developing landforms with the view to maintaining their function in line with stakeholder interests, while allowing natural processes to progress, further improving stability and diversity in beach and dune systems.'

– Environmental Conservation

"…an excellent, well-written resource … recommended."

– CHOICE

Praise for the second edition:

'Read this book for a thorough and up-to-date account of the methods currently used in dune and beach restoration. Nordstrom and Jackson are world leaders in this field and they use a multitude of real-life case studies to illustrate the methods described. The work is contextualized in the framework of international agreements on biodiversity and habitat preservation, that are tempered by local demands and actions. Importantly, the authors talk about various categories and goals of restoration that allow the reader to differentiate the various paradigms within which restoration is undertaken. This will appeal to those involved in coastal conservation, engineering and management.'

– Andrew Cooper, Ulster University

'Nordstrom and Jackson deliver fundamental insights into the complex dynamics of the world's human-altered coastlines. Essential reading for understanding the enigmatic ways in which humans change the physical coastal systems in which we live … a masterwork on the geomorphic interventions that typify human-dominated coastlines. Anyone thinking about future coastal change needs this book.'

– Eli Lazarus, University of Southampton

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Second Edition

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Preface

This book is an update of *Beach and Dune Restoration* (Nordstrom 2008). The aims of this second edition are to report on new research in the application of coastal geomorphology, ecology, and management to restoration; present results of progress on practices identified in the first edition; and address issues that have increased in popularity recently. These new issues include finding ways to address increases in rates of sea level rise as well as increases in the number of extreme events, adapting to change through managed realignment (retreat) on exposed coasts, altering shore protection structures to make beaches and dunes more dynamic, implementing hybrid projects and living shorelines that combine soft and hard solutions, rejuvenating dune landscapes by removing vegetation, and conducting mega nourishments (e.g., the "sand motor"). Attention has also increased on developing strategies to incorporate participation of local stakeholders and evaluating shorelines as a coupled natural–human system, with humans as intrinsic agents of landscape evolution. These new developments reflect an emerging shift toward thinking about coastlines as a product of physical, ecological, and human processes and the need to integrate these processes in restoration practice. The book is intended to offer readers an understanding of how basic and applied research findings can inform beach and dune restoration efforts at local and regional scales.

Many past transformations of the coastal landscape, even those involving construction of new landforms, were done with little thought given to the accompanying environmental losses and the potential for achieving new environmental gains. Traditional beach- and dune-building practices emphasized the use of landforms for protection and recreation, but that does not preclude adding new natural resource values compatible with those uses. In many cases, traditional shore protection projects can be modified to achieve nature goals with little change in design or cost. We acknowledge that human-use functions will be the driving force for managing beaches in developed areas, so a return to a

condition of pristine nature is not an option. Restored landforms and habitats will be subject to direct human use or indirect effects resulting from land uses in adjacent areas, so restored landforms may require periodic human adjustments to survive. The impossibility of returning to pristine nature should not deter efforts to regain elements of the natural environment and reverse the trend toward environmental loss.

The great competition for space near the land–ocean interface and the increasing demands of different interest groups require evaluation of beaches and dunes in a framework that considers physical, ecological, and social goals and objectives and the trade-offs and compromises involved. This focus on compromise and the need to accommodate different user groups is a distinguishing characteristic of this book. Another difference between this book and other books on restoration and management is the insight provided about restoration efforts at the local (municipal and property owner) scale. To many people, coastal restoration implies nourishing beaches, building dunes, and eliminating exotic species in dune preserves. We feel that restoration actions can extend beyond the ways they have traditionally been applied. Our working assumption is that some nature is better than none, even if it is imperfect, providing that no better option is available given the economic or political climate at the time. We consider this assumption valid if the restored environments are considered interim states that will be improved as natural features become more acceptable to stakeholders and greater resources are devoted to sustaining them.

Specific examples are used in many parts of the book to illustrate management practices. Several countries are highlighted, reflecting the greater number and scale of restoration activities there and the number of publications generated. The case studies mentioned may be in a specific location, but results are framed in terms of generic needs and capabilities and include citations to studies from other countries that support the findings. Species names may be different in different parts of the world, but pioneer and dune-building species and exotic species, for example, can play similar roles throughout the world, regardless of their species name. Many information sheets produced by government departments and environmental commissions for management of beaches and dunes are specific to their regions and readily available online. These information sheets and numerous technical reports provide practical guidelines for activities such as emplacing sediment, installing sand-trapping fences, and planting vegetation on dunes. Our intent is to provide a companion volume to design manuals rather than a substitute for them by presenting the broader rationale for restoration and introducing practitioners to approaches that may be unfamiliar to them but can be tailored to enhance local projects. Shore protection and restoration projects are inherently interdisciplinary,

with geomorphologic, sedimentologic, biologic, economic, engineering, and regulatory inputs, requiring a synthesis of these interrelated themes.

Readers familiar with the first edition will note the inclusion of a new chapter (Chapter 5) that addresses the rationale and results of changing the effects of hard structures to make them more compatible with restoration goals, and a change in the order of Chapter 8 that is placed after the chapter that preceded it in the first edition. Many advances have been made in beach and dune restoration since 2008 as reflected in the addition of more than 500 references to this new edition. The recent literature on beaches and dunes is vast and we had to be somewhat selective. We retained the earlier citations to give credit to the people who originated many of the ideas that are supported in subsequent studies. We selected new studies that specifically identify the goals and implications of restoration projects or address landscape alterations that have implications for restoration, even if restoration was not an original goal. Regional remote sensing datasets are now publically available in many countries as well as many different techniques to survey beach/dune systems, including airborne LiDAR, ARGUS cameras, drones, and terrestrial laser scanners. Model studies of potential effects of landscape modifications and scientific studies of beaches and dunes provide insight to beach and dune change. Studies that incorporate these techniques are only included here if they are accompanied by specific recommendations for changes in restoration practice. Similarly, we do not include studies that concentrate on single species unless those studies provide information that can inform restoration of more inclusive sub-environments or unless those efforts appear to potentially cause degradation of other natural functions or alter evolutionary trajectories in an undesirable way.

Our emphasis is on trying to find ways to modify beaches and dunes to enhance natural processes and make natural habitats as dynamic and resilient as possible while maintaining their value for human use. This is a difficult goal to accomplish. We hope that identifying the many ways restoration can be envisioned and practiced will encourage managers to try new ways to enhance coastal landscapes within their jurisdictions and contribute to local and broader sustainability goals.

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