

Published on *Marine Ecosystems and Management (MEAM)* (<https://meam.openchannels.org>)

The EBM Toolbox: Using decision support tools for Coastal Zone Management in Belize

By Gregg Verutes

Editor's note: The goal of The EBM Toolbox is to promote awareness of tools and methods for facilitating EBM and MSP processes. It is brought to you by the EBM Tools Network (www.ebmtools.org), a voluntary alliance of tool users, developers, and training providers.

Ocean planning requires balancing numerous competing uses such as recreation and commercial fisheries, tourism, and renewable and nonrenewable energy production. With careful planning, we can continue to engage in these and other coastal and ocean uses while protecting the natural capital that sustains these benefits.

To help meet the demand for information on how human actions affect ecosystems and the benefits that ecosystems provide to people, the Natural Capital Project (NatCap) developed the Integrated Valuation of Ecosystem Services and Tradeoffs (InVEST) toolkit. One of the earliest uses of InVEST to inform coastal planning and management was a collaboration with the national government of Belize.

Putting Science into Practice in Coastal Belize

In Belize, there are numerous competing uses for the coastal zone, such as transportation vessels interfering with marine recreation activities and offshore oil exploration near critical habitat and nesting sites. While legislation passed in 1998 mandated multi-sectoral planning, a lack of information and tools and limited local capacity stalled the development of an integrated management plan. In 2010, Belize's Coastal Zone Management Authority (CZMAI) partnered with World Wildlife Fund (WWF) and NatCap to answer the question, "Where should we site coastal and ocean uses to reduce risk to marine ecosystems and enhance benefits they provide to people?" CZMAI served as policy lead and the convening body for stakeholders for the process; WWF served as project facilitator and science-policy bridge; and NatCap led the science and tool development.

To start answering this question, we used a risk assessment tool in InVEST to assess how threats to marine ecosystems posed by humans and other factors can modify ecosystem condition and function. After that, NatCap and CZMAI applied a suite of other models within InVEST to map and measure key ecosystem services – annual production of spiny lobster, tourism and recreation, and coastal protection in this case – and changes in value under different management scenarios (described in detail in [Arkema et al. 2015](#)).

- To explore how the **spiny lobster fishery** would respond to changes in lobster habitat (i.e., seagrass, mangrove, and coral reefs) and fishing pressure, we modeled the population as nine regional, linked subpopulations (one per planning region, Figs. S2 and S14 in [supporting information of Arkema et al. 2015](#)) connected by lobster movement from juvenile habitat (mangroves and seagrass) to adult habitat (seagrass and coral reefs).
- To explore changes to **tourism and recreation**, we estimated the spatial distribution of tourism now and under the three future scenarios by modeling the relationship between visitation, human activities, and marine habitats (Fig. S16 in [supporting information of Arkema et al. 2015](#)). Tourism-related expenditures were computed by multiplying the visitation rate by estimates of tourists' daily expenses from the Belize Tourism Board.
- To explore changes to **coastal protection**, we estimated the area of land protected and the monetary value of erosion reduction in terms of avoided damages to property. Shoreline erosion and wave attenuation were modeled in the presence and absence of coral reefs, mangrove forests, and seagrass beds (Fig. S17 and Refs. 9 and 10 in [supporting information of Arkema et al. 2015](#)).

These InVEST tools were tested and refined throughout this Belize partnership. In particular, we used feedback from the process to improve the underlying science of each tool and design novel ways to synthesize and visualize information so it made sense to policy makers.

One important outcome of the Belize project is an "[Informed Management](#)" [zoning scheme](#) that blends development and conservation goals. This plan considers the needs of multiple sectors and stakeholders, advances the management and conservation of coastal and marine environments, and explicitly accounts for nature's benefits to people. It is currently under review by the Belize National Assembly, and lessons from this planning process are being applied in [new geographies](#) around the world.

A webinar on the use of InVEST for coastal zone management and marine spatial planning in Belize led by the Natural Capital Project and Belize Coastal Zone Management Authority will be held on Tuesday, June 7, at 1 pm US EDT/10 am PDT/6 pm UTC. You can register for the webinar at <https://attendee.gotowebinar.com/register/4148382978668819457>.

[Gregg Verutes leads NatCap's Training Program, which aims to empower partners and collaborators through in-person and online offerings. Gregg enjoys building tools that help communicate sustainability science using stories, maps, and interactive design technology. He also advises GIS analyses for marine planning processes in North America and the Caribbean, Vietnam, and the Galápagos. He can be contacted at gverutes@stanford.edu.]

Source URL: <https://meam.openchannels.org/news/meam/ebm-toolbox-using-decision-support-tools-coastal-zone-management-belize>