
Operationalizing safe operating space for regional social-ecological system

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Abstract

The safe operating space for humanity concept provided through the planetary boundary framework (Rockström et al., 2009a and 2009b) has attained significant policy and academic attention in sustainability science. Although this concept is increasingly mentioned in policy statements, its operationalization has been criticized in terms of the normative settings of the boundaries, exclusion of social systems, and the complexity of scales and interactions among the biophysical processes. Here, we make attempt to operationalize the concept at a regional scale, defining the safe operating space for social-ecological system in the Bangladesh coastal zone. Time series data for a range of ecosystem services and human wellbeing are analysed to understand the co-evolution of social-ecological system. Since the 1980s, human wellbeing improved at a cost of degradation of non-food ecosystem services such as water availability, water quality and land stability. We use generalized additive models (GAM) and other regression methods to develop a system dynamics model framework and to investigate how ecosystem services and human wellbeing are interlinked. After validating using stakeholder participation, we have used system dynamics model to simulate how the social system (e.g. income, production cost, GDP, migration) will respond to selected changes in the ecological system – and remain within a safe and socially just operating space. The changes are captured in ‘what if’ scenarios that include 20C and 3.50C temperature increases, further withdrawal of upstream water from the Ganges, and phasing-out of agricultural subsidy by 2030 in accordance with Sustainable Development Goals.

Keywords: social, ecological system, safe operating space and system dynamics

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