Literature Review

WORLD RESOURCES INSTITUTE

Coastal Capital Literature Review:
Economic Valuation of Coastal and Marine Resources in Jamaica

Photo credit: Krishna Desai

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Background

Coral reefs provide a diverse array of goods and services to the people and economy of Jamaica. They buffer coastlines from storms, slow erosion, provide habitat for valuable fish species, attract local and international tourists, and are a source of cultural and spiritual significance to many people. However, their value is often not reflected in policy and development decisions. A lack of information and knowledge of the extent and value of the benefits provided by reefs hinders effective decision making in support of reef conservation and contributes to the continued degradation of Jamaica's reefs from widespread overfishing, coastal development, and pollution.

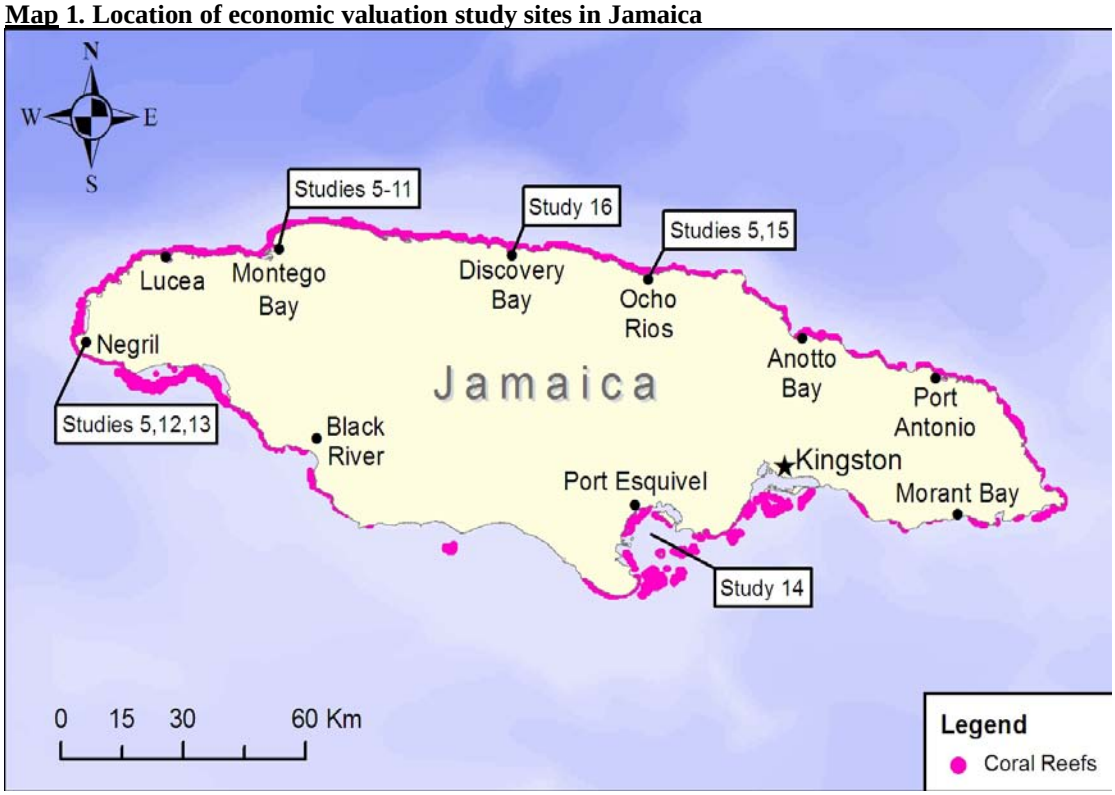
To help fill this information gap, several marine and coastal economic valuation studies have been conducted in Jamaica at both the national and local scales. Economic valuation—which assigns a monetary value to the goods and services provided by ecosystems—gives policy makers an important tool with which to set priorities and improve decision making regarding natural resources. Unfortunately, it became clear from many conversations with Jamaican partners that while quite a few marine and coastal economic valuation studies have been conducted in Jamaica, few of them have had an impact on decision making. There was significant interest in a document summarizing past valuation studies, including the methods, findings, and potential policy applications of these studies. In response, we conducted a literature review of 14 existing and 2 new marine and coastal valuation studies from Jamaica.

Of the 16 studies, four were focused at the national level, and the remaining 12 at local scales—Montego Bay, Negril, Portland Bight, Ocho Rios, and Discovery Bay (Map 1). These locations were likely chosen due to their importance as tourism destinations—particularly Montego Bay, Ocho Rios, and Negril, which account for over 70 percent of all visitors. Several studies emphasize the benefits associated with marine protected areas, particularly their importance in marine conservation. However, many of these protected areas face significant financial shortfalls and are unable to enforce park regulations. As a result, a number of studies identify possible sustainable sources of revenue. The remaining studies analyze the value of the benefits provided by coastal ecosystems, and the costs associated with additional investments in environmental protection and ecosystem management.

Information on the economic contribution of natural resources to the economy can help inform and improve policy and management decisions, but only if the information is properly disseminated and communicated to people making these decisions. With this in mind, we have resurrected, consolidated, and summarized this collection of economic valuation studies for Jamaica.

For more information, please contact Benjamin Kushner (bkushner@wri.org) or visit www.wri.org/coastal-capital.

Map 1. Location of economic valuation study sites in Jamaica



Note: Missing numbers (1–4) refer to national-level valuations.

The Coastal Capital Project

This literature review is part of the World Resources Institute's (WRI) Coastal Capital project in the Caribbean. The project was launched in 2005 and aims to provide decision makers with information and tools that link the health of coastal ecosystems with the attainment of economic and social goals. WRI and its local partners have conducted economic valuation studies of coral reefs and mangroves at national and subnational levels in five countries: Trinidad and Tobago, St. Lucia, Belize, the Dominican Republic, and, most recently, in Jamaica. We are using the results to identify and build support for policies that help to ensure healthy coastal ecosystems and sustainable economies.

Products from *Coastal Capital: Jamaica*, in addition to this literature review, include a working paper on coral reef-associated fisheries; a working paper on the value of coralline beaches to Jamaica's tourism industry; a working paper by the Mona GeoInformatics Institute on the shoreline protection function of reefs; and an 8-page summary of the three papers. These products, along with additional information about WRI's Coastal Capital series, are available online at http://www.wri.org/coastal-capital.

Overview Table: Economic Valuation Studies and their Policy Relevance for Jamaica

#	Case Study	Study Site	Ecosystem Services	Policy Relevance	Reference
1	Sustainable financing for coastal management in Jamaica	Jamaica	tourism / recreation	Tourists to Jamaica have a high consumer surplus and are willing to pay an environmental tax. Coastal zone management could be completely financed by a $2 pp tax.	Edwards, 2009a.
2	Measures the recreational value of changes in coral reef ecosystem quality	Jamaica	tourism, beaches, coral reefs	The results of the study are used to discuss the feasibility of generating revenues for the sustainable financing of ocean and coastal management in Jamaica.	Edwards, 2009b.
3	Compares the tourism industry's contribution to GDP to the environmental costs of the industry (freshwater use, sewage treatment, CO_2 storage).	Jamaica	NA	Looking at replacement cost for just three ecosystem services, environmental impacts more than cancel out the tourism industry's contribution to GDP. Results could support requirements for the tourism industry to compensate the public for some of these losses.	Thomas-Hope and Jardine-Comrie, 2007.
4	Total economic value of reef-related fisheries	Jamaica	fisheries	Jamaica's reef-related fisheries provide valuable jobs and revenue for the country contributing US$34.3 million per year.	Waite et al., 2011.
5	Economic contribution of reefs to beach erosion control and the benefits derived from beach tourism	Negril, Montego Bay, & Ocho Rios	tourism, beaches, coral reefs	The loss of beach due to coral reef degradation is projected to reduce tourist visitation by 9,000 to 18,000 visitors annually, costing an estimated US$23 million per year to the entire Jamaican economy. The paper thus makes the case for greater investment in reef conservation by key stakeholders.	Kushner et al., 2011.
6a	Total economic value of coral reefs in Montego Bay Marine Park	Montego Bay	tourism, fisheries, shoreline protection, biodiversity, pharmaceutical use	Total value of services associated with the park ($407M NPV) as well as per hectare value estimates can be used to set fees, justify greater investment in management, and assess losses from degradation.	Ruitenbeek and Cartier, 1999.

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#	Case Study	Study Site	Ecosystem Services	Policy Relevance	Reference
6b	Socioeconomic assessment of fishing and tourism associated with Montego Bay Marine Park	Montego Bay	tourism and fisheries	Assesses the level of social and economic dependence upon Montego Bay Marine Park (e.g. volume of reef tourism, hotel use; fisheries revenues). Results can inform policies and justify investment in management of the park.	Bunce and Gustavson, 1998.
6c	Financial analysis of reef-associated fisheries and tourism; avoided damages from shoreline protection	Montego Bay	tourism, fisheries, shoreline protection	The high value of services associated with the park (NPV US$381M, 10% discount rate) can be used to justify greater investment in management. Many jobs and businesses in Montego Bay rely upon the health of the park.	Gustavson, 1998.
7	Cost-effectiveness of different MPA management interventions	Montego Bay	NA	"Fuzzy logic" model weighed the cost-effectiveness of different management options for Montego Bay Marine Park, finding that the combination of household solid waste collection, the installation of an outfall, and the use of a sediment trap on the Montego River outlet present an optimal policy option, as they are relatively cost effective.	Ruitenbeek et al., 1999.
8	Local and tourist willingness to pay (WTP) for improvements in coral diversity	Montego Bay	biodiversity	Survey results could be used to set entrance fees or taxes for coral reef management (avg. WTP $23). The author cautions that ethical stance does affect willingness to pay.	Spash, 2000.
9	Visitor willingness to pay for park management	Montego Bay	tourism	Results can help set entrance fees to the park. Authors recommend $5 fee/wk. The revenue maximizing fee would be $10/wk, but this could reduce visitors to the area.	Dharmaratne et al., 2000.
10	Capturing ecotourism benefits from national parks	Montego Bay	tourism	Uses two valuation studies from Montego Bay to recommend a voluntary hotel room fee of US$1 per bed-night.	Huber, 2005.
11	Consumer surplus associated with use of Montego Bay Marine Park.	Montego Bay	tourism	Results suggest moderate taxes or user fees would not reduce visitor numbers to the Montego Bay area.	Reid-Grant and Bhat, 2009.
12	Fisheries and tourism values associated with Negril's coral reefs; potential losses if reefs degrade	Negril	tourism and fisheries	Tourists using Negril's coral reefs had a relatively high consumer surplus ($18); suggests they would be willing to pay a park fee, especially if assured the funds went to managing the reefs.	Cesar et al., 2003.

#	Case Study	Study Site	Ecosystem Services	Policy Relevance	Reference
13	Consumer surplus of tourists using Negril's coral reefs; potential losses if reefs degrade	Negril	tourism	Estimated WTP for coral reefs is $31. Results support a $5–$15 environmental tax to finance management of MBMP.	Wright, 1995.
14	Value of many ecosystem services provided by Portland Bight; includes scenarios of future tourism	Portland Bight	fisheries, forestry, tourism, carbon fixation, coastal protection, biodiversity	Study estimates US$40–53M/yr value from services associated with Portland Bight Protected Area. Results could justify greater investment in the reserve.	Cesar et al., 2000.
15	Financial analysis of reef-associated fisheries and tourism; avoided damages from shoreline protection	Ocho Rios	fisheries, tourism, shoreline protection, biodiversity	Estimated value of ecosystem services provided by ORMP is US$245M/yr. The study also estimates losses to the tourism sector if ecosystem quality degrades further. Management interventions are needed to avoid financial losses in the future.	Env. Management Unit, 2001.
16	Current value of Jamaica's reef fishery and estimated losses from lack of management over 25 years	Discovery Bay	fisheries	Estimates US$1.3B in lost revenues from reef fisheries due to poor management over 25 years; argues for implementing and enforcing strong fisheries regulations.	Sary et al., 2003.

Jamaican Economic Valuation Studies

Jamaica (National Level)

1. Edwards, P. 2009. "Sustainable Financing for Ocean and Coastal Management in Jamaica: The potential for revenues from tourist user fees." *Marine Policy* 33 (2): 376–385.	
Study Site	National level
Objective	Assessed the potential for tourist fees to provide long-term financing for conservation activities.
Ecosystem Services Valued	Recreation and tourism
Economic Valuation Method(s)	Contingent valuation
Data collection	Questionnaires were collected from 481 stopover tourist visitors to Jamaica at Montego Bay International Airport.
Results	Estimated costs of environmental and coastal zone management for Jamaica were US$1.94 million (US$0.19 million from the central government, US$0.70 million from NEPA, and US$1.05 million from five local NGOs). Projected tax revenues: • US$1 per person tax would bring in US$1.70 million and result in a 0.1% decline in visits • US$2 per person tax would bring in US$3.39 million, and result in a 0.2% decline in visits • US$10 per person tax would bring in US$16.35 million and result in a 3.9% decline in visits This study demonstrated that tourists are more willing to pay an environmental tax than a tourism tax, highlighting how tax labels can influence tourists' decision making, as can the institutional mechanism by which revenues are spent.
Potential Applications	Taxes targeted at primary beneficiaries of reefs and beaches can generate the income to support the management of Jamaica's coastal resources: • A US$2 per person environmental tax would have a negligible impact on visitation rates and could completely finance coastal zone management. • Any decline in visitation rates caused by the tax could be mitigated by informing visitors of how tax revenues are allocated.

2. Edwards, P. 2009. "Measuring the Recreational Value of Changes in Coral Reef Ecosystem Quality in Jamaica: The Application of Two Stated Preference Methods." Doctor of Philosophy in Marine Studies thesis, University of Delaware.	
Study Site	National level
Objective	Measured the recreational value of changes in coral reef ecosystem quality.
Ecosystem Services Valued	Recreation, tourism, beaches, and coral reefs
Economic Valuation Method(s)	Contingent valuation and stated choice
Data collection	Applied two types of stated preference techniques to provide estimates of the recreational values associated with quality changes to Jamaica's coastal ecosystem. A random airport intercept of tourists who visited Jamaica was conducted in January 2008. Two separate groups of respondents received either a self administered contingent behavior survey (with a total of 352 respondents) or a stated choice survey (522 data points).
Results	Contingent Behavior Study: • The results show that current coastal zone management activities could be financed from the introduction of a $2 per person environmental tax in addition to the existing $10. The potential negative impact on the annual visitation rate to Jamaica from the introduction of this additional tax appears to be negligible (– 0.9%). Stated choice study: • For a hypothetical decline in quality from the status quo—that is, good beach and water quality and fair marine life—the mean welfare loss for each individual was calculated at US$97(2008). • Mean welfare gain for an improvement in quality from the status quo was estimated at $22 per individual. • Access value (welfare loss from removing Jamaica from respondent's choice set) calculations of $128 per person also confirm that there is a significant consumer surplus associated with a typical coastal vacation in Jamaica.
Potential Applications	The results of the study are used to discuss the feasibility of generating revenues for the sustainable financing of ocean and coastal management in Jamaica.

3. Thomas-Hope, E. and A. Jardine-Comrie. 2007. "Valuation of environmental resources for tourism in small island developing states: Implications for planning in Jamaica." *International Development Planning Review* 29 (1):94–112.	
Study Site	National level
Objectives	Estimated the environmental costs of the tourism industry and compared them to the industry's contribution to Jamaican GDP.
Ecosystem Services Valued	Tourism (lodging only)
Economic Valuation Methods	Cost estimates were based on the replacement values of inputs used by the hotel industry, including: • Seawater desalinization cost as a proxy for freshwater costs • Additional costs of tertiary sewage treatment as a proxy for wastewater costs • The cost of establishing and maintaining a forest as a proxy for CO_2 production, measured by electricity usage by hotels.
Data collection	Water use data: Water Resources Master Plan for Jamaica (1985–2015) Sewage effluent: Calculations based on the assumption that effluent would be equal to the volume of water used Carbon dioxide emissions: Jamaica Public Service Company (JPSCO), National Water Commission (NWC) Tourism contribution to GDP: Government of Jamaica, National Accounts
Results	The tourism sector's environmental cost was at least two times as high as its contribution to GDP. Estimates of excess value to hoteliers: • Potable water: US$60–80 million per year • Sewage effluent assimilation: US$2–2.5 million per year • CO_2 sequestration: US$737 to US$2184 million per year after an $18 billion investment in years 1–3
Potential Applications	Cost estimates highlighted the value of prioritizing environmental protection and enhancement as a critical component of tourism planning. In particular, the following investments in clean technology and resource conservation are encouraged: • Sewage effluent assimilation: US$2–2.5 million per year • Tertiary treatment of sewage and reuse of water for irrigation • Composting of organic waste • Metal, glass, and plastic recycling • Use of renewable energy • Enforcement of energy-efficient building designs

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4. **Waite, R., E. Cooper, N. Zenny and L. Burke**. 2011. "Coastal Capital: Jamaica – The Economic Value of Jamaica's Coral Reef-Related Fisheries." Washington, DC: World Resources Institute.	
Study Site	National level
Objectives	Assessed the economic contribution of reef-related fisheries to the Jamaican economy.
Ecosystem Services Valued	Reef-related fisheries
Economic Valuation Methods	Economic impact analysis
Data collection	The study brought together the results of several other recent fisheries studies conducted in Jamaica, including assessments of the impacts of fisheries degradation on employment and local livelihoods, an estimate of the economic losses due to insufficient fisheries management over the past 25 years, and case studies of the conch fishery. It also updated all values to 2011 US dollars.
Results	• From 2001 to 2005, gross revenue from the sale of reef-related fish averaged US$33.1 million per year, including US$24.2 million per year from domestic sales and US$8.9 million per year from exports. • Authors estimated that the value of the subsistence catch (consumed domestically and not sold on the market) averaged US$1.2 million per year from 2001 to 2005. • Combined, these fish sales contribute US$34.3 million per year, a value equivalent to 0.3 percent of Jamaica's annual GDP. • Jamaica's failure to effectively manage its fisheries cost the country US$1.6 billion in lost revenues over the period from 1975 to 2000, not counting the Pedro Bank fishery (from Sary et al. 2003). • Reef-related fisheries are also important for employment (directly and indirectly supporting more than 100,000 jobs), as well as food security.
Potential Applications	The study makes an economic case for sustainable fisheries management and protection of coastal ecosystems. The study also takes a critical look at Jamaica's draft National Fisheries Policy—a document designed to overhaul national fisheries legislation—highlighting positive aspects of the draft policy as well as several recommendations to address gaps.

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Multiple Locations

5. Kushner, B., P. Edwards, L. Burke, and E Cooper. 2011. "Coastal Capital: Jamaica – Coral Reefs, Beach Erosion and Impacts to Tourism in Jamaica." Washington, DC: World Resources Institute.	
Study Site	Negril, Montego Bay, and Ocho Rios
Objective	Assessed the economic contribution of coral reefs to beach erosion control and the benefits derived from the beach tourism economy.
Ecosystem Services Valued	Recreation, tourism, and coral reefs
Economic Valuation Method(s)	Contingent valuation
Data collection	A model developed by Sheppard et al. (2007) was applied to each of the three sites, to estimate how the further loss of live reef structure and the subsequent erosion of the reef substrate over 10 years would lead to increased wave heights and thus increased beach erosion. Using the increased erosion rates as inputs, the loss in consumer welfare associated with a decline in beach quality due to erosion at each site was calculated. The study by Edwards (2009), which looked at visitors' willingness to pay for environmental quality, was used as the basis to determine the welfare loss per meter loss of beach width.
Results	• It was estimated that if further reef degradation occurs, erosion rates could increase significantly above the current rates at all three sites, by more than 50 percent for Montego Bay, 70 percent for Ocho Rios, and more than 100 percent for Negril over a 10-year period. • It was estimated that at the end of 10 years, current erosion rates at the beaches in Negril, Montego Bay, and Ocho Rios will cause an annual loss in value of US$19 million. If reefs degrade further, it was estimated that the additional beach erosion will increase this annual loss to US$33 million that year. This represents an additional US$13.5 million per year—a 70 percent increase in the annual loss of value from the base scenario if the reef degrades further. • This loss of value is projected to have knock-on impacts by reducing tourist visitation by 9,000–18,000, costing an estimated US$9 million to US$19 million per year to the Jamaican tourism industry and US$11 million to US$23 million per year to the entire Jamaican economy.
Potential Applications	The results of this study demonstrate that the economic risks to the Jamaican tourism industry are large, as beach erosion due to reef degradation will reduce visitor demand. In order to protect beaches and tourism revenue, it is crucial that key stakeholders invest in conservation measures to protect coral reefs.

Montego Bay

The next four studies are part of two World Bank initiatives on marine system valuation (RPO#682-22 – papers 3a-3c) and cost effectiveness modeling (RPO#680-08 – paper 4) in the Montego Bay Marine Park in Jamaica. Additional information on these two projects is available at: <http://www.island.net/~hjr/coralwb.htm>.

6a. Ruitenbeek, H. and C. Cartier. 1999. "Issues in Applied Coral Reef Biodiversity Valuation: Results for Montego Bay, Jamaica." World Bank Research Committee Project RPO# 682-22. Washington, DC: World Bank.	
Study Site	Montego Bay Marine Park (MBMP)
Objective	Estimated the net present value of the Montego Bay reef.
Ecosystem Services Valued	• Tourism, fisheries, shoreline protection (based on Gustavson, 1998) • Biodiversity/existence value (based on Spash, 2000) • Biological prospecting (based on Cartier and Ruitenbeek, 1999)
Economic Valuation Method(s)	Tourism: Financial analysis Fisheries: Financial analysis, also drawing upon surveys conducted by Bunce and Gustavson (1998) Shoreline Protection: Avoided damages Non-use benefits of marine biodiversity: Contingent valuation Biological prospecting (for marine-based pharmaceutical products): Modeled using cost information for Jamaica, typical success rates, and end-use values
Data collection	Predominantly used secondary data sources: Gustavson (1998) and Spash (2000) Biological prospecting: Localized cost information for Jamaica (based on information from the Government of Jamaica); and values obtained from pharmaceutical firms.
Results	Estimated net present value (NPV) from reef was US$408 million: • Direct use: Total of US$381.3 million (US$315 million from tourism & recreation, US$65 million from coastal protection, US$1.3 million from artisanal fishing) • Non-use: Total of US$19.6 million (US$13.6 million from visitor value, US$6 million from resident value) • Other (biological prospecting): Total of US$7.01 million The authors projected that every 1% increase in coral abundance was likely to generate a marginal benefit of approximately US$10 million.
Potential Applications	The authors emphasized that economic valuation should focus on specific policy contexts and be narrowly implemented due to their complexity. However, they offered several recommendations, including: (i) A new park zoning plan (with mooring and demarcation buoy programs) (ii) A watershed management program, including planting mangroves and coastal plants to reduce impacts of runoff (iii) Alternative income programs for fishermen (iv) Merchandise, user fee, and ecotourism programs for revenue generation (v) Education programs for school children and the community (vi) Volunteer and public relations programs (vii) Enhanced enforcement to protect fisheries resources from poaching (viii) Research and monitoring programs to evaluate the recovery of the ecosystem and track the success of park programs.

6b. Bunce, L., and K. Gustavson. 1998. "Coral reef valuation: A rapid socioeconomic assessment of fishing, watersports, and hotel operations in the Montego Bay Marine Park, Jamaica and an analysis of reef management implications." World Bank Research Committee Project #RPO 681-05. Washington, DC: World Bank.	
Study Site	Montego Bay Marine Park
Objective	Assessed the benefits provided by the MBMP reef for three primary beneficiary groups (fishers, watersports operators, and hoteliers).
Ecosystem Services Valued	The study did not directly value the ecosystem, but instead attempted to identify Jamaicans' dependence on the MBMP for their primary source of income.
Economic Valuation Method(s)	Financial analysis was used to estimate fishers' income, but the main analysis focused on the number of workers in each group and their reliance on the MBMP.
Data collection	Document and database analysis, interviews, focus groups, a telephone survey, and participant observation of the three users' groups
Results	Fishing: • Estimated that there were 378 fishers within park boundaries • Average yearly individual net income was approximately US$3,000–$4,500 • Total annual income for fishers in the MBMP was US$1.13–$1.70 million • Roughly 70% of fishers were full-time fishers, but many had a secondary source of income Watersports • Approximately 200 people were employed through direct watersports in the park. • Twenty-eight dive operations, snorkel businesses, party cruisers, and small-scale watersports businesses operated in Montego Bay • Watersport operators took over 3,100 tourists and nearly 220 trips each week, totaling 11,000 trips and 163,000 tourists per year Hoteliers • Hotels accounted for 16,000 jobs: 6,400 direct and 9,700 indirect • Montego Bay had 56 hotels, with a total of 5,371rooms • 75% of hotels were Jamaican-owned and -managed
Potential Applications	The Montego Bay Marine Park could improve its financial sustainability and effective management by engaging user groups that are economically dependent on its services. Specifically, there is a need to: • Promote the perception of the park as a community resource and an asset • Actively include the full range of the park's users in the program planning process • Recognize intersectoral coordination as an important component of developing an effective and comprehensive reef management program.

<table>
<tr><td colspan="2">6c. Gustavson, K. 1998. “Values Associated with the Local Use of the Montego Bay Marine Park. as a component of Marine System Valuation: An Application to Coral Reef Systems in the Developing Tropics.” World Bank Research Committee Project #RPO 681-05. Washington, DC: World Bank.</td></tr>
<tr><td>Site</td><td>Montego Bay Marine Park</td></tr>
<tr><td>Objective</td><td>Calculated the net present value (NPV) of the local-use components of the Montego Bay reef system (including tourism, fisheries, and shoreline protection).</td></tr>
<tr><td>Ecosystem Services Valued</td><td>Tourism, fisheries, shoreline protection</td></tr>
<tr><td>Economic Valuation Method(s)</td><td>Tourism: Financial analysis – all spending on accommodation, food and beverage service, entertainment, transportation, shopping, misc. in Montego Bay

Fisheries: Financial analysis based on previous surveys / socioeconomic assessments (see Bunce and Gustavson 1998)

Shoreline protection: Avoided damages: Estimation of value of land vulnerable to erosion in the Montego Bay Marine Park</td></tr>
<tr><td>Data collection</td><td>Tourism: Revenue and expense analysis for the Jamaican tourism sector (OAS); annual tourist arrivals, expenditures, and accommodations sales (Annual Travel Statistics, Jamaica Tourist Board); capital cost models for accommodations (Jamaica Promotions Corporation)

Fisheries: number and type of fishers and number of boats (Registration of Fishermen Database, Fisheries Division, Jamaican Ministry of Agriculture); fishing type, revenues, and costs (Bunce and Gustavson 1998; Nicholson 1994)

Shoreline protection: Data on property values in the area were collected from real estate offices, land developers, and government offices (Jamaica Promotions Corporation and the Urban Development Corporation)</td></tr>
<tr><td>Results</td><td>
<table>
<tr><td></td><td colspan="3">Net Present Value (millions of 1996 US$)</td></tr>
<tr><td>Discount Rate</td><td>5%</td><td>10%</td><td>15%</td></tr>
<tr><td>Recreation and Tourism</td><td>$630</td><td>$315</td><td>$210</td></tr>
<tr><td>Nearshore Fishery</td><td>$2.92</td><td>$1.31</td><td>$0.815</td></tr>
<tr><td>Coastal Protection</td><td>$130.0</td><td>$65.0*</td><td>$43.3</td></tr>
<tr><td>Total</td><td>$762.9</td><td>$381.1</td><td>$254.8</td></tr>
</table>
* or $5.1 million per mile of shoreline
</td></tr>
<tr><td>Potential Applications</td><td>The authors supported the application of user fees to facilitate the MBMP’s ability to capture portions of the producer surplus/rent enjoyed by tourism operators and shoreline properties to pay for management and enhancement of MBMP.</td></tr>
</table>

7. Ruitenbeek, J., M. Ridgley, S. Dollar, and R. Huber. 1999. "Optimization of economic policies and investment projects using a fuzzy logic cost-effectiveness model of coral reef quality: empirical results for Montego Bay, Jamaica." *Coral Reefs* (18): 381–392.

Study Site	Montego Bay Marine Park
Objective	Compared the cost-effectiveness of different reef management interventions, measuring the cost of intervention relative to an anticipated change in coral abundance.
Ecosystem Services Valued	Cost-effectiveness model of different reef management interventions (not an economic valuation of ecosystem services)
Economic Valuation Method(s)	N/A: cost-effectiveness evaluation of reef management possibilities
Data collection	Literature review, supplemented by review of workshops and other consultations with the academic, private, public, NGOs, and consultant communities.
Results	**Changes in Montego Bay coral reef quality arising from an individual intervention**

Intervention	**Coral abundance (%)**	**Coral change above baseline (%)**	**Total cost (millions US$)**	**Average cost (millions US$)***
0. Base case condition - high economic growth	28.94	0.00		
1. Sediment trap	32.13	3.20	9.30	2.91
2. Planting of trees in upper watershed	30.57	1.63	27.90	17.12
3. Aeration of waste	30.57	1.63	11.84	7.25
4. Large-scale centralized treatment facility	34.18	5.24	98.40	18.78
5. Agricultural extension	29.00	0.07	2.40	36.81
6. Outfall and pump	34.33	5.39	2.52	0.47
7. Household solid waste collection	30.73	1.80	0.43	0.24
8. Hotel tax	28.97	0.03	0.60	17.30
1-8. All interventions combined	49.17	20.23	153.40	7.58

*Average cost (millions US$) per additional % of coral abundance

Potential Applications	The combination of several interventions—including household solid waste collection (7), the installation of an outfall (6), and the use of a sediment trap on the Montego River (1)—present an optimal policy option, as they are relatively cost effective, impose a low present value cost of about US$12 million, and would likely improve coral abundance in excess of 10%. Achieving the maximum potential improvement of 20% would cost over 12 times as much—US$153 million—and as a result is not a likely political option.

8. Spash, C. 2000. "Assessing the benefits of improving coral reef biodiversity: The contingent valuation method." In H. Cesar, ed. *Collected essays on the economics of coral reefs.* Kalmar, Sweden: CORDIO	
Study Site	Montego Bay Marine Park
Objective	Measured the benefits of maintaining and improving coral reef biodiversity; and estimated the willingness to pay (WTP) for improvements in reef quality.
Ecosystem Services Valued	Biodiversity (proxy: coral abundance)
Economic Valuation Method(s)	Contingent valuation
Data collection	Used a survey of 565 locals and 493 tourists, informing participants of the current state of the MBMP and asked their willingness to pay (WTP) to create a trust fund to be managed by the MBMP, which would be used to finance projects to improve coral biodiversity (defined as coral abundance).
Results	Among locals, the mean WTP was US$28, though the median was US$2.87. The primary direct benefits claimed from the marine park were swimming (34%) and eating seafood (30%), though 28% claimed no direct benefit. Among tourists, the mean WTP was $US23, with a median of US$2.00. The primary direct benefits again were swimming (35%), and seafood (23%), along with beach usage (18%) and diving/snorkeling (12%). 12% of tourists claimed to enjoy no direct benefit from the marine park. These results were likely underestimates, as nearly one-quarter of locals and half of tourists stated a willingness-to-pay of zero due to their belief that no monetary compensation would be acceptable for the loss of coral reef.
Potential Applications	The results of this study could be used to devise a tax or user fee policy for park upkeep. Huber (2005) used these findings to recommend an earmarked voluntary hotel room fee of US$1 per bed-night, which could generate a total revenue of approximately US$1.5 million per year for the Montego Bay Marine Park Trust.

9. Dharmaratne, G., F. Y. Sang, and L. J. Walling. 2000. "Tourism Potentials for Financing Protected Areas." *Annals of Tourism Research*, 27 (3): 590-610.

Study Site	Montego Bay Marine Park
Objective	Evaluated the use and non-use values from the Montego Bay Marine Park, exploring opportunities for revenue generation and self-financing.
Ecosystem Services Valued	Tourism
Economic Valuation Method(s)	Contingent valuation—assessed the willingness to pay (WTP) for use and non-use values
Data collection	231 questionnaires were randomly distributed at major beaches in MBMP
Results	WTP for first-time visitors to MBMP was estimated to be US$19.93, and for repeat visitors was US$9.57. Non-use value was found to be relatively negligible at US$1.45. The authors attribute this low value to the fact that the coastline of the park is not perceived as much different from the surrounding area.
Potential Applications	The authors estimated that a weekly admission fee of US$10 would bring in the maximum revenue for the park. However, a fee of US$10 might have adverse effects on the length or number of stays for repeat tourists. The authors recommended that any fee over US$5 per week would require further study to explore the potential economic effects on the tourism industry.

Willingness to Pay Different Admission Fees (for a seven-day visit)

Fee (in US$)	% First Time Visitors	% of Max WTP collected	% Repeat Visitors	% of Max WTP collected	Total Expected Revenue
$1.75	84	9	73	18	$194,871
$2.50	81	13	70	26	$267,982
$5.00	74	25	60	50	$480,328
$7.50	65	38	49	78	$616,435
$10.00	54	50	39	105	$678,453
$12.50	43	63	29	131	$663,192

10. Huber, R. 2005. "Capturing ecotourism benefit values in riverine and marine parks: socioeconomic and institutional context of two sites, Montego Bay Marine Park, Jamaica, and the Canaima National Park in Venezuela." Paper presented to the symposium and workshop of the North American Marine Protected Areas Network: benefits and financing of MPAs measuring the effectiveness of MPAs. Loreto, Mexico, February 28 to March 4, 2005.	
Study Site	Montego Bay Marine Park
Objective	Explored options for developing sustainable financing for the MBMP by capturing some of the consumer and producer surplus from ecotourism.
Ecosystem Services Valued	Tourism
Economic Valuation Method(s)	Drew from economic valuations of tourism conducted by Spash (2000) and Gustavson (1998) (financial analysis, travel cost, contingent valuation)
Data collection	Data was taken from the results of economic valuations of tourism conducted by Spash (2000) and Gustavson (1998)
Results	Three options to generate sustainable financing for the MBMP based on benefit capture from producers or consumers were identified: • A hotel room fee of US$1 per bed-night: this method would be easiest to implement, and would capture some of the consumer surplus of the foreign tourists who use the MBMP. • A fee on fishers and tour operators: this approach is harder to implement and enforce, as it would likely require licenses and monitoring. Additionally, the rents enjoyed by fishers are minimal. • Attempting to influence consumer preferences via a "green certification" of local businesses: if tourists are more likely to patronize businesses that support the park, this could be a productive method. However, it requires a provision of information, and many tourists make their choice of hotel long before their trip.
Potential Applications	The study recommended a specific policy for the MBMP: a US$1 per bed-night hotel tax to capture tourist consumer surplus. This would provide the park with annual revenue of approximately US$1.5 million.

11. Reid-Grant, K., and M. Bhat. 2009. "Financing Marine Protected Areas in Jamaica: An Exploratory Study." *Marine Policy* 33 (1): 128–136.	
Study Site	Montego Bay Marine Park
Objective	Looked at how to sustainably finance the MBMP in response to a decline in park funds and the resulting degradation of the marine ecosystem.
Ecosystem Services Valued	Tourism (recreation, swimming, sport-fishing)
Economic Valuation Method(s)	Travel cost
Data collection	Surveyed 5 hotels, 21 businesses, and 99 tourists. The tourist surveys were used as the basis for the valuation, while the hotel and business surveys were used to help identify policy options. Tourist surveys captured demographics, travel activities, the nature of recreational activities, and tourists' perception of recreational resources and activities. Hotel and business surveys determined how to strengthen ties between the private sector and the MBMP, opinions on the current condition of the park, potential solutions, options for collaboration with park authorities, and existing avenues to donate money to support park activities.
Results	Consumer surplus from use of the park was estimated to be US$586/person for cruise-ship travelers and US$509/person for air travelers. Total annual surplus benefits (consumer surplus) of cruise travelers and air travelers was estimated to be US$189 and $993 million, respectively. In comparison, projected 2010 administration costs of the MBMP were only US$117,448, approximately 0.01% of the total consumer surplus.
Potential Applications	A small environmental tax on tourists and/or a user fee could provide sustainable funding for the park. A 0.1% tax on tourist equipment alone would more than cover the park's costs. Alternatively, a tax on businesses would be possible: 69% recognized their dependence on the park. Given the small size of the tax or fee necessary to provide funding, the authors conclude the additional cost would have little influence on visitation. Any change, however, would require a government commitment to allow the MBMP to collect fees, or to earmark taxes for it.

Negril

12. Cesar H., P. van Beukering, and G. de Berdt Romilly. 2003. "Case Study – Negril, Jamaica," In *Mainstreaming economic valuation in decision making: Coral reef examples in selected CARICOM countries.* Amhem, Netherlands: ARCADIS-Euroconsult.	
Study Site	Negril
Objective	Assessed the potential economic impact of climate change on Negril's coral reefs.
Ecosystem Services Valued	Tourism and fisheries
Economic Valuation Method(s)	Effect on production; contingent valuation
Data collection	Tourist and resident surveys, literature review, government statistics Survey: A total of 295 people were surveyed (101 foreign non-divers, 101 local non-divers, 81 foreign divers, 12 local divers).
Results	Fisheries: • The study used Francis's (2002) estimate that 151–206 fishers utilize Negril, producing a value of US$0.5 million. Tourism: • The average additional WTP was estimated to be US$18 with current reef conditions, and US$19 with environmental improvements. • Aggregate recreational consumer surplus was estimated to be US$2.56 million, with a value added of US$5.33 million. Effects of planning: • Effective physical planning was projected to produce a benefit of US$0.8 million; recreational value would increase from US$4 to 5 million, while fishery value would decrease from US$0.5 to 0.3 million. • Implementing an adaptation strategy for climate change was projected to produce a benefit of US$1.8 million; recreational value with the strategy would be US$5 million (vs. US$3 million without such a strategy), while fishery value would fall to US$0.3 million. • Compared to Wright's (1995) study, degradation of the reef significantly impacted consumer surplus; Wright reported a consumer surplus nearly double of that found in this study, and a WTP of US$31,versus the US$18 found here.
Potential Applications	Given the significant economic value of the reef and the potential for further losses, physical planning can produce major cost savings. Possible changes include: • Increasing the number of dive sites and limiting dives, which would reduce the pressure on any given dive site • Decreasing fishing, which would lead to increased yields per fisherman as well as increased biodiversity.

<table>
<tr><td colspan="2">13. Wright, Matthew G. 1995. “An economic analysis of coral reef protection in Negril, Jamaica.” Working Paper No. 11. Kingston, Jamaica: UWI Center for Environment and Development.</td></tr>
<tr><td>Study Site</td><td>Negril</td></tr>
<tr><td>Objective</td><td>Estimated tourists’ consumer surplus of Negril as a whole, as well as for the coral reef alone.</td></tr>
<tr><td>Ecosystem Services Valued</td><td>Tourism and recreation</td></tr>
<tr><td>Economic Valuation Method(s)</td><td>Contingent valuation survey for value of coral reef
Travel cost method to estimate tourist demand and consumer surplus</td></tr>
<tr><td>Data collection</td><td>CV: 240 questionnaires distributed randomly at dive shops and hotels, with a response rate of 44%.
Travel cost: based on cost of airfare, average hourly wage in the US, and the amount spent on the vacation in Jamaica by visitors from 10 US states.</td></tr>
<tr><td>Results</td><td>Total willingness to pay:
Visitors to Negril were willing to pay an average of US$31/yr to ensure that Negril’s reefs are preserved at current levels (up to 60% coral coverage).
Visitors were willing to pay an average of US$49/yr to improve coral reefs to >90% live coral cover.
Willingness to pay by category (in US$)<table><tr><th></th><th>60% coral coverage</th><th>90% coral coverage</th></tr><tr><td>Scuba Divers</td><td>$38</td><td>$75</td></tr><tr><td>Snorkelers</td><td>$30</td><td>$47</td></tr><tr><td>Glass Bottom Boat Users</td><td>$32</td><td>$43</td></tr><tr><td>Never Seen Reefs</td><td>$28</td><td>$37</td></tr><tr><td>Average</td><td>$31</td><td>$49</td></tr><tr><td>Total (for 162,000 visitors)</td><td>$5.088 million</td><td>$7.938 million</td></tr></table>The travel cost study estimated average consumer surplus of US$121, for a total net benefit of US$19.6 million for all visitors to Negril per year.
The author estimated that if the reef were to degrade to 10% coral coverage, Negril would lose an estimated US$18.2 million in annual tourism revenue, while an increase to 90% coral coverage would bring in an additional US$8.6 million annually.</td></tr>
<tr><td>Potential Applications</td><td>The results support the implementation of a US$5–$15 environmental (“reef protection”) tax as a payment mechanism, well below the WTP of US$31–$49.</td></tr>
</table>

Portland Bight

14. Cesar, H., M. Öhman, P. Espeut, and M. Honkanen. 2000. "Economic Valuation of an Integrated Terrestrial and Marine Protected Area: Jamaica's Portland Bight." In H. Cesar, ed.. *Collected essays on the economics of coral reefs.* Kalmar, Sweden: CORDIO.	
Study Site	Portland Bight
Objective	Estimated the costs and benefits associated with the Portland Bight Protected Area (PBPA).
Ecosystem Services Valued	Direct benefits: • Fishery: covers 258,590 ha, and while severely depleted is still economically valuable • Forestry: timber and fuel sources, honey, orchids, and medicinal plants Indirect benefits: • Tourism and recreation: quite underdeveloped relative to the rest of Jamaica, but valuable nonetheless • Navigation: two major ports • Environmental: waste treatment, sediment retention, coastal protection Non-use values: • Biodiversity
Economic Valuation Method(s)	Fisheries: Financial analysis Forestry, tourism and recreation, carbon fixation, biodiversity: Benefit transfers based on other studies, many from outside the Caribbean region. Coastal protection: Unclear from this paper. Presumably uses either the replacement cost or avoided damages method.[1]
Data collection	Literature review
Results	The authors estimated the accumulated benefit over 25 years from the presence of the PBPA to be US$40.8 million in NPV, with an additional US$11.8 million added if tourism expands with the sustainable addition of infrastructure. The costs of establishing and running PBPA over the next 25 years were projected to be US$19.2 million.
Potential Applications	Given that the NPV costs of running the PBPA over the 25-year period are estimated to be US$19.2 million, and the added NPV benefit of the PBPA is US$40.8–$52.6 million, the costs of the protected area are well-justified. This study could help justify establishing / raising user fees in PBPA.

[1] WRI only had access to the CORDIO paper, which was a summary of a longer working paper that included the full methodology.

Ocho Rios

15. Environmental Management Unit (EMU). 2001. Socioeconomic Valuation Study of the Ocho Rios Marine Park. Department of Geology and Geography, University of the West Indies.	
Study Site	Ocho Rios
Objective	Quantified the economic and social value of the marine and coastal zone resources of the Ocho Rios Marine Park.
Ecosystem Services Valued	Tourism, fisheries, recreation, coastal protection, biodiversity
Economic Valuation Method(s)	Tourism and fisheries: financial analysis Recreation: travel cost calculation Coastal protection: avoided damages Biodiversity: benefit transfer
Data collection	Primary data: obtained from questionnaire surveys, site visits, and informal interviews Secondary data sources: based on existing statistics from government agencies and real estate offices.
Results	Value estimates: • Consumer surplus: US$132.53 per person, equaling US$20.7 million annually for all visitors to Ocho Rios. • Economic value: US$245.2 million per year, with tourism providing about half of this value. Ocho Rios stands to lose an estimated 58,504 stopover visitors annually from coastal degradation, totaling US$60.8 million dollars annually. Over half of this cost is borne by hoteliers, with the entertainment, shopping, transportation, and food and drink sectors share the rest of the burden.
Potential Applications	To avoid these losses, the authors recommended that the government and park authorities should actively manage their fisheries, resource users, and land-based activities: These include: • Fisheries: Combat overfishing and increasing fishing pressure; introduce gear restrictions such as minimum mesh size; designate fish sanctuaries; limit user entry • Manage resource users: Implement zoning in park; enforce zoning laws (focusing on co-management / community involvement); design educational program to raise awareness of the critical importance of the coastal and marine resources to the viability of the town of Ocho Rios. • Manage land-based activities**:** Control pollution by decreasing negative land-based impacts on coastal resources; implement long-range development strategies that ensure habitat preservation and the protection of sensitive coastal areas; restore and rehabilitate areas where degradation has already occurred.

Discovery Bay

16. Sary, Z., J. L. Munro, and J.D. Woodley. 2003. "Status report on a Jamaican fishery: Current value and the costs of non-management." In L. Creswell, ed. *Proceedings of the Fifty-fourth Annual Gulf and Caribbean Fisheries Institute*. Fort Pierce, Florida: GCFI.

Study Site	Discovery Bay
Objective	Estimated the loss in revenue of Jamaica's fisheries from 1975–2000 due to insufficient management.
Ecosystem Services Valued	Fisheries
Economic Valuation Method(s)	Financial analysis of the Discovery Bay area, extrapolated to the rest of Jamaica.
Data collection	Catch and effort data were recorded from July 2000 to July 2001 for five landing sites near Discovery Bay. Catch and sales data were also available from 1968 for a few landing sites on the north coast and from previous Discovery Bay fisheries analyses between 1970–97.
Results	**Change in Catch Rates, 1968–2001** **1968** / **2001** / **change** / **% change** **Number of boats**: 47 / 39 / -8 / -17.0% **Total Catch (kg)**: 28,020 / 24,264 / -3,756 / -13.4% **Catch per boat (kg)**: 596.17 / 622.15 / 26 / 4.4% **Total Value (2001 US$)**: 152,197 / 125,840 / -26,357 / -17.3% **Earnings per boat**: 3,238.23 / 3,226.67 / -12 / -0.4% The authors estimated that over US$6.4 million was lost between 1975–2000 from a 12 km^2 area of fishing ground in Discovery Bay. Using estimates of shelf area and productivity for the north and south coasts of Jamaica, the authors scaled this up to a rough estimate of US$1.3 billion in lost revenues for the country (not including the Pedro or Morant Banks) over the 25-year period.
Potential Applications	The large size of the value lost makes it clear that fisheries management would be well worth the cost. Increasing the size of the mesh of fish traps to a 66 mm aperture would have increased the value of trap catches by 30% and would have had a positive impact on line catches as well as allowing fish to grow to maturity before being caught.

Appendix 1: Glossary

Benefit capture. Actions taken to allow a governmental actor to take some of the value enjoyed by private actors, who often enjoy the rewards of an environmental good without bearing much of the cost of sustaining it.

Benefits transfer. A practice used to estimate economic values for ecosystem services by transferring information available from studies already completed in one location or context to another.

Consumer surplus. The difference between the total value consumers receive from a good or service and the total amount they pay for it. This is calculated by analyzing the difference between what consumers are willing to pay for something and its market price. In the case of reef recreation, for example, divers often state that they would have been willing to pay $X more than the actual price charged.

Discount rate. The interest rate at which an agent discounts future events in preferences in a multi-period model. A present-oriented agent discounts the future heavily and thus has a *high* discount rate.

Ecosystem services. The tangible benefits provided by ecosystems that sustain and fulfill human life.

Excess value. The value obtained from a good or resource in excess of *all* costs associated with its use.

Gross revenue. Total revenues (income from sales) collected by a business or industry.

Local use. Local use of a natural resource for recreation, enjoyment, or income. The most common benefits are recreation, fisheries, and shoreline protection, though other aspects, like aquarium trade, craft production, and bioprospecting are also included.

Marine protected area. Any area of the intertidal or subtidal terrain—together with its overlying water and associated flora, fauna, historical and cultural features—that has been reserved by law or other effective means to protect part or all of the enclosed environment (*IUCN World Conservation Union*).

Multipliers. Multipliers are used to capture the indirect impacts arising within an economy as the expenditures in one industry generate expenditures throughout the rest of the economy. A multiplier of 1.5, for instance, means that each dollar spent in the initial industry generates an additional 50 cents of spending in the rest of the economy.

Net revenue. Total revenue (income from sales) collected by a business minus the total costs of running that business.

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Net present value (NPV). The value that stands to be lost if a resource is completely degraded. It is based on the future benefits the resource will provide, discounted by the social preference for current use over future use.

Operating costs:

> **Labor costs**. The amount a business spends on paying its employees. For industries where this information is more difficult to collect, average labor costs for the industry can be estimated as a % of gross revenue.
>
> **Non-labor operating costs**. All expenses incurred by a business except payment of wages, expressed as a % of gross revenue.

Producer surplus / rent. The total revenue obtained from using a productive resource minus all opportunity costs of production (opportunity costs, labor, capital, and ownership of natural resources).

Willingness to pay (WTP). The maximum amount a person would be willing to pay, sacrifice, or exchange for a good.

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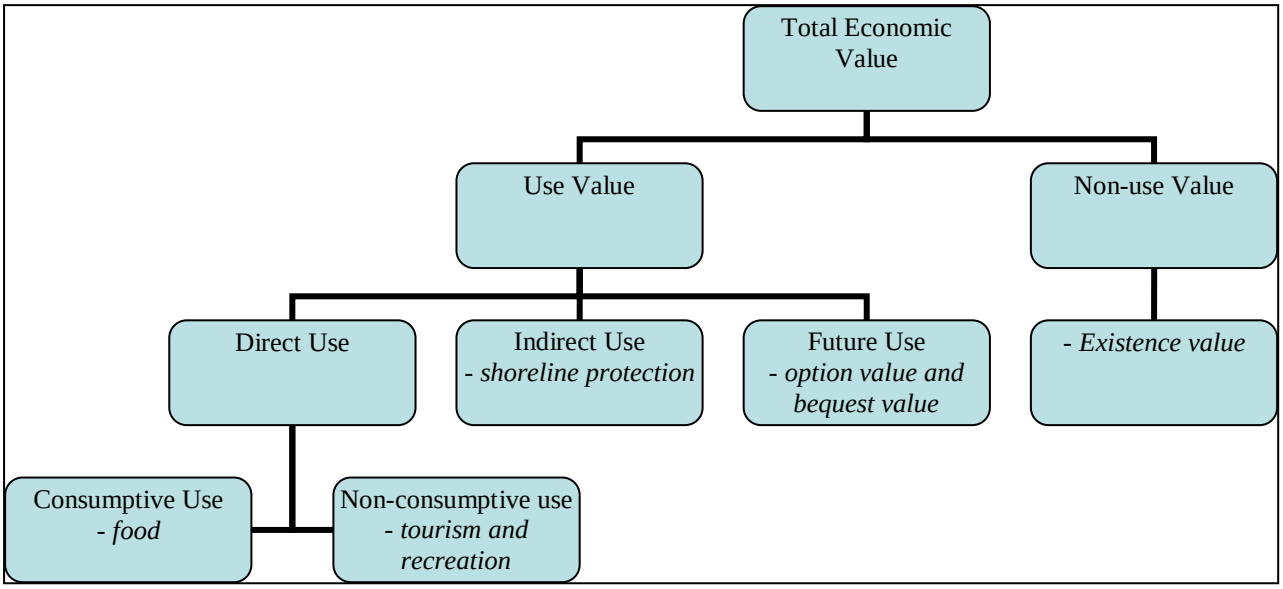
Appendix 2: Economic Valuation Methods

Economic valuation assesses a resource in terms of its value to humans. The commonly used total economic value (TEV) framework (see Figure 1) divides the value of ecosystem goods and services into *use* and *non-use* values. *Use* values are further broken into *direct use*, *indirect use*, and *option* (future use) values. *Direct use* values include consumptive uses—such as timber and food—and non-consumptive uses, such as tourism and recreation. *Indirect use* values include ecosystem services such as water filtration and shoreline protection. *Option values* estimate the value of preserving the use of ecosystem goods and services for the future, including "bequest value," where the value is for future generations. *Non-use values* typically refer to *existence* value; i.e., the value humans place on the knowledge that a resource exists, even if they never visit or use it. Non-use and option values are frequently the most controversial elements of TEV; they are the most difficult to quantitatively measure, and have the greatest uncertainty attached to them.

Economic valuation studies may attempt to quantify all or some of the use and non-use values of a resource. Although valuation is a useful and potentially powerful decision-making tool, users should always bear in mind the high degree of uncertainty in most economic valuation studies, and should pay attention to the methods used, assumptions made. and the caveats attached to their results.

Figure 1. Total Economic Value (TEV)



Note: Adapted from Pagiola et al. 2005.

Common Economic Valuation Techniques

As ecosystem services are typically not traded in conventional markets, a variety of approaches have been developed to estimate their value. Some of the economic valuation methods that are commonly used to quantify the benefits of ecosystem services include:

Methods based directly on the observed behavior of humans

An **economic impact analysis** assesses the impacts of spending (revenues, wages, taxes, etc.) related to market-based uses of an ecosystem good or service. **Direct** economic impact can be estimated by calculating gross revenues associated with a service (for instance, diving and snorkeling). **Indirect** economic impact (impacts on the wider economy spurred by direct spending) can be calculated using a country- or sector-specific multiplier.

The **effect on productivity** method estimates a change in value by assessing the change in a provided good or service that results from a change in the environmental resource (e.g., assessing whether fish productivity will decrease after damage to or destruction of a coral reef). One challenge with this method is determining and modeling the relationship between the damage to an environmental resource and its corresponding impact on the production of the specified good or service.

Financial analysis uses observed market prices to analyze the economic activity generated by use of an ecosystem good or service. This method focuses on current financial flows in the economy from market-based uses of the reef. Unlike an economic impact analysis, operating costs are subtracted from all revenue calculations to arrive at net rents.

Methods based indirectly on the observed behavior of humans (Revealed Preference)

The **hedonic pricing** method is used to estimate economic values for ecosystem or environmental services that directly affect market prices. It is most commonly used to examine variations in housing prices that reflect the value of local environmental attributes. Environmental attributes can be included in an analysis to assess their impact on the market price of the specified commodity in that area. For example, hedonic pricing has been used to assess the influence of an ocean view on land and housing prices. One challenge of this approach is to ensure that all relevant attributes are included in the analysis; it often has substantial data requirements.

The **travel cost** method uses data about visitation to a site or set of sites to construct a demand curve for an environmental resource, e.g., a beach. This method is primarily used to ascertain the recreational use value of a resource based on its specific characteristics.

Replacement cost methods value an environmental service by determining the cost of manmade infrastructure required, or products that need to be purchased, to replace the service provided by the ecosystem in its current state. It has been frequently used to assess values such as nutrient filtering by wetlands and shoreline protection by coral reefs. This method relies on the assumption that society would actually pay to replace the good or service that is damaged or destroyed and requires accurate estimates of the engineered solution for the location in question.

Avoided damages methods look at the costs that are avoided because a given ecosystem good or service is present. It is often used to estimate the damages avoided by having protection against natural disasters such as hurricanes and floods. One challenge with this method is determining the value of threatened areas as well as estimating the damages under different storm scenarios and different levels of protection.

Methods based on the hypothetical behavior of humans (Stated Preference)

The **contingent valuation** (CV) method attempts to place a value on ecosystem goods or services by directly asking people to state their willingness-to-pay (WTP) or willingness-to-accept (WTA) for a specific set of ecosystem goods and services or for changes in those goods and services. This method is useful for assessing non-use values such as the value of simply knowing that a coral reef exists. This method is vulnerable to many sources of bias and requires careful survey design. CV studies can be expensive to carry out, and require personnel with survey and analytical training. They vary widely in quality and design, and can be difficult to compare or replicate. Appropriately designed CV studies, however, can be useful in providing a defensible estimate of the value of natural resources when faced with development or damage assessment decisions.

Other methods

Benefits transfer methods involve applying results obtained in existing studies to different areas (e.g., estimating the value of one beach using the value calculated for a different beach of a similar size and type in a different area). Some benefits transfer approaches may use an economic model developed in one location to estimate the value of a resource in another, new location; characteristics of the new location can then be inserted in the previously developed model, providing a potential advantage over simply transferring the value estimates between locations. Because of the difficulty of accurately assessing the many factors affecting the values of an ecosystem good or service that may vary between sites, this method should be used with caution.

Note: Text on common economic valuation techniques adapted from Emerton and Bos 2004; Pagiola et al. 2005; MA 2003; updated in WRI 2009.

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Emerton, L., and E. Bos. 2004. *Counting Ecosystems as an Economic Part of Water Infrastructure.* Gland, Switzerland and Cambridge, UK: IUCN.

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