

## ABSTRACT

A Novel Framework for Optimising Coral Reef Ecosystem Service Trade-offs to Deliver Benefits to People: A Case Study from the Island of Tobago, in Trinidad and Tobago

Jahson Berhane Alemu I

Coral reefs are important to the socio-economic and cultural development of Tobago, where they contribute significantly to the gross domestic product and support livelihoods. However, the increasing demand for multiple ecosystem services, a sectorial approach to coral reef management and poor governance, characterised by short term planning has engendered a number of conflicts and trade-offs among stakeholders and services. In order to optimise the long-term delivery of multiple ecosystem services, a holistic approach to coral reef management is recommended such that considers not only nature's benefits but the flow of ecosystem services from supply to benefit areas and the influence of ecological stressors on ecosystem services production. However given limited management resources and capacity, innovative ways must be found to adapt existing methods to achieve ecosystem services goals, especially among developing island nations. Using the island of Tobago as a case study, we quantified and mapped the production and interactions (trade-offs, synergies and bundling) of the supply and benefits sides of shoreline protection, fisheries production and recreational opportunity across southwest Tobago (21 sites). We also assessed the impact of ecological pressures on ecosystem service production. By linking ecological integrity and ecological pressures to ecosystem services we demonstrated i) a strong positive service-integrity relationships, ii) a strong negative service-pressure relationships, iii) the positive influence of human interventions on ecosystem services and iv) a number of utility thresholds that might inform trade-off decision making. Further, we note that for some ecosystem services, the production even among degraded reefs can produce equivalent or near-equivalent levels of benefit and support livelihood opportunity. Finally, by linking ecosystem services to the economy, we were able to demonstrate a preference of recreational users for improved coral reef management expressed as willingness-to-pay.

Keywords: ES production; ES bundling; ES utility; ES valuation; ES indicators; Coastal ecosystems.