

Puerto Rico Coral Reef Ecosystem Valuation: Scenario Analysis of Non-Market Values of Reef-Using Visitors



Photo: Environmental Protection Agency

The Usefulness of Scenarios

The natural resources valued in this study were carefully selected based upon existing literature and research, natural science teams and focus groups. One of the primary considerations of this work was identifying realistic improvements given additional management or policy interventions in the Guánica Bay Watershed.

Since the improvements to the resources are expected to be attainable with additional management and policy intervention, the monetary benefits of targeted management actions can be evaluated. This means that if management decides to engage in restoration in the Guánica Bay watershed in southern Puerto Rico or other area's corals and reef fish, the value to coral reef users can be estimated. This benefit can then be compared to the cost of restoration.

Managers have many tools at their disposal to raise the condition of the coral reef attributes from the low-to-medium or high condition. Knowing the value and costs to implement a strategy or policy can help to ensure that there are net positive benefits to the public for restoration or conservation measures.

Background

In 2016-2017, in partnership with the U.S. Environmental Protection Agency (EPA) and Puerto Rico Sea Grant, NOAA's Office of National Marine Sanctuaries was able to estimate the non-market value of various coral reef attributes to reef-using visitors. The report, *Non-market Economic Value by Reef Using Visitors on Puerto Rico's Coral Reef Ecosystems, An Attributes Approach: Policy/ Management Scenarios, 2018*, presents the results of the marginal willingness to pay of users for four distinct management scenarios.

The four policy scenarios were developed and provided by the EPA Office of Research and Development, and the National Health and Environmental Effects Research Laboratory to demonstrate the benefits of coral reef ecosystem restoration. The scenarios are not real plans but simply serve to demonstrate the utility of the models.

Non-Market Value

The environment and earth ecosystems provide many benefits to humans. The ways in which humans benefit from ecosystems, such as recreation, food supply, and shoreline protection from storms, have come to be known as ecosystem goods and services. The economic value of some of these goods and services, such as fish for food, can be estimated through market sales and pricing. But others, such as recreation, which depends on water quality and the abundance and diversity of colorful fish, coral and sponges, are not traded in markets. The monetary value of these 'non-market' goods and services must be estimated using alternative methods.



Map of Puerto Rico

Scenario Outcomes

Three of the four policy scenarios analyzed in the report are highlighted in the table below. The present value for each attribute was determined from reef-using visitors to Puerto Rico based on existing (low) conditions, and then summed. The combined values of all attributes were then estimated over time based on expected improvements from a management scenario. The estimates of total annual benefits are then capitalized to estimate the net present value of the changes. This is done for three time periods: 1) 10 years; 2) 20 years; and 3) perpetuity or the indefinite future.

The capitalized value of net present value (NPV) is the value someone would pay today for the flow of annual returns over time. A good example is a house that delivers a flow of services over time, but, at any point in time, there is a price people are willing to pay for the house. The same concept can be applied to this research. To convert the future values to net present values, discount rates of 2.0 percent and 3.0 percent were selected. The values of the scenarios and the tool developed to evaluate various scenarios are useful in determining the monetary value of improvement to reefs by reef-using visitors to Puerto Rico.

Net Present Value of Benefits to Puerto Rico Reef Using Visitors¹

Net Present Value of Benefits to Puerto Rico Reef Using Visitors		Time Period for Capitalization		
Scenario	Discount Rate	10 years	20 Years	Perpetuity
Creation of a No Fishing Zone	2%	\$1,891,416,891	\$3,443,037,522	\$10,321,807,610
	3%	\$1,813,770,519	\$3,163,386,125	\$6,881,205,073
Reduction in Sediment	2%	\$2,578,287,958	\$4,693,382,101	\$14,070,188,538
	3%	\$2,472,444,181	\$4,312,174,851	\$9,380,125,692
Reduce Physical Damage	2%	\$604,988,329	\$1,101,289,476	\$3,301,531,865
	3%	\$580,152,371	\$1,011,840,221	\$2,201,021,243

¹ Estimates are based upon improving resources conditions as a result of different policy and management decisions.

Policy/Management Scenarios

Each of the scenarios above represents a mix of improving various habitat and resource attributes. For example, if Puerto Rico were to create a no fishing zone (see the table above), where all reefs were protected from the taking of fish and shellfish, then stony and soft corals would be expected to improve from low-to-medium quality. Consumptive fish, ornamental fish, invertebrates, large wildlife, and sport/trophy fish would be expected to improve from low-to-high, and water clarity and cleanliness would see no change.

The reduction in sediment scenario involves reducing sediment from run-off in the watersheds that affect coral reefs. In doing so, stony corals, soft corals, consumptive fish, and invertebrates improve from low to medium condition. Large wildlife, sport/trophy fish, water clarity, and water cleanliness improve from the low-to-high condition, but water clarity and cleanliness would see no change.

Reducing physical damage involves the installation of mooring buoys, no anchoring regulations and education on buoyancy control for diver and vests for snorkelers on coral reefs. Soft corals and invertebrates would improve from low-to-medium, stony corals would improve from low-to-high condition, and consumptive fish, ornamental fish, large wildlife, sport/trophy fish, water clarity, and water cleanliness would see no change.

For more information

A complete copy of the report is available at:

https://www.coris.noaa.gov/activities/projects/pr_reef_ecosystem_valuation/

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