ReefFix: An ICZM Coral Reef Restoration, Watershed Management and Capacity Building Demonstration Project for the Caribbean
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ORGANIZATION OF AMERICAN STATES
INTER-AMERICAN BIODIVERSITY INFORMATION NETWORK (IABIN)

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1. INTRODUCTION

Responding to the importance in the Americas of protection of biodiversity (the Americas houses 8 of the world's 25 biodiversity hotspots), the Inter-American Biodiversity Information Network (IABIN) was officially mandated by the Presidents of the countries in the Americas, at the Summit of the Americas on Sustainable Development, convened by the OAS in Santa Cruz de la Sierra, Bolivia, in December 1996. IABIN is an Internet-based forum for technical and scientific cooperation that seeks to promote greater coordination among Western Hemisphere countries in the collection, sharing, and use of biodiversity information relevant to decision-making and education.

The objective of IABIN is to promote sustainable development and the conservation and sustainable use of biological diversity in the Americas through better access to and management of biological information. While IABIN is envisioned as a distributed system of data providers in which the data are maintained and controlled by the provider, coordinated access to the integrated resources of the network is a key component of IABIN.

IABIN has 5 Thematic Networks, (i) Species-Specimens, (ii) Ecosystems, (iii) Protected Areas, (iv) Pollinators, and (v) Invasive Species, and a metadata catalogue (see www.iabin.net.)

This REEFfix exercise is a subproject within the Protected Areas Thematic Network (PATN), supported by the Government of Chile by a grant of US$93,500 and follows on three initiatives:

- the development of the Caribbean Protected Areas Database Initiative – CPADI (See Annex 1.)
- MPAGlobal Databse and workshop where details can be found at: http://www.oas.org/dsd/Events/english/08.03.10.htm, and
- an extensive study completed in Montego Bay, Jamaica: (See: (i) Kent Gustavson, Richard M. Huber and Jack Ruitenbeek (eds). (2000) Integrated Coastal Zone Management of Coral Reefs: Decision Support Modeling. World Bank Discussion Paper, March. and (ii) Ruitenbeek HJ, Ridgley M, Dollar S, Huber RM (1999) Optimization of economic policies and investment projects using a fuzzy logic based cost-effectiveness model of coral reef quality: empirical results for Montego Bay, Jamaica. Coral Reefs. 18:381-392) (See Box 1.)

Box 1. Ecological Economic Decision Support Modeling for the Integrated Coastal Zone Management of Coral Reefs in Montego Bay Marine Park
Coral reefs are sometimes referred to as “canaries of the sea” because of their early warning ability to forecast near-shore oceanic stress. Because of their biological diversity, they are also

called “rainforests of the sea”. Coral reefs are vital to the well being of millions of people. Coral reef managers and government officials trying to save their valuable national resources need management-related information on coral reefs. Research[1] presented is useful for decision support and training in integrated coastal zone management (ICZM). Ecological economic decision support models can play a critical role in the development of effective ICZM for the protection and restoration of coral reefs. Two streams of research: i) cost-effectiveness modeling of management interventions (i.e., a question of the “supply” of biodiversity as an economic asset) and, ii) marine system valuation (i.e., a question of the “demand” for biodiversity) are for Montego Bay Marine Park, Jamaica. Total benefits from the Montego Bay reefs are US$401 million NPV, with an estimated additional potential benefit of US$70 million NPV through pharmaceutical bioprospecting. Up to a 20% increase in coral abundance may be achievable through the use of appropriate policy measures with a present value cost of US$153 million over 25 years. Optimization requires a 13% improvement in coral reef abundance, requiring net expenditures of US$27 million. The expenditures include installation of a sediment trap, waste aeration, installation of a sewage outfall, implementation of improved household solid waste collection, and implementation of economic incentives to improve waste management by the hotel industry.

This REEFfix study continues these 3 initiatives by conducting 3 valuation methodologies applied to 5 case study sites in Jamaica, DR, Haiti, the Bahamas, and Grenada.

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Country	Marine Park	Lead Contact	Status	IABIN Focal Point IABIN Focal Point email	Consultant
Jamaica	Montego Bay Marine Park Trust	Omar Ebanks Operations Manager Montego Bay Marine Park Trust MBMPT Office: (876) 952-5619 manager@mbmp.org	Workshop completed January 13-15, 2009	Dionne Newell Zoology.nhd@cwjamaica.com;	Brian L. Zane
Bahamas	Moriah Harbour Cay National Park in Exuma situated between Little & Great Exuma.	Janeen Bullard Parks Planner and Community Liaison Officer Bahamas National Trust P.O. Box N 4105 Nassau, Bahamas Tel: 242-393-1317 Fax: 242-393-4978 and LaKeshia Anderson Assistant Fisheries Officer Department of Marine Resources phone: (242)393-1014 ext. 229 fax: (242)393-0238	Workshop Completed April 27-29, 2009	Mr. Phillip Weech pswbest@hotmail.com bestnbs@hotmail;	Olethea Gardiner Msc., Consultant, BEST Commission
DR	National Park of	Ing. Hector Ivan Gonzalez	Workshop completed	Marina Hernández marina_hernandez@ho	Enrique Pugibet Bobea, Msc.

[1] Gustavson, K., Huber, R.M. and J. Ruitenbeek (eds.) (2000) Integrated Coastal Zone Management of Coral Reefs: Decision Support Modeling, Work in Progress for Public Discussion. World Bank, Washington, D.C.

	the East.	Brioso hector ivan gonzalez brioso [deoleo66@hotmail.com]	February 10-12, 2009	tmail.com; recursos.geneticos@medioambiente.gov.do;	Marine Biologist Centro de Investigación en Biología Marina (CIBIMA), Universidad Autónoma de Santo Domingo (UASD).
Haiti	Carocol Mangrove park or Arcadins Coast and Islands	Lucienna Exil Responsible of Coastal and Water Ecosystems Ministry of Environment 181 Haut-Turgeau Port-au-Prince, Haiti Tel: (509) 37 17 05 07 (509) 34 61 48 80 Email: exillucienna@yahoo.fr	Redesigned program to complete action plan to establish Carocol Mangrove park as Haiti's first marine park.	Dimitri Norris dimitrinorris@hotmail.com	Jean W. Wiener [jeanw@foprobim.org]
Grenada	South Coast of Grenada encompassing several marine parks.	Roland A. Baldeo Fisheries Dept. Roland Baldeo [rolandbaldeo@hotmail.com]	Workshop dates TBD	Jocelyn Paul, Planning Office, Planning Division, Ministry of Finance jpcop4@hotmail.com	Jerry Mitchell mitchell.jerry@gmail.com

For this exercise, Dionne Newell, IABIN Focal Point for Jamaica and member of the IABIN Executive Committee is keeping the Caribbean Focal Points in the IABIN Council informed.

A Marine Database Specialist consultant will be hired in each country based on a short list as indicated by the IABIN Focal Point and is expected to work with the other IABIN Partners to make technically operational and sustainable the network working with the different Thematic Networks (TNs) and their Coordinating Institutions (CIs), Focal Points, and local, regional and global partners.

The consultant will:

1. Check in with appropriate Ministry and the IABIN Focal Point and brief them on this IABIN activity
2. Work with the appropriate Ministry and IABIN Focal Point to gather tourism, fisheries, and bio-physical and socio-economic data decide on the marine park that already has a (i) management plan with significant data and maps on visitation, (ii) an entry fee, and (iii) lots of different kinds of tourism that visit the park (e.g. dive tourism, day boating, etc)
3. Compile necessary data on GIS, maps, ecosystems in and around the marine park, tourism, and fisheries data. Complete the 2 methodologies developed by the World Resources Institute
4. (see http://www.wri.org/map/marine-protected-areas-world, http://www.wri.org/project/reefs-caribbean, http://www.wri.org/project/valuation-caribbean-reefs, (download tourism and fisheries here) and http://www.buccooreef.org/economic.html e.g. "A tool to guide the economic valuation of goods and services from coral reefs") and other valuation data (see values attached). And the third methodology called ecosystem value transfer.

5. Once the data is filled out, support a 3 day workshop with in-country marine park managers and policynakers to analyze and confirm the data and field trip to the marine park.
6. The workshop will cover all expenses, and the in-kind resources that are indicated in the budget are for the time of the ministry and any NGO that might be helping out in this valuation exercise.
7. Work in a team to specify/highlight predictability and develop standard and protocol for the tool to be interactive with other value added tools developed by IABIN where possible and effective,
8. Executive summary (3 pages) in French and SpanishSpanish.

2. OBJECTIVE

GOAL The ICZM (Integrated Coastal Zone Management) Capacity Building Program component will assist the IABIN Caribbean Protected Areas Database Initiative – CPADI through a REEFIX activity in 4 case study sites that transfers information between OAS CARICOM Member States specific to ICZM and marine parks.
PURPOSE ReefFix is an ICZM tool that has multi-level linkages that trains participating countries in valuation ecosystem valuation methodologies and management techniques to restore a coral reef, mangrove ecosystems, watersheds, through integrated marine park management.
OUTPUTS Strengthen management frameworks that regulate coastal activities and develop a plan for adaptation to coral reef and mangrove responses to climate change effects. Outputs will be: 1) improved ecosystem valuation technical capacity of individual Caribbean countries to collect and manage their protected areas data in a way that meets their specific needs and context; 2) improved individual country's protected areas data management systems based on output from 4 case study sites; 3) Centralized data management system for the Caribbean region (drawing from protected areas databases where they exist or from other sources of protected areas information) which serves as a regional node for input to the Americas Database on Protected Areas and the World Database on Protected Areas (WDPA). 4) Capacity building activities in ICZM

3. JUSTIFICATION

Compared to just a few decades ago, the ever-increasing number and strength of forces affecting coastal ecosystems, including mangroves, require coastal managers to respond and adapt to ensure the sustainability of valued ecosystem services and products. One of the major challenges in the Caribbean region is strengthening the resilience of coastal ecosystems to the climate change-induced sea level rise and temperature increases (See Box 2.).

Box 2. Key findings from Reefs at Risk in the Caribbean Authors: Lauretta Burke, Jon Maidens and contributing authors: Mark Spalding, Philip Kramer, Edmund Green, Suzie Greenhalgh, Hillary Nobles, Jonathan Kool. 2004
• **Nearly two-thirds of coral reefs in the Caribbean are threatened by human activities.** Integrating threat levels from all sources considered in this analysis (coastal development, watershed-based sediment and pollution, marine based threats, and overfishing), the Reefs at Risk Threat Index identified about one-tenth of Caribbean coral reefs at very high levels of threat, one-third at high threat, one fifth at medium threat, and one-third at low threat. • **An estimated one-third of Caribbean coral reefs are threatened by coastal development.** This includes sewage discharge, urban runoff, construction, and tourist

development.

- **Sediment and pollution from inland sources threaten about one-third of Caribbean coral reefs.** Analysis of more than 3,000 watersheds across the region identified 20 percent of coral reefs at high threat and about 15 percent at medium threat from damage caused by increased sediment and pollution from agricultural lands and other land modification.
- **Marine-based threats to coral reefs are widespread across the Caribbean.** Our indicator of marine-based damage and pollution identified about 15 percent of Caribbean reefs as threatened by discharge of wastewater from cruise ships, tankers and yachts, leaks or spills from oil infrastructure, and damage from ship groundings and anchors.
- **Overfishing threatens over 60 percent of Caribbean coral reefs.** Fishing above sustainable levels affects coral reefs by altering the ecological balance of the reef. The removal of herbivorous fish, which consume algae, facilitates algal overgrowth of corals. Declines in coral cover and increases in algal cover have been observed across the region. This analysis identified about one-third of Caribbean reefs at high threat from overfishing pressure and about 30 percent at medium threat.
- **Diseases and rising sea temperatures threaten to damage coral reefs across the Caribbean region.** Diseases have caused profound changes in Caribbean coral reefs in the past 30 years, with very few areas unscathed by disease, even reefs far removed from human influence. In addition, coral bleaching episodes-the most direct evidence of stress from global climate change on Caribbean marine biodiversity-are on the rise.
- **Ineffective management of protected areas further threatens Caribbean coral reefs.** With the growth of tourism, fisheries, and other development in coral reef areas, marine protected areas (MPAs) are an important tool for safeguarding coral reefs. At present, over 285 MPAs have been declared across the Caribbean, but the level of protection afforded by MPAs varies considerably. The Reefs at Risk Project found only 6 percent of MPAs to be rated as effectively managed and 13 percent as having partially effective management.
- **The coastal communities and national economies of the Caribbean region are poised to sustain substantial economic losses if current trends in coral reef degradation continue.** Coral reefs provide valuable goods and services to support local and national economies, and degradation of coral reefs can lead to significant economic losses, particularly in the coastal areas of developing countries, through loss of fishing livelihoods, malnutrition due to lack of protein, loss of tourism revenues, and increased coastal erosion. Analyses carried out by the Reefs at Risk project indicate that Caribbean coral reefs provide goods and services with an annual net economic value in 2000 estimated at between US$3.1 billion and US$4.6 billion from fisheries, dive tourism, and shoreline protection services.

Caribbean Countries have requested technical assistance to achieve the commitments laid out in the WSSD Plan of Implementation and the CBD targets. A critical component of this technical assistance is the availability of appropriate and adequate data with which to establish robust baselines and monitor progress towards the goals.

Ecosystem services are the benefits people obtain either directly or indirectly from ecological systems (Millennium Ecosystem Assessment, 2003, page v.) The process of identifying and quantifying ecosystem services is increasingly recognized as a valuable tool for the efficient allocation of environmental resources (Heal et al., 2005; Millennium Ecosystem Assessment, 2003). By estimating and accounting for the economic value of ecosystem services, social costs or benefits that otherwise would remain hidden can potentially be revealed and vital information that might otherwise remain outside of the economic decision making calculus at local, national, and international scales can be internalized (Millennium Ecosystem Assessment, 2005).

However, achieving such an objective requires considerably better understanding of ecosystem services and the landscapes that provide them. Through four case studies, a framework for the spatial analysis of ecosystem service values (ESVs) will be illustrated. Thanks to the increased ease of using Geographic Information Systems (GIS) and the public availability of high quality

land cover data sets (in this case through Google Maps), bio-geographic entities such as forests, wetlands and beaches can now more easily be attributed with the ecosystem services they deliver on the ground.

3. TASKS

The IABIN Marine Database Specialist will compile data and fill out 3 databases, one developed as part of this study that will formulate a decision framework designed for spatially explicit value transfer that will be used to estimate ecosystem service flow values and to map results for one of 4 case studies to be completed representing a diversity of spatial scales and locations.

Three separate methodologies will be utilized:
1.) Two methodologies developed by the World Resources Institute (see http://www.wri.org/project/valuation-caribbean-reefs e.g. "A tool to guide the economic valuation of goods and services from coral reefs") and other valuation data (see values attached as annex 2.) and,
2.) a third methodology developed by Troy, Austin and Matthew A. Wilson, Mapping ecosystem services: Practical challenges and opportunities in linking GIS and value transfer Ecological Economics 60 (2006)435-449. For this valuation method, a unique typology of land cover and aquatic resources will be developed and relevant economic valuation studies will be queried in order to assign estimates of ecosystem service values to each category in the typology (See Annex 2.) The result will be a set of unique standardized ecosystem service value coefficients broken down by land cover class and service type for each case study. GIS analysis (Google maps) will be used to map the spatial distribution of each cover class at each study site. Economic values will be summarized and mapped for each marine park drawing on lessons learned during the implementation of the case studies; the Countries will then present some of the practical challenges that accompany spatially explicit ecosystem service value transfer. They will also explore how variability in the site characteristics and data availability for each project limits the ability to generalize a single comprehensive methodology.

Finally, as work from the 4 case study sites develops, observations on current trends and expected future directions in spatially explicit ecosystem value transfer will be explored, and the relevance of this data for value added products, decision tools, and socio-economic and biophysical policymaking.

Annex 1. Concept Note and Terms of Reference
For the development of the Caribbean Protected Areas Database Initiative - CPADI

I. INTRODUCTION AND RATIONALE

Vast volumes of data on protected areas (PAs) have been collected in the past and are stored in different formats and often using incompatible standards. In addition, although the knowledge and technology for managing PA data are well developed, many countries still lack the capacity and funding to collect and manage their own data and databases. In the context of the Caribbean region, a recent study undertaken by UNEP-WCMC for the InterAmerican Biodiversity Information Network has identified a wide range of scenarios of data standards and management, ranging from countries with no data collection or management systems to others with well-developed and functional PAs databases.

Building and improving the technical capacity of these countries to collect, gather and manage their information on protected areas would enable them to get a better picture of their protected areas sites and system and to track progress on the improvement of conservation *in situ.*

In order to address this need, the concept of the Caribbean Protected Areas Database Initiative – CPADI – was developed during a meeting with IABIN protected areas representatives of the Caribbean countries, promoted by the IABIN and the GEF CAM in April 2008 in Ocho Rios, Jamaica. This meeting (http://www.oas.org/dsd/Events/english/08.03.10.htm) included participation of representatives from the Bahamas, Barbados, Dominican Republic, Jamaica, St Kitts and Nevis, Saint Lucia and Trinidad and Tobago. With support from the UNEP-WCMC, the countries' representatives have elaborated this Terms of Reference which aims to seek financial and technical support for the development and implementation of the following objectives:

II. OBJECTIVES

The three stated objectives of the Caribbean Protected Areas Database Initiative – CPADI are:

1) To improve and develop technical capacity of individual Caribbean countries to collect and manage their protected areas data in a way that meets their specific needs and context;
2) To help develop or improve, when appropriate, individual country's protected areas data management systems;
3) To develop a centralized data management system for the Caribbean region (drawing from protected areas databases where they exist or from other sources of protected areas information) which serves as a regional node for input to the Americas Database on Protected Areas and the World Database on Protected Areas (WDPA).

Annex 2.

Ecosystem Service Values by Cover Type for marine Parks and Environs in the Caribbean

Land Cover	Ave.$/ha/yr	Lower Bound	Upper Bound	Area (ha)	Total ESV Flow
Disturbed and Urban Beach					
Beach	88,000	77,000	99,000		
Beach near dwelling	117000	140,000	94000		
Coastal & Riperian Forest	1826	5542	13,000		
Freshwater Stream	1595	1231	939		
Freshwater Herbaceous Swamp	72,787	32000	96000		
Grassland/pasture	118	118	118		
Near shore aquatic habitat	16, 283	4630	27935		
Coral Reef environ	100,000				
Mangrove	37,500				
Mangrove	500,000	200,000	900,000		
Mangrove restoration		225	216,000		

Caribbean tourism reefs are estimated to be worth US$1 million per square kilometer, based on the cost of maintaining sandy beaches and the value of attracting snorkelers and scuba divers.

The annual economic values of mangroves, estimated by the cost of the products and services they provide, have been estimated to be between USD 200,000 -- 900,000 per ha. The range of reported costs for mangrove restoration is USD 225 -- 216,000 per ha.