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## Preface

### *Why are West African estuaries so important in land/sea interactions?*

One of the major challenges that humans face today is the management of estuaries so that future generations can also enjoy the remarkable visual, cultural and food products that they provide. The book series “Estuaries of the World” (EOTW) by Springer uses a multidisciplinary approach in presenting the science of estuaries. Such an approach presupposes that all users of the environment can share views and are able to communicate effectively on the basis of robust science.

Estuaries are vulnerable because they are exposed to multiple human activities such as fish and shrimp farming, industrial and domestic pollution, dredging, land reclamation and agriculture in the watershed. The threat to coastal ecosystems posed by human activities is well recognised and documented, yet the mitigation of human impact remains a major challenge due to a lack of understanding of the scale and rate of observed changes. Mangroves, for instance, are subject to clear-cutting and overlogging and such disturbances increase the variability of natural systems. The variability of natural systems is difficult to include in any political agenda due to the certainty of information required for decision making. It is possible, however, to better understand how humans change the way in which ecosystems function using a combination of different approaches aimed at combining functional ecology studies and a pressure/risk assessment approach (both on ecological and socio-economic aspects). In this way, it is possible to integrate the novel and interdisciplinary scientific evidence of multiple research disciplines. Such a dynamic interplay between theory and empirical study forms the basis for the transdisciplinary approach of the EOTW series.

With this perspective in mind, it is important to assess the capacity of ecosystems in fulfilling their role within the biosphere. Integration can be seen as one of the tools or methodologies for realising this goal by encompassing all aspects of an issue through a collaborative approach between natural sciences and economic, socio-cultural, legal and institutional disciplines. Integrated Coastal Zone Management (ICZM) is still a relatively new and evolving concept and there is no consensus regarding issues such as the fundamental nature and structure of the coastal zone, the most appropriate timescales for the application of ICZM policies, or the key criteria for defining sustainability in coastal zone development. Integration needs to be established between disciplines, sectors and in governance across the land–water interface. Through improving the scientific understanding of the performance of coastal ecosystems in terms of fluxes of energy and matter in relation to human impacts, ICZM should be able to predict the effects of measures taken and find responses to the fast evolving demands from society. The EOTW series offers a framework for facilitating such integration.

The notion of ecosystem services is useful in that it provides insight into the resilience of ecosystems and how changes affect them. The reduction in marine biodiversity and productivity is multifactorial, especially in coastal waters. Direct habitat destruction through the erection of engineering and drainage works, which disturb the physical integrity of coastal and marine systems is the most drastic, as the habitat itself is changed

to a point where the ecosystem loses its identity and assumes a different function. Poor fisheries management, including the uncontrolled exploitation of corals and molluscs and the by-catch of large numbers of non-target species in fisheries, is another pertinent example of detrimental marine resource exploitation. An integrated approach to coastal zone management of fisheries is predicted to prevent impoverished functioning of such ecosystems. The consequence of unchecked exploitation is that the productivity of fisheries and important ecosystems, such as mangroves and coral reefs, reduces which in turn causes suffering for the affected local communities.

In general, estuaries and salt marshes, mangrove forests and sea grass beds near cities and towns are severely degraded worldwide with many species now threatened to become extinct in the near future. Found in tropical and subtropical regions, mangroves are especially vulnerable. These salt-tolerant forested wetlands at the sea–land interface form the link between the terrestrial landscapes and the marine environment. Rapid changes in anthropogenic activities in coastal zones impact on the structure of organism populations, which will in turn affect the geochemical cycles of the ecosystem, to a point where such cycles might become dysfunctional. Changes in coastal ecosystems can lead to an imbalance in fluxes of energy and minerals at the interface between land and sea. These localised changes have the propensity to reach a global level. The dynamics of such systems are complex and conservation should address all aspects of this complexity and not solely focus on fixing the coastline to its physical limits, or preventing erosion and sea level rise. Because coastal systems are alive, they are able to cope with a multitude of changes. The critical determinant of an ecosystem's capacity to cope with change, however, is the rate of change, and it is the rapidity of change inflicted by humans to natural systems, which makes the anthropocene unique.

This volume in the EOTW series offers case studies in West and Central Africa and demonstrates that mangrove ecosystems are extremely valuable in mitigating effects from deleterious human activities, providing ecosystem services like carbon sequestration, protection from storms, floods and erosion, processing of waste and nutrient pollution, aquaculture and agriculture support and a refuge for aquatic and terrestrial species.

In order to discriminate between global and local influences, it is essential to acquire an in-depth knowledge of natural processes, as well as understand relevant institutional, cultural, economic, social and political frameworks based on a robust scientific approach. Suitable studies have been developed and used to analyse causal linkages within West African coastal ecosystems, forecasting the effects of acute or chronic interference on resource use, and to address wider, management-related issues such as the restoration of damaged habitats and the potential for aquaculture. The context of natural resource management in West Africa is complex. If the elements of ecosystems are interconnected and interdependent, those of regional environmental systems are even more so. Thus, the work as presented in this volume of the EOTW series contributes to improve the understanding of the dynamics and functioning of coastal ecosystems and habitats, including mangrove forests that constitute the most apparent features along western and central African coasts. Considering the highly threatened nature of marine and coastal ecosystems in this part of Africa and bearing in mind that the major drivers of change, degradation and loss of marine and coastal ecosystems and services are mainly anthropogenic, the question will be what types of options exist to respond to such challenges? By all means, addressing uncertainties and elaborating trade-offs could provide useful mechanisms for operational responses and this should be undertaken through established ecosystem-based approaches and improving the capacity of scientists to predict the consequences of the change of drivers in marine and coastal ecosystems. In this regard, long-term ecological processes and further research are needed in a number of areas in order to improve sustainable management policies of coastal and marine ecosystems of West and Central Africa.

The complex problems caused by human–environment interactions occur within the intricate structure of ecosystems, which are in a natural state of constant flux and change. This book explores the complex problems caused by human–environment interactions within the naturally and artificially fluctuating and changing coastal ecosystems of West and Central Africa. The authors have shared their knowledge and experience on ecological, social and cultural aspects simultaneously. This interdisciplinary approach makes the discovery of this fascinating region even more enriching.

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The Land/Ocean Interactions in the Coastal Zone of  
West and Central Africa

Diop, S.; Barousseau, J.-P.; Descamps, C. (Eds.)

2014, XXII, 210 p. 133 illus., 122 illus. in color.,

Hardcover

ISBN: 978-3-319-06387-4