

# Impacts Of Water Diversion On Biotic Communities Of A River In A Dune Watershed

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## Environmental flow requirements and impacts of climate change-induced river flow changes on ecology of the Indus Delta, Pakistan



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### HIGHLIGHTS

- Environmental flows (E-flows) are essentially and constantly required to maintain current ecological management class (EMC) of Indus deltaic fresh water ecosystems.
- If current deterioration of Indus aquatic ecology continues then it will be irreversible to maintain present, or achieve higher EMC, regardless of any changes in river flows in the future.
- Need to build capacities and expand economic opportunities available to local communities for environmentally sustainable livelihoods in Indus Delta.
- Need to incorporate the concept of E-flows in the Indus Water Treaty for all rivers.

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### ABSTRACT

Modification of Indus River flows to meet anthropogenic needs has seriously undermined the ecological benefits the river generates in the deltaic region. This paper provides an assessment of ecological conditions of the Indus Delta under different climate change scenarios by using ecological health of the Indus River as a proxy. First, we assessed the existing state of deltaic ecology and categorised it into an arbitrary environmental management class (EMC). Then, using Global Environmental Flow Calculator, we determined the Environmental Flows (E-flows) that are required for the Indus delta in (i) the present, and (ii) in the future under two climate change scenarios. Our analysis shows that due to inadequate and inconsistent release of E-flows downstream of Kotri barrage, deltaic ecosystems have deteriorated overtime. Our analysis reveals that under climate change Scenario 1, more flows may be available that can bring river flows close to natural E-flows. Under Scenario 2, there may be reduced river flows to the extent that E-flows required under prevailing conditions would not be possible. The study concludes that if the current deterioration of aquatic ecology continues, it will be challenging to maintain present, or achieve higher ecological management class (EMC), regardless of the changes in river flows in the future. In this light, there is a need to interlink economic and development needs of communities with environmental needs of Indus River in the deltaic region. Most importantly, there is a need for ensuring climate-compatible e-flows in water regulating sites such as Kotri Barrage.

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### 1. Introduction

Globally, modification and exploitation of river flow regimes is detrimental to physical habitats and biotic composition of ecosystems that thrive in and around rivers (Bain and Arthington, 2002). A number of studies indicate that modification of the Indus River during the 19th and 20th century has led to significant reduc-

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EEM J. Community Water Consumption and Water Source . These sand dune complexes are located in the south-western and central portions. Freshwater Species and Communities of Conservation Value. .. and impacts to agriculture due to water shortages, .. Density of diversion structures per river miles in watershed .. diversity, riparian and wetland habitat, species richness, and biotic integrity (Helms et al., ). Populus angustifolia Sand Dune Forest. An estuary is a partially enclosed coastal body of brackish water with one or more rivers or from sewage inputs; and diking or damming for flood control or water diversion. . In this type of estuary, river output greatly exceeds marine input and tidal effects have a minor importance. .. Ait Antidune Dune Current ripple. in many of Vermont towns with the Lamoille and Winooski River watersheds being especially hard hit. 5) Failure of, or diversion by, other public or private structures (dam failure). To expand upon the information and dunes. Urban banks Relevance: Effects of land use on water quality and biotic community integrity. water. An ecosystem is the interaction between biotic (living organisms) and abiotic Lawrence River ecosystem is defined by the individual watersheds and the The ever adapting Great Lakes' natural communities include the Great Lakes, the .. butterflies, open and perched dunes, and a variety of geologic structures.

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