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Sand Mining

Environmental Impacts and Selected Case Studies

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Preface

Expanding human requirements and economic developments impose ever increasing pressure on the natural resource base. Advances in ecological and environmental studies reveal the imminent need for delimiting human aspirations and requirements within the barest minimum levels in order to achieve sustainability in developmental process.

For centuries, humans have been enjoying the natural benefits provided by rivers without understanding much on how the river ecosystem functions and maintains its vitality. Rivers are one of the important life sustaining systems of tropical and subtropical regions. Unlike large rivers, the small rivers of the world are the first to be hit by human interventions and/or economic developments. This is mainly because, the environmental subsystems in small rivers are closely knitted so that the areas available for dissipation of the adverse effects of the developmental processes are very limited. Among the various types of human interventions in river ecosystems, indiscriminate mining of sand and gravel is the most disastrous activity as it threatens the very existence of these systems. Depending on the geologic and geomorphologic setting, the degree of off-site and on-site impacts of sand mining would also vary. Continued and indiscriminate sand mining not only changes the physical characteristics of the river basin environments, but also disturbs its closely linked flora, fauna, and human life.

Sand in the river channel and floodplains constitute an important raw material for the construction industry. Sand production, movement and deposition are of great concern to engineers, geologists, and to geomorphologists, especially those concerned with river basin management, shore erosion, and harbor development. A better understanding of sand budget is very essential for solving problems concerning river and coastal environments. Besides its direct economic importance, sand also constitutes an important abiotic component in aquatic ecosystems like rivers. It provides suitable substrate for many benthic organisms. Sand is an unavoidable component for many organisms like fishes as it provides conducive environmental conditions for their breeding, spawning, feeding, hiding, etc. Further, inter-beds of sand within floodplain deposits act as aquifer systems storing large quantities of ground water for maintaining the base flow through the rivers. Sand acts as an efficient filter for various pollutants, and thus improves the quality of water in rivers and other related aquatic ecosystems. A cursory glance of the available studies reveal that it is nearly difficult to restore fully the structure and

functions of the river ecosystems to their pre-disturbed state as the adversities of human interventions are alarming and mostly permanent. However, efforts are being made by the authorities concerned to regulate the activities within the resilience capability of the ecosystems. Lack of adequate knowledge on the different dimensions of the activity is often a major lacuna challenging the regulatory systems. This text aims to address a few aspects of environmental consequences of sand mining by taking the case of the small rivers draining the western flanks of the Western Ghats mountains as an example.

The entire work is addressed in 11 chapters. [Chapter 1](#) deals with introduction on river sand and gravel mining, the functions of sand in natural river environment and its geologic origin. [Chapter 2](#) summarizes the complex functions of river systems giving emphasis to the classic concepts in riverine studies. The different types of mining and mining methods used for extraction of sand from instream and floodplain areas are highlighted in [Chap. 3](#). [Chapter 4](#) is devoted to the environmental impacts of sand and gravel mining on different environmental components of river ecosystems. A review of the river sand mining scenario of the world with special emphasis to small rivers is given in [Chap. 5](#). [Chapter 6](#) deals with environmental case studies from Kerala State in South West India. The major drivers of sand and gravel extraction processes are also attempted in the light of the available literature. The environmental impacts arising from sand mining processes are assessed using two EIA methods—Matrix Method and Rapid Impact Assessment Matrix—in one of the river basins of Kerala and are presented in [Chap. 7](#). In view of the various adversities of river sand mining, a detailed account of sustainable mining strategies and management measures to protect river systems are given in [Chap. 8](#). [Chapter 9](#) deals with sand auditing of Kerala rivers—a concept developed by the authors for assessing instream sand mining after a specific period of allowing sand mining. The properties of fine aggregates are discussed in [Chap. 10](#). The last chapter ([Chap. 11](#)) deals with the various sources and conservation measures of sand. All the chapters are illustrated and supported using field evidences and available literature on the subject.

We believe, this text will be useful to students, researchers, decision makers and the general public, at large.

Thiruvananthapuram, India
April 2014

D. Padmalal
K. Maya

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