



Fondation pour la Protection de la Biodiversité Marine

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ReefFix

**Rapid Assessment of the Economic Value
of Ecosystem Services Provided
by Mangroves and Coral Reefs
and Steps Recommended for the
Creation of a Marine Protected Area
Caracol Bay, Haïti**

May, 2009

For the
Organization of American States (OAS)
and the
Inter-American Biodiversity Information Network (IABIN)

Funded by the
Government of Chile

Summary

The area of Caracol Bay in northeastern Haiti (19°43'51"N, 72°02'44"W) is the target site for this report.

In an attempt to estimate the monetary value of the services that ecosystems provide various methods of ecosystem valuation have been designed. Dollar-based valuation systems can include : travel cost, productivity, benefit transfer, and others. The Ecosystem Value Transfer (EVT)/Benefit Transfer Method (BTM) was used for this activity in which values which have already been estimated for similar ecosystems are extrapolated to the study site.

The total estimates for ecosystem services for Caracol Bay are US\$ 105,228,000 for mangroves and US\$ 4,505,000 for coral reefs for a total estimated value for ecosystem services of US\$ 109,733,000 (this total does not include ecosystem services provided by sea grass beds).

In 2004 an assessment by the World Resources Institute arrived at certain key findings concerning Caribbean reefs. They include:

- Nearly two-thirds of coral reefs in the Caribbean are threatened by human activities
- An estimated one-third of Caribbean coral reefs are threatened by coastal development
- Sediment and pollution from inland sources threaten about one-third of Caribbean coral reefs
- Marine-based threats to coral reefs are widespread across the Caribbean
- Overfishing threatens over 60 percent of Caribbean coral reefs
- Diseases and rising sea temperatures threaten to damage coral reefs across the Caribbean region
- Ineffective management of protected areas further threatens Caribbean coral reefs
- 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

With over 1,771km of coastline Haiti remains the only Caribbean nation without any type of coastal and marine managed area. Several areas of Haiti have been identified as areas of interest for the development of Coastal and Marine Protected Areas.

The Caracol Bay of northeastern Haiti, as well as several other locations, contains very good potential for the development of coastal and marine protected areas. Caracol Bay contains a large expanse of mangroves as well as a fringing coral reef. There are several fishing communities harvesting marine resources in the bay, and the exploitation of mangroves occurs not only by these fishing communities but also by other communities located further inland.

The methodology for the development of these areas as reserves/preserves should certainly include periods for public comment from concerned stakeholders and may end in, in the quickest of circumstances, a presidential decree (Arrêté), and otherwise a significantly longer process ending in parliamentary approval.

Statement of Work

Original:

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:

<http://www.wri.org/map/marine-protected-areas-world>,

<http://www.wri.org/project/reefscaribbean>, <http://www.wri.org/project/valuation-caribbean-reefs>,

and <http://www.buccooreef.org/economic.html>, and a third methodology called Ecosystem Value Transfer (EVT)/Benefit Transfer Method (BMT).

Revised:

Due to the lack of available information relating to socio-economic conditions, any type of tourism activities or revenue as well as a total lack of reliable information in regard to fisheries activities which would be required to accomplish the socio-economic portion of the original statement of work for Caracol Bay, it was revised to the following:

1. Provide the economic value analysis of coral reefs and mangroves using the values/ha/yr methodology for the proposed Caracol Marine park (EVT/BMT);
2. Design an action plan with the steps necessary to establish the area as a marine park.

Introduction/Background

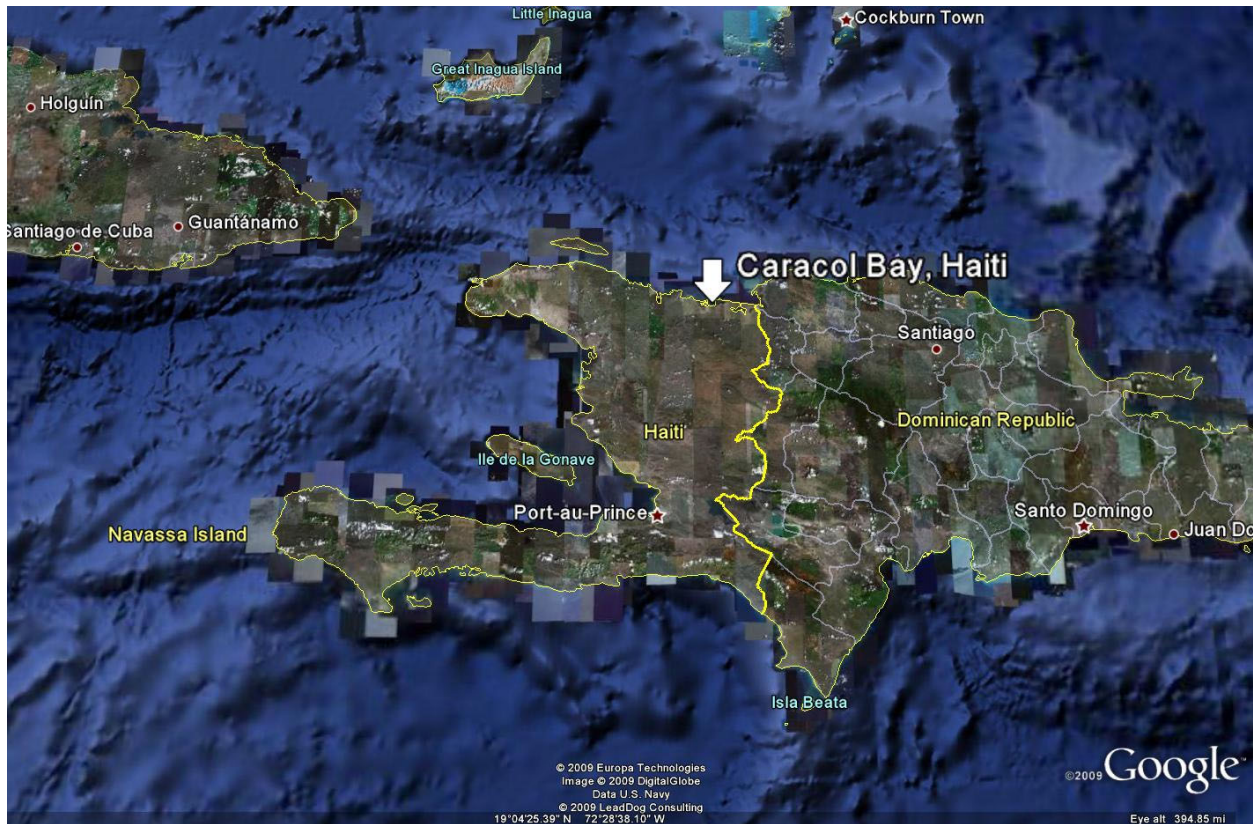
ReefFix, supported by the government of Chile, is an Integrated Coastal Zone Management (ICZM) Coral Reef and Mangrove Restoration and Watershed Management Demonstration program that works with Small Island Developing States (SIDS) to restore and effectively manage coastal resources through the use and development of cost-effective techniques and economic validation of ecosystems (OAS/DSD).

The World Resource Institute's (WRI) economic valuation methodology provides a simple and replicable method for estimating the value of coral reefs and mangroves in the Caribbean. The methodology uses the concept of "ecosystem services" – the tangible benefits ecosystems provide which sustain and fulfill human life – as the basis for measurement. The approach looks primarily at the direct economic benefits provided by these resources; it does not attempt to calculate the Total Economic Value (TEV) of coral reefs and mangroves, which would include non-use values (for instance, the 'existence value' non-users place on the presence of the reef). The methodology focuses instead on three important ecosystem goods and services associated with coral reefs: fisheries, tourism, and shoreline protection services. These services comprise an integral part of many Caribbean economies. The methodology also offers guidance on estimating the wider (indirect) impact on the economy of these resources, the consumer surplus associated with their use, and the potential losses or gains in value associated with changes in ecosystem condition. (WRI, Economic Valuation of Coral Reefs, Methodology v2.1, October, 2007)

Key findings from the Reefs at Risk in the Caribbean Report (Lauretta Burke, Jon Maidens and contributing authors: Mark Spalding, Philip Kramer, Edmund Green, Suzie Greenhalgh, Hillary Nobles, Jonathan Kool, September, 2004) include:

- **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

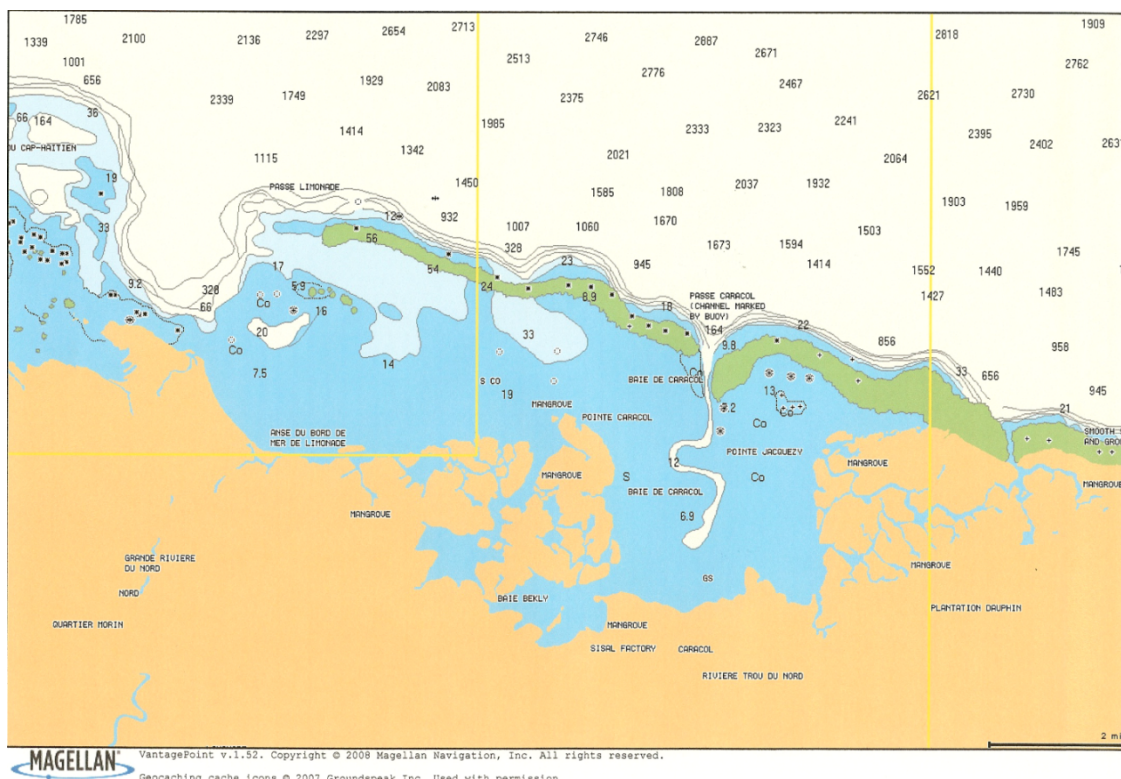
coastal erosion. Analyses carried out by the Reefs at Risk project indicate that Caribbean coral reefs provide goods and services with an annual net economic value in 2000 estimated at between US\$3.1 billion and US\$4.6 billion from fisheries, dive tourism, and shoreline protection services.



Location of Caracol Bay, Haiti



Satellite image of Caracol Bay, Haiti 2007



Bathymetry of Caracol Bay area, Haiti

Methodology

The Ecosystem Value Transfer (EVT)/Benefit Transfer Method (BTM) was used for this activity in which values which have already been estimated for similar ecosystems are extrapolated to the study site.

Maps and tools from Google Earth Pro were used to estimate ecosystem areas. The latest maps from GE-Pro for the Caracol Bay area are dated 2007.

Economic Valuation of Ecosystem Services Results

The Ecosystem Value Transfer (EVT)/Benefit Transfer Method (BTM) was used to calculate the estimated value for ecosystem services. In this methodology values which have already been estimated for similar ecosystems are extrapolated to the study site. For this activity, a value of US\$ 20,000 (\$/Ha/yr) rate for mangroves, and US\$ 5,000 (\$/Ha/yr) rate for coral reefs is used based on a conservative low end average from a high of US\$ 35,000 (\$/Ha/yr) for mangroves and US\$ 10,000 (\$/Ha/yr) estimated by UNEP.

ReefFix Caracol, Haiti
Perimeter, Area, and Value of Resources

	Perimeter	Area	\$/ha/yr rate	Total
Mangrove 1	58,163 m 63,607 yd	52,094,952 m ² 62,305,015 yd ² 5,209 Ha	\$20,000	\$ 104,180,000
Mangrove 2	905 m 990 yd	13,518 m ² 16,167 yd ² 1.4 Ha	\$20,000	\$28,000
Mangrove 3	2,150 m 2,352 yd	194,574 m ² 232,708 yd ² 19 Ha	\$20,000	\$ 380,000
Mangrove 4	3,635 m 3,975 yd	321,536 m ² 384,554 yd ² 32 Ha	\$20,000	\$ 640,000
Total Mangrove	64,853 m 79,924 yd	52,624,580 m² 62,938,444 yd² 5,261.4 Ha	\$20,000	\$ 105,228,000
Coral 1	24,942 m 27,277 yd	4,042,788 m ² 4,835,134 yd ² 404 Ha	\$5,000	\$ 2,020,000
Coral 2	21,358 m 23,357 yd	3,451,957 m ² 4,128,507 yd ² 345Ha	\$5,000	\$ 1,725,000
Coral 3	7,404 m 8,097 yd	1,520,220 m ² 1,818,168 yd ² 152 Ha	\$5,000	\$ 760,000
Total Coral	53,704 m 58,731 yd	9,014,965 m² 19,781,809 yd² 901 Ha	\$5,000	\$ 4,505,000
Total value for mangrove and coral reefs				US\$ 109,733,000 (does not include seagrass beds)
Total Caracol Coastal and Marine Area (mangroves/coral reefs/seagrass beds)	71,820 m 78,543 yd	132,243,863 m² 158,162,353 yd² 13,224 Ha		



Outline of Mangrove and Coral Reef resources, Caracol, Haiti

	Study site outline
	Mangroves
	Coral Reefs

Considerations for the Creation of a Marine Protected area at Caracol Bay, Haiti

Many considerations must be addressed when deciding on the designation of a site or sites as Coastal and Marine Protected Areas (marine preserves/reserves or marine protected areas). Among these are:

- Where it should be located and why (e.g. beaches, biodiversity, tourism corals, or any combination of factors)
- Its size
- Its possible interlinking with other reserves (both terrestrial or marine)

Other aspects which must be taken into consideration include:

- Public sector support
- Private sector support
- What type of enforcement regime will be implemented
- What type of zoning will be implemented
- Who will benefit
- Who may lose
- Sustainability (financial)
- Stakeholder involvement
- Mechanisms for mediating potential conflicts
- Scientific

For the Caracol Bay area the most directly concerned fishing communities are :

- Bord de Mer de Limonade
- Montolon
- Caracol
- Jacquezy
- Boue
- Defraille
- Cap Haitien
- Phaëton
- Ft. Liberté

The most directly implicated Government entities are:

- Ministry of Environment
- Ministry of Agriculture – Fisheries and Forest Services
- Ministry of Planification and External Cooperation
- Ministry of Justice – (regular police and coast guard)
- Office of the Prime Minister
- Government offices of the Department of the Northeast

The most directly concerned private sector entities are:

- Association Hôtelier et Touristique d'Haïti
- Association Hôtelier et Touristique d'Haïti – Nord
- Individual hotels
- Chambre de commerce – Nord
- Concerned fisher's associations
- Environmental/Developmental NGOs working in the area

Recommended steps towards the creation of MPAs in Haiti:

- 1) Determination of need (why)
- 2) Consultations with public and private sector to determine the support level for the creation of a marine reserve
- 3) Initial survey for the preliminary outline of the reserve
- 4) Consultations with public and private sector to determine approval for outline
- 5) Designation of site either through:
 - Presidential Decree (Arrêté), or
 - Parliamentary approved law (much more difficult and a much longer process)
- 6) Establish internal zoning as needed according to a classification system (e.g. IUCN)
- 7) Establish management regime and responsibilities

Proposed Presidential Decree (Arrêté) for the creation of the
« Parc de Caracol »

Vu les Articles 36, 36-1, 36-5, 52-1.h, 136, 138, 215, 253, 254, et 256 de la Constitution ;

Vu la Loi du 6 juin 1963 établissant les règles spéciales relatives à l'habitation et à l'aménagement des villes et des campagnes en vue de développer l'urbanisme ;

Vu le décret du 18 mars 1968 dénommant "Parcs Nationaux ou Sites Naturels " toutes étendues de terres boisées ou pas sur lesquelles sont établis des monuments historiques ou sites naturels" ;

Vu le décret du 27 Octobre 1978 sur la pêche ;

et toute autre loi, arrêté, ou décret qui pourrait être applicable ;

Considérant que l'Etat Haïtien exerce sa souveraineté sur les eaux nationales, sur le plateau continental, la zone contigüe, la zone économique exclusive, sur les sous-sols marins et fluviaux.

Considérant qu'il lui échoit l'obligation d'organiser et de réglementer la protection et l'exploitation de la faune et de la flore qui y croissent;

Considérant que la rationalisation de l'exploitation des ressources biologiques aquatiques exige la protection de la faune et de la flore maritimes et fluviales, le contrôle des méthodes de capture et des engins utilisés, ainsi que celui de la pression de pêche face au stock disponible.

Considérant que l'érosion de plus en plus accentuée du sol des régions montagneuses constitue un très grave danger pour l'avenir du pays;

Considérant que le site désormais dénommé Parc de Caracol est d'une importance majeure pour l'environnement naturel d'Haïti par ses richesses biologiques, historiques, culturelles, et scientifiques et qu'il incombe à l'Etat d'en assurer la protection et la préservation;

Considérant qu'il convient de déclarer le site désormais dénommé Parc de Caracol Zone Réservée;

Sur le rapport des Ministres de l'Environnement, du Tourisme, de l'Agriculture des Ressources Naturelles et le Développement Rural, et de la Planification et après délibération en Conseil des Ministres.

Arrêté

Article 1.-

Est déclarée Zone Réservée la zone désormais dénommée Parc de Caracol délimitée par le littoral et haute mer suivant les coordonnées GPS : Pin (1) 19°45'30.73"N, 72° 9'26.53"W; Pin (2) 19°46'51.60"N, 72° 5'44.93"W; Pin (3) 19°43'57.70"N, 71°54'18.88"W; Pin (4) 19°43'33.89"N, 71°54'23.96"W.

Cette zone comprend :

tous les mangliers situés à l'intérieur ou adjacents à cette zone y compris une zone de tampon de 25 mètres autour des mangliers ;

tous les récifs ;

toutes les îles ou îlots ;

tous les herbiers ;

tous les étangs séparés de la mer par moins de 100 mètres de terre ;

toutes les épaves ;

toute forme biologique ;

le fonds marin ;

et toutes les formes et structures naturelles ou créées par l'homme.

Cette zone comprend toute zone décrite comme plage ou littoral et, le cas échéant, s'étant jusqu'au niveau de la marée haute de la mer.

Le Parc de Caracol est déclaré Zone Réservée en vue de la mise en place de différentes zones de gestion visant 1) la protection de l'environnement 2) la protection de la biodiversité 3) le développement durable du tourisme 4) l'exploitation durable des ressources côtières, marines, et autres, spécifiquement les ressources de pêche 5) l'aménagement durable des villes et des campagnes.

Article 2.-

Tous les droits de propriété dans cette zone seront respectés. Toute activité et tout développement dans cette zone ou dans les zones adjacentes ne devront en aucun cas aller à l'encontre des stipulations de l'Article 1 susmentionné.

Article 3.-

Un comité composé de membres du secteur publique et privé sera mis en place et sera chargé de la surveillance et de la gestion durable de cette zone.

Article 4.-

Le présent Arrêté sera publié et exécuté à la diligence des Ministres de l'Environnement, du Tourisme, de l'Agriculture des Ressources Naturelles et du Développement Rural, et de la Planification, chacun en ce qui le concerne.

Donné au Palais National, à Port-au-Prince, le _____ 2009, An 206 de l'Indépendance.

Par le Président

Le Premier Ministre

Le Ministre de l'Environnement

Le Ministre du Tourisme

Le Ministre de l'Agriculture, des Ressources Naturelles et du Développement Rural

Le Ministre de la Planification

Map of Proposed MPA at Caracol Bay, Haiti

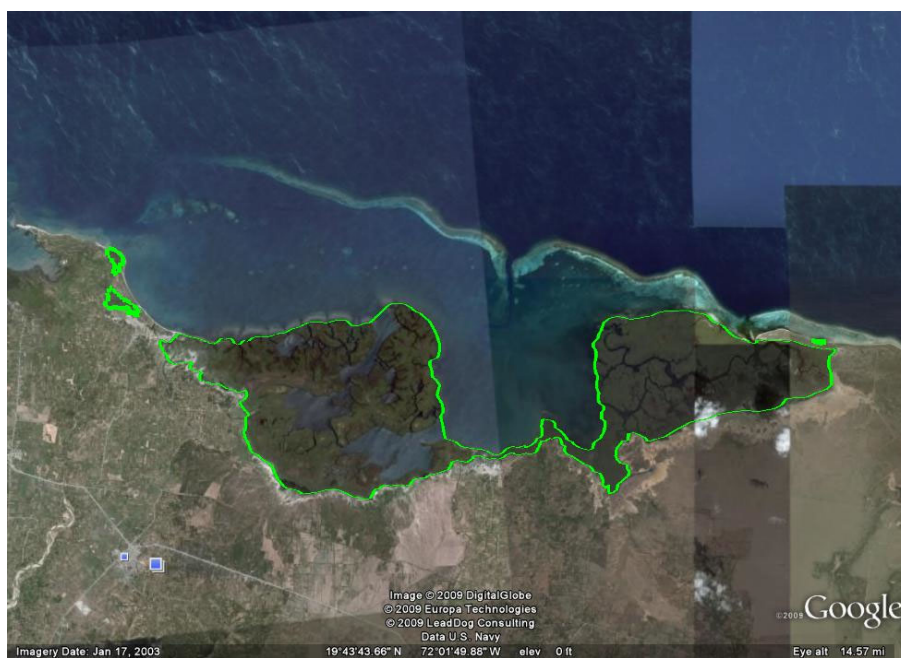


ANNEX

Satellite imagery of different study sites



Study site outline



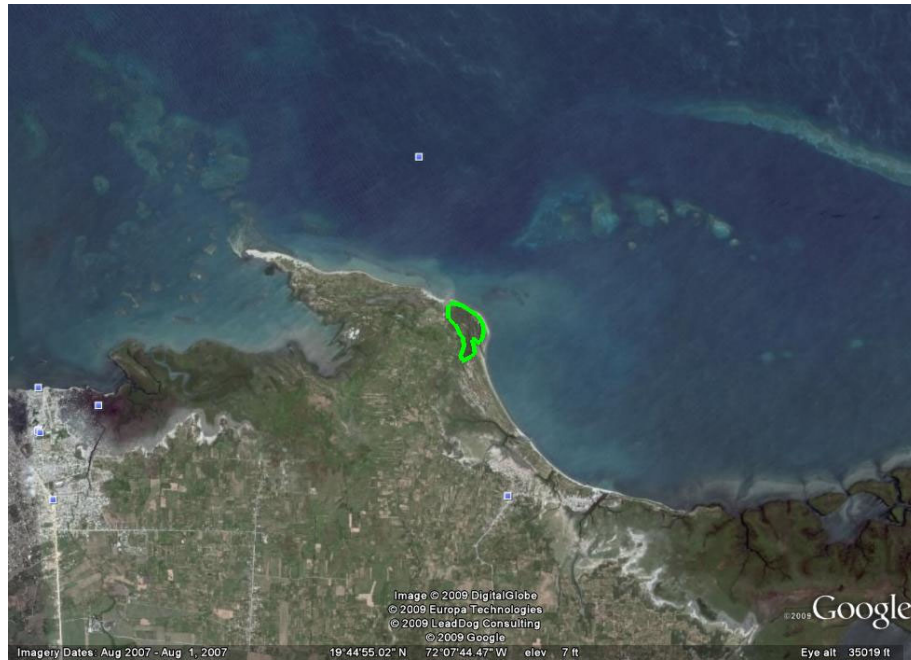
Mangroves 1, 2, 3, and 4



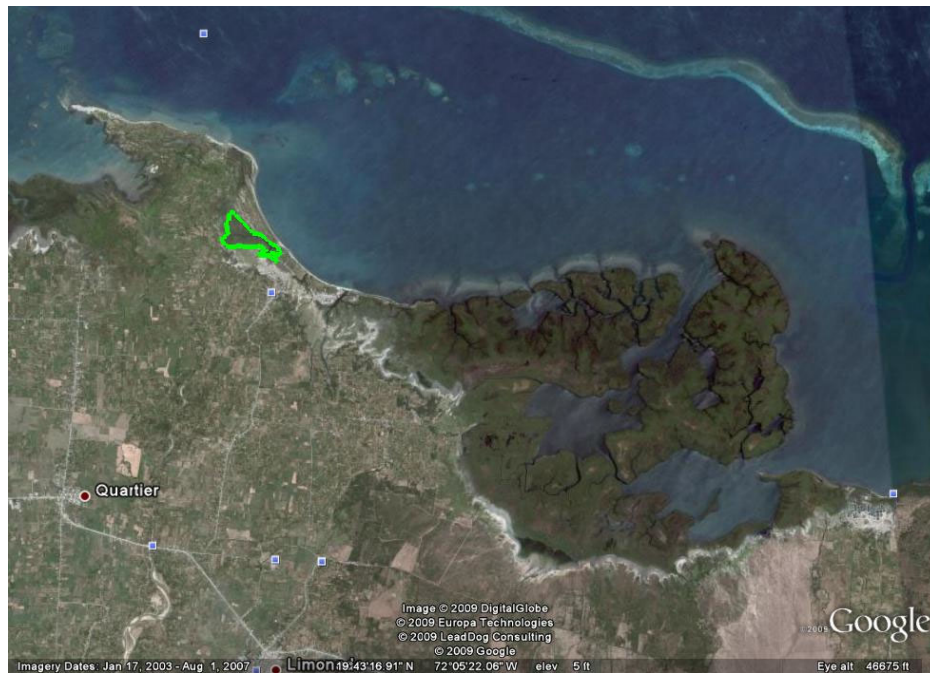
Mangrove 1



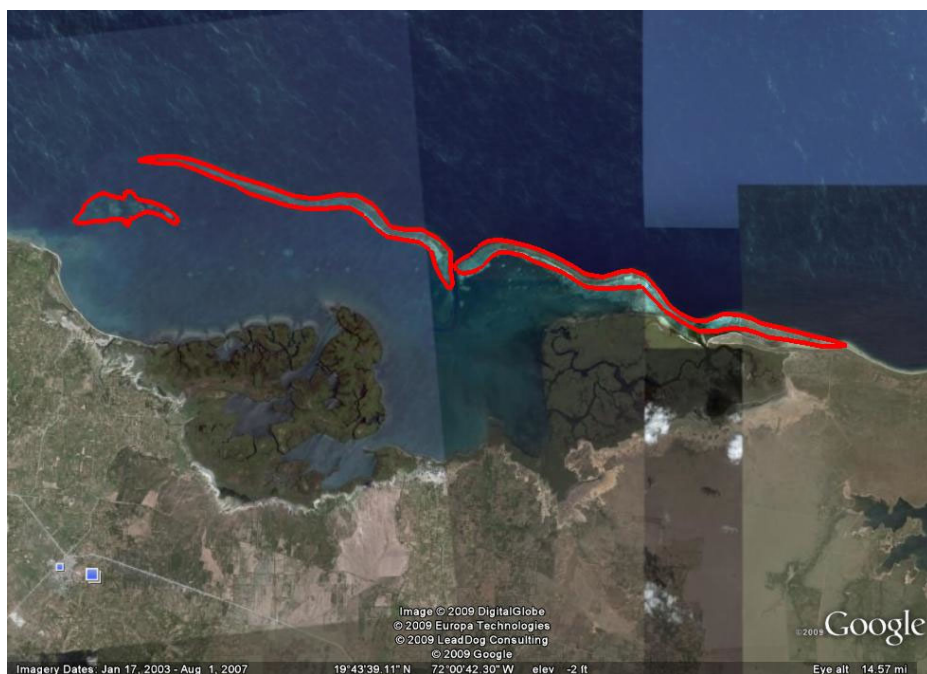
Mangrove 2



Mangrove 3



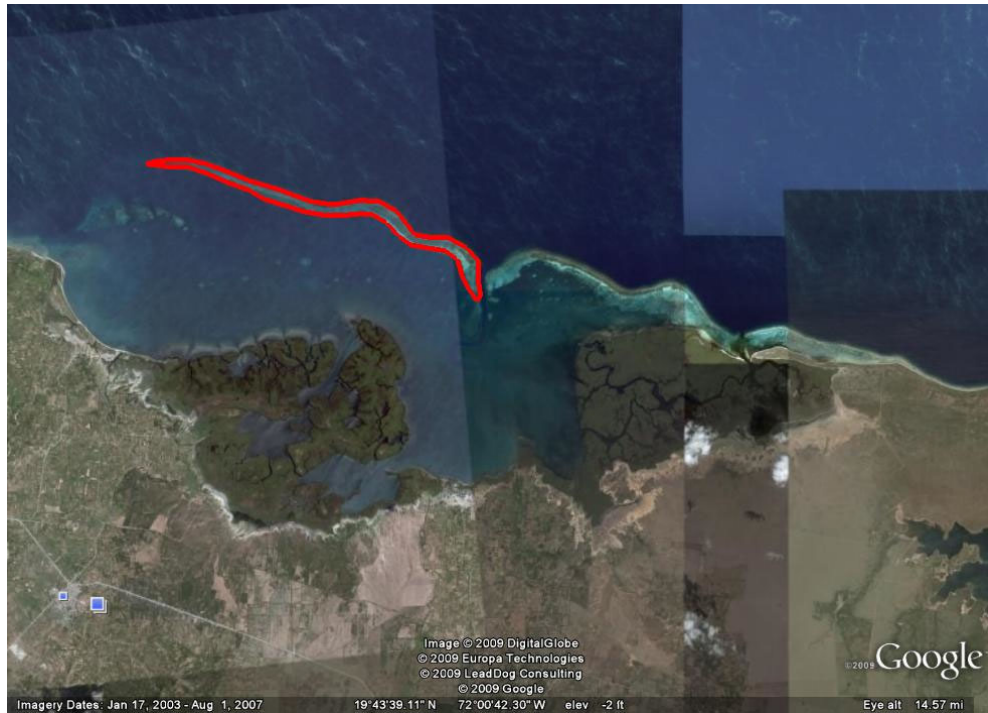
Mangrove 4



Coral reefs 1, 2, and 3



Coral reef 1



Coral reef 2



Coral reef 3