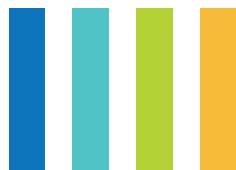




# Local Action Strategies (LAS) for Coral Reef Conservation 2011-2015



PUERTO RICO



# LIST OF ACRONYMS

**AAA:** Autoridad de Acueductos y Alantarillados

**ACDEC:** Autoridad de Desarrollo y Conservación de Culebra

**ARPE:** Administración de Reglamentos y Permisos

**BMPs:** Best Management Practices

**CAFO:** Confined Animal Feeding Operation

**CaRa:** Caribbean Regional Association

**CCPS:** Comité Caborrojeños Pro Salud y Ambiente

**CCRI:** Caribbean Coral Reef Institute

**CES:** Control Erosion and Sedimentation

**CFMC:** Caribbean Fishery Management Council

**CIEL:** Centro Interdisciplinario de Estudios del Litoral

**COE/USACOE:** United States Army Corps of Engineers

**CRCP:** Coral Reef Conservation Program

**CTPR:** Compañía de Turismo de Puerto Rico

**USDA:** United States Department of Agriculture

**DA:** Departamento de Agricultura (Puerto Rico)

**DNER/DRNA:** Department of Natural and Environmental Resources

**DTOP:** Departamento de Transportación y Obras Públicas

**EPA:** Environmental Protection Agency

**EQB:** Environmental Quality Board (Puerto Rico)

**FCPR:** Fideicomiso de Conservación de Puerto Rico

**FEMA:** Federal Emergency Management Administration

**FURA:** Fuerzas Unidas de Rápida Acción (Puerto Rico Police)

**FHWA:** Federal Highway Administration

**FWS:** Fish and Wildlife Service

**IRF:** Island Resource Foundation

**JP:** Junta de Planificación

**LAS:** Local Action Strategies

**MPA:** Marine Protected Area

**NER:** North East Reserves

**NGO:** Non-governmental Organization

**NOAA:** National Oceanic and Atmospheric Administration

**NCCOS:** National Centers for Coastal and Ocean Science

**NMFS:** National Marine Fisheries Services

**NRCS:** Natural Resources Conservation Service

**OAR-AOML:** Oceanic and Atmospheric Research–Atlantic Oceanographic and Meteorological Lab

**OCAM:** Oficina del Comisionado de Asuntos Municipales

**OGPE:** Oficina de Gerencia de Permisos

**OSDS:** On Site Sewage Disposal

**POC:** Point of Contact

**PRCZMP:** Puerto Rico Coastal Zone Management Program

**PRPB:** Puerto Rico Planning Board

**SEFCS:** Southeast Fisheries Science Center

**TNC:** The Nature Conservancy

**UMET:** Metropolitan University

**UPR:** University of Puerto Rico

**UPR-M:** University of Puerto Rico Mayagüez

**USDA:** United States Department of Agriculture

**USEPA:** United States Environmental Protection Agency

**USFWS:** United States Fish and Wildlife Service

**USVI:** United States Virgin Islands

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Thanks to the School of Environmental Affairs/Metropolitan University personnel, specially Ms. Sharon Torres, Administrative Assistant, Ivonne Archilla and Marisol Quiñones who did, in a very short call, all the necessary procedures to convene the LAS workshops.

Thanks are given also to the graduate students: Pedro de León and Héctor Horta for their support with the fieldwork.



# EXECUTIVE SUMMARY

In 2010 a group of experts, convened by NOAA, identified four Issue Areas concerning Puerto Rico's Coral Reef Management Priorities that included water quality, protection of coral reef fisheries, reduction of human impacts and manage for climate change. Goals and objectives were proposed to address those issues in four selected priority areas: Culebra, the North East Reserves, Cabo Rojo and Guánica and Marine Extension. This document has served in 2011 as the baseline for the proposal of Local Action Strategies for 2011- 2015.

The Puerto Rico's LAS constitutes the guideline that will be followed to address key issues and facilitate solutions for the conservation and protection of the coral reefs. It targets important and solvable issues with specific projects that are feasible and measurable. Four-priority areas were selected in 2010 for LAS application: Culebra, the North East Reserves, Cabo Rojo and Guánica and its marine extensions.

The strategy selected to produce the 2011 LAS was to conduct a two-day LAS Workshop in each one of the priority areas. All workshops were well-attended, very productive in terms of projects, and in the final evaluations, participants expressed high level of satisfaction with the activity.

Some Goals and Objectives remained exactly as expressed in the 2010 document, while others were merged, rephrased or totally discarded if they were found not pertinent to the area. Issue Areas were kept as established in 2010.

Participants in the workshops identified four areas of concern for coral reef management, conservation and protection. In essence, they are related to the Issue Areas identified in 2010, but address more specific problems.

- Sediment load from inland reaching the coast.
- Impacts to water quality from a large diversity of sources.
- Outreach (as community participation) and education (formal, informal) for all citizens, not just coastal residents.
- How to maintain the coral reef integrity as a functioning ecosystem

The analysis of all the projects proposed in all the LAS workshops identify 17 projects applicable to all coral reefs areas in Puerto Rico to address the four areas of concern identified by the participants. Besides those, in each LAS Workshop, the participants identified specific issues related to the specific priority area.

Summary of LAS Workshops:

Location	Date	Attendance	Goals & Objectives	Number of projects
Culebra	Aug. 11-12	24	5 Goals 13 Objs.	33
NER	Aug.31- Sept. 1	31	6 Goals 25 Objs.	28
Cabo Rojo	Sept. 7-8	28	5 Goals 31 Objs.	26
Guánica	Aug 18-19	30	5 Goals 9 Objs.	21

In Culebra, the following specific issues for the conservation of the coral reefs were identified:

- Poor enforcement of land-use regulations resulting in negative impacts on the coral reef.
- Negative impacts of recreational boats and other recreation and tourism activities on coral reef areas.
- Absence of management and enforcement to control human activities around coral reefs.
- Consider, for LAS project application, the waters around Culebra, Culebrita and all the small cays within 9 nautical miles.

The North East Reserves priority area includes: the Cordillera Reef Marine Reserve, Las Cabezas de San Juan Reserve, Seven Seas National Park (a public bathing beach or balneario), the Seven Seas Natural Reserve and the newly designated North East Ecological Corridor. Specific issues for the conservation of the coral reefs in the NER priority area were identified:

- Impacts of recreational activities.
- Negative impacts of navigation of recreational boats and other recreation and tourism activities on coral reef areas.
- Need for community participation.
- The priority area should be extended South East to include the coral reefs present in Ceiba-Naguabo waters.
- Training and capacity building needs of recreational service providers
- Absence of management and enforcement to control human activities around coral reefs.

The fact that recreational use of the coral reefs in Culebra and the NER priority areas is one of the major activities was reflected in the common issues, goals & objectives and projects presented by participants in these workshops.

In the priority area of Cabo Rojo the following specific issues for the conservation of the coral reefs were discussed:

- Poor water quality due to human impacts.
- Zoning problems: lack of same and/or very poor.
- Need of field studies to determine no anchoring zones, based on density
- Lack of consistency in education and outreach programs.
- Need specific data on status of fisheries in the area.
- Adequate use of fishing gear.
- Invasive species.
- Extend the priority area to the North West to include the mouth of the Guanajibo River.

The group identified the following issues as areas of concern for the conservation of the coral reefs in the Guánica priority area:

- Presence of visitors beyond carrying capacity/limit of acceptable change in the area.
- Need of BMPs in agriculture activities to prevent runoff.
- Inefficient used water treatment systems.
- Training and education needs of enforcement personnel.
- Extension of the priority area to the East, to include Guayanilla Bay, and to the West to include the coral reefs in La Parguera, Lajas.

The issues of concern on the status of the coral reefs presented by the participants in the LAS workshops closely followed the technical reports on the status of the coral reef ecosystems presented by scientists and experts in the field, reflecting that there is an awareness of the coral reef conditions among the stakeholders.

The most prevalent issues are those stresses caused by human activities: such as increase in sedimentation and contaminants, loss of water quality due to inland activities along the watershed and removal of essential coral reef species due to over fishing. These are similar to conditions found elsewhere in the tropics (Wilkinson, Ed., 2008).

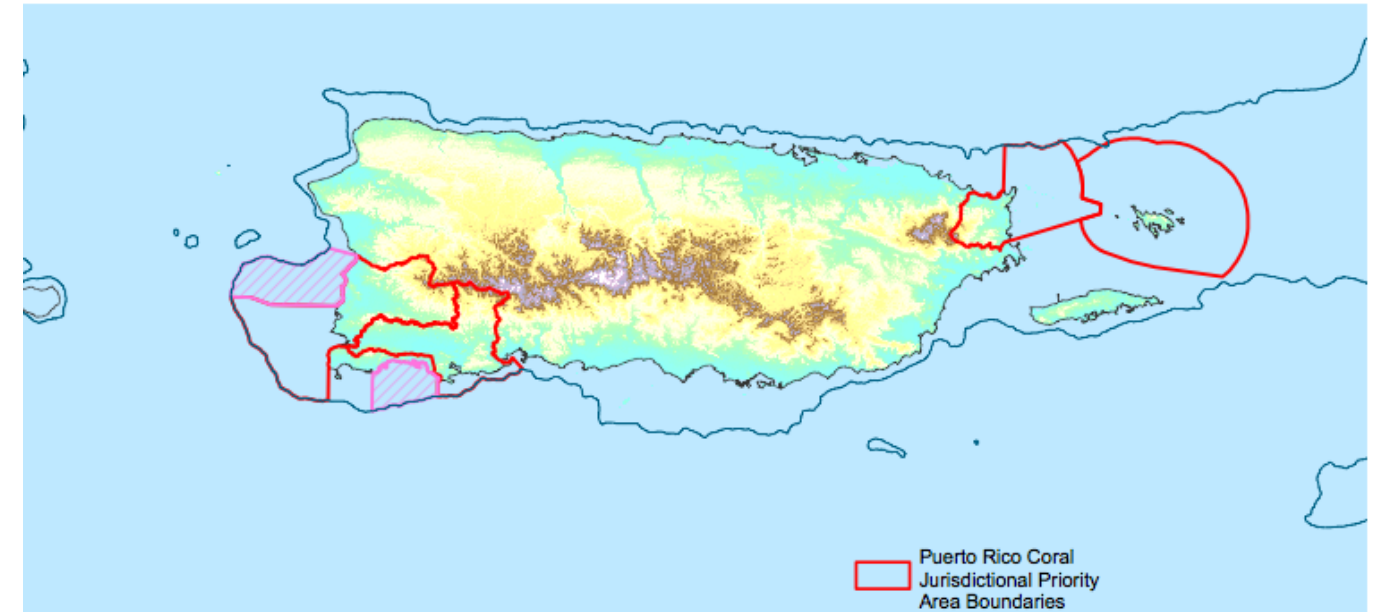
The alternatives presented by the stakeholders, as suggested projects, to address these issues, are also very similar to those recommended by the global coral reef conservation organizations. Alternatives such as: increase the size and number of marine protected areas; better enforcement of laws and regulations to reduce impacts from tourism, marine recreation and fishing activities; application of best practices in agriculture and used water treatments to reduce erosion and sediment transport to the coral reef; implementation of best management practices in the marine protected areas and more efficient outreach, education and environmental communication programs to all citizens are all present in the projects presented by the stakeholders in all four-priority areas LAS workshops.

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# INTRODUCTION

The Puerto Rico's local action strategy (LAS) constitutes the guideline that will be followed to address key issues and facilitate solutions for the conservation and protection of the coral reefs. It targets important and solvable issues with specific projects that are feasible and measurable. The Metropolitan University (UMET), was contracted by DNER to facilitate the process of developing the 2011 LAS for Puerto Rico. Dr. Alida Ortiz-Sotomayor, with extensive education and field experience in the conservation of marine resources, was assigned as Coordinator and responsible for the final document.



There are environmental conditions present throughout Puerto Rico that affect coral reefs. The results of recent and ongoing research and the monitoring activities on the coral reefs throughout the Island evidence notable deterioration of these ecosystems (García, et al 2010, Scharer, et al 2009). The causes for this decline in coral reef live cover and general ecosystem health originate from human impacts of different sources, diseases and other natural stresses (Wusinich-Mendez, et al 2007). Also, research shows a decrease in fishing activity in the Island (Valdez-Pizzini, 2011). However, the decline of fisheries activities on coral reefs, have not alleviated the impact, due to the fact that an increase in sediment load from inland activities have increased in the past ten years thus maintaining a constant stress environment on all coastal ecosystems, specially on coral reefs (Ramos Scharron 2009, Norat, Mattei & Hernández, 2010). All four-priority areas, selected in 2010 for LAS application: Culebra, the North East Reserves, Cabo Rojo and Guánica, present evidence of these research findings. This will be reflected in the projects that have been proposed to address these issues in each area.

Due to government restructure actions in the DNER, there are not enough personnel in the marine protected areas within the four-priority areas. This fact makes more urgent and imperative the recruitment of volunteers from communities and non-government organizations for the implementation of the LAS. This action will require effective communication, outreach and education programs to generate citizen's interest and compromise for monitoring activities and other conservation practices.

# THE PROCESS

A working team, composed by the Coordinator, Ms. Damaris Delgado, the DNER Point of Contact for the NOAA's Coral Reef Conservation Program (CRCP) and Ms. Antares Ramos, the NOAA Coral Management Liaison in Puerto Rico was formed to facilitate the process of developing the LAS for 2011. The working team conducted several meetings to select the best strategy to reach a group, as wide as possible, of stakeholders in each one of the priority areas. The strategy selected to produce the 2011 LAS was to conduct a two-day LAS Workshop in each of the priority areas: Culebra, the North East Reserves, Cabo Rojo and Guánica. All four areas were consulted. To these workshops a diverse group of stakeholders from different government agencies, scientists, teachers, community organizations, service providers, marine protected areas managers, fishermen, business representatives, students were invited to participate and contribute in the formulation of the LAS. All workshops were well-attended, very productive in terms of projects, and in the final evaluations, participants expressed high level of satisfaction with the activity.

The agenda for the workshops proceeded as follows. The first day, local areas of concern were identified and the Goals and Objectives identified in 2010 were examined. During the second day, in small groups, for each goal selected, participant proposed projects to achieve the objectives identified as pertinent.

The 2010 Puerto Rico's Coral Reef Management Priorities document served as the base for the selection of Goals and Objectives pertinent for each priority area: Culebra, the North East Reserves, Cabo Rojo and Guánica and Marine Extension. Some Goals and Objectives remained exactly as expressed in the 2010 document, while others were merged, rephrased or totally discarded if they were found not pertinent to the area. Issue Areas were kept as established in 2010. However, as result of the consultation with stakeholders, four areas of concern for coral reef management, conservation and protection were identified. In essence, they are related to the Issue Areas, but address more specific problems.

- Sediment load from inland reaching the coast.
- Impacts to water quality from a large diversity of sources.
- Outreach (as community participation) and education (formal, informal) for all citizens, not just coastal residents.
- How to maintain the coral reef integrity as a functioning ecosystem

The following represents the strategic coral reef management priorities for all four-priority areas. In the discussion of Projects for each area we will find the specifics goals and objectives selected with the corresponding proposed projects. Texts in red are the changes, if any, originated in the workshops. Highlighted goals are those that were discarded from the 2010 document. It is important to note, as product of the workshops, that their essence has been retained as well as with the objectives that were transformed into projects

## ISSUE AREA A.

IMPROVE WATER QUALITY AND RELATED REEF SYSTEMS BY REDUCING POLLUTANT INPUTS FROM TERRESTRIAL SOURCES.

**GOAL 1 (A1). Implement land-use planning at the watershed scale to minimize water quality impacts to the coral reef ecosystem.** *Guánica (Goal A1 + Goal A2): Implement land-use planning at the watershed scale to control and reduce pollutant transport to the marine environment, minimizing water quality impacts to the coral reef ecosystem/ Cabo Rojo (Goal A1 + Goal C2): Implement sustainable development practices through land-use planning at the watershed scale, including coastal zone and upland areas, to minimize water quality impacts to the coral reef ecosystem.*

**Objective 1 (A1.1).** Support the use of a watershed approach in the development and implementation of new and existing Municipal Ordinance Plans and Puerto Rico Land Use Plan. These plans will consider the cumulative impacts of existing and expected land use and require best management practices that avoid and minimize impacts to water quality be developed and applied (this could include restricting land clearing activities to the dry season). This applies to urban, residential, recreational (including off-road vehicles) and agricultural uses. (See Natural Resources Conservation Service, Department of Natural and Environmental Resources, Puerto Rico Planning Board, Environmental Quality Board, Federal Highway Administration, Agricultural Extension Service and other best management practices documents.) *Guánica: (Obj A1.1 + A1.4) : Support the use of a watershed approach in the development and implementation of new and existing Municipal Ordinance Plans and Puerto Rico Land use Plan to maintain water quality, consider cumulative impacts in order to avoid impacts and minimize loss of coastal habitats (wetlands, seagrass) that serve as filters to maintain sea water quality.*

**Objective 2 (A1.2):** Develop stricter regulations and enhance enforcement capabilities for agricultural and development activities to ensure that best management practices that reduce sediment, nutrient, fecal coliform and pesticide transport be implemented and erosion, including channel protection, be mitigated. *Cabo Rojo 1.2 (A1.2 modified): Develop stricter regulations and enhance enforcement capabilities to ensure compliance with best management practices for agricultural and development activities practices that reduce stormwater runoff, and erosion to reduce pollutant (sediment, nutrient, pesticide, herbicide, fecal coliform, etc.) transport to the marine environment, working through the Environmental Protection Agency (EPA), Environmental Quality Board (EQB), U.S. Army Corps of Engineers (USACE), and other regulatory entities.*

**Objective 3 (A1.3):** Use existing incentive programs and strengthen partnerships with United States Department of Agriculture (USDA) and local

**GOAL 2 (A2). Control and reduce pollutant transport to the marine environment. Cabo Rojo (Goal A2 + Goal A3): Strengthen enforcement and engage stakeholders through education to control and reduce pollutant transport to the marine environment.**

**Objective 1 (A2.1):** Eliminate combined sewers where stormwater and wastewater systems are joined to reduce overflows and associated water quality impacts to water bodies (i.e., San Juan, Boqueron, Calle Calaf ).

**Objective 2 (A2.3):** Support the development of

Department of Agriculture, Environmental Protection Agency (EPA), Public Health and Environmental Quality Board (EQB) to provide incentives and ensure compliance with regulations at the same time. *Cabo Rojo 1.3 (A1.3): Work with private landowners to develop land use and conservation management plans through participation in the Forest Stewardship Program and other impact reducing programs offered by the United States department of Agriculture (USDA), the local Department of Agriculture, to use existing incentive programs, strengthen partnerships with these and other agencies and to provide incentives ensuring compliance with regulations at the same time.*

**Objective 4 (A1.4):** Ensure that planning activities are at a watershed scale and loss of coastal habitats (wetlands, seagrass) that serve as filters to maintain water quality is avoided and minimized.

**Objective 5 (A1.5):** Ensure compliance with the requirement to include cumulative impacts in environmental documents so as to improve agency evaluation of all project impacts. Require that environmental assessments for developments be submitted to DNER for DNER to provide comments to EQB regarding potential impacts to the coral reef ecosystem. Currently, including cumulative impacts is a legal requirement in the permit process, requiring that EQB certify compliance with the environmental document requirements of Public Law 4. However, cumulative impact analysis is often not included in the environmental assessment and therefore lost from the project evaluation.

**Objective 6 (A1.6):** New and existing sediment reduction and stormwater management plans should take a holistic watershed approach, considering the interaction between upland actions and their impacts on the marine environment, including seagrass and mangroves. *North East Reserves: Promote and implement erosion and sediment reduction practices as well as stormwater management plans should take a holistic watershed approach, considering the interaction between upland actions and their impacts on the marine environment, including seagrass and mangroves.*

measurable standards that create allowable levels of nutrient and fecal loading to inland and coastal water bodies. This should build from the current EQB initiative to write standards for contaminant loading to inland water bodies by extending the standard to coastal areas. Improve aquatic life criteria based on



data for Puerto Rico, where possible, to make marine and coastal water quality standards appropriate for marine organisms. **North East Reserves:** *Promote the development of measurable standards that create allowable levels of nutrient and fecal loading to inland and coastal water bodies. This should build from the current EQB initiative to write standards for contaminant loading to inland water bodies by extending the standard to coastal areas. Improve aquatic life criteria based on data for Puerto Rico, where possible, to make marine and coastal water quality standards appropriate for marine organisms.*

**Objective 3** (A2.4): Establish water quality monitoring stations in coral reef ecosystem areas and add water quality monitoring components to established coral monitoring sites around Puerto Rico. Establish standards in terms of what to monitor for and how to ensure comparability of data across locations. Use data regarding areas where water quality is an issue to enhance agency decision-making related to issuance of permits.

**Objective 4** (A2.5): Implement sediment reduction practices and stormwater management plans that take a holistic watershed approach, considering the interaction between upland actions and their impacts on the marine environment, including seagrass and mangroves.

**Objective 5** (A2.6): Support, whenever possible, upgrading existing wastewater treatment facilities to increase capacity and level of treatment, provided that the changes will be adequate to address sewage load and improve water quality (i.e., Parguera).

### **GOAL 3 (A3). Strengthen enforcement and engage stakeholders through education to reduce pollutant transport to the coral reef ecosystem.**

**Objective 1** (A3.1): Reduce erosion from any earth movement activities (e.g., development, home expansion, agriculture) through a mix of education and enforcement.

**Objective 2** (A3.2): Improve the efficiency of the implementation of the regulations related to the control of erosion and sedimentation and stormwater runoff at the commonwealth and federal levels.

**Objective 3** (A3.3): Ensure that mitigation plans are properly implemented and that the project has not resulted in the loss of habitat and take necessary enforcement action for noncompliance with mitigation plans. Coordinate between EPA, Corps of Engineers (COE), EQB, etc., to ensure enforcement is geared toward protecting habitat and less toward issuing fines.

**Objective 4** (A3.4): Create certification program

**Objective 6** (A2.8): Develop and implement new regulations and practices for onsite sewage disposal systems (OSDS) standards that ensure these systems are built, installed and maintained according to known best practices. Single-family units are currently not regulated under OSDS and should be included. Leverage the collaborative Watershed Stewardship Program, which provides resources and expertise to upgrade household septic systems so they adhere to known best practices, to expand it throughout the island if the pilot project is successful.

**Objective 7** (A2.10): Create and deploy best practices that reduce pollutant loading from Confined Animal Feeding Operations (CAFO) and other livestock operations. Management practices should reduce nutrient levels in the feed provided to livestock. Work with Natural Resources Conservation Service (NRCS), Environmental Protection Agency (EPA) and EQB to ensure that regulations are appropriate to an island where CAFOs may not be large, but can have major impacts to water bodies for nonpoint source permits for stormwater runoff. Ensure that regulations between EPA and EQB are consistent in prohibiting direct discharges from CAFOs to water bodies. Ensure implementation of best management practices for all livestock operations to minimize nonpoint discharges from the operation related to the management of animals and land-use management.

**Objective 8** (A2.11): Restore, acquire and enhance coastal wetlands, forests and riparian zones as possible to maintain these filters to water quality.

for developers, contractors, agricultural operators and consultants certifying that they have been trained in best management practices for different land uses appropriate to their activities.

**Objective 5** (A3.5): Provide all law enforcement officials (rangers, lawyers and judges) with educational opportunities to increase their effectiveness and efficiency at implementing conservation and resource management regulations.

**Objective 6** (A3.7): Develop additional requirements that look at the potential impacts—instead of the size or amount of earth movement and storage—to ensure that the transport of sediments to water bodies is minimized.

**Objective 7** (A3.9): Ensure that citizens (e.g., developers, agricultural operators, homeowners) receive orientation through educational campaigns

regarding regulations related to protection of water quality (e.g., earth movement, sewage, disposal of materials such as oil) and make them aware of consequences of noncompliance.

**Objective 8** (A3.10): Create certification program for agency personnel who implement regulations that could impact erosion, sediment transport and water quality for any land use to ensure agency personnel are familiar with regulations, best management practices and requirements related to habitat

### **ISSUE AREA B.**

**APPLY IMMEDIATE PROTECTION TO COMMERCIAL, RECREATIONAL AND ARTISANAL CORAL REEF FISHERIES AND RELATED CORAL ECOSYSTEMS BY EMPLOYING AVAILABLE AND KNOWN MANAGEMENT TOOLS TO PROTECT AND CONSERVE.**

**GOAL 4 (GOAL B2 + GOAL B3) Enhance enforcement, management and education programs to encourage public compliance with fishing regulations and reduce impacts of fishing to coral reef ecosystems. NEW GOAL**

**Objective 1** (B1.1): Identify, designate and implement a minimum of 3% of the insular platform as no-take marine reserves in compliance with Resolution Number 307 and prepare management plans in collaboration with communities as practicable for these reserves. The areas to be designated should be concerned with the protection of coral reefs ecosystems. **North East Reserves:** *Identify, designate and implement, within the North East Reserves a minimum of 3% of the insular platform as no-take marine reserves in compliance with Resolution Number 307 and prepare management plans in collaboration with communities as practicable for these reserves. The areas to be designated should be concerned with the protection of coral reefs ecosystems.*

**Objective 2** (B1.3): Search for and identify management tools that could be applied to fisheries and related ecosystem protection and management in Puerto Rico.

**Objective 3** (B2.1): Enhance the fisheries data collection programs.

**Objective 4** (B3.1): Create an outreach and educational campaign to reduce fishing *recreational and maritime impacts* over coral reef ecosystems aimed at

### **ISSUE AREA C.**

**REDUCE THOSE HUMAN IMPACTS THAT ARE MOST CRITICAL TO CORALS' PROTECTION AND HEALTH.**

**GOAL 5 (C1). Manage the recreational and maritime uses of marine and coastal areas to reduce the impacts on coral reefs.**

conservation and other natural resource issues.

**Objective 9** (A3.12): Workshops with EQB, Department of Agriculture (DA), NRCS and other relevant agencies to orient personnel regarding CAFOs, new regulations and appropriate best management practices based on physical characteristics of the agricultural areas.

the following:

- a. Recreational fishing community.
- b. Commercial fishing community.
- c. The judicial system.
- d. Decision makers

**Objective 5** (B3.2): Provide education to enforcement personnel strengthening their understanding of impacts from recreational and maritime uses on coral reef ecosystems.

**Objective 6** (B3.3): Export positive experiences from communities that have successfully implemented no-take zones to other communities that would benefit from such an approach.

**Objective 7** (B3.4): Empower enforcement agencies so they are able to implement existing regulations in areas that require immediate protection. **Guanica:** *Strengthen enforcement agencies so they are able to implement existing regulations in areas that require immediate protection.*

**Objective 8** (B3.5): Enable joint enforcement agreement between local, national and federal agencies to improve efficiency of operations.



**Objective 1 (C1.1):** Reduce the impact of vessel anchoring and boat grounding on seagrass beds and coral reefs and enable efficient enforcement by:

- a. Establishing vessel use zones.
- b. Installing navigation and mooring buoys that demarcate different use zones.
- c. Rerouting large vessel traffic to avoid sensitive coral areas, if navigation aids are not effective and/or if there are repetitive groundings.
- d. Establishing no-anchor zones.
- e. **Cabo Rojo:** Developing outreach programs for recreational, commercial and maritime operators to encourage compliance with coral reef regulations and to use best management practices in their operations.

**Objective 2 (C1.2):** Identify specific areas for recreational use. Should focus on already impacted reefs and artificial reef sites so as to preserve and limit activities on higher quality reef ecosystems.

**GOAL 6 (C2). Enable and promote sustainable development practices in the coastal zone and upland areas of Puerto Rico that are associated with priority coral reef areas. North East Reserves: Through management and education strategies enable and promote sustainable development practices in the coastal zone and upland areas of Puerto Rico that are associated with priority coral reef areas.**

**Objective 1 (C2.1):** Develop a land-use plan for Puerto Rico that includes the Puerto Rico Coastal Zone as defined by the PR Coastal Zone Management Program (PRCZMP) (including territorial waters) and identifies zones for different uses including conservation, recreation and different types of development. The plan should address issues of light pollution, listed species and habitat protection. *Ensure that the proposed land-use plan for Puerto Rico that includes the Puerto Rico Coastal Zone as defined by the PR Coastal Zone Management Program (PRCZMP) (including territorial waters) and identifies zones for different uses including conservation, recreation and different types of development. The plan should address issues of light pollution, listed species and habitat protection.*

**Objective 2 (C2.2):** Identify and prioritize coastal and upland areas associated with priority coral reef areas for land acquisition, preservation, protection and restoration, such as important watershed areas or buffer areas adjacent to protected areas. **North East Reserves: Acquire, preserve, restore and protect coastal and upland areas associated with priority coral reef areas for land acquisition, preservation, protection and restoration, such as important watershed areas or buffer areas adjacent to protected areas.**

**Objective 3 (C1.3):** Develop outreach programs for recreational operators to encourage compliance with coral reef regulations and to use best management practices for recreational use in their operations.

**North East Reserves: Develop outreach programs for recreational operators, as well as commercial and maritime operators, to encourage compliance with coral reef regulations and to use best management practices for recreational use in their operations. Guanica: (Obj. C1.3 + C1.4): Develop outreach programs for recreational, commercial and maritime operators to encourage compliance with coral reef regulations, assist with the management of lionfish infestation and use best management practices in their operations.**

**Objective 4 (C1.5):** Prepare and implement a coordinated approach that describes how to respond to physical impacts (vessel groundings, anchor damage, storm damage, etc.) so all the pertinent laws and regulations can be properly enforced. *debidamente aplicados.*

**Objective 3 (C2.3):** Support the effective management of existing protected areas (such as natural reserves, state forests, and national park and wildlife refuges) within or adjacent to priority coastal areas, including the development and implementation of management plans.

**Objective 4 (C2.4):** Increase the capacity of development permitting agencies (DNER, EQB, JP,ARPE, USACOE, USEPA) to monitor development activity and ensure permit compliance.

**Objective 5 (C2.6):** Identify degraded coastal natural areas with restoration potential, particularly mangrove habitat, coastal wetlands and estuaries. **North East Reserves: Restore degraded coastal natural areas with restoration potential, particularly mangrove habitat, coastal wetlands and estuaries.**

**Objective 6 (C2.7):** Work with relevant agencies to establish written guidelines for the granting of variances and/or waivers to regulations for projects that are located in the coastal zone or will potentially impact watershed stability

## ISSUE AREA D.

MANAGE FOR CLIMATE CHANGE AND DISEASES EMANATING FROM INCREASE IN STORM FREQUENCY AND IMPACT, WATER TEMPERATURE AND AIR POLLUTION AND PROMOTE RECOVERY OF REEFS FROM PREVIOUS EVENTS.

**GOAI 7 (Goal C3) Reduce the impact of invasive species with regulation, enforcement and education..**

**Objective 1 (C3.1):** Prepare for and protect against invasive species. Work should include monitoring effects of lionfish infestation, work with researchers and managers from the USVI to share lessons and experience, prepare standard operating procedures for handling invasive sightings and prepare standard operating procedures for handling infestations in protected areas.

**GOAL 8 (DI modified) Promote recovery of reefs from natural stressors, atmospheric phenomena and invasive species.**

**Objective 1 (D1.1):** Identify areas of high diversity and live coral coverage for additional protection and expand existing protected areas to include these areas. Close areas when bleaching and disease or hurricane damages are extensive to allow for the recovery of reef areas.

**Objective 2 (D1.2):** Support more research on coral diseases and on the relationship of bleaching to disease; support more research on coral resistance to bleaching/disease and resilience following global, regional and local stressors and on possible effects of climate change on coral reefs and other ecosystems.

**Objective 3 (D1.4):** Strengthen response capability when natural disasters occur.

**Objective 2 (C3.2):** Teach people about invasive and exotic species, how they affect coastal and marine ecosystems and how they can help with the problem.

**Objective 3 (C3.3):** Develop and enforce stricter policies to regulate the importation of exotic aquatic species that can affect coral reef ecosystems

**Objective 4 (D1.7):** Implement coastal planning that addresses sea level rise and directs new development away from the coastline.

After the first day exercise of selecting goals and objectives for each priority areas, the results were presented to the participants, revised and ratified. The selection has been compared with the Goals established in the 2010 Puerto Rico's Coral Reef Management Priorities to ensure that the 2011 selection is tuned with those already presented. This does not imply, that the participants did not have the options of clarifying, updating or just reject the 2010 selection and this is exactly what happened.





The following Table summarizes the correlation between the Goals established in 2010 and the Goals selected in 2011 in each of the priority areas

**TABLE 1: CORRELATION BETWEEN THE GOALS ESTABLISHED IN 2010 AND THE GOALS SELECTED IN 2011.**

NOAA National Goals	PR Goals and Objectives	Culebra	Northeast Reserves	Cabo Rojo	Guánica
Goal 1 (A1): Implement land-use planning at the watershed scale to minimize water quality impacts to the coral reef ecosystem.	•	Goal 1	Goal 1	Goal 1 (GA1 + GC2)	Goal 1 (GA1 + GA2)
Goal 2 (A2): Control and reduce pollutant transport to the marine environment.	•			Goal 2 (GA2 + GA3)	
Goal 3 (A3): Strengthen enforcement and engage stakeholders through education to reduce pollutant transport to the coral reef ecosystem.	•	Goal 2	Goal 5		Goal 5
<i>Goal B1: Protect coral reef ecosystems from large- and small-scale fisheries impacts through an informed planning process.</i>					
<i>Goal B2: Enhance enforcement and management programs to reduce fishing impacts to coral reef ecosystems.</i>					
Goal 4 (B3): Utilize enforcement and education to encourage public compliance with fishing regulations and reduce impacts of fishing.	•	Goal 3	Goal 6	Goal 4	Goal 4
Goal 5 (C1): Manage the recreational and maritime uses of marine and coastal areas to reduce the impacts on coral reefs.	•	Goal 4	Goal 2	Goal 3	Goal 2
Goal 6 (C2): Enable and promote sustainable development practices in the coastal zone and upland areas of Puerto Rico that are associated with priority coral reef areas.	•	Goal 5	Goal 4		Goal 3
Goal 7 (C3): Reduce the impact of invasive species with regulation, enforcement and education.	•				
Goal 8 (D1): Manage for climate change and diseases emanating from increase in storm frequency and impact, water temperature and air pollution and promote recovery of reefs from previous events. <i>Promote recovery of reefs from natural stressors, atmospheric phenomena and invasive species.</i>	•		Goal 3	Goal 5	

Seventeen (17) projects were proposed that apply to all four-priority areas, and they can be correlated to the general areas of concern identified before. These are:

- Goal 1 Obj. 1 (A1.1)
  - Project 1: Review the proposed and approved Territorial Plans to evaluate if the proposed or established zoning is adequate to prevent or minimize coral reef impacts associated with land use or development.
- Goal 3 Obj. 4 (A3.4)
  - Project 2: Design and implement a capacitation course and certification system for the “CEST Plan” and “Best Management Practices” and require it to obtain licenses for Engineers, Inspectors, Authorized Professionals, Architects and any other professional involved or related to construction activities.
- Goal 3 Obj. 3 (A3.3)
  - Project 3: Vessel grounding enforcement & response
- Goal 3 Obj. 5 (A3.5)
  - Project 4: Capacity building program for DNER Rangers on coral reefs, other marine ecosystems and related laws and regulations.
- Goal 4; Goal 5 Objs. 3 (C1.3); 4(B3.1); 7 (B3.4)
  - Project 5: Create an outreach and educational campaign to reduce fishing, recreational and commercial impacts on coral reef ecosystems aimed at the following: a. recreational fishing community, b. commercial fishing community, c. judicial system, d. boat operators (recreational, commercial and maritime).
  - Project 6: Create ID cards with images of fish and reef etiquette messages.
- Goal 5 Obj. 3 (C1.3)
  - Project 7: Develop and establish a certification process for service providers such that clients receive an orientation regarding best practices to protect the marine ecosystem prior to starting the trip.
  - Project 8: Develop and establish a certification process for marina’s clients as part of their user contract.
  - Project 9: Develop two video-based coral reef etiquette messages –one for SCUBA divers and one for snorkelers, emphasizing proper behavior while visiting coral reefs.
  - Project 10: Create PSAs to increase public awareness of the importance of the marine environment (ecological, economical, etc) and of its conservation.
- Goal 5 Obj. 1 (C1.1)
  - Project 11: Develop and implement a Vessel Management Plan specific to Culebra, Fajardo, Guánica and Cabo Rojo regions.
- Goal 5 Obj. 2 (C1.2)
  - Project 12: Engage tourist service providers, recreational divers and commercial fishers in the location and removal of lionfish through training and special permits (for lionfish removal in no-take Reserves) and create a promotional consumer campaign to market lionfish to restaurants and food stands.
  - Project 13: Identify areas for Conservation vs areas for recreational activities and establish zoning based on recreational activities.
- Goal 6 Obj. 3 (C2.3)



- Project 14: Study the limit of acceptable change to establish the recommended number of visitors per day for the most frequently visited and or utilized sites within the managed areas in Culebra, Guánica, Fajardo and Cabo Rojo.
- Project 15: Identify areas of high diversity and live coral coverage for additional protection and expand existing protected areas to include these areas.
- Project 16: Outreach and education campaign to enforce compliance with concession permits to operate in managed areas in Culebra, Guánica, Fajardo and Cabo Rojo.
- Project 17: Development of a Web and Cell phone based mapping interphase for the localization and report of event sites, including coral bleaching, along the Puerto Rico coast and waters.

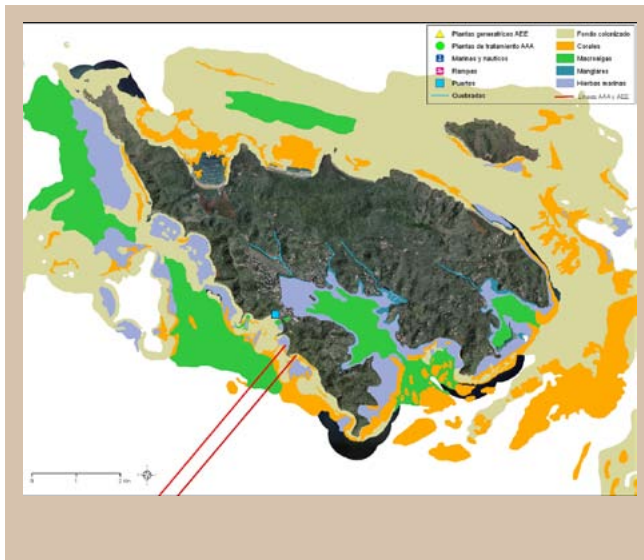


## Puerto Rico's Coral Reef Local Action Strategies (LAS)

CULEBRA







## PROCESS FOR SELECTING LAS

A two-day LAS Workshop was held in Culebra, on August 11-12, 2011. Twenty-four people, representing municipal, state and federal agencies and local community members, attended the Workshop. The group identified the following issues as areas of concern for the conservation of the coral reefs in Culebra:

- Erosion with the consequence of sediment transport to the coral reef.
- Poor water quality.
- Poor enforcement of land-use regulations resulting in negative impacts on the coral reef.
- Negative impacts of recreational boats and other recreation and tourism activities on coral reef areas.
- Absence of management and enforcement to control human activities around coral reefs.
- Need of effective outreach and education activities for different stakeholders.

These Worksheets are found at the end of this section.

## GOALS, OBJECTIVES AND PROJECTS

The Culebra LAS Workshop participants identified a total of 33 projects. Ten of these are applicable to all four-priority areas, and 23 are pertinent for Culebra exclusively. Full Worksheets for these projects are found at the end of this section.

### GOAL 1: (GOAL A1). Implement land-use planning at the watershed scale to minimize water quality impacts to the coral reef ecosystem.

**Objective 1:** Support the use of a watershed approach in the development and implementation of new and existing Municipal Ordinance Plans and Puerto Rico Land Use Plan to maintain water quality, consider cumulative impacts in order to avoid impacts and minimize loss of coastal habitats (wetlands, seagrass) that serve as filters to maintain sea water quality.

#### LAS Projects:

1. Development of erosion and sedimentation control plans (CES Plans) for the watershed. **All areas.**

2. Revise proposed Culebra's Municipal Land Use Plan to analyze possible impacts of proposed zoning districts.
3. Implement BMPs to control erosion and Sediment transport in the watershed. **All areas.**
4. Develop an updated map of Culebra land-use and a marine habitat baseline.
5. Assessment of the effects of land-based sources of pollution: pollutants, sediments & nutrients on coral reefs ecosystems in Culebra.
6. Spatial identification and assessment of land-

based sources of pollution in Culebra: pollutants, sediments & nutrients.

7. Development of an interdisciplinary approach to mitigate the effects of erosion on the marine environment of Culebra.

### GOAL 2: (GOAL A2 + GOAL A3) Strengthen enforcement and engage stakeholders through education to reduce pollutant transport to the coral reef ecosystem.

**Objective 2 (A3.2):** Improve the efficiency of the implementation of the regulations related to the control of erosion and sedimentation and stormwater runoff at the commonwealth and federal levels.

#### LAS Projects

8. Monitoring of water quality in coastal waters.
9. Develop a guide/protocol for action, response and supervision in case of illegal activities such as: deforestation, land removal, erosion, sedimentation (or sediment movement).

**Objective 3 (A3.4):** Create certification program for developers, contractors, agricultural operators and consultants certifying that they have been trained in best management practices for different land uses appropriate to their activities.

#### LAS Projects

10. Design and implement a training course and certification system for CEST Plan and BMPs requisite for engineers, land surveyors, inspectors and other authorized professionals. **All areas.**

**Objective 4 (A3.5):** Provide all law enforcement personnel (rangers, lawyers and judges) with educational opportunities to increase their effectiveness and efficiency at implementing conservation and resource management regulations.

#### LAS Projects

11. Training workshops for DNER Rangers on the implementation of CEST Plan. **All areas.**
12. Implementation of an erosion control and marine turbidity- monitoring plan for the Island of Culebra.

### GOAL 3: (GOAL B3). Utilize enforcement and education to encourage public compliance with fishing regulations and reduce impacts of fishing.

**Objective 5 (B3.4):** Empower enforcement agencies so they are able to implement existing regulations in areas that require immediate protection.

#### LAS Projects

13. Training of DNER Rangers in: Regulations and species identification.
14. Develop formal collaborative agreement between DNER Rangers, and State Police (FURA) to strengthen their capacity to enforce environmental laws and regulations.
15. Develop mass media campaign addressing Culebra's natural resources.
16. Create and outreach and educational campaign to reduce fishing impacts to coral reef

ecosystems aimed at the following:

- a. Recreational fishing community,
  - b. Commercial fishing community,
  - c. Judicial system.
17. Capacity building for DNER Rangers on coral reefs and other marine ecosystems, and related laws and regulations. **All areas.**
  18. Documentation of Culebra MPA enforcement bottlenecks and implementation and monitoring of progressive enforcement solutions in Culebra's MPA, employing a local and federal Government agency and citizen collaborative approach to reduce costs of implementation project cost.



**GOAL 4: (GOAL C1) Manage the recreational and maritime uses of marine and coastal areas to reduce the impacts on coral reefs.**

**Objective 6 (C1.1):** Reduce the impact of vessel anchoring and boat grounding on seagrass beds and coral reefs and enable efficient enforcement by:

- a. Establishing vessel use zones.
- b. Installing navigation and mooring buoys that demarcate different use zones.
- c. Rerouting large vessel traffic to avoid sensitive coral areas, if navigation aids are not effective and/or if there are repetitive groundings.
- d. Establishing no-anchor zones.
- e. Developing outreach programs for recreational, commercial and maritime operators to encourage compliance with coral reefs regulations and to use best management practices in their operations.

**LAS Projects**

19. Install navigation aids (targets) to delimit shore safe access.
20. Prepare and implement a coordinated approach that describes how to respond to physical impacts (vessel groundings, anchor damage, storm damage, etc.) so all the pertinent laws and regulations can be properly enforced. **All areas.**

**Objective 7 (C1.2):** Identify specific areas for recreational use. Should focus on already impacted

reefs and artificial reef sites so as to preserve and limit activities on higher quality reef ecosystems.

**LAS Projects**

21. Identify and prioritize seagrass beds restoration areas.
22. Identify Areas for Conservation versus areas for Recreational Activities and Establish Zoning based on recreational activity. **All areas.**

**Objective 8 (C1.3):** Develop outreach programs for recreational operators to encourage compliance with coral reef regulations and to use best management practices for recreational use in their operations.

**LAS Projects**

23. Develop and establish a certification process for service providers such that clients receive an orientation regarding best practices to protect the marine ecosystem prior to starting the trip. **All areas.**
24. Create ID cards with images of fish and reef etiquette messages **All areas.**
25. Develop a local and federal permitting process that would allow for a team emergency coral reef responders to identify and immediately stabilize fragments of coral resulting from physical damage caused by tourists, boaters and/or storms, which would otherwise die.

30. Coral reef ecosystem resilience enhancement through ecosystem-based landscape level restoration and management.

31. Engage tourist service providers, recreational divers, and commercial fishers in the location and removal of lionfish through training and special permits (for removal of lionfish in no-take reserves) and create a promotional campaign to market lionfish to restaurants and food stands

**Objective 11 (C2.2):** Identify and prioritize coastal and upland areas associated with priority coral reef areas for land acquisition, preservation, protection and restoration, such as important watershed areas or buffer areas adjacent to protected areas.

**LAS Projects**

32. The Culebra Marine Ecosystem Inventory: Identification of priority coral reef, seagrass and mangrove areas for conservation and restoration.
33. Community-based designation and management of the Culebrita Island no-take Natural Reserve.

**Objective 12 (C2.4):** Increase the capacity of development permitting agencies (DNER, EQB, JP, OGPE, USACOE, USEPA) to monitor development activity, ensure permit compliance and increase community transparency.

**Objective 13 (C2.6):** Restore degraded coastal natural areas, particularly, coral reef, mangrove habitats, coastal wetlands and estuaries.

**GOAL 5: (GOAL C2). Enable and promote sustainable development practices in the coastal zone and upland areas of Puerto Rico that are associated with priority coral reef areas.**

**Objective 9 (C2.1):** Ensure that the Island wide land-use plan for Puerto Rico that includes the policies of the Puerto Rico Coastal Zone as defined by the PR Coastal Zone Management Program (PRCZMP) (including territorial waters), the Culebra segment document of the PRCZMP and identifies zones for different uses including conservation, coral restoration, recreation and different types of development. The plan should address issues of light pollution, listed species and habitat protection.

**Objective 10 (C2.3):** Support the effective management of existing protected areas (such as natural reserves, state forests, and national park and wildlife refuges) within or adjacent to priority coastal areas, including the development and implementation of management plans.

**LAS Projects**

26. Low-tech propagation and restoration of star coral (*Montastrea annularis* and *M. faveolata*) populations depleted by post-bleaching mass mortalities.
27. Apply artificial coral reefs and ecosystem-based approaches to enhance coral reef resilience within the Canal Luis Peña No-Take Natural Reserve, Culebra.
28. Long-term ecological monitoring in support of management of the Culebra Island no-take MPA network.
29. Community-based designation and management of the Bahía Flamenco no-take natural reserve.



## Worksheet: Collaborative Implementation Plan #1

**Priority Area:** Culebra

**Goal:** A1

**Objective:** A1.1, A3.2 (contributes to B3/ B3.4, C2/C2.1; 2.3; 2.4; 2.6)

**Project 1:** Erosion and sedimentation control plans for watershed (CES Plan).

**Description:** The leading organization and associated organizations will prepare erosion and sedimentation control plans for the priority watersheds of the island of Culebra.

Work areas:

1. Prepare up to date land use maps
2. Perform a sequential analysis of the land use changes (1930-present)
3. Develop a matrix of characterization of usage, production relation and sediment export and discharges to costal water bodies.
4. Identify critical areas for the CES (hot spots)
5. Identification of sensitive areas (critical) to protect in order to implement practices and erosion control measures in critical areas of the CES plan within the watershed.
6. Develop a database of sedimentation for each sensitive area to protect (times of draught and rain) with priority in the protection of coastal wetlands and coral areas.
7. Develop an education and outreach component (extension) to raise awareness in official government constructors and to citizens about the importance of controlling erosion and sedimentation.

**Lead person:** EQB, Universities, NGO's or consulting firms

**Proposed partners:**

**When (mm/yr) TO:**

**Products or outputs:**

1. Up to date maps of land-use by priority watershed of Culebra;
2. Evaluation of balance of sediments in the watersheds;
3. Identification of hotspots and sensitive areas to protect;
4. Identification of CES best practices to protect sensitive coral reef areas.

**Expected costs:** \$85,000

**Propose funding Source:** EPA, CRCO, NGO's, TNC? Gulf of Mexico Foundation and others

**Measures of Success:** Reduction of sediment discharges in coastal waters and wetland and coral areas.

Reduction of levels of suspended sediments in coastal waters- sensitive coral reef areas (turbidity)

Reduction of risks of loosing coral reefs due to sedimentation.

## Worksheet: Collaborative Implementation Plan #2

**Priority Area:** Culebra

**Goal:** A1

**Objective:** A1.1 Support the use of a watershed approach in the development and implementation of new and existing Municipal Ordinance

**Project 1:** (work that needs to be done to achieve objective and goal)

Revise the Territorial Ordinance Plan proposed for Culebra, analyze the impact that the proposed zoning districts can have to the plan.

**Description:** Analyze the impact that zoning districts proposed by the Territorial Ordinance Plan can have.

Take into consideration the mechanisms that law #81 provide for compensating owners for not developing areas of high ecological value. Transference of rights for development.

According to the findings of the sedimentation study in the watersheds of Culebra, carry out an inventory of the areas that should be conserved.

Design a mechanism or create a special fund for the purchase of land.

**Lead person:** Puerto Rico Planning Board

**Proposed partners:** Culebra Municipality

**When (mm/yr) December 2011 TO:**

**Products or outputs:** Classification Map and qualification of the Culebra Municipality and inventories of land to be conserved.

**Expected costs:** \$5 millions

**Propose funding Source:** OCAM, Culebra Municipality

**Measures of Success:** That the Territorial Ordinance Plan of Culebra is adopted by the Planning Board and that incorporates the required regulation of land use to promote the conservation of coral reefs.



### Worksheet: Collaborative Implementation Plan #3

**Priority Area:** Culebra  
**Goal:** A1  
**Objective:** A1.1 and A3.2

**Project I:** (work that needs to be done to achieve objective and goal) Implementation of priority actions (BMP's) by watershed.

**Description:** The leading organization and associated organizations will implement the following best practices of erosion and sedimentation control in the watersheds of Culebra:

- 1.Reduction of export and discharge of sediments to coastal waters and sensitive coral reef areas in unpaved roads.
- 2.Reduction of production, export and discharge of sediments to coastal waters and sensitive coral reef areas in new constructions of infrastructure and households utilizing identified BMP's for the Culebra watersheds.

**Lead person:** DTOP, Culebra Municipality/ACDC, OGP, JCA, DRNA  
**Proposed partners:**  
**When (mm/yr) TO:**  
**Products or outputs:**  
**Expected costs:** They vary by BMP  
**Propose funding Source:** DTOP-AC, Road Authority, Developer of project (inspectors) and DRNA  
**Measures of Success:**  
 Reduction of sediment discharges to coastal waters and sensitive coral reef areas of the watersheds of Culebra.

### Worksheet: Collaborative Implementation Plan #4

**Priority Area** (from Priority Setting Document)  
 A. Improve water quality and related reef systems by reducing pollutant inputs from terrestrial sources  
**Goal** (from Priority Setting Document)  
 A1. Implement land-use planning at the watershed scale to minimize water quality impacts to the coral reef ecosystem  
 A3. Strengthen enforcement and engage stakeholders through education to reduce pollutant transport to the coral reef ecosystem  
**Objective** (from Priority Setting Document) A1.1,A1.2,A3.5

**Project I** (work that needs to be done to achieve objective and goal) Culebra Island land-use and , marine habitat baseline mapping

**Description:**  
 WHAT: This project propose to generate a baseline database for Culebra that is up-to-date and complete to provide managers, scientists, and the community with basic yet fundamental information to identify and prioritize human impacts to the marine environment, to include:

1. A baseline map of current land-use and land-cover activities in Culebra (i.e. residential, commercial, agricultural, vegetation, etc.)
2. An updated baseline map showing the spatial distribution of coral reef habitats at community and geomorphological level.
3. Detailed groundtruth assessment and characterization of inland and marine spatially distributed sites as control data to access the accuracy of maps 1 & 2. Each marine surveyed site should include percent cover of coral communities (e.g. stony coral, algae, bare substrate, seagrass, etc.). When possible and necessary, the habitats might be described to the species level.
4. Generate a complete and comprehensive database integrating all pertinent archived documentation that could assist understand the historical trends in land use, climate changes, and erosion-sedimentation patterns (i.e. maps, aerial photographs, demographic data, scientific reports and data, etc.)

HOW: Remote sensing and GIS tools and techniques, along with complimentary groundtruth field data are to be use to generate these Island-wide critical baseline maps.

The baseline maps should be derived from the most current and quality controlled datasets (i.e. aerial photography 2007-2010, 2011?) at a high spatial resolution (~5-10m) to meet today's onservaion objectives. This includes all shallow water ( up to 30m depending on water turbidity) coral reefs sites within 3 miles offshore.

**Lead person:** DNER  
**Proposed partners:**  
 Damaris Torres-Pulliza, MSc.  
 Fernando Gilbes (UPRM)  
 Edwin A. Hernández-Delgado, PhD  
 NOAA CRCP, Junta de Planificación de Puerto Rico  
 UPR, servicio extension agrícola, NASA  
**When FROM (11/2011) TO (11/2013)**  
**Products or Outputs:**

- Digital raster and vector GIS layers
- Groundtruth coral reefs surveys
- Digital informational and accessible databank
- Report on the methods and outputs
- Workshop with the municipality, researchers, and the general public to disseminate the data and help understand the importance and uses of the output products
- Provide baseline data to create a realistic Valuation on the natural resources on Culebra's economy

**Expected Costs:** \$50,000 – 100,000 / yr  
**Proposed Funding Source:** NOAA, JP,TNC, DRNA...  
**Measures of Success:**

- When it is publicly available
- Used as an Integral part of any governmental, management and scientific marine conservation efforts

### Worksheet: Collaborative Implementation Plan #5

**Priority Area** (from Priority Setting Document)  
 A. Improve water quality and related reef systems by reducing pollutant inputs from terrestrial sources  
**Goal** (from Priority Setting Document)  
 A1. Implement land-use planning at the watershed scale to minimize water quality impacts to the coral reef ecosystem  
**Objective** (from Priority Setting Document) A1.1,A1.2

**Project I** (work that needs to be done to achieve objective and goal) An assessment on the effects of land-based sources of pollution on coral reefs ecosystems in Culebra: pollutants, sediment & nutrients

**Description:**  
 Assess and characterize Culebra Island coral reef historical condition trends as derived from the measures of annual growth density bands from coral cores and analyses of sediment coring samples spatially distributed under different in-land influence scales. This database will be correlated with observed and measured data on the impacts (i.e. diseases, mortality, bleaching, or general disruption of coral reef ecological functions) from inland sources of pollution on coral reef ecosystems. As well as, to investigate the long-term connectivity patterns between in-land sediment, nutrients and pollutant yields and the resilience of high priority coral reef ecosystems.

Other than to generate a spatially distributed analysis of coral reef condition throughout Culebra, this study will help identify resilient coral reefs to land-based sources of pollution and propose or adapt needed management actions for conservation and restoration.

Data collection involves underwater coral and sediment coring as well as a rapid characterization assessment of surveyed sites. Data analysis will consider, among others, coral skeletal extension, density, calcification rates and accumulation of humic acid on growth bands as a mean to measure long-term impacts to surveyed corals.

**Lead person:** Wilson Ramirez, UPRM  
**Proposed partners:**  
 Edwin A. Hernández-Delgado, PhD  
 Carlos Ramos Scharrón, PhD  
 Damaris Torres-Pulliza, MSc  
 EPA, USDA, USGS, NOAA CRCP, JCA  
**When FROM (01/2012) TO (03/2014)**  
**Products or Outputs:** A detailed spatial distribution analysis map on major coral  
**Expected Costs:** \$60,000 – 120,000 / yr  
**Proposed Funding Source:** NOAA CRCP,TNC, USDA, USGS, NOAA CRCP  
**Measures of Success:**

- The understanding on the direct impacts and and effects of local land-based sources of pollution to generate action plans
- Outreach workshops to communicate to relevant personnel and the general public of the importance of good management practices at watershed scales.
- Create protocols to reduce pollutant, nutrients, and sediment loading from watersheds to priority coral reefs ecosystems

### Worksheet: Collaborative Implementation Plan #6 Fill out a different Worksheet for each priority selected

**Priority Area** (from Priority Setting Document)  
 A. Improve water quality and related reef systems by reducing pollutant inputs from terrestrial sources  
**Goal** (from Priority Setting Document)  
 A1. Implement land-use planning at the watershed scale to minimize water quality impacts to the coral reef ecosystem  
**Objective** (from Priority Setting Document) A1.1,A1.2

**Project I** (work that needs to be done to achieve objective and goal) Spatial identification and assessment of Land-based-sources of pollution in Culebra: pollutants, sediment & Nutrients

**Description:**  
 This project aims to use hydrological modeling (i.e. SWAT,APEX, etc.) to quantify watershed scale sediment yields and identify point sources of pollution. These physically oriented models incorporate the historical trends on precipitation, temperature, land-use, soil type, and topography to quantify inland erosion and sediment yields. Resulting data will modulate the identification and prioritization of coastal and upland areas for preservation, protection and restoration.

Might be fusion with Ernesto Diaz's project on quantifying sediment yields for priority watersheds associated to coral reefs ecosystems (?)

**Lead person:** Carlos Ramos Scharrón (U. of Texas)  
**Proposed partners:**  
 Damaris Torres-Pulliza (Sinoptica)  
 USGS, USDA, NOAA CRCP  
**When FROM (02/2012) TO (11/2013)**  
**Products or Outputs:**

- A baseline map identifying the geographic distribution of land-based sources of pollution and associated and their potential as ecosystem stressors.
- A protocol suggesting mitigation

**Expected Costs:** \$50,000 – 80,000 / yr  
**Proposed Funding Source:** USGS, USDA, NOAA CRCP  
**Measures of Success:**

- A map of high priority sites for better management practices enforcement

## Worksheet: Collaborative Implementation Plan #7

**Priority Area** (from Priority Setting Document) Island of Culebra

**Goal** (from Priority Setting Document)

A1. Implement land-use planning at the watershed scale to minimize water quality impacts to the coral reef ecosystem.

**Objective** (from Priority Setting Document)

A1.1. Support the use of a watershed approach in the development and implementation of new and existing Municipal Ordinance Plans and Puerto Rico Land Use Plan.

**Project 1** (work that needs to be done to achieve objective and goal) Development of an interdisciplinary approach to mitigate the effects of erosion on the marine environment of Culebra

**Description:** Coral reef systems thrive under conditions characterized by low sediment and nutrient inputs. This had been the case in Culebra until recently, where dry climatological conditions combined with low density development helped to maintain favorable natural conditions for healthy corals. The expansion of the unpaved road network and increased density of homesites have increased the frequency and magnitude of sediment delivery to the island's coastal waters. The proposed project will rely on field mapping, on-site evaluations, and the application of existing models to generate an assessment of the contribution of sediment from inland sources into the marine environment. An updated version of the STJ-EROS GIS model that integrates natural and anthropogenic sources of sediment will be used to generate watershed-level erosion and sediment delivery assessments for all watersheds on the island of Culebra. The model not only allows for the quantification of sediment delivery rates into the marine environment, but also provides the geographic location of erosion 'hot-spots' and allows for the evaluation of the cost-effectiveness (tons reduced per dollar applied) of BMP implementation techniques at eroding sites throughout each watershed. In combination with existing and newly-generated coral reef and marine habitat assessments this project will devise an innovative erosion control prioritization strategy that integrates watershed assessments, marine habitat characterization, and engineering aspects that could be replicated elsewhere in PR and throughout the Caribbean. The project will result in the development of a Culebra-wide erosion mitigation plan and the methodology could be used to assess future land development plans.

**Lead person:** Carlos E Ramos-Scharrón, PhD (Island Resources Foundation & Univ. of Texas-Austin)

**Proposed partners:**

J. Amador, PE (Greg L Morris Engineering)

E. Hernández, PhD (UPR-CATEC)

D. Torres (Synoptika Solutions)

E. Díaz (DNER)

S. Griffin (NOAA)

**When** (mm/yr) 10/2012 TO 09/2014

**Products or Outputs:**

- Assessment of sediment loads by site (e.g., road segment), by watershed, and island-wide

- An innovative erosion mitigation strategy that integrates watershed aspects, marine habitat conditions & engineering aspects of BMP implementation

- Prioritized erosion mitigation plan for the entire island of Culebra

**Expected Costs:** \$110K/yr for 2 years (\$220K)

**Proposed Funding Source:** NOAA-Coral Reef Program; DNER; US Fish & Wildlife; NFWF

**Measures of Success:**

- Reduced sediment loads from watersheds with STJ-EROS-assessed mitigation projects;

- Adoption of revised STJ-EROS GIS model results and protocols for use of local offices and PR-DNER evaluation of proposed projects.

## Worksheet: Collaborative Implementation Plan #8

**Priority Area** (from Priority Setting Document) Culebra

**Goal** (from Priority Setting Document) A1, A2

**Objective** (from Priority Setting Document) A1.1, A2.5, A2.11

**Project 1** (work that needs to be done to achieve objective and goal) Restoration of riparian areas of intermittent river to control erosion and sedimentation

**Description:** The project will identify areas that need reforestation, that prevent erosion during storm events. The sites to be identified for restoration will be bank/riparian areas that have been impacted by illegal road creation and erosion that transport sediment to the reef from upland areas. The project will plant native and endemic species to restore these areas. During several restoring/planting events, school group, community group, and all interested parties would be invited to help plant saplings, and be part of the event. Along with the further educate the public on the importance of upland forest and the high impact of reef sedimentation. The identifying and reforestation process should take 18 months

**Lead person:** DRNA

**Proposed partners:** USFS, USPA, FCPR, FWS, TNC, ACDEC

**When** (mm/yr) TO

**Products or Outputs:** Acres of reforested land report and progress report on restoration efforts  
reefs protected from sedimentation

**Expected Costs:** \$50,000-\$65,000

Proposed Funding Source: DRNA, FWS, USFS, TNC-FUNDS, DRNA, FCPR, FWS

**Measures of Success:** During and after the restoration efforts, periodic visits to the reforest areas are to be made to ensure that the tree plant are grow Sediment measurement should greatly be reduce and water quality measure will be taken from star to finish. Beach should also experience decrease in runoff.

## Worksheet: Collaborative Implementation Plan #9

**Priority Area:** Culebra

**Goal:** A1

**Objective:** A3.2

**Project 1:** (work that needs to be done to achieve objective and goal) Costal water quality monitoring.

**Description:** The leader organization and associated organization will carry out coastal water quality monitoring with emphasis in parameters such as:

- fecal coliforms
- total coliforms
- bacteria
- turbidity

Activities:

- Weekly monitoring of coastal waters in identified monitoring stations in sensitive coral reef areas.
- Weekly publishing of the monitoring
- Coastal water quality reports

**Lead person:** JCA, NGO's Universities or certified volunteers

**Proposed partners:** DRNA-ACDC

**When** (mm/yr) TO:

**Products or outputs:** weekly reports on coastal water quality

**Expected costs:** \$50,000-\$125,000/yr

**Propose funding Source:** JCA, EPA, NGO's, Universities, AAA

**Measures of Success:**

Effective application of water quality control regulations. Reduction of pollution and sedimentation of coastal water bodies and coral reef areas. Evaluation of the effectiveness of BMP's and erosion and sedimentation control measures.

## Worksheet: Collaborative Implementation Plan #10

**Priority Area:** Culebra

**Goal:** A3

**Objective:** A3.2 Improve the efficiency of the implementation of the regulation related to the control of erosion and sedimentation.

**Project 1:** (work that needs to be done to achieve objective and goal)

Develop an action guide/ protocol of response and supervision in cases of illegal activities of deforestation, soil movements, erosion and sedimentation (movement of sediment).

**Description:**

The procedures and roles of the agencies and citizens are not clear. This sums up that the enforcement is not that efficient and effective. We recommend developing a guide of the legal state and responsibilities of the agencies, lawsuits and fines etc. This measure will help with enforcement.

Activities:

Revision of legal framework and literature

Workshop with all the partners for developing the content of the guide/protocol

Dissemination of the guide/protocol (printed, on portals, internet, etc.)

Workshops where the guide is explained to community leaders and other partners identified.

**Lead person:**

**Proposed partners:** EQB, OGPE, DRNA, NGO's, NRCS, EPA

**When** (mm/yr) TO:

**Products or outputs:** legal research, workshops, guide/protocol, outreach components, education

**Expected costs:**

**Propose funding Source:**

**Measures of Success:**



### Worksheet: Collaborative Implementation Plan #11

**Priority Area:** Culebra  
**Goal:** A3  
**Objective:** A3.2

**Project I:** (work that needs to be done to achieve objective and goal) Accessibility of CEST plan in detail

**Description:** Make mandatory that the CEST plan is accessible in project areas. Not having it, would lead to stopping the project. We are talking about the details of the CEST Plan.

**Lead person:** OGPE  
**Proposed partners:** EQB, OGPE, DRNA, NGO's, NRCS, EPA  
**When (mm/yr) TO:**  
**Products or outputs:** A new requisite that helps with the enforcement of the implantation of the CEST Plan.  
**Expected costs:**  
**Propose funding Source:**  
**Measures of Success:** Reports from rangers about interventions related to CEST plan.

### Worksheet: Collaborative Implementation Plan #13

**Priority Area:** Culebra  
**Goal:** A3  
**Objective:** A3.5

**Project I:** (work that needs to be done to achieve objective and goal) Capacity building for rangers in the implementation of the CEST Plan

**Description:** Offer training workshops for rangers about the implementation of sediment control practices.

**Lead person:**  
**Proposed partners:** OGPE, JCA, DRNA, ACDEC, EPA  
**When (mm/yr) TO:**  
**Products or outputs:** Guide for rangers about sediment control practices  
**Expected costs:** \$60,000  
**Propose funding Source:**  
**Measures of Success:** Number of workshops offered and impacted staff.

### Worksheet: Collaborative Implementation Plan #12

**Priority Area:** Culebra  
**Goal:** A3  
**Objective:** A3.4

**Project I:** (work that needs to be done to achieve objective and goal) Develop and implement a training course and certification system for the CEST plan and best management practices to be requisite for Engineers, surveyors, inspectors and authorized professionals.

**Description:** Develop a legal research about the requirements of the CEST plan. Coordinate with the EQB, Board of Engineers and universities to design and create a course. Evaluate and make the necessary arrangements to make the course a requirement in professional licenses.

**Lead person:** OGPE, Green Building Council, EQB, Board of Engineers, Universities.  
**Proposed partners:** Board of Engineers, Surveyors, Costal Zone-DRNA.  
**When (mm/yr) TO:** August 2011 TO: June 2012  
**Products or outputs:** Course Syllabus  
**Expected costs:** \$50,000  
**Propose funding Source:** OGPE, JCA, EPA, and Program of terrestrial sources.  
**Measures of Success:** Establish the course as a requirement for engineers and inspectors to obtain their licenses.

### Worksheet: Collaborative Implementation Plan #14

**Priority Area** (from Priority Setting Document) Island of Culebra  
**Goal** (from Priority Setting Document)  
 A2. Control and reduce pollutant transport to the marine environment.  
**Objective** (from Priority Setting Document)  
 A3.5. Implement sediment reduction practices and stormwater management plans. (Also A2.4)

**Project I** (work that needs to be done to achieve objective and goal) Implementation of an erosion control and marine turbidity monitoring plan for the Island of Culebra

**Description:** Increased sediment inputs from inland sources are the main stressors adversely impacting water quality and marine ecosystems of Culebra. Improvised parking lots along the coastline, land clearing for homesite construction, and an ever-growing network of unpaved roads are the main sources of sediment on the island. All of these sediment source types not only have the ability to increase the amount of sediment entering coastal waters, but also have the potential to have a significant impact on the frequency at which runoff and sediment are delivered into the coast in the dry climatic and ephemeral hydrologic conditions that typify Culebra. The proposed work will consist in the implementation of BMP's targeting priority erosion hotspots identified by a parallel assessment study also being proposed as part of the LAS process. The number of sites to be addressed and the amount of reduction in sediment yields will depend on the amount of funds provided and the implementation costs in Culebra. Reduction in sediment delivery will be achieved by a combination of proven and low-cost methods carefully chosen to address site specific problems. Reductions in sediment delivery will be achieved by combining the three general aspects of erosion control: (a) promoting infiltration & surface protection (e.g., hydroseeding & energy dissipating structures); (b) stormwater management designed to reduce the energy applied by running water (e.g., swales & culverts); and (c) promoting sediment retention on land (e.g., sediment traps & detention ponds). A built-in monitoring component will assess the impact of BMP implementation in water turbidity and marine habitat conditions.

**Lead person:** C. Ramos-Scharrón, PhD (Island Resources Foundation & Univ. of Texas-Austin) & J. Amador, PE (Greg L Morris Engineering)  
**Proposed partners:** E. Hernández (UPR-CATEC), Coralations, Sociedad Ambiente Marino, P. Sturm (Ridge to Reefs), L. Vandiver (NOAA), E. Díaz (DNER), S. Griffin (NOAA)  
**When (mm/yr) TO:** 10/2013 TO 09/2015-16  
**Products or Outputs:**

- On the field BMP implementation
- Report describing monitoring-based evaluation of BMP implementation on water quality/corals

**Expected Costs:** ~ \$450K to be spent over a span of 2-3 years (~80% on BMP implementation costs & 20% on monitoring)  
**Proposed Funding Source:** NOAA-Coral Reef Program; DNER; US Fish & Wildlife; NFWF  
**Measures of Success:**

- Estimated reduction in sediment yields to the marine environment
- Estimated reduction in the frequency of runoff/sediment delivery
- Observed changes in water turbidity resulting from BMP implementation
- Estimated savings (in dollars) in reduced need to maintain road infrastructure resulting from a stormwater improvements

**Worksheet: Collaborative Implementation Plan #15**

**Priority Area:** Culebra  
**Goal:** B3  
**Objective:** B3.4

**Project I:** (work that needs to be done to achieve objective and goal) Capacity building for rangers.

**Description:** Workshops targeted for rangers: Regulations, species identification, educational materials, and species guides (according to new regulation) for:  
 Rangers, community, tourists, fisheries, integration of fishermen,

**Lead person:** NOAA, NIMPS, CRCP, DRNA, CFMC  
**Proposed partners:** LAB, DNER Fishery, FURA, Police  
**When (mm/yr) TO:**  
**Products or outputs:**  
 Workshops, educational materials, species guide.  
**Expected costs:** \$60,000  
**Propose funding Source:** NOAA, CRCP  
**Measures of Success:** Number of workshops offered, impacted staff.

**Worksheet: Collaborative Implementation Plan #17**

**Priority Area:** Culebra  
**Goal:** B3  
**Objective:** B3.4

**Project I:** (work that needs to be done to achieve objective and goal) Media campaign/ publicity aimed to highlight the natural resources of Culebra

**Description:** Educational materials, press, radio and TV, creation of advertising campaign (that includes a slogan) connections with coral reefs/Culebra, promotion materials, stickers, etc., Triathlon, Reef Jam

**Lead person:** Municipality, Management official, Tourism Company, DNER, FWS, and NOAA  
**Proposed partners:** Business, NGO's, hotels, touristic operations (SCUBA kayaks)  
**When (mm/yr) TO:**  
**Products or outputs:** Press releases, radio, TV, slogan that connects Culebra and corals, promotion materials.  
**Expected costs:** \$100K  
**Propose funding Source:** Municipality, Tourism Company, CRP  
**Measures of Success:**

**Worksheet: Collaborative Implementation Plan #16**

**Priority Area:** Culebra  
**Goal:** B3  
**Objective:** B3.4

**Project I:** (work that needs to be done to achieve objective and goal) Develop a formal collaboration agreement between DNER rangers and the police –FURA to strengthen enforcement of laws and regulations.

**Description:** Meetings with police  
 Develop a collaboration agreement between DNER and the Police superintendent. Organize training for police officials or integrate them in the rangers' trainings. Investigate de readiness to establish agreements with the municipal police of Culebra.

**Lead person:**  
**Proposed partners:** DNER, Municipal Police, Police, volunteers, universities.  
**When (mm/yr) TO:**  
**Products or outputs:**  
 Agreements, vigilance  
**Expected costs:**  
**Propose funding Source:**  
**Measures of Success:** Interventions, completion of cases and cases won in court.

**Worksheet: Collaborative Implementation Plan #18**

**Priority Area** (from Priority Setting Document) Culebra  
**Goal** (from Priority Setting Document) CI  
**Objective** (from Priority Setting Document) I.I

**Project I** (work that needs to be done to achieve objective and goal) To install navigations aids (target), to delineate shore safe access.

**Description:** Navigational aids will indicate the safe (only) acces to shore to eliminate / reduce impact to coral reef / sea grass bead

**Lead person:**  
**Proposed partners:** DRNA, USCG, USCO  
**When (mm/yr) TO:** 1 Year  
**Products or Outputs:** UV resistant material / structure  
**Expected Costs:** \$50k  
**Proposed Funding Source:** DRNA Navigational officers  
**Measures of Success:** Reduction / elimination on coral reef / sea grass impact, recovery- before / after



**Worksheet: Collaborative Implementation Plan #19**

**Priority Area** (from Priority Setting Document) Culebra Island  
**Goal** (from Priority Setting Document) C2: Enable and promote sustainable development practices in the coastal zone and upland areas of Puerto Rico that are associated with priority coral reef areas.  
**Objective** (from Priority Setting Document) C2.3: Support the effective management of existing protected areas (such as natural reserves, state forests, and national parks and wildlife refuges) within or adjacent to coastal areas, including the development and implementation of management plans

**Project 1** (work that needs to be done to achieve objective and goal) Low-tech propagation and restoration of star coral (*Montastraea annularis* and *M. faveolata*) populations depleted by mass post-bleaching mortalities

**Description:** Coral reefs at some Puerto Rican offshore islands such as Culebra and Mona have been significantly decimated by massive coral bleaching and post-bleaching mass mortalities. This has particularly impacted star coral (*Montastraea* spp.) populations. This project will be aimed at fostering the low-tech propagation and restoration of columnar star coral (*Montastraea annularis*) and laminar star coral (*M. faveolata*) populations depleted by mass post-bleaching mortality events within the Canal Luis Peña Natural Reserve (CLPNR), Culebra, and at Mona Island Natural Reserve (MINR) as a control site (without adjacent known pollution sources). Briefly, 200 replicate 1 cm<sup>2</sup> samples from remnant wild populations of each species will be collected at each island to develop a low-tech coral farming program aimed at producing small colonies of each species. Approximately, 50% of the harvested colonies will be replanted on natural *Montastraea* reef substrates after two years. The remaining 50% of the corals will be harvested to duplicate the coral farm size. Harvesting will be repeated after the fourth year. Survival and growth rates will be monitored at fixed time intervals during the project at each site. This should produce after the fourth year of the project 200 “coral recruits” and 400 corals at the farms. This project will also empower local volunteer stakeholders, as well as technical personnel from PRDNER, in low-tech coral farming methods.

**Lead person:** Edwin A. Hernández-Delgado, Ph.D. (UPR-CATEC)  
**Proposed partners:**  
 National Science Foundation  
 UPR-CATEC  
 Sociedad Ambiente Marino (Samuel Suleimán)  
 Bernard J. Rosado (CBP)  
 Coralatons (Mary Ann Lucking, Robert Kingsley)  
 Mona Aquatics  
 NOAA Restoration Center (Sean Griffin)  
 PRDNER (Officer Managers CLPNR, MINR)  
**When** (mm/yr) 10/2012 TO 09/2017  
**Products or Outputs:**  
 200 transplanted coral colonies  
 400 coral colonies in farms  
 Train volunteer and PRDNER personnel on coral farming and reef restoration methods  
**Expected Costs:** \$500,000/5 years (\$100,000/year)  
**Proposed Funding Source:** NOAA  
**Measures of Success:**  
 Number of colonies replanted to the reef.  
 Number of colonies maintained in coral farms.  
 Percent survival rates of harvested corals.  
 Coral skeletal growth rates.  
 Number of persons trained.

**Worksheet: Collaborative Implementation Plan #20**

**Priority Area** (from Priority Setting Document) Culebra Island  
**Goal** (from Priority Setting Document) C2: Enable and promote sustainable development practices in the coastal zone and upland areas of Puerto Rico that are associated with priority coral reef areas.  
**Objective** (from Priority Setting Document) C2.3: Support the effective management of existing protected areas (such as natural reserves, state forests, and national parks and wildlife refuges) within or adjacent to coastal areas, including the development and implementation of management plans

**Project 1** (work that needs to be done to achieve objective and goal) Artificial coral reefs and ecosystem-based approaches to enhance coral reef resilience within the Canal Luis Peña No-Take Natural Reserve, Culebra Island, PR

**Description:** Coral reef fish communities have been impacted by the long-term degradation trends of reef benthic communities in Culebra as a result of localized human stressors (i.e., fishing, water quality decline, sedimentation) and climate change-related impacts (i.e., massive bleaching, mass coral mortalities). These have negatively affected fish species richness, abundance and biomass. This project will be aimed at fostering an ecosystem-based approach to recover fish communities within the Canal Luis Peña No-Take Natural Reserve through the combined use of benthic and mid-water fish aggregating devices (FADs), coral farming and semi-artificial reefs. Briefly, benthic artificial reef units will be placed at two deep water (15-20 m) sites off Playa Carlos Rosario and off Bahía Tamarindo, and at two shallow water (5 m) sites off Punta Tamarindo Chico and Punta Melones. A total of three replicate units will be established per site. Each unit will also support five mid-water FADs, as well as a system of harvested Staghorn coral (*Acropora cervicornis*) mini-reefs to foster fish recruitment and provide additional juvenile fish shelter, and larval aggregation devices to foster fish and Caribbean Spiny lobster larval recruitment. In addition, they will support a system of lobster “casitas” to foster the establishment of lobster populations. Long-spine urchins (*Diadema antillarum*) will also be transplanted to the units to foster increased herbivory.

**Lead person:** Edwin A. Hernández-Delgado, Ph.D.  
**Proposed partners:**  
 National Science Foundation  
 UPR-CATEC, Bernard J. Rosado-Matías (CBP)  
 Sociedad Ambiente Marino (Samuel Suleimán)  
 Coralatons (Mary Ann Lucking, Robert Kingsley)  
 PRDNER (Officer Manager CLPNR)  
**When** (mm/yr) 10/2012 TO 09/2017  
**Products or Outputs:**  
 Fish and lobster spillover to adjacent coral reefs within and outside CLPNR.  
 Help restore adjacent overfishing reefs.  
 Provide new areas for recreational SCUBA diving And snorkeling  
**Expected Costs:** \$650,000/5 years (\$150,000/year 1; \$125,000/year x 4 years)  
**Proposed Funding Source:** NOAA  
**Measures of Success:**  
 Reef fish parameters (i.e., species richness, abundance, biomass, diversity) on experimental and adjacent control sites.  
 Fish and lobster recruitment rates.  
 Number of colonies maintained in coral farms.  
 Percent survival rates of harvested corals.  
 Coral skeletal growth rates.  
 Lobster abundance and biomass on experimental and adjacent sites.

## Worksheet: Collaborative Implementation Plan #21

**Priority Area** (from Priority Setting Document) Culebra Island

**Goal** (from Priority Setting Document)

C2: Enable and promote sustainable development practices in the coastal zone and upland areas of Puerto Rico that are associated with priority coral reef areas.

D1: Manage for climate change and diseases emanating from increase in storm frequency and impact, water temperature and air pollution and promote recovery of reefs from previous events.

**Objective** (from Priority Setting Document)

C2.3: Support the effective management of existing protected areas (such as natural reserves, state forests, and national parks and wildlife refuges) within or adjacent to coastal areas, including the development and implementation of management plans.

D1.1: Identify areas of high diversity and live coral coverage for additional protection and expand existing protected areas to include these areas. Close areas when bleaching and disease or hurricane damages are extensive to allow for the recovery of reef areas.

D1.4: Strengthen marine protected areas response capability when natural disasters occur.

**Project 1** (work that needs to be done to achieve objective and goal) Long-term ecological monitoring in support of management of the Culebra Island no-take MPA network

**Description:** Long-term ecological monitoring of coral reef benthic and fish communities within the Canal Luis Peña Natural Reserve (CLPNR) has existed since 1996, even three years before its designation in 1999. Monitoring data is critical to support the CLPNR management plan goals of enhancing fish communities, and conserving and restoring benthic communities. Further, two additional no-take natural reserves are being suggested in separate projects at Bahía Flamenco and Culebrita Island. Therefore, there will be a need to expand existing long-term monitoring efforts to include these sites. These sites used to be military training grounds, are all Federal-designated critical habitats of the endangered green turtle (*Chelonia mydas*), and of threatened Acroporid corals. Further, Culebrita Island, Península Flamenco and Cayo Luis Peña are also part of the Culebra National Wildlife Refuge managed by the U.S. Fish & Wildlife Service.

This project will be aimed at continuing the existing Coral Reef Long-Term Ecological Monitoring Program within the CLPNR at three sites within the reserve, and a control site outside. Also, a similar approach is proposed for each of the newly proposed reserves at Bahía Flamenco and Culebrita Island, with three replicate sites inside of each of the proposed reserves, and a control site outside. Data collected from 12 permanently photo-transects (4 per depth zone, 3 depth zones/site) will include benthic information such as coral species richness, colony abundance, coral recruit abundance, % cover of benthic components (i.e., scleractinian corals, hydrocorals, octocorals, macroalgae, algal turfs, crustose coralline algae, erect calcareous algae, *Halimeda* spp., cyanobacteria, sponges, zoanthids, other components), coral species diversity index and evenness. It will also provide the following information: densities of *Diadema antillarum*, damselfish, lobsters and lionfishes from permanent transect sites.

Fish monitoring data will include: species richness, total abundance, total biomass, species diversity index, evenness, as well as abundance and biomass data for each species, families, functional groups (i.e., herbivores – browsers, non-denuders, scrapers; carnivores – generalists, piscivores, planktivores; omnivores), and fishery target species.

We also propose to establish a Long-Term Seagrass Monitoring Program for each site, particularly, for CLPNR and Culebrita Island, where seagrasses are more prominent. This will include information regarding % seagrass and algal cover, seagrass shoot density, maximum leaf size, standing crop biomass, and conch densities.

Information will be maintained in a permanent database, geo-referenced, and GIS-based maps will be annually produced to facilitate interpretation of results. All of this information will be paramount to help DNER make sound management decisions regarding the conservation and restoration of marine resources within the natural reserve network.

**Lead person:** Edwin A. Hernández-Delgado, Ph.D. (UPR-CATEC)

**Proposed partners:**

National Science Foundation

Caribbean Coral Reefs Institute

Sociedad Ambiente Marino (Samuel Suleimán)

Bernard J. Rosado (CBP)

Coralations (Mary Ann Lucking, Robert Kingsley)

U.S. Fish & Wildlife Service

Culebra Conservation and Development Authority

PRDNER (Officer Manager CLPNR)

**When** (mm/yr) 10/2012 TO 09/2017

**Products or Outputs:**

Baseline documentation regarding the status of coral reef benthic and fish communities, and of seagrass communities.

Permanent geo-referenced database.

Annual GIS-based maps of all data.

Technical training of PRDNER personnel.

**Expected Costs:** \$625,000/5 years (\$125,000/year)

**Proposed Funding Source:** NOAA

**Measures of Success:**

Amount and quality of data obtained.

Management actions implemented by PRDNER

based on data produced by the Long-Term

Ecological Monitoring Program.

Number of persons trained.

## Worksheet: Collaborative Implementation Plan #22

**Priority Area** (from Priority Setting Document) Culebra Island

**Goal** (from Priority Setting Document)

A1. Implement land-use planning at the watershed scale to minimize water quality impacts to the coral reef ecosystem.

A2. Control and reduce pollutant transport to the marine environment.

B1. Protect coral reef ecosystems from large- and small-scale fisheries impacts through an informed planning process.

C2: Enable and promote sustainable development practices in the coastal zone and upland areas of Puerto Rico that are associated with priority coral reef areas.

D1: Manage for climate change and diseases emanating from increase in storm frequency and impact, water temperature and air pollution and promote recovery of reefs from previous events.

**Objective** (from Priority Setting Document)

A1.3a. Make sure the landowners have a management plan developed by Department of Natural and Environmental Resources (DNER) technicians under the Forest Stewardship Program. Make sure that incentive program is available to those who rent farmland. Ensure that owners are obligated to implement erosion control and buffer zone requirements on their land that they rent.

A1.4: Ensure that planning activities are at a watershed scale and loss of coastal habitats (wetlands, seagrass, coral reefs) that serve as filters to maintain water quality is avoided and minimized.

A2.4: Establish water quality monitoring stations in coral reef ecosystem areas and add water quality monitoring components to established coral monitoring sites around Puerto Rico. Establish standards in terms of what to monitor for and how to ensure comparability of data across locations. Use data regarding areas where water quality is an issue to enhance agency decision-making related to issuance of permits.

A2.5: Implement sediment reduction practices and stormwater management plans that take a holistic watershed approach, considering the interaction between upland actions and their impacts on the marine environment, including seagrass and mangroves.

B1.1: Identify, designate and implement a minimum of 3% of the insular platform as no-take marine reserves in compliance with Resolution Number 307 and prepare management plans in collaboration with communities as practicable for these reserves. The areas to be designated should be concerned with the protection of coral reefs ecosystems.

B1.3: Search for and identify management tools that could be applied to fisheries and related ecosystem protection and management in Puerto Rico.

B1.4: Reduce overfishing on critical stocks that most directly affect the health and resilience of the reef system by immediately implementing a closed season and catch limits of known spawning and aggregating species.

C2.3: Support the effective management of existing protected areas (such as natural reserves, state forests, and national parks and wildlife refuges) within or adjacent to coastal areas, including the development and implementation of management plans.

C2.new: Expansion of protected areas (land acquisition, preservation, additional protection and restoration), such as important watershed areas or buffer areas adjacent to protected areas.

D1.1: Identify areas of high diversity and live coral coverage for additional protection and expand existing protected areas to include these areas. Close areas when bleaching and disease or hurricane damages are extensive to allow for the recovery of reef areas.

D1.4: Strengthen marine protected areas response capability when natural disasters occur.

**Project 1** (work that needs to be done to achieve objective and goal) Community-based designation and management of the Bahía Flamenco no-take natural reserve

**Description:**

Bahía Flamenco, Culebra Island, has been considered to be one of the ten most important and beautiful recreational beaches of the world. It used to be part of a military training ground until 1978. Since then it became the most significant tourist attraction of Culebra Island. Fishing within reefs adjacent to the camping ground has been banned for a long time by the Culebra Conservation and Development Authority, but never enforced. More recently, private developers have caused extensive habitat fragmentation and deforestation across adjacent steep lands, creating dramatic recurrent impacts on adjacent fringing reefs by sediment-laden and nutrient-loaded runoff pulses after rainfall events. These reefs still support remnant populations of threatened Staghorn (*Acropora cervicornis*) and Elkhorn coral (*A. palmata*). However, they are showing significant signs of habitat decline during recent years due to a combination of factors that include recurrent impacts of turbid runoff pulses from adjacent deforested lands and coral mortality associated to recurrent climate-related impacts.

We propose the designation of a no-take natural reserve at least 1.6 km offshore from Bahía Flamenco, to the east up to approximately 0.5 km offshore Punta Flamenco, and to the west up to 0.6 km offshore the point located just west of Playa Blanca. Aimed at 1) conducting a series of workshops and focal group meetings with base communities and interested stakeholders in Culebra to identify the main issues, agree into the proposed dimensions and location of the no-take zone, develop the designation document, and establish a co-management board; 2) carry out a full biological characterization of the proposed natural reserve; 3) complete the designation document; 4) establish MPA demarcation buoys as well as a system of mooring buoys; 5) draft a management plan that will also include a management component of adjacent watersheds; 6) establish a marine zoning system; and 7) establish a baseline water quality monitoring program.

**Lead person:** UPR-CATEC

**Proposed partners:** Coralations; Asoc. Pescadores de Culebra, Water taxi and charter boat operators, Escuela Ecológica de Culebra, Sociedad Ambiente Marino, Bernard J. Rosado (CBP), Caribbean Coral Reefs Institute, Centro Interdisciplinario de Estudios del Litoral, UPR Sea Grant College Program, NOAA Restoration Center U.S. Fish & Wildlife Service, Culebra Conservation and Development Authority, PRDNER

**When** (mm/yr) 10/2012 TO 09/2017

**Products or Outputs:**

Community-based, consensus-based identification and suggestion of a new no-take natural reserve  
Full biological characterization of the proposed marine reserve (baseline for future management-oriented long-term ecological monitoring  
Designation document of the marine reserve  
Designation of a co-management board  
Development and implementation of a management plan  
Train and educate local stakeholders in MPA management strategies  
Develop a base model of MPA designation and participatory management that can be implemented in other locations in PR

**Expected Costs:** \$875,000/5 years (\$175,000/year)

**Proposed Funding Source:** NOAA

**Measures of Success:**

Designation of the no-take natural reserve.  
Engagement and participation of local stakeholders.  
Number of local stakeholders engaged in management.  
Production of solid baseline information about the status of natural resources within the MPA.  
Establish a model water quality monitoring program that will provide important information to enhance agency decision-making related to issuance of permits.



**Worksheet: Collaborative Implementation Plan #23**

Fill out a different Worksheet for each priority selected

**Priority Area** (from Priority Setting Document) Culebra Island

**Goal** (from Priority Setting Document)

C2: Enable and promote sustainable development practices in the coastal zone and upland areas of Puerto Rico that re associated with priority coral reef areas.

**Objective** (from Priority Setting Document)

C2.3: Support the effective management of existing protected areas (such as natural reserves, state forests, and national parks and wildlife refuges) within or adjacent to coastal areas, including the development and implementation of management plans

**Project 1** (work that needs to be done to achieve objective and goal) Coral reef ecosystem resilience enhancement through ecosystem-based landscape level restoration

**Description:** Shallow-water coral reef communities within the Canal Luis Peña No-Take Natural Reserve (CLPNR) have suffered a significant coral decline, reaching up to 80% live coral loss in some areas over the last 15 years. Benthic community decline has also resulted in the degradation of a significant portion of essential fish habitats. This project will be aimed at: 1) fostering the expansion of existing low-tech coral aquaculture activities within CLPNR to include eight coral species (Acropora cervicornis, A. palmata, Porites porites, P. divaricata, P. furcata, P. astreoides, Madracis mirabilis, Agaricia agaricites); 2) establish larval aggregation devices at coral farms to foster fish and lobster recruitment; 3) use harvested corals to experimentally restore a shallow-water coral reef patch to foster the enhancement of fish communities; 4) establish “casitas” to provide enhanced shelters for the common reef octopus and Spiny lobsters; 4) transplant Long spine urchins (Diadema antillarum) to locally increase herbivory levels and enhance recruitment habitats for grunts (Haemulidae); and 5) monitor changes in fish community structure. This approach will foster the recovery of shallow coral reef ecosystem resilience and functions through the implementation of low-tech coral farming and coral reef restoration efforts.

**Lead person:** DNER

**Proposed partners:**

Samuel E. Suleimán, M.A. (Sociedad Ambiente Marino)

National Science Foundation

Edwin A. Hernández-Delgado (UPR-CATEC)

Bernard J. Rosado-Matías (CBP)

Coralations (Mary Ann Lucking, Robert Kingsley)

PRDNER (Officer Manager CLPNR)

NOAA Coral Reef Restoration Center (Sean Griffin)

**When** (mm/yr) 10/2012 TO 09/2017

**Products or Outputs:**

Expansion of existing coral farming in support of CLPNR management plan

Enhanced coral reef fish communities

Enhanced Caribbean Spiny lobster populations

Potential spillover effects to adjacent reefs within and outside CLPNR

Training volunteer and PRDNER technical personnel

**Expected Costs:** \$650,000/5 years (\$150,000/year 1; \$125,000/year x 4 years)

**Proposed Funding Source:** NOAA

**Measures of Success:**

Number of colonies replanted to the reef.

Number of colonies maintained in coral farms.

Percent survival rates of harvested corals.

Coral skeletal growth rates.

Reef fish parameters (i.e., species richness, abundance, biomass, diversity) on experimental and adjacent control sites.

Fish and lobster recruitment rates.

Number of persons trained.

**Worksheet: Collaborative Implementation Plan #24**

Fill out a different Worksheet for each priority selected

**Priority Area** (from Priority Setting Document) Culebra Island

**Goal** (from Priority Setting Document)

B1. Protect coral reef ecosystems from large- and small-scale fisheries impacts through an informed planning process.

C2: Enable and promote sustainable development practices in the coastal zone and upland areas of Puerto Rico that are associated with priority coral reef areas.

D1: Manage for climate change and diseases emanating from increase in storm frequency and impact, water temperature and air pollution and promote recovery of reefs from previous events.

**Objective** (from Priority Setting Document)

B1.3: Search for and identify management tools that could be applied to fisheries and related ecosystem protection and management in Puerto Rico.

C2.3: Support the effective management of existing protected areas (such as natural reserves, state forests, and national parks and wildlife refuges) within or adjacent to coastal areas, including the development and implementation of management plans.

C2.new: Expansion of protected areas (land acquisition, preservation, additional protection and restoration), such as Important watershed areas or buffer areas adjacent to protected areas.

D1.1: Identify areas of high diversity and live coral coverage for additional protection and expand existing protected areas to include these areas. Close areas when bleaching and disease or hurricane damages are extensive to allow for the recovery of reef areas.

D1.4: Strengthen marine protected areas response capability when natural disasters occur.

**Project 1** (work that needs to be done to achieve objective and goal) The Culebra Marine Ecosystem Inventory: Identification of priority coral reef, seagrass and mangrove areas for conservation and restoration.

**Description:** This project will be aimed at producing a multi-disciplinary baseline characterization of: 1) shallow and deep water coral reef benthic (36 sites), 2) seagrass communities (12 sites); and 3) mangroves (12 sites) around the Culebra archipelago. Sampling will include corals, invertebrate, algal and fish communities. Characterizations will be conducted using a combination of methods including visual censuses, high-definition video transects, and specimen collections when necessary. Data will be used to diagnose the actual status of coastal and marine resources in Culebra with the objective of identifying priority areas for conservation, additional protection and restoration. This may include the future designation of additional marine protected areas and the development of specific management plans.

**Lead person:** DNER

**Proposed partners:**

National Science Foundation

UPR-CATEC

Bernard J. Rosado-Matías (CBP)

Sociedad Ambiente Marino

Consultores Educativos, Inc.

Coralations Water taxi operator

Culebra Conservation and Development Authority

PRDNER (Officer Manager CLPNR)

CFMC

**When** (mm/yr) 10/2012

TO 09/2014

**Products or Outputs:**

Multi-species baseline data bank from coral reef, seagrass and mangrove ecosystems.

Baseline assessment of Federal- and State-managed fishery resources (i.e., Goliath and Nassau groupers,

Rainbow and Midnight Parrotfish, Queen Conch)

Potential identification of spawning aggregation sites

Specific recommendations for conservation-oriented management actions

**Expected Costs:** \$600,000/3 years (\$200,000/year x 3 years)

**Proposed Funding Source:** NOAA

**Measures of Success:**

Creation of baseline database per site and per ecosystem type.

Fostering specific management actions.

Fostering the designation of future marine protected areas.

Identification of priority sites for long-term monitoring.

## Worksheet: Collaborative Implementation Plan #25

**Priority Area** (from Priority Setting Document) Culebra Island

**Goal** (from Priority Setting Document)

B1. Protect coral reef ecosystems from large- and small-scale fisheries impacts through an informed planning process.

C2: Enable and promote sustainable development practices in the coastal zone and upland areas of Puerto Rico that are associated with priority coral reef areas.

D1: Manage for climate change and diseases emanating from increase in storm frequency and impact, water temperature and air pollution and promote recovery of reefs from previous events.

**Objective** (from Priority Setting Document)

B1.1: Identify, designate and implement a minimum of 3% of the insular platform as no-take marine reserves in compliance with Resolution Number 307 and prepare management plans in collaboration with communities as practicable for these reserves. The areas to be designated should be concerned with the protection of coral reefs ecosystems.

B1.3: Search for and identify management tools that could be applied to fisheries and related ecosystem protection and management in Puerto Rico.

B1.4: Reduce overfishing on critical stocks that most directly affect the health and resilience of the reef system by immediately implementing a closed season and catch limits of known spawning and aggregating species.

C2.3: Support the effective management of existing protected areas (such as natural reserves, state forests, and national parks and wildlife refuges) within or adjacent to coastal areas, including the development and implementation of management plans.

C2.new: Expansion of protected areas (land acquisition, preservation, additional protection and restoration), such as Important watershed areas or buffer areas adjacent to protected areas.

D1.1: Identify areas of high diversity and live coral coverage for additional protection and expand existing protected areas to include these areas. Close areas when bleaching and disease or hurricane damages are extensive to allow for the recovery of reef areas.

D1.4: Strengthen marine protected areas response capability when natural disasters occur.

**Project 1** (work that needs to be done to achieve objective and goal) Community-based designation and management of the Culebrita Island no-take natural reserve

**Description:** Culebrita Island and Arrecifes Los Corchos, located east of Culebra Island, support the most significantly developed and unblemished mid-shelf coral reef ecosystems of the entire eastern Puerto Rican shelf. They also support the largest known continuous stands of threatened Staghorn coral (*Acropora cervicornis*) in Puerto Rico, as well as relatively abundant colonies of threatened Elkhorn coral (*A. palmata*).

We propose the designation of a no-take natural reserve at least 1 km around Culebrita Island and at an area of Arrecife Los Corchos extending for approximately 1.6 x 1.6 km south of Culebrita Island. This proposed project will be aimed at 1) conducting a series of workshops and focal group meetings with base communities and interested stakeholders in Culebra to identify the main issues, agree into the proposed dimensions and location of the no-take zone, develop the designation document, and establish a co-management board; 2) carry out a full biological characterization of the proposed natural reserve; 3) complete the designation document; 4) establish MPA demarcation buoys as well as a system of mooring buoys; 5) draft a management plan; and 6) establish a marine zoning system.

**Lead person:** DNER

**Proposed partners:**

UPR-CATEC), Coralations, Asociación de Pescadores de la Isla de Culebra

Water taxi and charter boat operators, Escuela Ecológica de Culebra Sociedad Ambiente Marino (Samuel Suleimán)

Bernard J. Rosado (CBP), Caribbean Coral Reefs Institute

Centro Interdisciplinario de Estudios del Litoral

UPR Sea Grant, NOAA Restoration Center, U.S. Fish & Wildlife Service

Culebra Conservation and Development Authority

**When** (mm/yr) 10/2012 TO 09/2017

**Products or Outputs:**

Community-based, consensus-based identification and suggestion of a new no-take natural reserve

Full biological characterization of the proposed marine reserve (baseline for future management-oriented long-term ecological monitoring)

Designation document of the marine reserve

Designation of a co-management board

Development and implementation of a management plan

Train and educate local stakeholders in MPA management strategies

**Expected Costs:** \$750,000/5 years (\$150,000/year)

**Proposed Funding Source:** NOAA

**Measures of Success:**

Designation of the no-take natural reserve.

Engagement and participation of local stakeholders.

Number of local stakeholders engaged in management.

Production of solid baseline information about the status of natural resources within the MPA.

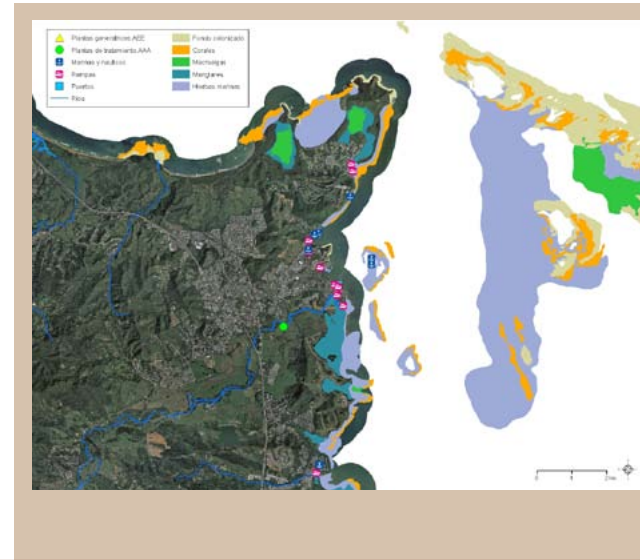
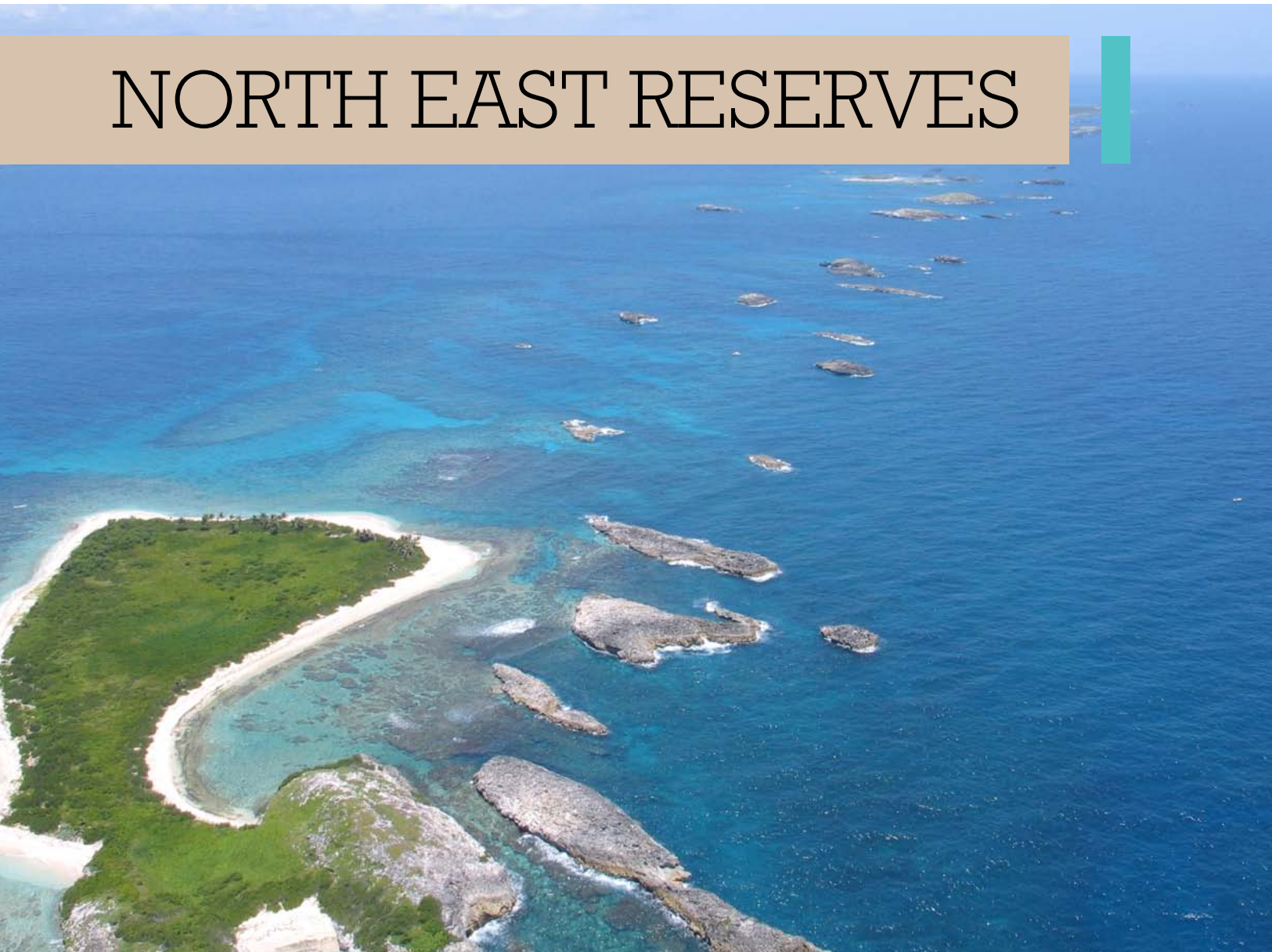
## CULEBRA LAS WORKSHOP ATTENDANCE

Name	Agency/Organization	Email
1. Lisamarie Carrubba	NOAA Fisheries	lisamarie.carrubba@noaa.gov
2. Humberto Figueroa	DRNA	humbertoabx@yahoo.com
3. Raimundo Espinoza	TNC	respinoza@tnac.org
4. Nilda M. Jiménez	DRNA	njimenez@drna.gobierno.pr
5. Rose A. Ortiz	JP	
6. Aileen T. Velazco	DRNA	avelazco@drna.gobierno.pr
7. Damaris Delgado	DRNA	ddelgado@drna.gobierno.pr
8. Damaris Torres Pulliza	Free Lance	Damaris@sinoptica.com
9. Jeiger Medina Muñoz	UPR- RP	Jeiger.medina@gmail.com
10. Mary Ann Lucking	CORALations	maryann@coralations.org
11. Antares Ramos	NOAA /NOS	Antares.ramos@noaa.gov
12. Edwin A. Hernández	CCRI; UPR/ CATEC	coral_giac@yahoo.com
13. Bernard J. Rosado	UPR/CATEC	bjrosado@hotmail.com
14. Misael Feliciano	DRNA/Vigilante	Misael-feliciano@hotmail.com
15. Carlos J. Carrión	DE Escuela Antonio R. Barceló	carrion-carlos@yahoo.com
16. Miriam Navarro	ACDEC	secretariardec@gmail.com
17. Joselyn Polanco	ACDEC	imonell@prtc.net
18. Paul Franklin	Residente Culebra	prwfranklin@gmail.com
19. Sylvia V. Nieves	Unidad Comunitaria por Culebra	svnieves@yahoo.com
20. Ana M. Román	USFWS	ana_roman@fws.gov
21. Miguel A. García	DRNA	magarcia@drna.gobierno.pr
22. Ernesto L. Díaz	DRNA	ediaz@drna.gobierno.pr
23. Alida Ortiz	UMET	alortiz@suagm.edu
24. Pedro A. de León	UMET	pedrotulus@yahoo.com



# Puerto Rico's Coral Reef Local Action Strategies (LAS)

## NORTH EAST RESERVES



### PROCESS FOR SELECTING LAS

A two-day LAS Workshop was held in Fajardo, on August 31-September 1, 2011 for stakeholders in the priority area of the North East Reserves. This area includes: the Cordillera Reef Marine Reserve, Las Cabezas de San Juan Reserve, Seven Seas National Park ( a public bathing beach or balneario), the Seven Seas Natural Reserve and the newly designated North East Ecological Corridor. Thirty-one people, representing municipal, state and federal agencies, tourism service providers, scientists and local community members, attended the Workshop. See Appendix \_ for Attendance Sheet. The group identified the following issues as areas of concern for the conservation of the coral reefs in the priority area of the North East Reserves:

- Impacts of recreational activities.
- Negative impacts of navigation of recreational boats and other recreation and tourism activities on coral reef areas.
- Need for community participation.
- Need of effective outreach and education activities for different stakeholders.
- Training and capacity building needs of recreational service providers
- Water quality control for coral reefs.
- Erosion with the consequence of sediment transport to the coral reef.
- Absence of management and enforcement to control human activities around coral reefs.

### GOALS, OBJECTIVES AND PROJECTS

The North East Reserve LAS Workshop participants identified a total of 28 projects. Eleven of these are applicable to all four-priority areas, and 17 are pertinent for the North East Reserves priority area exclusively. Full Worksheets for these projects are found at the end of this section.

**GOAL I (GOAL A1). Implement land-use planning at the watershed scale to minimize water quality impacts to the coral reef ecosystem.**

**Objective I (A1.2):** Develop stricter regulations and enhance enforcement capabilities for agricultural and development activities to ensure that best management practices that reduce sediment, nutrient,

fecal coliform and pesticide transport be implemented and erosion, including channel protection, be mitigated.



### LAS Projects:

1. NE Reserves land-use and marine habitat baseline mapping.
2. Alliance between state and federal agencies for the effective application of laws and regulations. (2 phases: Organization and Implementation).
3. Water quality monitoring and inspection of septic and sewer systems at the Watershed scale. Design of onsite treatment alternative using appropriate technologies as well as recommendation of measures to repair and maintain sewer systems in collaboration with State and federal agencies.

**Objective 2 (A1.4):** Ensure that planning activities are at a watershed scale and loss of coastal habitats (wetlands, seagrass) that serve as filters to maintain water quality is avoided and minimized.

### LAS Projects:

4. Assessment and simulation of land-use effects and BMP practices on water quality in the reef watersheds within the NE Reserves.
5. Development and implementation of BMPs programs and technology available for land development and agricultural activities. **All areas.**

## GOAL 2 (GOAL C1). Manage the recreational and maritime uses of marine and coastal areas to reduce the impacts on coral reefs.

**Objective 5 (B1.1):** Identify, designate and implement, within the Northeast Reserves a minimum of 3% of the insular platform as no-take marine reserves in compliance with Resolution Number 307 and prepare management plans in collaboration with communities as practicable for these reserves. The areas to be designated should be concerned with the protection of coral reefs ecosystems.

### LAS Projects:

9. Administrative order for the creation of a no-take zone around (1.6km) Cayo Lobos, Blanquilla and Cayo Diablo in the Cordillera Reef Reserve.

**Objective 6 (B1.3):** Search for and identify management tools that could be applied to coral reefs related ecosystem protection and management in Puerto Rico.

### LAS Projects:

10. Determine carrying capacity/limits of acceptable change of the heavily used areas, such as Cayo Icacos. **All areas.**

**Objective 3 (A1.6):** Promote and implement erosion and sediment reduction practices as well as stormwater management plans with a holistic watershed approach, considering the interaction between upland actions and their impacts on the marine environment, including seagrass and mangroves.

**Objective 4 (A2.3):** Promote the development of measurable standards that create allowable levels of nutrient and fecal loading to inland and coastal water bodies. This should build from the current EQB initiative to write standards for contaminant loading to inland water bodies by extending the standard to coastal areas. Improve aquatic life criteria based on data for Puerto Rico, where possible, to make marine and coastal water quality standards appropriate for marine organisms.

### LAS Projects:

6. Evaluate water quality standards for the protection of coral reefs and marine life in other jurisdictions for possible adoption in Puerto Rico.
7. Reduction of waste water discharges to rivers and coastal waters.
8. Fine scale GIS-based mapping of  $\delta^{15}N$  isotopic signals for management of eutrophication impacts across the North East Reserves.

11. Designation of coral reef recovery areas to support reef ecosystem rehabilitation. **All areas.**

**Objective 7 (C1.1):** Reduce the impact of vessel anchoring and boat grounding on seagrass beds and coral reefs and enable efficient enforcement by:

- a. Establishing vessel use zones.
- b. Installing navigation and mooring buoys that demarcate different use zones.
- c. Rerouting large vessel traffic to avoid sensitive coral areas, if navigation aids are not effective and/or if there are repetitive groundings.
- d. Establishing no-anchor zones.
- e. Developing outreach programs for recreational, commercial and maritime operators to encourage compliance with coral reef regulations and to use best management practices in their operations.

### LAS Projects:

12. Develop signage for Ensenada Yegua.
13. Zoning area of Cordillera Reef Natural Reserve according to uses.
14. Mass media campaign/social marketing to promote adequate conduct for the protection of the natural resources of the North East. **All areas.**

**Objective 8 (C1.2):** Identify specific areas for recreational use. Should focus on already impacted reefs and artificial reef sites so as to preserve and limit activities on higher quality reef ecosystems.

### LAS Projects:

15. Habilitate public sanitary facilities and other services for visitors use in Cayo Icacos, Reserva Natural de La Cordillera, Fajardo

**Objective 9 (C1.3):** Develop outreach programs for recreational operators as well as commercial and maritime operators to encourage compliance with

## GOAL 3: (GOAL D1). Promote recovery of coral reefs from natural stressors, including atmospheric phenomena and invasive species.

**Objective 11 (D1.2):** Support more research on coral diseases and on the relationship of bleaching to disease; support more research on coral resistance to bleaching/disease and resilience following global, regional and local stressors and on possible effects of climate change on coral reefs and other ecosystems.

**Objective 12 (D1.4):** Strengthen marine protected areas response capability when natural disasters occur.

## GOAL 4 (GOAL C2). Enable and promote sustainable development practices in the coastal zone and upland areas of Puerto Rico, through management strategies and education, associated with priority coral reef areas.

**Objective 14 (C2.1):** Develop a land-use plan for Puerto Rico that includes the Puerto Rico Coastal Zone as defined by the PR Coastal Zone Management Program (PRCZMP) (including territorial waters) and identifies zones for different uses including conservation, recreation and different types of development. The plan should address issues of light pollution, listed species and habitat protection.

**Objective 15 (C2.2):** Acquire, preserve, restore and protect coastal and upland areas associated with priority coral reef areas such as important watershed areas or buffer areas adjacent to protected areas.

coral reef regulations and to use best management practices in their operations.

### LAS Projects:

16. Build a public information and education center for the Northeast Reserves at Las Croabas, Fajardo.
17. Develop two video-based coral reef etiquette messages – one for SCUBA divers and one for snorkelers. The videos will emphasize proper behavior for divers and snorkelers visiting coral reefs in Puerto Rico. **All areas.**
18. Create fish identification cards that also contain reef etiquette messages for divers and snorkelers to take into the water while around the reef. **All areas.**

**Objective 10 (C1.5):** Prepare and implement a coordinated approach that describes how to respond to physical impacts (vessel groundings, anchor damage, storm damage, etc.) so all the pertinent laws and regulations can be properly enforced.

**Objective 13 (C3.2):** Teach people about invasive and exotic species, how they affect coastal and marine ecosystems and how they can help with the problem.

### LAS Projects:

19. Inventory of invasive, exotics and native fish species for the promotion of BMPs and education.

### LAS Projects:

20. The North East Reserves Marine Ecosystem Inventory: Identification of priority coral reef, seagrass and mangrove areas for conservation, protection and restoration.

**Objective 16 (C2.3):** Support the effective management of existing protected areas (such as natural reserves, state forests, and national park and wildlife refuges) within or adjacent to priority coastal areas', including the development and implementation of management plans.



**LAS Projects:**

21. Development the management plans for the Natural Reserve of the North East Ecological Corridor, and other North East Natural Protected Areas and creation of advisory board for them. **All areas.**
22. Coral reef ecosystem resilience enancement through ecosystem-based landscape level restoration.

23. Artificial coral reefs and ecosystem-based approaches to enhance coral reef resilience within the North East Reserves.

**Objective 17 (C2.6):** Restore degraded coastal natural areas, particularly mangrove habitat, coastal wetlands and estuaries.

**Objective 25 (B3.5):** Enable joint management agreements between local, national and federal agencies and other entities (NGOs, academia,

communities and business) to improve efficiency of operations

**GOAL 5 (GOAL A3). Strengthen enforcement and engage stakeholders through education to reduce pollutant transport to the coral reef ecosystem.**

**Objective 18 (A3.1):** Reduce erosion from any earth movement activities (e.g., development, home expansion, agriculture) through a mix of education and enforcement.

**Objective 19 (A3.2):** Improve the efficiency of the implementation of the regulations related to the control of erosion and sedimentation and stormwater runoff at the commonwealth and federal levels.

**Objective 20 (A3.3):** Ensure that mitigation plans are properly implemented and that the project has not resulted in the loss of habitat and take necessary enforcement action for noncompliance with mitigation plans. Coordinate between EPA, Corps of Engineers (COE), EQB, etc., to ensure enforcement is geared toward protecting habitat and less toward issuing fines.

**Objective 21 (A3.4):** Create certification program for developers, contractors, agricultural operators and consultants certifying that they have been trained in best management practices for different land uses appropriate to their activities.

**LAS Projects:**

24. Certification on management, protection and

enforcement of laws and regulations related to coral reef conservation for different users. **All areas.**

25. Certification course for compliance with CEST Plan. **All areas.**

**Objective 22 (A3.5):** Provide all law enforcement officials (rangers, lawyers and judges) with educational opportunities to increase their effectiveness and efficiency at implementing conservation and resource management regulations.

**LAS Projects:**

26. Capacity building for DNER Rangers on coral reefs and other marine ecosystems, and related laws and regulations. **All areas.**
27. Capacity building for lawyers & judges on coral reefs and other marine ecosystems, and related laws and regulations. **All areas.**

**Objective 23 (A3.6):** Provide education and outreach to the judicial system, including legal departments, lawyers and judges, so they can effectively prosecute noncompliance cases.

**GOAL 6 (GOAL B3). Utilize enforcement and education to encourage public compliance with fishing regulations and reduce impacts of fishing.**

**Objective 24 (B3.1):** Create an outreach and educational campaign to reduce fishing, recreational and maritime impacts over coral reef ecosystems aimed at the following:

- a. Recreational fishing community.
- b. Commercial fishing community.

c. The judicial system.

**LAS Projects:**

28. Training program for DNER Rangers on coral reef conservation strategies, applicable laws and regulations.
29. Educational videos on coral reef conservation for the Vieques-Fajardo-Culebra ferries.



## Worksheet: Collaborative Implementation Plan #1

**Priority Area:** (from Priority Setting Document) Northeast Reserves

**Goal:** (from Priority Setting Document)

A1. Implement land-use planning at the watershed scale to minimize water quality impacts to the coral reef ecosystem

A3. Strengthen enforcement and engage stakeholders through education to reduce pollutant transport to the coral reef ecosystem

**Objective:** (from Priority Setting Document) A1.1, A1.2, A3.5

**Project :I** (work that needs to be done to achieve objective and goal) NE Reserves land-use and marine habitat baseline mapping

### Description:

This project is to generate a baseline database for the NE Reserves that is up-to-date and complete to provide managers, scientists, and the community with basic yet fundamental information to identify and prioritize human impacts to the marine environment, to include:

1. A detailed baseline map of current land-use and land-cover activities in the NE Reserves (i.e. residential, commercial, agricultural, vegetation cover, etc.)
2. An updated baseline map showing the spatial distribution and general characteristics of coral reef habitats at community and reef geomorphology level.
3. Detailed groundtruth assessment and characterization of inland and marine spatially distributed sites to serve as control data to access the accuracy of maps 1 & 2. Each marine surveyed site should include percent cover of coral communities (e.g. stony-soft coral, algae, substrate type, seagrass, etc.).
4. Generate a complete and comprehensive data library integrating all pertinent archived documentation that could assist understand the historical trends in land use, climate changes, and erosion-sedimentation patterns as well as documents relevant to NE Reserves' marine resources (i.e. maps, aerial photographs, demographic data, scientific reports and data, etc.)

Remote sensing and GIS tools and techniques, along with complimentary groundtruth field data are to be employed to generate these NE Reserves critical baseline maps.

The baseline maps should be derived from the most current and quality controlled datasets (i.e. aerial photography 2007-2010, 2011?) at a high spatial resolution (~5-10m) to meet today's conservation and management objectives, to include all shallow water ( up to 30m depending on water turbidity) coral reefs sites.

### Lead person:

D.Torres-Pulliza, MSc. (Sinoptica) & Fernando Gilbes (UPRM)

### Proposed partners:

Edwin A. Hernández-Delgado, PhD (UPR-CATEC)

Carlos E Ramos-Scharrón, PhD (IRF & UT)

NOAA CCMA, Sociedad Ambiente Marino, Junta de Planificación de Puerto Rico,

Servicio de Extensión Agrícola, NASA

**When FROM** (03/2012) **TO** (06/2014)

### Products or Outputs:

- Digital raster and vector land-use/benthic-habitats GIS layers
- Groundtruth coral reefs surveys database
- Digital archive of available relevant documents (maps, imagery, reports, papers, etc.)
- Report on the methods and outputs
- Workshop with relevant personnel, researchers, and general public to disseminate the data and help understand the multiple applications of the output products
- Baseline data to support create a realistic valuation of the natural resources contributions to the region's economy

**Expected Costs:** \$90,000 – 110,000 / yr

### Proposed Funding Source:

NOAA, NASA, TNC, DNER, NFWF

### Measures of Success:

- Availability of these updated high resolution baseline land-use and benthic habitats maps as hard and soft datasets
- Number of external projects that benefits from these datasets as it supports their different governmental, management and scientific marine spatial planning efforts.



## Worksheet: Collaborative Implementation Plan #2

**Priority Area:** (from Priority Setting Document) Northeast Reserves

**Goal:** (from Priority Setting Document) GOAL 2 (GOAL C1). Manage the recreational and maritime uses of marine and coastal areas to reduce the impacts on coral reefs.

**Objective:** (from Priority Setting Document) C1.5: C1.5: Prepare and implement a coordinated approach that describes how to respond to physical impacts (vessel groundings, anchor damage, storm damage, etc.) so all the pertinent laws and regulations can be properly enforced.

**Project I** (work that needs to be done to achieve objective and goal) Develop formal collaboration agreements between agencies and community to strengthen the established procedures.

### Description:

Meetings between these groups: DNER, Marina Police, NOAA, Coast Guard, FURA, FWS, commercial vessels, fishermen, Tourism Company etc.

Organize trainings to disseminate the agreements and the procedures that should be used to respond to physical impacts.

Establish monitoring mechanisms to establish the scope of the educational efforts.

**Lead person:** DRNA, NOAA,

**Proposed partners:** Coast Guard, Municipality, Management official, Tourism Company, DNER, FWS, NOAA, Commercial vessels, Marinas, Hotels

**When** (mm/yr) 10/2012 TO 09/2017

**Products or Outputs:** Agreements, strategies, educational material, measurement mechanisms

**Expected Costs:**

**Proposed Funding Source:** NOAA, Municipality, Tourism Company

**Measures of Success:**

## Worksheet: Collaborative Implementation Plan #3

**Priority Area:** (from Priority Setting Document) Northeast Reserves

Issue Area A. Improve water quality and related reef systems by reducing pollutant inputs from terrestrial sources.

**Goal:** (from Priority Setting Document) A1. Implement land-use planning at the watershed scale to minimize water quality impacts to the coral reef ecosystem.

**Objective:** (from Priority Setting Document) A2.8 Develop and implement new regulations and practices for onsite sewage disposal systems (OSDS) standards that ensure these systems are built, installed and maintained according to known best practices. Single-family units are currently not regulated under OSDS and should be included. Leverage the collaborative Watershed Stewardship Program, which provides resources and expertise to upgrade household septic systems so they adhere to known best practices, to expand it throughout the island if the pilot project is successful.

**Project I:** (work that needs to be done to achieve objective and goal) Water quality monitoring and inspection of septic and sewer systems at the Watershed scale. Design of onsite treatment alternative using appropriate technologies as well as recommendation of measures to repair and maintain sewer systems in collaboration with State and federal agencies.

### Description:

Wastes kept in poorly maintained septic tanks can leak into surrounding ground water, eventually seeping out to the reefs. Poorly constructed tanks can overflow during intense rainfall events or directly discharge improperly treated wastewater into surface water bodies. The tasks included in proposed project are to:

1. Sample surface water bodies in the Fajardo watershed for bacterial indicator density analyses, to identify "hot spots" of microbial pollution from both septic and sewer systems.
2. Evaluate areas with faulty septic or sewer systems to identify intervention priority communities based on loading factors and cost effectiveness.
3. Identify best practices and repair and maintenance measures applicable to the control of fecal pollution from problematic septic systems and faulty sewers.
4. Design a treatment system using appropriate technology to control fecal pollution from priority area that could serve as a model for other communities in the watershed. This design should consider multiple family onsite treatment systems as possible alternatives.
5. Coordinate efforts with State and Federal agencies to recommend specific repair and maintenance measures to control fecal pollution from faulty sewers.

**Lead person:** DNER

**Proposed partners:** José Norat, UPR, Medical Sciences Campus, Department of Environmental Health Private Environmental Engineering Consultants

**When** (mm/yr) October 2012 TO September 2014

**Products or Outputs:**

- Identification of communities and areas with high levels of fecal pollution from septic and sewer systems at the watershed scale
- Design of onsite treatment system for problematic community and recommendation of measures for faulty sewers

**Expected Costs:** \$250,000 per year for two years

**Proposed Funding Source:** NOAA Coral Reef Protection Program

**Measures of Success:** Repair priority – identifying "hot spot" of fecal pollution sources within watershed based on monitoring and modeling Repair design – develop engineering design plan for on-site treatment system applicable to "hot spot" within watershed using appropriate technology and recommend measures for faulty sewers with government collaboration.

## Worksheet: Collaborative Implementation Plan #4

**Priority Area:** (from Priority Setting Document) Northeast Reserves

**Goal:** (from Priority Setting Document)

A2. Control and reduce pollutant transport to the marine environment

**Objective:** (from Priority Setting Document) A2 (3, 4, 5 or 11)

**Project I:** (work that needs to be done to achieve objective and goal) Assessment and simulation of land-use effects and BMP practices on water quality in the reef watersheds within the NE Reserves.

### Description:

Use robust modeling tools and spatial data integration to target and better manage nutrients and sediments loads from in-land sources discharging to the reef system. This, to provide a scientifically defensible basis that link multidisciplinary spatial data analyses with decision making in order to propose suitable watershed BMPs to minimize further damage and help in the long-term recovery of coral reef habitats.

First, watershed scale hydrological models (i.e. SWAT) will be applied to each of the watersheds (e.g. seven) that drain into the NE reserves to:

- Measure daily loads (i.e. sediments, nutrients)
- Allocate sources

Second, modeling techniques will be aimed to dynamically simulate alternate management scenarios and conservation practices base on current and projected land-use trends, also considering climate change, within relevant watersheds until 2050. The modeling framework allows evaluating the effectiveness (i.e. reduced erosion and sediment/nutrients yields) of a suite of watershed BMP practices, by simulation, without having to wait years to see the outcomes of a decision in the field. As the most sensitive sources (i.e. sediment, nutrients) are identified, it is possible to simulate and depict the management scenario that achieves the water quality standards suited to NE reserves coral reefs ecosystems. Remote sensing, GIS and well documented modeling techniques will be employed to derive and scrutinize the necessary spatial data sets. Two monitoring gage stations will be established at different stream sites as further calibration of the model and to support future water quality assessments.

### Lead person:

C. Ramos-Scharrón, PhD (Island Resources Foundation & Univ. of Texas-Austin) & D. Torres-Pulliza (Sinoptica)

**Proposed partners:**

J. Amador, PE (Greg L Morris Engineering)  
P. Sturm (Ridge to Reefs)  
E. Díaz (DNER)  
S. Griffin (NOAA)

**When** (mm/yr) 03/2012 TO 06/2014

**Products or Outputs:**

- A calibrated and validated physical model
- A suite of vector and raster GIS layers
- Identification of sensible in-land sources of pollution
- Estimations of daily sediments and nutrients yields per watershed to reef waters
- A report presenting model results on BMP simulations until 2050 and the potential implications of various management practices to water quality

**Expected Costs:** \$110K/yr for 2 years (\$220K)

**Proposed Funding Source:** NOAA-Coral Reef Program; DNER; US Fish & Wildlife; NFWF

**Measures of Success:**

- The use of the calibrated model in further watershed scale analyses
- Support the setting of management targets within the reef watersheds
- The integration of robust modeling results into EBM decision making

## Worksheet: Collaborative Implementation Plan # 5

**Priority Area:** (from Priority Setting Document) Northeast Reserves

**Goal:** (from Priority Setting Document) A1

**Objective:** (from Priority Setting Document) A1.6

**Project I** (work that needs to be done to achieve objective and goal) Development and implementation of BMP programs and available technologies in land development and agricultural activities.

### Description:

1. Education or outreach component. Certification program for staff that implement CES plans and heavy machinery operators.
2. Technical assistance program (manuals, brochure, etc.)
3. Compliance incentives, partial reimbursement of filing costs, taxes, etc.
4. Enforcement, fines to regulation violators

**Lead person:** EQB

**Proposed partners:** DNER

**When** (mm/yr) 12/2011 TO 9/2016

**Products or Outputs:** Reduce sedimentation in water bodies

**Expected Costs:** \$100,000

**Proposed Funding Source:** NOAA/OGPE (REFUNDS)

**Measures of Success:** Technical certification of the implemented practices vs. non compliance

## Worksheet: Collaborative Implementation Plan #6

**Priority Area:** Northeast Reserves  
**Goal:** A1  
**Objective:** A2.3

**Project 1:** Evaluation of existing water quality standards for the protection of the corals and marine organisms in other jurisdictions for possible adoption in PR.

### Description:

1. More successful tests have been the water quality standards for coral reef and marine habitat protection in those jurisdictions.
2. Give priority to examine established standards in the Caribbean as a zone.

**Lead person:** EQB

**Proposed partners:** EPA

**When (mm/yr)** 12/11 TO: 12/12

**Products or outputs:**

Reports making the recommendation of adapting water quality standards adequately.

**Expected costs:** \$200K

**Proposed funding Source:** EPA

**Measures of Success:**

To find implementation of the water quality standard approved by de EQB and EPA

## Worksheet: Collaborative Implementation Plan #7

**Priority Area:** Northeast Reserves  
**Goal:** A1  
**Objective:** A2.3

**Project 1:** Reduction of waste water discharges into water bodies

### Description:

Phase 1- With the help of the municipalities, identify those communities that have problems with waste water discharge. Use GPS and information systems for their localization.

Phase 2- In coordination with the EQB and EPA; require the PRASA to do a work plan to address this problem. Establish short and long term goals. The plan should have a defined timeline for its implementation.

Phase 3- Establish a monitoring plan in areas of more impact and in the mouth of rivers and streams.

**Lead person:** DRNA

**Proposed partners:** EQB, EPA, Municipality, PRASA

**When (mm/yr)** TO:

**Products or outputs:**

**Expected costs:**

**Proposed funding Source:**

**Measures of Success:**

## Worksheet: Collaborative Implementation Plan #8

**Priority Area:** Northeast Reserves  
**Goal (from Priority Setting Document)**  
 A1. Implement land-use planning at the watershed scale to minimize water quality impacts to the coral reef ecosystem  
 A3. Strengthen enforcement and engage stakeholders through education to reduce pollutant transport to the coral reef ecosystem  
**Objective (from Priority Setting Document)** A1.1,A1.2,A3.5

**Project 1 (work that needs to be done to achieve objective and goal)** NE Reserves land-use and marine habitat baseline mapping

### Description:

This project is to generate a baseline database for the NE Reserves that is up-to-date and complete to provide managers, scientists, and the community with basic yet fundamental information to identify and prioritize human impacts to the marine environment, to include:

1. A detailed baseline map of current land-use and land-cover activities in the NE Reserves (i.e. residential, commercial, agricultural, vegetation cover, etc.)
2. An updated baseline map showing the spatial distribution and general characteristics of coral reef habitats at community and reef geomorphology level.
3. Detailed groundtruth assessment and characterization of inland and marine spatially distributed sites to serve as control data to access the accuracy of maps 1 & 2. Each marine surveyed site should include percent cover of coral communities (e.g. stony-soft coral, algae, substrate type, seagrass, etc.).
4. Generate a complete and comprehensive data library integrating all pertinent archived documentation that could assist understand the historical trends in land use, climate changes, and erosion-sedimentation patterns as well as documents relevant to NE Reserves' marine resources (i.e. maps, aerial photographs, demographic data, scientific reports and data, etc.)

Remote sensing and GIS tools and techniques, along with complimentary groundtruth field data are to be employed to generate these NE Reserves critical baseline maps.

The baseline maps should be derived from the most current and quality controlled datasets (i.e. aerial photography 2007-2010, 2011?) at a high spatial resolution (~5-10m) to meet today's conservation and management objectives, to include all shallow water ( up to 30m depending on water turbidity) coral reefs sites.

**Lead person:**

D.Torres-Pulliza, MSc. (Sinoptica) & Fernando Gilbes (UPRM)

**Proposed partners:**

Edwin A. Hernández-Delgado, PhD (UPR-CATEC)  
 Carlos E Ramos-Scharrón, PhD (IRF & UT)  
 NOAA CCMA, Sociedad Ambiente Marino, Junta de Planificación de Puerto Rico,  
 Servicio de Extension Agricola, NASA

**When FROM (03/2012)** TO (06/2014)

**Products or Outputs:**

- Digital raster and vector land-use/benthic-habitats GIS layers
- Groundtruth coral reefs surveys database
- Digital archive of available relevant documents (maps, imagery, reports, papers, etc.)
- Report on the methods and outputs
- Workshop with relevant personnel, researchers, and general public to disseminate the data and help understand the multiple applications of the output products
- Baseline data to support create a realistic valuation of the natural resources contributions to the region's economy

**Expected Costs:** \$90,000 – 110,000 / yr

**Proposed Funding Source:**

NOAA, NASA, TNC, DNER, NFWF

**Measures of Success:**

- Availability of these updated high resolution baseline land-use and benthic habitats maps as hard and soft datasets
- Number of external projects that benefits from these datasets as it supports their different governmental, management and scientific marine spatial planning efforts



## Worksheet: Collaborative Implementation Plan #9

**Priority Area:** Northeast Reserves

**Goal:** Goal 2 (GOAL C1). Manage the recreational and maritime uses of marine and coastal areas to reduce the impacts on coral reefs.

**Objective:** B1.1: Identify, designate and implement a minimum of 3% of the insular platform as no-take marine reserves in compliance with Resolution Number 307 and prepare management plans in collaboration with communities as practicable for these reserves. The areas to be designated should be concerned with the protection of coral reefs ecosystems.

**Project 1:** Administrative order for the creation of a no capture area in adjacent areas (1.6Km) of the Lobos, Blanquilla and Diablo keys.

### Description:

- Establish a no capture Administrative Order for commercial and recreational fishing in areas where the coral reef population has been proved to have more resilience against bleaching, therefore having more recovery potential.
- Installation of demarcation buoys in the no capture zones, at least four (4) by key.
- Implement educational actions to notify the establishment of the no capture zones such as workshops (10), outreach materials, posters in marinas, fisheries and restaurants, etc.
- Implement a baseline survey about the general conditions of the corals before establishing the no capture zone.
- Implement a seasonal survey (4 by year) in each of the no capture zones.

**Lead person:** DRNA

**Proposed partners:**

Commercial operators  
Conservation Trust of Puerto Rico  
Sociedad Ambiente Marino

**When (mm/yr)** 10/2012 TO: 09/2017

**Products or outputs:**

Recovery of the coral reefs in designated areas  
Increase of abundance of fish  
Demarcation Buoys

**Expected costs:** \$36K- buoys (initial cost), \$50K –base line study, seasonal monitoring (4 by year in 3 zones shallow and deep water), \$10K-workshops, \$4K- outreach material and posters. Total- \$100K for 5 years

**Proposed funding Source:**

NOAA

**Measures of Success:**

Increase in coral and fish populations

## Worksheet: Collaborative Implementation Plan #10

**Priority Area:** Northeast Reserves

**Goal:** Goal 2 (Goal C1) Manage the recreational and maritime uses of marine and coastal areas to reduce the impacts on coral reefs.

**Objective:** B1.3: Search for and identify management tools that could be applied to fisheries and related ecosystem protection and management in Puerto Rico.

**Project 1:** Carrying capacity/acceptable change limit of the most used areas such as Icos islet.

### Description:

Develop and implement in the designated zones in different seasons of the year and at different times of the day inventories of:

- vessels, including their characterizations as motorboats, sailboats, commercial boats, marine taxi, jet sky and fishing boats, etc.
- people in beaches
- superficial scuba divers
- any other user and other circumstances

Interview users to study their appreciation for the place, satisfaction with its state and other circumstances, and preferences regarding different parameters, among other things.

State the carrying capacity of the place with the information obtained in previous studies altogether with the physical characteristics of each area.

**Lead person:**

**Proposed partners:**

**When (mm/yr)** 10/2012 TO: 09/2017

**Products or outputs:**

**Expected costs:**

**Proposed funding Source:**

**Measures of Success:**

## Worksheet: Collaborative Implementation Plan #11

**Priority Area:** Northeast Reserves

**Goal:** C2

**Objective:** C 2.1

**Project 1:** Signaling in the Ensenada Yegua zone

### Description:

Identify with simple or attractive signs permitted and prohibited uses in the Seven Seas bath beach zone and adjacent areas.

**Lead person:** DRNA

**Proposed partners:** National Park Company, FCPR

**When (mm/yr)** TO:

**Products or outputs:**

**Expected costs:**

**Proposed funding Source:**

**Measures of Success:**

## Worksheet: Collaborative Implementation Plan #12

**Priority Area:** Northeast Reserves

**Goal:** 2 (Goal C1) Manage the recreational and maritime uses of marine and coastal areas to reduce the impacts of the coral reefs.

**Objective:**

- C1.1: Reduce the impact of vessel anchoring and boat grounding on seagrass beds and coral reefs and enable efficient enforcement by:
- a. Establishing vessel use zones.
  - b. Installing navigation and mooring buoys that demarcate different use zones.
  - c. Rerouting large vessel traffic to avoid sensitive coral areas, if navigation aids are not effective and/or if there are repetitive groundings.
  - d. Establishment of no-anchor zones.

**Project 1:** Zoning of the Reserva La Cordillera areas by its usages.

### Description:

- Identify the uses to be established in the different areas of La Cordillera Reserve
- Signage and demarcation of anchorage areas in sandy bottom places.
- Installation of mooring buoys identified by colors according to the user.
- Installation of mooring line for small vessels (dinghies) in places where there is need.
- Demarcation of sensitive areas by the presence of coral reefs.
- Demarcation of navigation channels
- Monitoring of the established strategies to corroborate their reach and efficiency, also to study their potential to be implemented in other areas.
- Establish outreach strategies of this information where marinas, fisheries, hotels, Tourism Company and commercial vessels are involved.

**Lead person:** DRNA

**Proposed partners:** NOAA, Coast Guard, COE

**When (mm/yr)** 10/2012 TO:

**Products or outputs:**

- Use zoning map for the La Cordillera Reserve
- Signs and anchorage demarcations
- Mooring buoys, mooring lines and other demarcation

**Expected costs:**

**Proposed funding Source:** NOAA

**Measures of Success:**

### Worksheet: Collaborative Implementation Plan #13

**Priority Area:** Northeast Reserves

**Goal:** 2 (GOAL C1) Manage the recreational and maritime uses of marine and coastal areas to reduce the impacts on coral reefs.

**Objective:** C1.3 Develop outreach programs for recreational operators to encourage compliance with coral reef regulations and to use best management practices for recreational use in their operations.

**Project 1:** Media/publicity/marketing campaign targeted to promote the adequate behavior to protect the natural resources of the northeast.

**Description:**

- Educational materials, press, radio
- Creation of publicity campaign, outreach materials, stickers, etc
- Establishment of obligatory dissemination strategies so the marinas, fisheries, commercial vessels, hotels, restaurants and Tourism Department make a contribution in the education to users about ecosystems, their protection, and correct behavior.

**Lead person:**

**Proposed partners:**

**When (mm/yr)** 10/2012 TO: 09/2017

**Products or outputs:**

**Expected costs:**

**Proposed funding Source:** NOAA, Tourism Department

**Measures of Success:**

### Worksheet: Collaborative Implementation Plan #14

**Priority Area:** Northeast Reserves

**Goal:** C.1 Manage the recreational and maritime uses of marine and coastal areas to reduce the impacts on coral reefs

**Objective:** C 1.2 Identify specific areas for recreational use. Should focus on already impacted reefs and artificial reef sites so as to preserve and limit activities on higher quality reef ecosystems.

**Project 1:** Develop Cayo Icacos as a recreational area with facilities for boaters, snorkelers, divers, bathers and other visitors with the intention to reduce impacts on other areas.

**Description:** La Cordillera Reefs Natural Reserve receive an enormous number of visitors during peak tourist seasons. Widespread impacts of a variety of uses and users visiting the keys damage marine ecosystems, by the unconscious or careless boat handling, injuries to corals and seagrasses, large amounts of trash, and other harmful behaviors that degrade these marine environs and limit the enjoyment of the area. Phase I This action will begin by evaluating Cayo Icacos, determine number of people/day during high season and low season (weekdays vs. weekends & holidays); record their activities and areas or resources they visit and/or utilize; it's general area and any existing structures that could be utilized, modified, eliminated or incorporated into the overall visitor's experience, the area where gazebos, compost toilets, eco-friendly alternatives to illumination, underwater and/or inland interpretative trails and needed signage, mooring buoys, floating decks -if needed-, any restoration projects (inland or underwater) and others needed to produce a design of the recreational facilities and zoning of activities. Phase II Construction of facilities based on design and recommendations as part of the outcomes of Phase I (design of facilities) Phase III An education and outreach component will be designed to engage the community and orient visitors and service providers.

**Lead person:** Reserve Manager, DNER

**Proposed partners:** Concessionaires, service providers, local community, NGO's, academy, Municipality, Tourism Company

**When (mm/yr)** 2012 TO: 2016

**Products or Outputs:** Report that includes recommendation on Regulations per site, and Outreach campaign (PSA's, signage, and others as identified in the study)

**Expected Costs:** Study (Phase I \$150,000; Phase II \$450,000); Phase III Outreach campaign (\$20,000)

**Proposed Funding:** NOAA (Cons& Manag., Coral Grants), NFWF

**Measures of Success:** Implementation of recommendations; Level of compliance; Surveys of visitors' satisfaction; Completion of education and outreach component

### Worksheet: Collaborative Implementation Plan #15

**Priority Area:** Northeast Reserves

**Goal:** C.1 Manage the recreational and maritime uses of marine and coastal areas to reduce the impacts on coral reefs

**Objective:** C 1.2 Identify specific areas for recreational use. Should focus on already impacted reefs and artificial reef sites so as to preserve and limit activities on higher quality reef ecosystems.

**Project 2:** Develop and establish an Information Center at Las Croabas, Fajardo to service visitors to the Fajardo and Culebra Region.

**Description:** Las Croabas, Fajardo is one of the major points of access to the Cordillera Reefs Natural Reserve and the Culebra Region, and thus provides an excellent outreach opportunity to orient and educate potential visitors who utilize Las Croabas as their main access to reefs and related ecosystems. This Information Center may show PSA's and other informational and outreach videos on the resources available and activities compatible with the conservation and protection of coral reefs and other marine ecosystems present in the areas, provide maps and local navigation charts among other informational materials and orientations to help reduce users impacts on these ecosystems.

Phase I Establish collaboration with Municipality, evaluate and determine best area to develop the center at Las Croabas and produce a design of the facilities. (The municipality could also agree utilizing one of the gazebos already present in Las Croabas. This action of modifying a structure may reduce construction costs.)

Phase II Construction of facilities based on design and recommendations as part of the outcomes of Phase I

Phase III Education and outreach component (kiosk could be operated by trained volunteer university students)

**Lead person:** DNER, Turism Company, Municipality

**Proposed partners:** operators, NGOs/community groups, National Parks, academy

**When (mm/yr)** 2012 TO: 2015

**Products or Outputs:** Phasel: Report that includes recommendation on Information Center site, and design. Phase II: Construction of Information Center; Phase III Education and outreach component operational

**Expected Costs:** Study Phase I: \$30,000; Phase II \$170,000; Phase III \$30,000

**Proposed Funding** NOAA, NFWF, CRCP, Private Foundations, Sea Grant

**Measures of Success:** Information Center built; Implementation of recommendations; Level of use; Surveys of visitors' satisfaction; Completion of education and outreach component

### Worksheet: Collaborative Implementation Plan #16

**Priority Area:** Northeast Reserves

**Goal:** D1

**Objective:** C3.2

**Project 1:** Inventory of invasive, exotic and native species of fish for promoting best management practices and education.

**Description:**

The diversity of fish species in the northeast zone represents an important factor of the food chain. However, the lack of up to date species inventories is an important and limiting factor for the long term development of management plans and solutions to possible risks that affect marine ecosystems. Through internships of undergraduate of university students of PR, data of invasive, exotic and native species will be collected with the objective of obtaining an up-to-date database that helps with the management of species, promotion and recovery of coral reefs and to educate about invasive and exotic species of the northeast area.

**Lead person:** UPRA, UMET, UPRR, Lyliana Crespo Dr. Alberto Sabat

**Proposed partners:** Sociedad Ambiente Marino, DRNA, EPA, UPR Education Department

**When (mm/yr)** 10/2012 TO: 09/2017

**Products or outputs:** Training of undergraduate students for the production of educational materials and to stimulate them to continue graduate studies.

Contribution to the Northeast Reserve Marine Ecosystem Inventory: identification of priority coral reef, sea grass and mangrove areas for conservation and restoration Project.

**Expected costs:** \$325K

**Proposed funding Source:** NOAA

**Measures of Success:**

- Use of 3 students per year
- Management oriented data
- Educational talks in schools of Puerto Rico.



## Worksheet: Collaborative Implementation Plan #17

**Priority Area:** Northeast Reserves  
**Goal:** C2  
**Objective:** C2.3

**Project I:** Development of a Management Plan for the RNCEN and of the PNA of the NE and the origination of an advisory board for the management of the PNA of the NE

### Description:

The northeastern region of the Island of Puerto Rico contains natural resources of high ecological value that have justified the designation of diverse protected areas. In the NE there are: 1. Yunque National Forest, 2. Espiritu Santo NR, 3. Cabezas de San Juan NR, 4. 7 seas NR, 5. Cordillera Reefs NR, 6. Northeastern Ecological Corridor NR that interconnects the others and contains samples of the 6 ecological zones described for PR (Ewel and Whitmore, 1979, using Holdridge classification system) and provides protection to the coral reefs located between PR and Culebra that have never been protected. To achieve the effective management of the resources, there is a requirement of landscape vision y ecosystem management that requires coordination between DNER, CPN, Forest Service, FCPR, Municipality, community, NGO's and the users of the resources. It is proposed to develop an integral Management Plan of the PNA's of the NE of marine and terrestrial environments that include existing plans (Yunque) inserted in the APEGRNCEN Plan under a vision of a sustainable NE, productive and resilient and guided by a Management Advisory Board that include representation of identified groups.

**Lead person:** DNER, PNA and corals committees, Coral Reef Program, PMZC

**Proposed partners:** FCPR, Forest Service, CEN Coalition, National Parks Company

**When (mm/yr)** 2012 TO: 2014

### Products or outputs:

Institutional framework for the active management of the PNA of the NE Management Plan PNA-NE

Coordinated Management Strategies

**Expected costs:** \$145K

### Proposed funding Source:

NOAA, Coral Reef Program, PMZC, Forest Service, FCPR

### Measures of Success:

Implementation of coordinated vigilance and resource protection projects  
Development of research and monitoring of natural resources joint initiatives

Development and implementation of Active Management Projects (reforestation, restoration of marine and terrestrial biological corridors)

Development and implementation entrepreneurship projects (guides, eco touristic operators for the NPA of the NE)

Development and implementation of educational projects with the participation of community and local NGO's

## Worksheet: Collaborative Implementation Plan #18

**Priority Area:** Northeast Reserves  
**Goal:** A.3  
**Objective:** A.3.4; 3.5, 3.6

**Project I:** Certification in the management, protection and enforcement of laws related for the conservation of coral reefs.

### Description:

1. Develop and implement a practical educational workshop with contact hours that trains people with coral reef basic knowledge.

2. Phase 1: It should be a requirement for users

- Acquisition of navigational license o renewal of vessel permits
- Law and order officials
- Concessionaries, at the moment of obtaining permits.

Phase 2: To be requisite of continuing education contact hours for decision makers

- members of professional boards (lawyers, engineers, etc.) at the moment of license renewal

3. It can be 8 to 16 contact hours, depending in the group of interest.

**Lead person:** DNER

**Proposed partners:** UPR, private universities, Sea Grant, NOAA, FCPR, Municipal Government, Professional boards

**When (mm/yr)** TO:

### Products or outputs:

**Expected costs:**

**Proposed funding Source:**

**Measures of Success:**

## Worksheet: Collaborative Implementation Plan #19

**Priority Area:** Northeast Reserves  
**Goal:** A3  
**Objective:** A3.2

**Project I:** Certification Course for the compliance of the CEST Plan

### Description:

Design and Implement a course that leads to a certification for the compliance of the CEST plan and best management practices for runoff, erosion and sediments with innovative techniques and aligned with the protection of the Northeast reserves priority zones.

It should be requisite for "decision makers", developers, engineers, heavy machinery operators, etc. It can be through continuing education, once a year to give the opportunity to learn about new techniques and methods.

**Lead person:** EQB, Engineers board

### Proposed partners:

What was ARPE, Home Builders Association

**When (mm/yr)** TO:

### Products or outputs:

Course and certificate

### Expected costs:

**Proposed funding Source:**

EQB, EPA, USCOE

### Measures of Success:

That every development project has at least one person certified

## Worksheet: Collaborative Implementation Plan #20

**Priority Area:** Northeast Reserves  
**Goal:** B3  
**Objective:** B3

**Project I:** Video propaganda in the Culebra and Vieques ferry etc. related to coral reefs and fishing. Aggressive radio and TV campaigns about violation to the coral reef and fishing laws and to explain the consequences people are being exposed. For example, like the campaign of buckling up the seat belt and/or driving drunk.

To establish that the people who file fishing licenses assist to a coral reef and fishing talk.

Educational campaign for schools, community, malls, fisheries, beaches etc.

Establish a data system of environmental law violators for example: if a person was fined in Vieques and the next day is intervened in Fajardo, the law enforcers know that the person was intervened the day before.

Make the rangers experts in coral reef and fishing laws.

### Description:

The diversity of fish species in the northeast zone represents an important factor of the food chain. However, the lack of up to date species inventories is an important and limiting factor for the long term development of management plans and solutions to possible risks that affect marine ecosystems. Through internships of undergraduate of university students of PR, data of invasive, exotic and native species will be collected with the objective of obtaining an up-to-date database that helps with the management of species, promotion and recovery of coral reefs and to educate about invasive and exotic species of the northeast area.

**Lead person:**

**Proposed partners:**

**When (mm/yr)** TO:

**Products or outputs:**

**Expected costs:**

**Proposed funding Source:**

**Measures of Success:**



# ATTENDANCE

## NORTHEAST LAS WORKSHOP ATTENDANCE

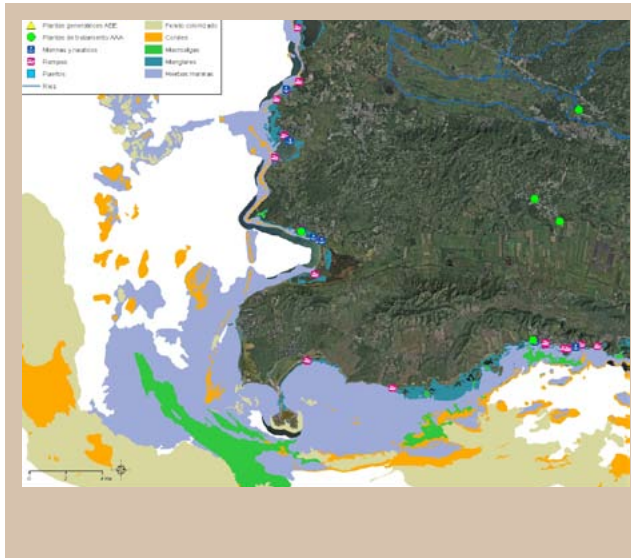
Name	Agency/Organization	Email
1. Sorren Varney	East Island Excursions	sorren25@yahoo.com
2. Jon Pearlman	East Island Excursions	
3. Lyliana Crespo	Col. Wilma Chaves	crespolyliana@gmail.com
4. Edwin Quiñones	East Island Excursions	aqueopr@hotmail.com
5. Manuel José Martínez	APRODEC	manuel@concretek.com
6. Leonor Alicea Rodríguez	FCPR	leonoralicea@gmail.com
7. Jorge L. Coll	Coll Rivera Environmental	coll.environmental@yahoo.com
8. Waleska Llabrés	FCPR	llabresw@fideicomiso.org
9. Arlyn L. Fuentes	FCPR	fuentesa@fideicomiso.org
10. Eduardo Esquilín Solís	FCPR	esquiline@fideicomiso.org
11. José A. Norat Martínez	UPR-RCM	jose.norat@uper.edu
12. Samuel Caraballo-López	APRODEC	samcaraballo@gmail.com
13. Mariela M. Goyco Cortés	Ambienta Inc.	ambienta@caribe.net
14. Samuel Suleiman	S.A.M.	samuelsuleiman@gmail.com
15. Frances Candelas	S.A.M.	
16. Raúl Santini-Rivera	DRNA	
17. Suhey Ortiz	IITF	suhey.ortiz.pr@gmail.com
18. Mariano Solórzano	IITF	msolorzano@fs.fed.us
19. Edwin A. Hernández	CCRI/CATEC	coral_giac@yahoo.com
20. Mark Martin	Fideicomiso de Conservación de Vieques	biobaypatrick@mail.com
21. Alida Ortiz	UMET	alortiz@suagm.edu
22. Antares Ramos	NOAA	antare.ramos@noaa.gov
23. Walter E. Soler	Ambienta, Inc.	ambienta@caribe.net
24. Damaris Delgado	DRNA	ddelgado@drna.gobierno.pr
25. Aida Rosario	DRNA	arosario@drna.gobierno.pr
26. Gloria M. Ortiz	V.S. Assoc.	gloria_ortiz@onelinkpr.net
27. Enrique Pérez Prado	DRNA-CV	eperez@drna.gobierno.pr
28. Ismael Rivera Skerrett	DRNA-CV	iriveras@drna.gobierno.pr
29. Maryguel Fuentes	JP-Zona Costanera	fuentes_m@jp.pr.gov
30. Ernesto L. Díaz	DRNA/PMZC	ediaz@drna.gobierno.pr
31. Ana M. Román	USFWS	ana_roman@fws.gov
32. José Caballero	Salvage	bucanero@prw.net

## Puerto Rico's Coral Reef Local Action Strategies (LAS)

### CABO ROJO







## PROCESS FOR SELECTING LAS

A two-day LAS Workshop was held in Cabo Rojo, on September 7 - 8, 2011 for stakeholders in the priority area of Cabo Rojo. Thirty-four people, representing municipal, state and federal agencies, tourism service providers, scientists and local community members, attended the Workshop. See Appendix \_ for Attendance Sheet. The group identified the following issues as areas of concern for the conservation of the coral reefs in the priority area of Cabo Rojo:

- Poor water quality due to human impacts.
- Zoning problems: lack of same and/or very poor.
- Need of field studies to determine no anchoring zones, based on density
- Legal issues: users education, enforcement
- Lack of consistency in education and outreach programs.
- Need specific data on status of fisheries in the area.
- Adequate use of fishing gear.
- Invasive species.
- Absence of management and enforcement to control human activities around coral reefs.

## GOALS, OBJECTIVES AND PROJECTS

The Cabo Rojo LAS Workshop participants identified a total of 26 projects. Twelve of these are applicable to all four-priority areas, and 14 are pertinent for the Cabo Rojo priority area exclusively. Full Worksheets for these projects are found at the end of this section.

**GOAL 1** (Goal A1+ Goal C2 modified): **Implement sustainable development practices through land-use planning at the watershed scale, including coastal zone and upland areas, to minimize water quality impacts to the coral reef ecosystem.**

**OBJECTIVE 1** (A1.1): Support the use of a watershed approach in the development and implementation of new and existing Municipal Ordinance Plans and Puerto Rico Land Use Plan. These plans will consider the cumulative impacts

of existing and expected land use and require best management practices that avoid and minimize impacts to water quality be developed and applied (this could include restricting land clearing activities to the dry season). This applies to urban,

residential, recreational (including off-road vehicles) and agricultural uses. (See Natural Resources Conservation Service, Department of Natural and Environmental Resources, Puerto Rico Planning Board, Environmental Quality Board, Federal Highway Administration, Agricultural Extension Service and other best management practices documents.)

### LAS Projects

1. Assessment of land based sources of pollution affecting the coral reefs of Cabo Rojo through watershed analyses, water quality monitoring, and oceanographic characterization.

**Objective 2** (A1.2 modified): Develop stricter regulations and enhance enforcement capabilities to ensure compliance with best management practices for agricultural and development activities practices that reduce stormwater runoff, and erosion to reduce pollutant (sediment, nutrient, pesticide, herbicide, fecal coliform, etc.) transport to the marine environment, working through the Environmental Protection Agency (EPA), Environmental Quality Board (EQB), U.S. Army Corps of Engineers (USACE), and other regulatory entities.

### LAS Projects

2. Establish sampling stations to monitor water quality.
3. Water quality monitoring and inspection of septic and sewer systems at the Watershed scale. Design of onsite treatment alternative using appropriate technologies as well as recommendation of measures to repair and maintain sewer systems in collaboration with State and federal agencies.

**Objective 3** (A1.3): Work with private landowners to develop land use and conservation management plans through participation in the Forest Stewardship Program and other impact reducing programs offered by the United States department of Agriculture (USDA), the local Department of Agriculture, to use existing incentive programs, strengthen partnerships with these and other agencies and to provide incentives ensuring compliance with regulations at the same time.

### LAS Projects

4. Identify pollution sources.

**Objective 4** (A1.4): Ensure that planning activities are at a watershed scale and loss of coastal habitats (wetlands, seagrass) that serve as filters to maintain water quality is avoided and minimized.

### LAS Projects

5. Gap Analysis of Coastal Planning in Puerto Rico.

**Objective 5** (A1.5): Ensure compliance with

the requirement to include cumulative impacts in environmental documents so as to improve agency evaluation of all project impacts. Require that environmental assessments for developments be submitted to DNER for DNER to provide comments to EQB regarding potential impacts to the coral reef ecosystem. Currently, including cumulative impacts is a legal requirement in the permit process, requiring that EQB certify compliance with the environmental document requirements of Public Law 4. However, cumulative impact analysis is often not included in the environmental assessment and therefore lost from the project evaluation.

### LAS Projects

6. Create a working group to identify existing regulations that affect coral reef protection.

**Objective 6** (A3.9): Ensure that citizens (e.g., developers, agricultural operators, homeowners) receive orientation through educational campaigns regarding regulations related to protection of water quality (e.g., earth movement, sewage, disposal of materials such as oil) and make them aware of consequences of noncompliance.

### LAS Projects

7. Educational community outreach to prevent septic water sweeps to intermittent water bodies or with runoff water.
8. Prepare workshops for Municipality Personnel
9. Design and implement a capacitation course and certification system for the "CEST Plan" and "Best Management Practices" and require it to obtain licenses for Engineers, Inspectors, Authorized Professionals, Architects and any other professional involved or related to construction activities. **All areas.**

**Objective 7** (C2.1): Ensure that the proposed land-use plan for Puerto Rico includes the Puerto Rico Coastal Zone as defined by the PR Coastal Zone Management Program (PRCZMP) (including territorial waters) and identifies zones for different uses including conservation, recreation and different types of development. The plan should address issues of light pollution, listed species and habitat protection.

### LAS Projects

10. Review the proposed and approved Territorial Plans to evaluate if the proposed or established zoning is adequate to prevent or minimize coral reef impacts associated with land use or development. **All areas.**

**Objective 8** (C2.2): Identify and prioritize coastal and upland areas associated with priority coral reef areas, including degraded coastal natural areas with

restoration potential, for land acquisition, preservation, protection and restoration, such as mangrove habitats, coastal wetlands, estuaries and important watershed areas or buffer areas adjacent to protected areas.

**Objective 9 (C2.3):** Support the effective management of existing protected areas (such as natural reserves, state forests, and national park and wildlife refuges) within or adjacent to priority coastal areas, including the development and implementation of management plans.

## **GOAL 2 (Goal A2 + Goal A3): Strengthen enforcement and engage stakeholders through education to control and reduce pollutant transport to the marine environment.**

**Objective 11 (A2.1):** Eliminate combined sewers where stormwater and wastewater systems are joined to reduce overflows and associated water quality impacts to water bodies (i.e., San Juan, Boquerón, Calle Calaf ).

### **LAS Projects**

12. Assess the state of the water-treatment plants, septic tanks, and hook-ups to sewage plants in areas that already have been identified as have been identified as having fecal bacteria.

**Objective 12 (A2.6):** Support upgrading existing wastewater treatment facilities to increase capacity and level of treatment, provided that the changes will be adequate to address sewage load and improve water quality.

**Objective 13 (A2.8):** Develop and implement new regulations and practices for onsite sewage disposal systems (OSDS) standards that ensure these systems are built, installed and maintained according to known best practices. Single-family units are currently not regulated under OSDS and should be included. Leverage the collaborative Watershed Stewardship Program, which provides resources and expertise to upgrade household septic systems so they adhere to known best practices, to expand it throughout the island if the pilot project is successful.

**Objective 14 (A2.11):** Restore, acquire and enhance coastal wetlands, forests and riparian zones as possible to maintain these filters to water quality.

**Objective 15 (A3.1):** Reduce erosion from any earth movement activities (e.g., development, home expansion, agriculture) through a mix of enforcement and education, such as hands-on workshops showing BMP implementation.

### **LAS Projects**

11. Zoning framework of southwestern submerged areas.

**Objective 10 (C2.7):** Work with relevant agencies to establish written guidelines for the granting of variances and/or waivers to regulations for projects that are located in the coastal zone or will potentially impact watershed stability.

### **LAS Projects**

13. Workshop geared to promote BMP's practices and the use of green infrastructure to reduce erosion from earth movement activities. **All areas.**

**Objective 16:** Promote green infrastructure projects (such as low impact development, green roofs, rain gardens, porous pavements, etc) to minimize stormwater runoff and sedimentation. **NEW**

**Objective 17 (A3.3):** Ensure that mitigation plans are properly implemented and that the project has not resulted in the loss of habitat and take necessary enforcement action for noncompliance with mitigation plans. Coordinate between EPA, Corps of Engineers (COE), EQB, etc., to ensure enforcement is geared toward protecting habitat and less toward issuing fines.

**Objective 18 (A3.4):** Create certification program for developers, contractors, agricultural operators, consultants and government employees certifying that they have been trained in best management practices for different land uses appropriate to their activities.

**Objective 19 (A3.5):** Provide all law enforcement officials (rangers, police officers, lawyers and judges) with educational opportunities to increase their effectiveness and efficiency at implementing conservation and resource management regulations.

**Objective 20 (A3.7):** Develop additional requirements that look at the potential impacts— instead of the size or amount of earth movement and storage—to ensure that the transport of sediments to water bodies is minimized.

## **GOAL 3 (Goal C1): Manage the recreational, commercial and maritime uses of marine and coastal areas to reduce the impacts on coral reefs.**

**Objective 21 (C1.1):** Reduce the impact of vessel anchoring and boat grounding on seagrass beds and coral reefs and enable efficient enforcement by:

- a. Establishing vessel use zones.
- b. Installing navigation and mooring buoys that demarcate different use zones.
- c. Rerouting large vessel traffic to avoid sensitive coral areas, if navigation aids are not effective and/or if there are repetitive groundings.
- d. Establishing no-anchor zones.
- e. Developing outreach programs for recreational, commercial and maritime operators to encourage compliance with coral reef regulations and to use best management practices in their operations.

### **LAS Projects**

14. Aids to navigation to prevent groundings. **All areas.**

**Objective 22 (C1.2):** Identify specific areas for recreational use. Should focus on already impacted reefs and artificial reef sites so as to preserve and limit activities on higher quality reef ecosystems.

### **LAS Projects**

15. Develop two video-based coral reef etiquette messages – one for SCUBA divers and one for snorkelers. The videos will emphasize proper behavior for divers and snorkelers visiting coral reefs in Puerto Rico.

**Objective 23 (C1.5):** Prepare and implement a coordinated approach that describes how to respond to physical impacts (vessel groundings, anchor damage, storm damage, etc.) so all the pertinent laws and regulations can be properly enforced.

### **LAS Projects**

16. Vessel Grounding Enforcement & Response. **All areas.**

## **GOAL 4 (Goal B3): Utilize enforcement and education to encourage public compliance with fishing regulations and reduce impacts of fishing.**

**Objective 24 (B3.1):** Create an outreach and educational campaign to reduce fishing impacts over coral reef ecosystems aimed at the following:

- a. Recreational fishing community.
- b. Commercial fishing community.
- c. The judicial system including DNER Legal Division.
- d. Decision makers

### **LAS Projects**

17. Create and outreach and educational campaign to reduce fishing, recreational and commercial impacts to coral reef ecosystems aimed at the following: a. Recreational fishing community, b. Commercial fishing community, c. Judicial system, d. Boat operators (recreational, commercial, and maritime). **All areas.**

18. Identify stakeholders, marinas, businesses fisheries, general public, DNRA educational material and navigation courses. Produce multimedia information and capacitating program for staff members. **All areas.**

19. Create fish identification cards that also contain reef etiquette messages for divers and snorkelers to take into the water while around the reef. **All areas.**

**Objective 25 (B3.2):** Provide education to enforcement personnel strengthening their understanding of impacts from recreational and maritime uses on coral reef ecosystems.

**Objective 26 (B3.5):** Create and/or enable joint enforcement between municipal, state and federal agencies to improve efficiency of operations.

## **GOAL 5 (Goal D1 modified): Promote recovery of reefs from natural stressors, atmospheric phenomena and invasive species.**

**OBJECTIVE 27 (D1.1):** Identify areas of high diversity and live coral coverage for additional protection and expand existing protected areas to include these areas.

### **LAS Projects**

20. Inventory to determine areas of potential coral reef development and assess the condition of



those reefs.

- 21. Demographic monitoring of elkhorn coral
- 22. Coral reef resiliency monitoring
- 23. Emergency Coral Reef Response Team **All areas**

**Objective 28** (DI.2): Support more research on coral diseases and on the relationship of bleaching to disease; support more research on coral resistance to bleaching/disease and resilience following global, regional and local stressors and on possible effects of climate change on coral reefs and other ecosystems.

**LAS Project**

- 24. Coral reef farming “ heap start”

**Objective 29** (DI.4): Strengthen response capability of Natural Reserves when natural disasters occur.

**LAS Projects**

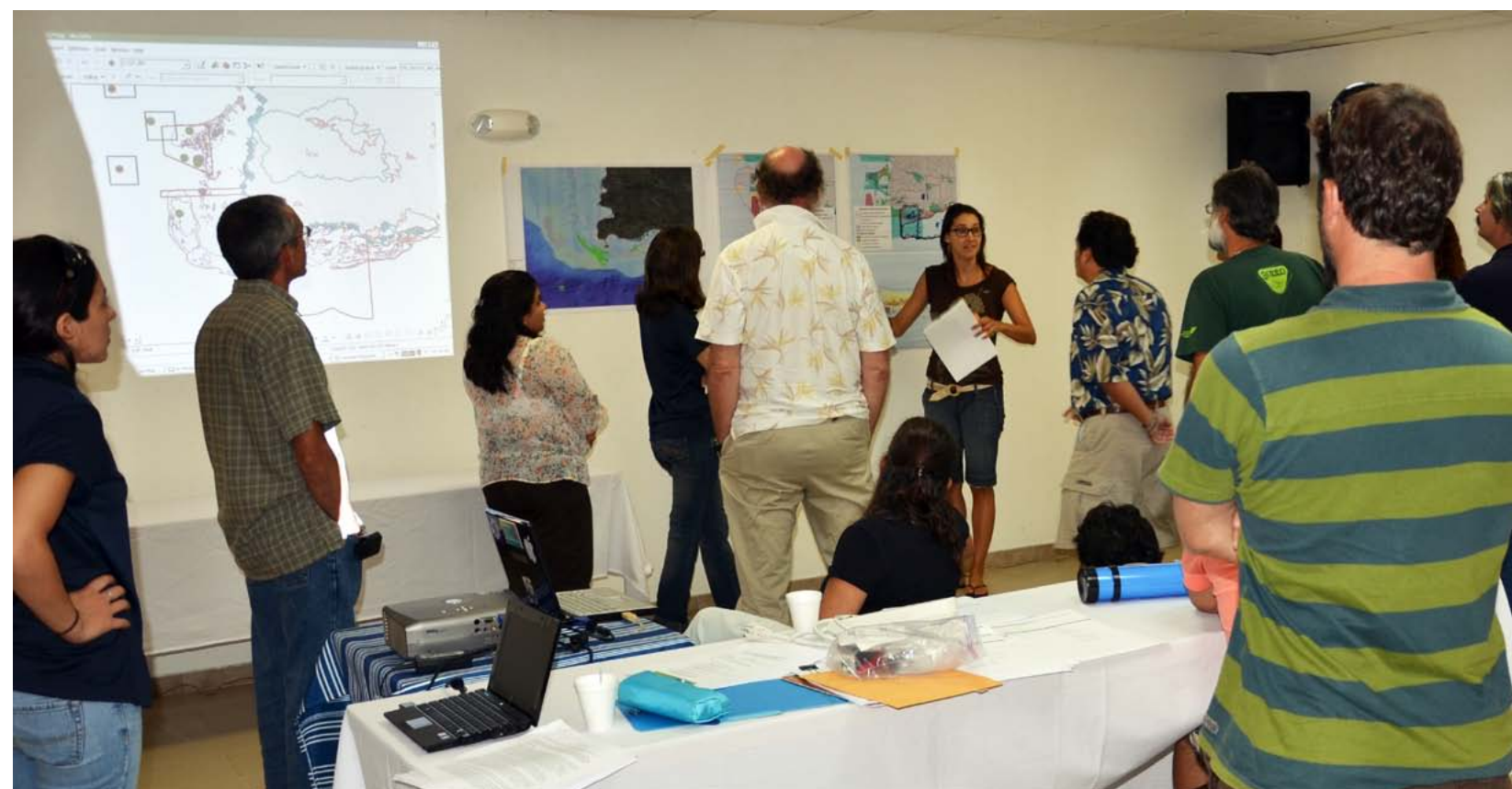
- 25. Development of a Web and Cell Phone Based Mapping Interface for the Allocation and Report of events sites along the Puerto Rico coast and waters. **All areas**

**Objective 30**(DI.7): Implement coastal planning that addresses sea level rise and directs new development away from the coastline.

**Objective 31**(DI.8): Control the impact of invasive species on coral reefs.

**LAS Projects**

- 26. Control of invasive species establishing a protocol to manage the situation along with a training and implementation campaign. **All areas**



## Worksheet: Collaborative Implementation Plan #1

**Priority Area:** (from Priority Setting Document) Cabo Rojo-PR

**Goal:** (from Priority Setting Document)

A1. Implement land-use planning at the watershed scale to minimize water quality impacts to the coral reef ecosystem.

**Objective:** (from Priority Setting Document)

A1.1. Support the use of a watershed approach in the development and implementation of new and existing Municipal Ordinance Plans and Puerto Rico Land Use Plan.

**Project 1:** (work that needs to be done to achieve objective and goal) Assessment of land based sources of pollution affecting the coral reefs of Cabo Rojo through watershed analyses, water quality monitoring, and oceanographic characterization.

**Description:** Coral reef systems thrive under conditions characterized by low sediment and nutrient inputs. Nearshore reef systems in the vicinity of Cabo Rojo originally developed under these types of conditions given the small size of the watersheds and the relatively dry conditions that characterize the area encompassed between Belvedere-Puerto Real to the Refugio de Boquerón and Reserva La Parguera. Land development over the past several decades has altered those pristine conditions and has induced an adverse effect on the reef systems, but the spatial relationships between pollutants from in-land sources and the reefs are still not well determined. The geographical location of the CR reefs in the southwest corner of the PR platform make them likely prone to the effects of all watersheds draining to the coastline between the Río Guanajibo outlet eastward all the way to Guayanilla or even Peñuelas. The exact extent of the source area and the types of contaminants affecting coral reefs is largely unknown, therefore the LAS program currently lacks a well-defined target to recommend how to mitigate any effects. This project proposal intends to address this by: 1) conducting watershed assessments using field surveys, remote sensing techniques, and watershed models beginning with watersheds in the immediacy of the reefs and expanding to those farther away but larger and wetter and with a higher potential for affecting a greater area; 2) review of already available water quality records and establishment of new water quality data collection points; and 3) use of remote sensing and oceanographic techniques to identify linkages between watersheds and reefs. The project would be structured so that future activities and areas of study are suggested according to the results of the water quality and oceanographic study results. For example, new WQ data collection points or watersheds in need of assessment will be suggested once oceanographic linkage patterns have been established. BMP implementation activities that could be part of a second parallel project responding to the needs exposed by watershed analyses and the established linkages could begin as early as during the second year of this project.

**Lead person:** Carlos E Ramos-Scharrón, PhD (Island Resources Foundation & Univ. of Texas-Austin)

**Proposed partners:**

F. Gilbes, PhD (UPR-Mayaguez)

R. Armstrong, PhD (UPR-Mayaguez)

P. Méndez Lázaro, PhD (UPR-Ciencias Médicas)

D. Torres (Synoptika Solutions)

E. Díaz (DNER)

R. Fergusson (NOAA)

**When** (mm/yr) 10/2012 TO 09/2017

**Products or Outputs:**

- Watershed assessment: identify the spatial distribution and contribution of sources of pollution
- WQ analyses: list pollutants likely affecting reefs
- Oceanographic studies: establish geographical linkages between watersheds and reefs

**Expected Costs:** ~\$250K/yr for up to 3-5 years

**Proposed Funding Source:** NOAA-Coral Reef Program; DNER; US Fish & Wildlife; NFWF

**Measures of Success:**

- Identification of specific pollutants and inland sources affecting coral reefs, thus providing specific targets to improve the effectiveness of the LAS efforts.
- Development of watershed-specific management recommendation plans.
- Identification of sensitive land areas meriting special attention in future plans due to connectivity to reef systems.
- Recommendations for permanent WQ monitoring stations.

## Worksheet: Collaborative Implementation Plan #2

**Priority Area:** (from Priority Setting Document) Cabo Rojo

Improve water quality and related reef systems by reducing pollutant inputs from terrestrial sources.

**Goal:** (from Priority Setting Document)

I. Implement sustainable development practices through land-use planning at the watershed scale, including coastal zone and upland areas, to minimize water quality impacts to the coral reef ecosystem.

**Objective:** (from Priority Setting Document) I.9

**Project 1:** (work that needs to be done to achieve objective and goal) Establish sampling stations to monitor water quality.

**Description:**

Identify points of discharge of surface fresh water (continuous and intermittent) to marine waters and establish sampling stations to monitor effluents to the marine environment.

- Nitrates
- Phosphates
- Total Suspended Solids
- Coliforms
- Enterococcus
- Total Petroleum Hydrocarbons
- CDOM

**Lead person:**

**Proposed partners:**

Sea Grant

EQB

EPA

**When** (mm/yr) 1 year TO

**Products or Outputs:**

A seasonal data base that can be use to correlate with water quality at the reef area.

**Expected Costs:**

**Proposed Funding Source:**

**Measures of Success:**

## Worksheet: Collaborative Implementation Plan #3

**Priority Area:** (from Priority Setting Document) Cabo Rojo

Improve water quality and related reef systems by reducing pollutant inputs from terrestrial sources.

**Goal:** (from Priority Setting Document)

I. Implement sustainable development practices through land-use planning at the watershed scale, including coastal zone and upland areas, to minimize water quality impacts to the coral reef ecosystem.

**Objective:** (from Priority Setting Document) I.9

**Project 1:** (work that needs to be done to achieve objective and goal) Establish sampling stations to monitor water quality.

**Description:**

Identify points of discharge of surface fresh water (continuous and intermittent) to marine waters and establish sampling stations to monitor effluents to the marine environment.

- Nitrates
- Phosphates
- Total Suspended Solids
- Coliforms
- Enterococcus
- Total Petroleum Hydrocarbons
- CDOM

**Lead person:** DNER

**Proposed partners:**

Sea Grant

EQB

EPA

**When** (mm/yr) 1 year TO

**Products or Outputs:**

A seasonal data base that can be use to correlate with water quality at the reef area.

**Expected Costs:**

**Proposed Funding Source:**

**Measures of Success:**



### Worksheet: Collaborative Implementation Plan #4

**Priority Area:** (from Priority Setting Document) Cabo Rojo  
 Improve water quality and related reef systems by reducing pollutant inputs from terrestrial sources.  
**Goal:** (from Priority Setting Document)  
 1. Implement sustainable development practices through land-use planning at the watershed scale, including coastal zone and upland areas, to minimize water quality impacts to the coral reef ecosystem.  
**Objective:** (from Priority Setting Document) 1.8, 1.3

**Project 1:** (work that needs to be done to achieve objective and goal) Identify pollution sources

<b>Description:</b> Locate for specific areas: <ul style="list-style-type: none"> <li>• Septic water sewage</li> <li>• Industrial Discharges</li> <li>• Crude water discharge (domestic septic tanks)</li> <li>• Sanitary Landfill leachate</li> </ul>	<b>Lead person:</b> <b>Proposed partners:</b> <b>When (mm/yr)</b> TO <b>Products or Outputs:</b> Control runoff quality Create a program for better construction practices <b>Expected Costs:</b> <b>Proposed Funding Source:</b> <b>Measures of Success:</b>
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### Worksheet: Collaborative Implementation Plan #6

**Priority Area:** (from Priority Setting Document) Cabo Rojo  
 Improve water quality and related reef systems by reducing pollutant inputs from terrestrial sources.  
**Goal:** (from Priority Setting Document)  
 1. Implement sustainable development practices through land-use planning at the watershed scale, including coastal zone and upland areas, to minimize water quality impacts to the coral reef ecosystem.  
**Objective:** (from Priority Setting Document) 1.2, 1.5

**Project 1:** (work that needs to be done to achieve objective and goal) Create a working group to identify existing regulations that affect coral reef protection

<b>Description:</b> <ul style="list-style-type: none"> <li>• Identify and study all the applicable regulations Local and Federal pertinent to coral reef protection.</li> <li>• Read and analyze each one</li> <li>• Identify:                         <ul style="list-style-type: none"> <li>• point of non-compliance</li> <li>• redundancies</li> </ul> </li> <li>• Develop guidances which includes all the pertinent regulations.</li> </ul>	<b>Lead person:</b> <b>Proposed partners:</b> Regulatory Agencies <b>When (mm/yr)</b> TO <b>Products or Outputs:</b> Guidance on best practices to comply with regulations to protect coral reef Guidance to regulatory agencies to enforce compliance with PR Regulations <b>Expected Costs:</b> <b>Proposed Funding Source:</b> <b>Measures of Success:</b>
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### Worksheet: Collaborative Implementation Plan #5

**Priority Area:** (from Priority Setting Document) Cabo Rojo  
 Improve water quality and related reef systems by reducing pollutant inputs from terrestrial sources.  
**Goal:** (from Priority Setting Document) 5. Promote recovery of coral reefs... (Manage climate change and diseases-)  
**Objective:** (from Priority Setting Document) 5.3/ 3.3

**Project 1:** (work that needs to be done to achieve objective and goal) Gap Analysis of Coastal Planning in Puerto Rico

<b>Description:</b> Phase 1: Gap Analysis considering different scenarios of sea level change in the next 100years. Phase 2: Adopt planning strategies that respond to the results of this analysis.	<b>Lead person:</b> Phase 1: Ernesto Díaz; Phase 2: PB <b>Proposed partners:</b> DNER/UPR/ PB/Coastal municipalities/NOAA <b>When (mm/yr)</b> 2013 TO 2015 <b>Products or Outputs:</b> Gap Analysis Adoption of strategies and revised zoning <b>Expected Costs:</b> 60K/yr= 120K Proposed Funding Source: PB/DNER/OGP <b>Measures of Success:</b> Gap completed
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### Worksheet: Collaborative Implementation Plan #7

**Priority Area:** (from Priority Setting Document) Cabo Rojo  
 Improve water quality and related reef systems by reducing pollutant inputs from terrestrial sources.  
**Goal:** (from Priority Setting Document) 1. Implement sustainable development practices through land-use planning at the watershed scale, including coastal zone and upland areas, to minimize water quality impacts to the coral reef ecosystem.  
**Objective:** (from Priority Setting Document) 1.6: Ensure that citizens (e.g. developers, agricultural operators, homeowners) receive orientation through educational campaigns regarding regulations related to protection of water quality and make them aware of consequences of noncompliance.

**Project 1:** (work that needs to be done to achieve objective and goal) Educational community outreach to prevent septic water sweeps to intermittent water bodies or with runoff water.

<b>Description:</b> Once identified the communities without PRASA sewer system, coordinate meetings and educational activities oriented to reduce septic water impact to marine waters. <ul style="list-style-type: none"> <li>• Lectures at resident schools.</li> <li>• Community Activities</li> </ul> Environmental Fairs <ul style="list-style-type: none"> <li>• Posters</li> <li>• Person to person communication</li> </ul> Provide assistance in propper septic tank construction	<b>Lead person:</b> <b>Proposed partners:</b> Sea Grant EQB EPA <b>When (mm/yr)</b> TO <b>Products or Outputs:</b> Minimize sewage discharges to water bodies. Orient in the proper construction <b>Expected Costs:</b> <b>Proposed Funding Source:</b> <b>Measures of Success:</b>
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## Worksheet: Collaborative Implementation Plan #8

**Priority Area:** (from Priority Setting Document) Cabo Rojo

Improve water quality and related reef systems by reducing pollutant inputs from terrestrial sources.

**Goal:** (from Priority Setting Document)

1. Implement sustainable development practices through land-use planning at the watershed scale, including coastal zone and upland areas, to minimize water quality impacts to the coral reef ecosystem.

**Objective:** (from Priority Setting Document) 1.1

**Project 1:** (work that needs to be done to achieve objective and goal) Prepare workshops for Municipality Personnel

### Description:

After performing some kind of compilation regarding the investigation, publications and regulations create a workshop to Municipality Personnel to attain revisions to the Municipal Land Use Plan in order to consider coral reef protection

### Lead person:

### Proposed partners:

**When** (mm/yr) TO

### Products or Outputs:

Revision to the Municipal Land Use Plan

### Expected Costs:

### Proposed Funding Source:

### Measures of Success:

## Worksheet: Collaborative Implementation Plan #9

**Priority Area:** (from Priority Setting Document) Cabo Rojo

**Goal:** (from Priority Setting Document) 3 (C1)

**Objective:** (from Priority Setting Document) 3.1 zoning framework of southwestern submerge areas

**Project 1:** (work that needs to be done to achieve objective and goal)

### Description:

1. Carry out use analysis of marine area, with focus on:

- Coral reefs receiving high impacts
- Sea grass
- Groundings/ vessel recreational use
- Anchoring
- Recreational use

2. Develop zoning framework

3. See project "Aids to Navigation"

4. Install mooring bouys in high impacted areas to avoid anchoring

- If possible declare no-anchoring zones near coral reef systems (e.g. Cayo Ron & Cayo El Negro)

5. Develop map of area that includes reef markers and mooring bouys.

6. Carry out outreach efforts that include placing mapsigns in marinas & ramps.

**Lead person:** DNER, NOAA, UPR, CCRI, CONSULTANT

### Proposed partners:

Caborojeños, Sea Grant, Mayagüezanos, Marinas & club Nauticos, Vigilantes, Com. Navegación, local gov. (municipality)

**When** (mm/yr) 1 yr. TO

### Products or Outputs:

- zoning framework w/map & use categories
- management recommendations

**Expected Costs:** \$120k, \$50 K – zoning framework

### Proposed Funding Source:

NOAA, DNER, NFWF

### Expected Costs:

- Mooring bouys (\$40K)
- \$15k (\$1k per bouys, including installation).
- \$25K – Maintenance, \$5k/yr. in maintenance, 5yrs. total

## Worksheet: Collaborative Implementation Plan #10

**Priority Area:** (from Priority Setting Document) Cabo Rojo

**Goal:** (from Priority Setting Document)

Strengthen enforcement, and engage stakeholders, through education to control and reduce pollutant transport to the marine environments.

**Objective:** (from Priority Setting Document) 2.1 (a2.1) & 2.2 a.2.6

**Project 1:** (work that needs to be done to achieve objective and goal) Assess the condition of the on-site systems in areas that already have been identified have bacteria (fecal) contaminan

### Description:

1. Identify the location of the on-site system.

2. Identify the conditions.

3. Evaluate the tipe of soil where constructed, gradient ( from worst to better, location to the body of water, coastal area, reef ecosystems.)

4. Recommendations such as: closeouts, hook on to PRASA systems, cleanups, refurbished, relocation

5. Use of GIS

6. Identify disposal practices (gray waters, black waters)

7. Tax incentives

8. Community outreach

**Lead person:** PRASA, Municipalities

### Proposed partners:

academia, EPA, Diving Bussiness, JCA, Agricultural Extensión. OGPE

**When** (mm/yr) one TO three yrs.

### Products or Outputs:

Report

**Expected Costs:** \$30,000/project

### Proposed Funding Source:

NOAA, PRASA, DNER, JCA.

### Measures of Success:

1. Reduction of fecal bacteria.
2. Improve water quality.

## Worksheet: Collaborative Implementation Plan #11

**Priority Area:** (from Priority Setting Document) Cabo Rojo

**Goal:** (from Priority Setting Document) Strengthen enforcement, and engage stakeholders, through education to control and reduce pollutant transport to the marine environments.

**Objective:** (from Priority Setting Document) reduce erosion from any earth movement activities through a mix of enforcement and education, such as on works showing BMP implementation.

**Project 1:** (work that needs to be done to achieve objective and goal) Workshop glared to promote BMP's practices and the used of green infrastructure to reduce erosion from earth Movement activities.

### Description:

These workshops will be directed to contractors, developers and municipality that deal with construction project and earth movement activities.

To attract audience to participate in these workshop it could be given as contact hour in a Continuous Education Program.

In terms of municipality it could be part of MS\$ requeriments.

**Lead person:** NCRS- EPA

### Proposed partners:

EPA, ACADEMY, GREEN BUILDING ASSOCIATION, NCRS.

**When** (mm/yr) ONCE A YEAR

### Products or Outputs:

- Better development practices
- Municipalities Ornances
- Better BMP
- Reduced erosion

**Expected Costs:** \$5,000/workshop

### Proposed Funding Source:

NOAA, EPA

### Measures of Success:

1. Implement BMP's talk at the workshop.
2. Oversee the projects develop by the Participants at the Workshop.



## Worksheet: Collaborative Implementation Plan #12

**Priority Area:** (from Priority Setting Document) Cabo Rojo  
**Goal:** (from Priority Setting Document) 3 (C1)  
**Objective:** (from Priority Setting Document) C1.1 (b)

**Project 1:** (work that needs to be done to achieve objective and goal) Aids to navigation to prevent groundings

### Description:

Demaocation & navigation Markers

- ID type of signage thect isnBMP for area
- Mark coral reefs w/(small) warning signs that not establish its a reef: PRECAUCION"; or sign /universal sign).They should include reflectors for night sighting.

### Lead person:

DNER, NOAA, COAST GUARD, USCOE

### Proposed partners:

FWS,Sea Grant ,Municipio, CCRI

**When** (mm/yr) 1 yr. TO

### Products or Outputs:

- Inventory of reefs w/high potential of grounding Impacts
- marking / signage
- map

**Expected Costs:** \$30K

### Proposed Funding Source:

NOAA, DNER , NFWF,FWS, GULF OF MEXICO

### Measures of Success:

- Installation of signage
- Expected decrease in groundings
- Increase on awareness / knowledge of area to avoid when navigating

## Worksheet: Collaborative Implementation Plan #13

**Priority Area** (from Priority Setting Document) All priority Areas  
**Goal** (from Priority Setting Document) 3  
**Objective** (from Priority Setting Document) 3.3

**Project 1** (work that needs to be done to achieve objective and goal) Vessel Grounding Enforcement & Response

### Description:

1. Legaly establish DNER- CRCP (Institutionalize)
2. create financial /accounting system so that fines can be given to DNER-CRCP
3. Make sure Law 147 funds are used towards restoration efforts, when fine is related to a grounding
4. Work with salvers (e.g., seatow, searescue, torpedo towing,etc. ) to minimize impacts during vessel removal: have an approved observer onboard to ID sensitive resources
5. Restore impacts whenever possible
6. Outreach to vigilantes , boat users & salvers

### Lead person:

DNER,NOAA

Proposed partners:

Legal deivision, Hacienda, USCG

**When** (mm/yr) 2013/2018 TO

### Products or Outputs:

Framework to establish accounting planning for grounding response restoration of impacts

**Expected Costs:** \$50 K

### Proposed Funding Source:

NOAA, DRNA

### Measures of Success:

- Recover damages from vessel impacts
- Implement law 147
- Restore damages from vessel groundings.

## Worksheet: Collaborative Implementation Plan #14

**Priority Area:** (from Priority Setting Document) All priority Areas  
**Goal:** (from Priority Setting Document)

Develop outreach programs to utilize enforcement and education to encourage public compliance with fishing and coral reef regulations and reduce impacts of fishing.

**Objective:** (from Priority Setting Document)

A3.6: Provide education and outreach to the judicial system, including legal departments, lawyers and judges, so they can effectively prosecute noncompliance cases.

B.3 Empower enforcement agencies so they are able to implement existing regulations in areas that require immediate protection.

C1.3: Develop outreach programs for recreational operators as well as commercial and maritime operators to encourage compliance with coral reef regulations and to use best management practices in their operations.

**Project 1:** (work that needs to be done to achieve objective and goal) Create and outreach and educational campaign to reduce fishing, recreational and commercial impacts to coral reef ecosystems aimed at the following: a. Recreational fishing community, b. Commercial fishing community, c. Judicial system, d. Boat operators (recreational, commercial, and maritime)

### Description:

We propose to develop a Coral Reef Auxiliary Instructors Program. This program will consist of a group of volunteers from the enforcement divisions and communities that will be trained and certified as auxiliary educators to assist the Coral Reef program with outreach and education, island wide. The Coral Reef Auxiliary Instructors Program will serve as a vehicle to empower community members and other citizens to become stewards of our coral reefs and associated communities, thus improving our efforts of educating and informing users and potential users of the resource. The first year was to work in the rationale, planning and putting together the training part of the program. The second year we expect to be training the volunteers.

This second phase consist of testing the materials developed by delivering the first training to our initial target group within the agency; the education team from the DNER Rangers and other staff. After this, we will approach community groups, NGO's and other interested groups or individuals. Coastal municipal governments where coral reefs are present will be invited to participate. Instructors will be encouraged to conduct interpretative field visits and utilize the more than 60 coral reef educational signage previously placed by the PRCRP in areas where the DNER has managed areas (reserves and coastal forests) and other localities in coastal areas around Puerto Rico, Vieques and Culebra. As part of this effort, representatives of coastal communities will be encouraged to identify areas of collaboration and propose strategies to address their concerns. The Instructors will utilize the educational resources previously produced by the DNER Coral Reef Program and others from other sources pertinent to our objectives.

Continuous evaluation of the activities will be performed on the effectiveness of the program.

### Lead person:

### Proposed partners:

Rangers, Maritime Police, Coast Guard, judicial officers

**When** September 2013 TO: October 2014

### Products or Outputs:

1. Final Coral Reef Auxiliary Instructors Program --documents, protocols, training workshop.
2. Final materials for the training produced as well as the materials that the auxiliary instructors will utilize in their activities.
3. Conduct at least two workshops as part of the Coral Reef Auxiliary Instructors Program
4. Participate in committee discussions, meetings and conference calls.
5. Participate in public education and outreach efforts.
6. Reach decision makers.

**Expected Costs:** \$55,000

### Proposed Funding Source:

Federal CRCP

### Measures of Success:

- Increased Awareness about Coral Reef Ecosystem Issues.
- Initiated a new marketing activity or media campaign
- Held meetings or workshops with key stakeholders
- Conducted outreach activities.

**Worksheet: Collaborative Implementation Plan #15**

**Priority Area:** (from Priority Setting Document) Cabo Rojo  
**Goal:** (from Priority Setting Document) C1  
**Objective:** (from Priority Setting Document) C1.1 e Develop outreach programs for all marine related stakeholders

**Project 1:** (work that needs to be done to achieve objective and goal) Identify stakeholders, marinas, businesses fisheries, general public, DNRA educational material and navigation courses. Produce multimedia information capacitation program for staff members.

**Description:**  
 1. Compile all educational material and distribute among all stakeholders.  
 2. Developing and create new material that applies to this specific area.  
 3. Create and develop capacity- building educational program for staff members, volunteers, marina operators, marine related businesses, etc.

**Lead person:** DNER  
**Proposed partners:** Sea Grant program , marine related businesses, local gov. (municipality)  
**When (mm/yr)** 1 yr. TO  
**Products or Outputs:**  
 • brochures  
 • Capacitation development program  
 • outreach materials.  
**Expected Costs:** \$50 K  
**Proposed Funding Source:**  
 NOAA, DRNA  
 Seagrant (in-kind)  
 Private collaboration (in -kind)  
**Measures of Success:**  
 A complete capacitation and outreach program with all its components: program, staff, materials, recreational, commercial.  
 Increase awareness of coral reef regulations and best management practices in their operations.

**Worksheet: Collaborative Implementation Plan #16**

**Priority Area:** (from Priority Setting Document) Cabo Rojo  
**Goal:** (from Priority Setting Document) 5. Manage climate change and diseases  
**Objective:** (from Priority Setting Document) 5.1

**Project 1:** (work that needs to be done to achieve objective and goal) Inventario

**Description:**  
 Use existing data on geology- bathymetry, etc. To determine areas of potential coral reef development and assess the condition of those reefs.

**Lead person:** Michelle Scharer  
**Proposed partners:** NO/DNER  
**When (mm/yr)** TO  
**Products or Outputs:** GIS coral reef areas and Condition  
**Expected Costs:** 100k/yr = 300k  
**Proposed Funding Source:** NOAA/NMFS/DNER  
**Measures of Success:** Area covered

**Worksheet: Collaborative Implementation Plan #17**

**Priority Area:** (from Priority Setting Document) Cabo Rojo  
**Goal:** (from Priority Setting Document) 5. Promote recovery of coral reefs... (Manage climate change and diseases-)  
**Objective:** (from Priority Setting Document) 5.2

**Project 1:** (work that needs to be done to achieve objective and goal) Demographic monitoring of elkhorn coral Marine

**Description:**  
 Continue and expand elkhorn coral reef demography monitoring.

**Lead person:** Michelle Scharer  
**Proposed partners:** NOAA/ DNER/UPR  
**When (mm/yr)** 2013 TO 2016  
**Products or Outputs:** Trends in coral population  
**Expected Costs:** 100K/yr  
**Proposed Funding Source:** NOAA/DNER  
**Measures of Success:** Data on coral

**Worksheet: Collaborative Implementation Plan #18**

**Priority Area:** (from Priority Setting Document) Cabo Rojo  
**Goal:** (from Priority Setting Document) 5. Promote recovery of coral reefs... (Manage climate change and diseases-)  
**Objective:** (from Priority Setting Document) 5.2

**Project 1:** (work that needs to be done to achieve objective and goal) Coral reef resiliency monitoring

**Description:**  
 Expand and continue coral reef monitoring with chemical and physical measures of water quality to identify changes over time.

**Lead person:** Michelle Scharer  
**Proposed partners:** DNER/ NOAA/UPR  
**When (mm/yr)** 2012 TO 2015  
**Products or Outputs:** Continuous data  
**Expected Costs:** 1 million  
**Proposed Funding Source:** NOAA/DNER/EPA/EQB  
**Measures of Success:** Database



## Worksheet: Collaborative Implementation Plan #19

**Priority Area:** (from Priority Setting Document) Cabo Rojo  
**Goal:** (from Priority Setting Document) 5. Promote recovery of coral reefs... (Manage climate change and diseases-)  
**Objective:** (from Priority Setting Document) 5.3/ 3.3

**Project 1:** (work that needs to be done to achieve objective and goal) Emergency Coral Reef Response Team

### Description:

Train personnel/volunteers in response methods and assessment of impacts to coral reefs. Adapt response protocols to DNER methodology. One possibility would be through via an Administrative Order. Provide equipment.

Respond to events and determine course of action that may include restoration, assessment, after storm events on other impacts

**Lead person:** S. Griffin/Carlos Hdez-DRNA Em./ Rangers

**Proposed partners:**  
DNER/NOAA/USCG/FWS

**When (mm/yr)** 2013 TO 2018

**Products or Outputs:**

Personnel trained, protocol adopted DRNA, restored areas

**Expected Costs:** 100 k/ yr = 300 k

**Proposed Funding Source:**  
PB/DNER/OGP

**Measures of Success:**

Trained personal, protocol

M2 of reef restored

Number of colonies survived

## Worksheet: Collaborative Implementation Plan #20

**Priority Area:** (from Priority Setting Document) Cabo Rojo  
**Goal:** (from Priority Setting Document) 5. Promote recovery of coral reefs... (Manage climate change and diseases-)  
**Objective:** (from Priority Setting Document) 5.2/ 5.3/ 3.3

**Project 1:** (work that needs to be done to achieve objective and goal) Coral reef farming “ heap start”

### Description:

Continue and expand coral nursery to promote recovery of coral population, increase genetic diversity and restore areas, impacted by physical impact, disease or bleaching.

**Lead person:** S. Griffin/DRNA

**Proposed partners:**  
DNER/NOAA/ UPR

**When (mm/yr)** 2013 TO 2018

**Products or Outputs:**

Source of coral for restoration, knowledge of strains, genetic and resiliency

**Expected Costs:** 100 k/ yr

**Proposed Funding Source:**  
NOAA/EPA/FWS/DNER/NSF

**Measures of Success:**

Number of colonies transplanted

M2 of reef restored

Number of colonies survive

## Worksheet: Collaborative Implementation Plan #21

**Priority Area:** (from Priority Setting Document) All priority Areas  
**Goal:** (from Priority Setting Document) Enable & promote sustainable development practices in the coastal zone and upland areas of PR that are associated with priority coral reef areas  
**Objective:** (from Priority Setting Document)

C2.3: Support the effective management of coral ecosystems and existing protected areas (such as natural reserves, state forests, and national park and wildlife refuges) within or adjacent to priority coastal areas, including the development and implementation of management plans.

**Project 1:** (work that needs to be done to achieve objective and goal) Development of a Web and Cell Phone Based Mapping Interface for the Allocation and Report of events sites along the Puerto Rico coast and waters. This task is to develop an information system for the purpose of gathering and organizing data on coral bleaching, grounding, disease, algal overgrows events, etc. from the public. There is a need to know where, and when these events are occurring, the species involved, which species are not bleaching, among other pertinent data. The purposes of this effort is to 1) raise awareness, 2) promote stewardship, 3) provide DNER with timely and island wide information on the problems affecting coral reef ecosystem, and for provide for a rapid management response to emerging events.

### Description:

The goal of this task is to produce a web and cell based systems for the purpose of gathering data on coral bleaching, grounding, disease, algal overgrows events, etc. events from the public. Main objectives are: to have a web and cell based system capable of being accessed using current and popular web browsers, a system that has an easy to use web interface, a system capable to receive a picture of the incident and a system with a web based virtual map where the visitor can mark coordinates of the incident.

The system will provide a web interface where the visitor will submit a form. The form will gather observational data, a picture of the incident, coordinates on a map and a location name or reference. Coordinates can be either provided by marking a point on a map or by entering coordinate values in the form or supplied by the cell phone. The data will be stored in a database for visualization on a map accessible to management staff and the public. Coral reef management personnel will use this map to identify areas of interest and investigate. Information gathered by means such as telephone calls, visits to the DNER, or written reports can also be incorporated into the system by the DNER personnel. The solution will be developed, tested and maintained using the Systems Development Life Cycle. The project will be managed using a simplified version of the Project Management Body of Knowledge (PMBOK) project management methodology.

Major tasks that belong to the project management are: development of a project charter, development of a project management plan, execution of the project based on the management plan, monitoring and closure. Initial execution tasks are: evaluation of solution alternatives, identification of additional resources to be contracted, and elaboration of an RFP for outsourced contract.

The other execution tasks are: solution design, solution development, solution testing and implementation.

**Lead person:** DNER, Informatics and computer center.

**Proposed partners:**

Contract of professional services for software development and GIS tasks.

**When (mm/yr):** Oct 2012 TO: Sept. 2014

**Products or Outputs:**

Web based system for reporting coral bleaching incidents

- Online guide for the public
- Operation manuals
- System manual
- Software documentation

**Expected Costs:** \$220,000

**Proposed Funding Source:**

Federal CRCP

**Measures of Success:**

A form will gather observational data, a picture of the incident, coordinates on a map and a location name or reference. Coordinates can be either provided by marking a point on a map or by entering coordinate values in the form. The data will be stored in a database for visualization on a map accessible to management staff and the public. Coral reef management personnel will use this map to identify areas of interest and investigate.



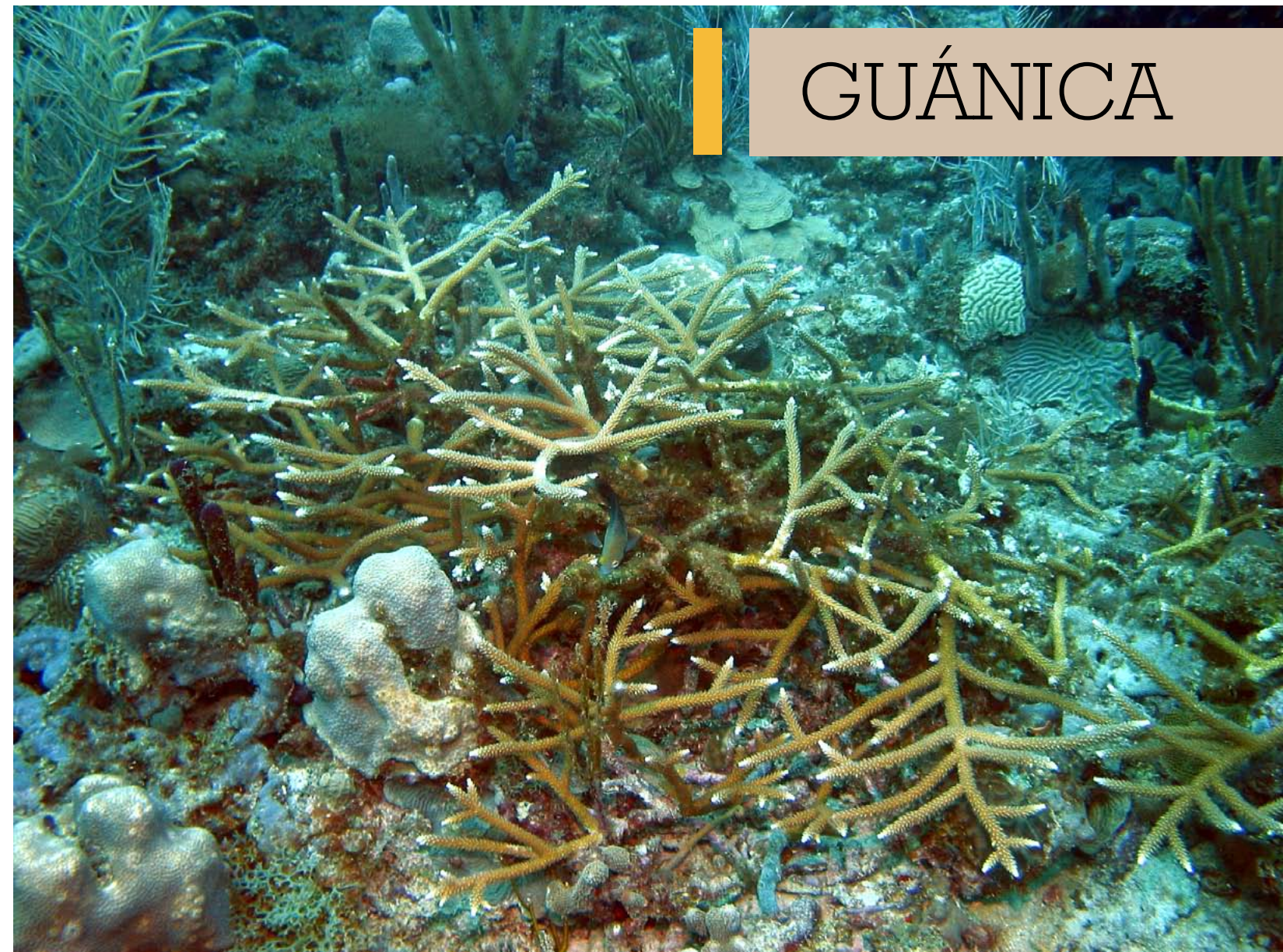
# ATTENDANCE

## CABO ROJO LAS WORKSHOP ATTENDANCE

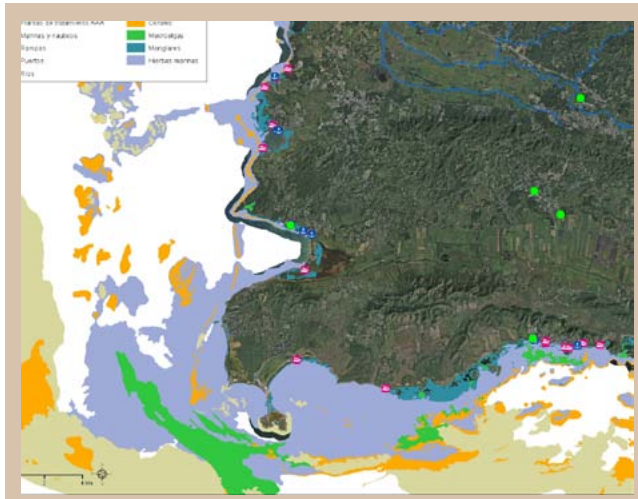
Name	Agency/Organization	Email
1. Gloria M. Toro	JCA	gloriatoro@jca.gobierno.pr
2. Patrick Reyes		pesaresip@gmail.com
3. Héctor J. Ruiz	HJR Reefscaping	Reefscaping reefscaping@gmail.com
4. Edgardo Ojeda	UPR Sea Grant	Edgardo.ojeda@upr.edu
5. Ildefonso Ruiz	DRNA/Ref. Boquerón	iruzv@drna.gobierno.pr
6. Antonio L. Ortiz	UPR-Aguadilla	Antonio.ortiz1@upr.edu
7. Evelyn Cepeda Pérez	CCPSAI	ccpsai@yahoo.com
8. Michelle Scharer	UPR	Michelle.scharer@upr.edu
9. Michael Nemeth	UPR	michaelnemeth@hotmail.com
10. Richard Appeldoorn	UPR	Richard.appeldoorn@upr.edu
11. Ilse Sanders	UIA	ilsepr@yahoo.com
12. Juan E. Casanova	DRNA	DRNA
13. Pablo Méndez Lazco	UPR-RCM	Pablo.mendez@upr.edu
14. Antares Ramos	NOAA	Antares.ramos@noaa.gov
15. Emmanuel Irizarry	NOAA	eirizarr@gmail.com
16. Coralys Ortiz	DRNA	cortiz@drna.gobierno.pr
17. Raimundo Espinoza	TNC	respinoza@tnc.org
18. Carlos Ramos Scharron	Island Research Foundation/U. Texas	cramos@irf.org
19. Raúl Santini	DRNA	Sant-nat@hotmail.com
20. Ana J. Navarro R	UPRM Sea Grant	Sea Grant Ana.navarro2@upr.edu
21. Evelyn Huertas	US-EPA	Huertas.evelyn@epa.gov
22. Beverly Yoshioka	USFWS	Beverly-yoshioka@fws.gov
23. Damaris Delgado	DRNA	ddelgado@drna.gobierno.pr
24. María Camacho Rodríguez	DRNA	mcamacho@drna.gobierno.pr
25. Julia Mignucci Sánchez	Mayagüezanos Pro Salud y Ambiente	imignucci@yahoo.com
26. Lisamarie Carubba	NOAA	Fisheries Lisamarie.carrubba@noaa.gov
27. Alida Ortiz	UMET	alortiz@suagm.edu
28. Héctor C. Horta	UMET	Tinglar1@gmail.com
29. Zoé Martínez Ramírez	CCPSAI	ccpsai@yahoo.com
30. Sean Griffin	NOAA	Sean.griffin@noaa.gov
31. Aida Rosario	DRNA	arosario@drna.gobierno.pr
32. Efra Figueroa	Geoambiente/UPR Sea Grant	efraphoto@gmail.com

## Puerto Rico's Coral Reef Local Action Strategies (LAS)

### GUÁNICA







## PROCESS FOR SELECTING LAS

A two-day LAS Workshop was held in Guánica, on August 18 - 19, 2011 for stakeholders in the priority area of Guánica. Thirty-two people, representing municipal, state and federal agencies, tourism service providers, scientists and local community members, attended the Workshop. See Appendix \_ for Attendance Sheet. The group identified the following issues as areas of concern for the conservation of the coral reefs in the priority area of Cabo Rojo:

- Visitors beyond carrying capacity/limit of acceptable change in the area.
- Need of BMPs in agriculture activities to prevent runoff.
- Inefficient used water treatment systems.
- Training and education needs of enforcement personnel.
- Absence of management and enforcement to control human activities around coral reefs.

## GOALS, OBJECTIVES AND PROJECTS

The Guánica LAS Workshop participants identified a total of 21 projects. Five of these are applicable to all four-priority areas, and 16 are pertinent for Guánica exclusively. Full Worksheets for these projects are found at the end of this section.

**GOAL 1 (Goal A1 + Goal A2) : Implement land-use planning at the watershed scale to control and reduce pollutant transport to the marine environment, minimizing water quality impacts to the coral reef ecosystem.**

**Objective 1 (1.1 A1.1 + A1.4) :** Support the use of a watershed approach in the development and implementation of new and existing Municipal Ordinance Plans and Puerto Rico Land use Plan to maintain water quality, consider cumulative impacts in order to avoid impacts and minimize loss of coastal habitats (wetlands, seagrass) that serve as filters to maintain sea water quality.

### LAS Projects

1. Audit used water treatment plants operations in Guánica and the entire watershed.
2. Determine correlation between waste water treatment plants discharges and coral reef degradation.
3. Develop research on the Sedimentation pattern in the watershed.

4. Monitoring seagrass beds conditions to evaluate water quality.
5. Identify, upgrade and improve current sewage disposal system.

6. Identification and documentation of CSO'S (Combined sewer overflows)
7. Separate runoff from wastewater discharges.
8. System monitoring to assess restoration. restauración.

**GOAL 2 (Goal C1). Manage the recreational and maritime uses of marine and coastal areas to reduce the impacts on coral reefs.**

**Objective 2 (C1.3 + C1.4):** Develop outreach programs for recreational, commercial and maritime operators to encourage compliance with coral reef regulations, assist with the management of lionfish infestation and use best management practices in their operations.

### LAS Projects

9. Development of a Web-Based Mapping Interface for the Allocation and Report of Coral Bleaching sites along the Puerto Rico coast.
10. Pollutant transport reduction through social marketing and local action
11. Establish Certification Program for Erosion and Sedimentation Control professionals. **All areas.**
12. Create an education and outreach Guánica Reserve Website

**Objective 3 (B3.4):** Strengthen enforcement

agencies so they are able to implement existing regulations in areas that require immediate protection.

### LAS Projects

13. Establish MOU with State Police / FURA and Municipal Police

**Objective 4 (B3.1):** Create an outreach and educational campaign to reduce fishing impacts over coral reef ecosystems aimed at the following:

- a. Recreational fishing community.
- b. Commercial fishing community.
- c. The judicial system.

### LAS Projects

14. Outreach to include marine resources (coral reef, fisheries, etc) beyond endangered species. **All areas.**
15. Creation of (CAC) Citizen Advisory Council or Pollutant Advisory Committee

**GOAL 3 (Goal C2.1). Enable and promote sustainable development practices in the coastal zone and upland areas of Puerto Rico that are associated with priority coral reef areas.**

**Objective 4 (C2.1):** Ensure that the Island-wide land-use plan for Puerto Rico that includes the policies of the Puerto Rico Coastal Zone as defined by the PR Coastal Zone Management Program (PRCZMP) (including territorial waters) and identifies zones for different uses including conservation, coral restoration, recreation and different types of development. The plan should address issues of light pollution, listed species and habitat protection.

**Objective 4 (C2.3):** Support the effective management of existing protected areas (such as natural reserves, state forests, and national park and wildlife refuges) within or adjacent to priority coastal areas, including the development and implementation of management plans.

### LAS Projects

16. Restoration/improvement of Guánica Lagoon - (CRTF Ongoing efforts).

**Objective 5 (C 2.2):** Identify and prioritize coastal and upland areas associated with priority coral reef areas for land acquisition, preservation, protection and restoration, such as important watershed areas or buffer areas adjacent to protected areas.

### LAS Projects

17. Identify areas of high diversity and live coral coverage for additional protection and expand existing protected areas to include these areas. Close areas when bleaching and disease or hurricane damages are extensive to allow for the recovery of reef areas. **All areas.**

**GOAL 4 (Goal B2 + Goal B3): Enhance enforcement, management and education programs to encourage public compliance with fishing regulations and reduce impacts of fishing to coral reef ecosystems.**

**Objective 6 (B3.2):** Educate enforcement personnel strengthening their understanding of impacts from recreational and maritime uses on coral reef ecosystems.

**LAS Projects**

- 18. Capacity building of DNER Rangers. **All areas.**
- 19. Provide DNER Rangers adequate equipment to undertake enforcement actions and improve results of interventions.

**GOAL 5 (Goal A3): Strengthen enforcement and engage stakeholders through education and outreach to reduce pollutant transport to the coral reef ecosystem.**

**Objective 7 (Obj.A1.2 + A3.2):** Improve the efficiency of the implementation of the regulations related to the control of erosion and sedimentation, pesticides, fecal coliforms and stormwater runoff at the Commonwealth and federal levels.

**Objective 8 (Obj.A3.11):**A3.11: Encourage programs that provide incentives to the regulated community for compliance with regulations. Incentives may include reduced monitoring requirements for a good compliance record, reduced permit fees, etc.

**LAS Projects**

- 20. Using the results from the sedimentation patterns in the watershed, revise the existing land use regulation (POT Planes Especiales).
- 21. Detect and eliminate illicit discharges & combined sewers





**Worksheet: Collaborative Implementation Plan #1 and #2**

**Priority Area:** Guánica  
**Goal:** A1 and A2: Implement land-use planning at watershed scale to control & reduce pollutant transport to the marine environment.  
**Objective:**  
 A2.6:A2.6: Support, whenever possible, upgrading existing wastewater treatment facilities to increase capacity and level of treatment, provided that the changes will be adequate to address sewage load and improve water quality (i.e., Parguera).

**Project I:**  
 I. Audit operations of waste water treatment plants in Guánica and all its land extension (watershed).  
 II. Establish the correlation between discharge of waste water treatment plants and the degradation of adjacent coral reefs.

**Description:**  
 1. Establish if there is a non-compliance pattern in the discharges.  
 2. Exact identification of discharge points that lead to the sea.  
 3. Analyses of the impacts in the discharge points and determine if the impacts are significant or excessive.

**Lead person:** DNER  
**Proposed partners:** EQB, EPA, PRASA  
**When (mm/yr) TO:**  
**Products or outputs:** Localization of discharge points  
**Expected costs:**  
**Proposed funding Source:**  
**Measures of Success:**

**Worksheet: Collaborative Implementation Plan #3**

**Priority Area:** Guánica  
**Goal:** A1  
**Objective:** A1.1

**Project I:** Carry out a survey about the sedimentation pattern of the watershed

**Description:**  
 1. Develop a survey to determine where the sediment is transported and its source. As part of the study, necessary monitoring stations should be installed to generate data to help understand the movement of sediments from inland to the sea.  
 2. After the data is gathered, inland areas where sediments are generated should be identified.

**Lead person:** DNER, NRCS, USGS, and Universities  
**Proposed partners:** NOAA, DNER, USGS, NRCS, EPA  
**When (mm/yr) as soon as possible TO:** Long term  
**Products or outputs:** Identification of the areas that are producing the majority of the discharges  
**Expected costs:** \$60K  
**Proposed funding Source:** NOAA, NRCS, USCGS, EPA, EQB  
**Measures of Success:** That the results of the study help identify the inland areas that need to be managed to control sediment discharges.

**Worksheet: Collaborative Implementation Plan #4**

**Priority Area:** Guánica  
**Goal:** 1, 2, 3  
**Objective:** A.2.11

**Project I:** Monitoring sea grass beds conditions to evaluate water quality

**Description:**  
 Choose a control site that would be an area that does not receive the river effluent. "Up Stream"  
 Research areas. One or various sampling sites in the mouth of the river an others downstream.  
 Measurements of density of grass, water quality, turbidity, temperature, abundance of organisms, nutrients, growing of epiphytes.  
 Put JOBOS  
 Monitoring stations in the river to measure water quality.

**Lead person:** DNER  
**Proposed partners:** UPR, NOAA, DNER, SEAGRANT  
**When (mm/yr) 2 yrs - 3yrs**  
**Products or outputs:** Parameters for water quality using marine resources.  
**Expected costs:** \$150K  
**Proposed funding Source:** NOAA, EPA  
**Measures of Success:** Meetings  
 Number of findings  
 Article, publications

**Worksheet: Collaborative Implementation Plan #5**

**Priority Area:** Guánica  
**Goal:** (from Priority Setting Document) Goal 1 – A1+A2  
**Objective:** (from Priority Setting Document) A2.6 A2.8

**Project I:** (work that needs to be done to achieve objective and goal) Identify, upgrade and improve current sewage disposal system.

**Description:**  
 In Guánica, a mayor problem is that many outfalls are or were not given proper maintenance and spill raw, untreated sewage into the watershed as well as directly into the bay. An example of this can be seen in many places, like Hotel Guanica 1929 and Barrio Chino. This project would also identify problem septic tanks, as well as help PRASA (AAA) further identify connections to the water treatment plant.

**Lead person:** AAA, Ridge to Reefs, JCA  
**Proposed partners:** EPA, DRNA, NOAA  
**When (mm/yr) ASAP 12-18 month**  
**Products or Outputs:** A reduction at raw sewage into the bay.  
 Better functioning of existing.  
**Expected Costs:** \$80,000  
**Proposed Funding Source:** AAA, EPA, NOAA, Rural Development (USDA)  
**Measures of Success:** Decrease of sewage overflow into the bay.

**Worksheet: Collaborative Implementation Plan #6**

**Priority Area:** Guánica  
**Goal:** (from Priority Setting Document) A.3 Enable and promote SD practices in CZ & upland areas of PR that are associated with priority CR areas.  
**Objective:** (from Priority Setting Document)

**Project I:** (work that needs to be done to achieve objective and goal) Identification and documentation of CSO'S (Combined sewer overflows)

<b>Description:</b>	<b>Lead person:</b> DNER
	<b>Proposed partners:</b> Miguel Canals DNER, EPA, RIDGE TO REEF
	<b>When (mm/yr)</b> One month
	<b>Products or Outputs:</b> List of Guanica CSO'S, & possible mitigation strategies. Meeting / agreements with EPA
	<b>Expected Costs:</b> < 5,000.00
	<b>Proposed Funding Source:</b> DNER; EPA
	<b>Measures of Success:</b> List – comprehensive locally agreed upon or acceptable possible mitigation strategies # of correspondence/ meetings with EPA. • EPA recognizes Guanica's CSO'S.

**Worksheet: Collaborative Implementation Plan #7**

**Priority Area:** Guánica  
**Goal:** (from Priority Setting Document) A1 yA2  
**Objective:** (from Priority Setting Document) A2.1 Eliminate combined sewers..... en la cuenca de Guanica

**Project I:** (work that needs to be done to achieve objective and goal) Separa descargas pluviales en aguas usadas

<b>Description:</b> I.D. plantas de trat. Donde el sistema pluvial esta conectado con el alcantarillado. Redirigir aguas usadas hacia alcantarillado correcto Darle mantenimiento a sistema de alcantarillado pluvial	<b>Lead person:</b> PRASA
	<b>Proposed partners:</b> EPA< JCA
	<b>When (mm/yr)</b> TO
	<b>Products or Outputs:</b> outcomed
	<b>Expected Costs:</b>
	<b>Proposed Funding Source:</b>
	<b>Measures of Success:</b>

**Worksheet: Collaborative Implementation Plan #8**

**Priority Area:** Guánica  
**Goal:** (from Priority Setting Document) Goal I  
**Objective:** (from Priority Setting Document)

**Project I:** (work that needs to be done to achieve objective and goal) System monitoring to assess restoration

<b>Description:</b> Continued Monitoring at identified priority (Base on existing data) factors ( e.g., nutrients, sediments, turbidity, contaminants, etc) to assess restoration effectiveness. Monitoring should occur within the river, bay and out to existing coral reef sites. Monitoring should include discrete sampled (variable internal for different factors) Coupled with continuously recording instruments (temperature, salinity, ph, turbidity , PAR).	<b>Lead person:</b> DNER
	<b>Proposed partners:</b> UPRM Marine Sciences, CCRI
	<b>When (mm/yr)</b> Continuous
	<b>Products or Outputs:</b> Data sets to verify the spatial and temporal scale of restoration success relative to LBSP.
	<b>Expected Costs:</b> \$200,000
	<b>Proposed Funding Source:</b> NOAA, EPA, NFWF
	<b>Measures of Success:</b> Project would provide data to assess success of Restoration to reduce LBSP.

**Worksheet: Collaborative Implementation Plan #9**

**Priority Area:** Guánica  
**Goal:** (from Priority Setting Document) 1 + 3  
**Objective:** (from Priority Setting Document) A 2.5.1

**Project I:** (work that needs to be done to achieve objective and goal) Pollutant transport reduction though social marketing and local action

<b>Description:</b> Social marketing (Not to be confused with education & outreach or social networking) is the business- model process of identifying barriers to changing behaviours through focus group discussions, experiments, & other methods. This social marketing project would focus on sedimentt and fecal coliform pollution. After identifying the barriers to changing behaviours of people & businesses, the team would identify ways to modify behaviour that are acceptable to the polluter & the key to this project is implementation of the techniques that were determined to successfully after behavior.	<b>Lead person:</b> DNER, EPA
	<b>Proposed partners:</b> SERI , NOAA< Ridge to Reef, UPR , Municipios
	<b>When (mm/yr)</b> One year – two years
	<b>Products or Outputs:</b> • Force group discussion resnets • techniques proved to modify behav. • implementation
	<b>Expected Costs:</b> \$50,000 - \$100,000
	<b>Proposed Funding Source:</b> EPA
	<b>Measures of Success:</b> Reduction of Pollution transport Altered behaviour of people & businesses Sutainability of behavior changes beyond the Project years.



**Worksheet: Collaborative Implementation Plan #10**

**Priority Area:** Guánica  
**Goal:** (from Priority Setting Document) 5  
**Objective:** (from Priority Setting Document) 3.4

**Project I:** (work that needs to be done to achieve objective and goal) Certification program for Erosion and Sedimentation Control professionals

**Description:**

- Identification of relevant professionals related to construction and agricultural practices that result in increased erosion and sedimentation of coastal watersheds and waterbodies.
- Identify legal- regulatory basis for certification.
- Develop the contents of the Certification ( i.e., training curriculum, training- workshop format).
- Initiate certification program.

ESC professionals:

- architects
- engineers
- heavy equipment operators.

**Lead person:** EQB, EPA, OGPE, OGIPE  
**Proposed partners:** DNER, RIDGETO REEF  
**When (mm/yr)** 2012  
**Products or Outputs:** Effectively certified professionals to implement erosion and sedimentation control BMPs  
**Expected Costs:** \$75,000  
**Proposed Funding Source:** EPA, EQB, NOAA  
**Measures of Success:**

- Reduce sediment loadings to water bodies and
- Increased numbers of professionals certified to effectively implement best management practices to reduce sediment loadings to coastal waters and coral reef areas.

**Worksheet: Collaborative Implementation Plan #11**

**Priority Area:** Guánica  
**Goal:** (from Priority Setting Document) 4, 5  
**Objective:** (from Priority Setting Document) A.3.1.1 ,B 3.1, B 3.2, B 3.3

**Project I:** (work that needs to be done to achieve objective and goal) Guanica Reserve Website

**Description:**

Interactive Guanica Reserve website to publish:

1. Scientific projects
2. Working schedule
3. Activities
4. Videos
5. Maps
6. Recruit volunteers

**Lead person:** DRNA  
**Proposed partners:** Seagrant, Amigos de Tres Palmas, DRNA, UPR, NOAA  
**When (mm/yr)** TO  
**Products or Outputs:** WEBSITE  
**Expected Costs:** \$10,000.00  
**Proposed Funding Source:** Sea grant, NOAA, DRNA  
**Measures of Success:**

- Encuestas a las personas (Usuarios)
- Numbers of Hrs.
- Comentarios del Público
- Sugerencias

**Worksheet: Collaborative Implementation Plan #12**

**Priority Area:** Guánica  
**Goal:** (from Priority Setting Document) 4 + 5  
**Objective:** (from Priority Setting Document) B 3.1)

**Project I:** (work that needs to be done to achieve objective and goal) B3.5 Enable joint enforcement agreement

**Description:**

Establish MOU with State Police / Fura and Municipal Police

- Train Police (FURA)

MOU with Coast Guard

En Proyecto de Educación- añadir:

- Create reference materials Identifying species and relevant regulations

**Lead person:** DRNA  
**Proposed partners:** Policia, Mun. Guanica, Fura  
**When (mm/yr)** TO  
**Products or Outputs:**  
**Expected Costs:**  
**Proposed Funding Source:**  
**Measures of Success:**

**Worksheet: Collaborative Implementation Plan #13**

**Priority Area:** Guánica  
**Goal:** (from Priority Setting Document) 4 & 5  
**Objective:** (from Priority Setting Document) B 3.1 Educate target audiences on how to reduce fishing impacts

**Project I:** (work that needs to be done to achieve objective and goal) Create outreach and education campaign

**Description:**

Develop 3 campaigns for:

1. Recreational fishers
2. Commercial fishers
3. Judicial system (bring experts such as environmental lawyers, scientists to explain fishing impacts in the ecosystem).

- Include an analysis of economic and social impacts
- Produce educational video, especially to judges

**Lead person:** DRNA  
**Proposed partners:** Consejo Pesquero, NMFS, NOAA  
**When (mm/yr)** TO  
**Products or Outputs:**  
**Expected Costs:**  
**Proposed Funding Source:**  
**Measures of Success:**

**Worksheet: Collaborative Implementation Plan #14**

**Priority Area:** Guánica  
**Goal:** (from Priority Setting Document) A1  
**Objective:** (from Priority Setting Document) A1.2; A1.1; A1.6; A2.4

**Project I:** (work that needs to be done to achieve objective and goal) (CAC) Citizen Advisory Council - creation Or Pollutant Advisory Committe

**Description:**  
 Creation of local CAC.  
 Technical advisor could advise tha CAC but it would be Chaired by two citizens.They would be required to have regular meetings in order to use funds for projects.  
 They would provide comments on dvlp. Projects with the reserve and they would implement their own projects.  
 For the first few months a DNER person would be the chair until the CAC determined the E-board.  
 The CAC would also report on the main inputs of point source pollution and work with businesses- homeowners- DNER to mitigate.  
 The businesses - homeowners would be required to go in front of the CAC or PAC to defind the pollution & strategize with the CAC and the technical advisor to mitigate.  
 Tha CAC would have to keep regular minutes and send them each quarte to a dner rep.

**Lead person:** NOAA CORAL FELLOW OR VIGILANTES  
**Proposed partners:** Ridge to Reef; DRNA; EPA; NOAA  
**When (mm/yr)** TO  
**Products or Outputs:**  
 1. CAC  
 2. Identification of point sources  
**Expected Costs:** Technical advisor \$3-5,000/ yr.  
**Proposed Funding Source:** NEMU; Violation fees from DNER  
**Measures of Success:**  
 # of regular meetings  
 # of businesses – homeowners  
 # of mitigation projects completed

**Worksheet: Collaborative Implementation Plan #15**

**Priority Area:** Guánica  
**Goal:** (from Priority Setting Document) I  
**Objective:** (from Priority Setting Document) A 2.11 Restore, acquire & enhance coastal wetlands

**Project I:** (work that needs to be done to achieve objective and goal) Restoring /improvement of Guánica Lagoon (CRTF ongoing efforts)

**Description:**  
 • Continue with inter agency coordination and scientific research.

**Lead person:** DRNA  
**Proposed partners:** NRCS, EPA, USCGS  
**When (mm/yr)** TO  
**Products or Outputs:**  
**Expected Costs:**  
**Proposed Funding Source:**  
**Measures of Success:**

**Worksheet: Collaborative Implementation Plan #16**

**Priority Area:** Guánica  
**Goal:** B.3  
**Objective:** Empowerment (B3.2?)

**Project I:**

**Description:**  
 Training to rangers:  
 Trainings  
 • Species identification (corals and fish)  
 • Management of evidence:  
 1.What to do with a specimen of illegally captured specie to rescue it and meet their conservation function.  
 2.Who to call (e.g., coral capture)  
 • Fishing gear: background of how different fishing gears affect the resource negatively; for example of why certain areas cannot be used (e.g., to use chlorine to capture octopus destroys the ecosystem). What does fishing finish implies in the area  
 • Management of the impacts on corals:  
 How to measure the level of damage  
 • Management of Lion fish:  
 • How to manage the wounds cause by it  
 • How to manage captured fish  
 • How to educate the public  
 • Research techniques  
 • How to know if there is suspected illegal act (e.g., removal of corals)  
 • Field guides (with new regulations) of species allowed and unallowed (fish and corals), with review of the pertinent laws and how to intervene.

**Lead person:** NOAA, DRNA  
**Proposed partners:**  
**When (mm/yr)** TO:  
**Products or outputs:**  
**Expected costs:**  
**Proposed funding Source:**  
**Measures of Success:**

**Worksheet: Collaborative Implementation Plan #17**

**Priority Area:** Guánica  
**Goal:** (from Priority Setting Document) C.I  
**Objective:** (from Priority Setting Document)

**Project I:**

**Description:**  
 Equipment to implement interventions:  
 • Cameras  
 • Regular (water resistant)  
 • Powerful zoom with included GPS  
 • Nocturnal lens  
 • Caliper  
 • GPS for terrestrial patrol  
 • “PR” system: when there are interventions related to vessels and register number (of PR), many times they call the person that has access to the database and the person is unavailable, that is why in the majority of the cases, the intervention does not go through. (Amendment to regulation 430)

**Lead person:** DRNA Navigation and rangers  
**Proposed partners:** FURA, State and Municipal Police  
**When (mm/yr)** TO  
**Products or Outputs:**  
**Expected Costs:**  
**Proposed Funding Source:**  
**Measures of Success:**



## Worksheet: Collaborative Implementation Plan #18

**Priority Area:** Guánica

**Goal:** (from Priority Setting Document) A1

**Objective:** (from Priority Setting Document) A1.2

**Project I:** (work that needs to be done to achieve objective and goal) (CAC) Using the results from the survey of sedimentation patterns in the watershed, revise the active land regulations (POT, Special Plans POT).

**Description:**

Using as a base the results of the survey of sedimentation patterns in the watershed, revise the up to date land regulations in accordance with Territorial Plans, Land use Plans, other active Special Plans.

This assessment's purpose should be to state if the proposed active regulation is adequate to control the problem or if there is need to propose changes.

- Evaluate if the land use regulation is being enforced or if there is a problem in the enforcement.
- In case of finding that the actual regulations (classification and rating districts) are not adequate, propose changes. If the problem is of enforcement, strengthen the legal mechanisms to enforce the regulation.

**Lead person:**

OGP, JP, Legislature

**Proposed partners:**

Municipal governments in the watershed, OGPE and OIGPE

**When** (mm/yr) August 2014 TO: June 2016

**Products or outputs:**

Proposal for changing rating and classification (revision and amendment of Plans) and reorganization of the enforcement system.

**Expected costs:** \$150K

**Proposed funding Source:** NOAA, OGP

**Measures of Success:**

## Worksheet: Collaborative Implementation Plan #19

**Priority Area:** Guánica

**Goal:** (from Priority Setting Document) I

**Objective:** (from Priority Setting Document) Empowerment 2.1

**Project I:** (work that needs to be done to achieve objective and goal) Detect and eliminate illicit discharges & combined sewers

**Description:**

- Visual inspections of outfalls to the bay
- Identify sources of raw sewage into the stormwater system.
- Undertake appropriate enforcement actions. (JCA,EPA)
- Initiate corrective actions. (PRASA & responsible party).

**Lead person:** PRASA,EPA,JCA

**Proposed partners:**

RIDGE TO REEF, DRNA, MUNICIPALITYS

**When** (mm/yr) TO

24 MONTHS

**Products or Outputs:**

Reduced illicit discharges.

Water quality improvement

**Expected Costs:** \$80,000 o más \$200,000

**Proposed Funding Source:**

EPA, PRASA, NOAA, RURAL DEVELOPMENT

**Measures of Success:**

Number of interventions lower counts of coliforms, Enterococos/meeting water quality standards.

## GUÁNICA LAS WORKSHOP ATTENDANCE

Name	Agency/Organization	Email
1. Conrado M. Calzada	PUCPR	c.calzada@mail.pucpr.edu
2. Ángel G. Rivera	PUCPR	
3. Vigilante Amilcar Caraballo Guzmán	DRNA	Kalua4@yahoo.com
4. Roberto Viqueira		rviqueira@hotmail.com
5. Melissa Meléndez	CARICOOS UPR-M	melissa.melendez@upr.edu
6. Aida Rosario	DRNA-LIP	arosario@drna.gobierno.pr
7. Raimundo Espinoza	TNC	respinoza@tnc.org
8. Paul Sturm	RTR	paul@ridgetoreef.org
9. José L. Orengo Gómez	Excursiones Ecoboriken	excursionesecoboriken@gmail.com
10. Miguel Canals	DRNA	menqui@hotmail.com
11. Vgte. Ana L. Díaz Espinosa	DRNA	aliann23@hotmail.com
12. Damaris Delgado	DRNA-NCRR	ddelgado@drna.gobierno.pr
13. Antares Ramos	NOAA-NOS	Antares.ramos@noaa.gov
14. Collin Daugherty	TNC	cdaugherty@tnac.org
15. Kasey Jacobs	DRNA-ZC	kjacobs@drna.gobierno.pr
16. Ernesto Díaz	DRNA Z-C	ediaz@drna.gobierno.pr
17. Jorge (Reni) García	UPRM	goingdeep49@gmail.com
18. Jeiger Medina Muñiz	UPR-RP	Jeiger.medina@gmal.com
19. Raúl Santini Rivera	DRNA	Sant-nat@hotmail.com
20. Alida Ortiz	UMET	alortiz@suagm.edu
21. Rina Hauptfeld	DRNA/NOAA	reservamarinatrespalmas@gmail.com
22. Pedro A. de León	UMET	pedrotulus@yahoo.com
23. Héctor C. Horta	UMET	tinglar1@gmail.com
24. Ilse Sanders	UIA	ilsepr@yahoo.com
25. Richard Appledoorn	UPRM-Cs. Marinas	Richard.appledoorn@upr.edu
26. Vivian Padilla Rosado	DRNA	naivpr@yahoo.com
27. Aileen T. Velazco Domínguez	DRNA	avelazco@drna.gobierno.pr
28. Evelio Valeiras Miní	DRNA-ZC	evaliras@drna.gobierno.pr
29. Nilda Jiménez	DRNA	njimenez@drna.gobierno.pr
30. Ignacio Martínez	JP	

# SUMMARY OF PROJECTS

PROJECTS	GOALS & OBJECTIVES	CULEBRA	NORTH EAST RESERVES	CABO ROJO	GUANICA	ALL AREAS
Proj. 1. Review the proposed and approved Territorial Plans to evaluate if the proposed or established zoning is adequate to prevent or minimize coral reef impacts associated with land use or development.	Goal I Obj.1 (A1.1)					•
Proj. 2. Development of erosion and sedimentation control plans (CES)	Obj.1 (A1.2)		•	•		•
Proj. 3. Revise proposed Culebra's Municipal Land Use Plan to analyze possible impacts of proposed zoning districts.			•			
Proj.4. Implement BMPs to control erosion and sediment transport in the watershed.			•		•	
Proj.5. Develop an updated map of Culebra land-use and a marine habitat baseline.	Obj. 2 (A1.4)	•				
Proj. 6. Assessment of the effects of land-based sources of pollution: pollutants, sediments & nutrients on coral reefs ecosystems in Culebra.		•				
Proj 7. Spatial identification and assessment of land-based sources of pollution in Culebra: pollutants, sediments & nutrients.		•				
Proj. 8. Development of an interdisciplinary approach to mitigate the effects of erosion on the marine environment of Culebra.		•				
Proj. 9. Creation of (CAC) Citizen Advisory Council or Pollutant Advisory Committee		•				

PROJECTS	GOALS & OBJECTIVES	CULEBRA	NORTH EAST RESERVES	CABO ROJO	GUANICA	ALL AREAS
Proj. 10. Audit used water treatment plants operations in Guánica and the entire watershed.		•		•	•	
Proj. 11. Determine correlation between wastewater treatment plants discharges and coral reef degradation.					•	
Proj. 12. Develop research on the sedimentation pattern in the watershed.				•		
Proj. 13. Monitoring seagrass beds conditions to evaluate water quality.				•	•	
Proj. 14. Identify, upgrade and improve current sewage disposal system.				•	•	
Proj. 15. Identification and documentation of CSO'S (Combined sewer overflows)				•	•	
Proj. 16. Separate runoff from wastewater discharges.				•	•	
Proj. 17. System monitoring to assess restoration.				•	•	
Proj. 18. Using the results from the sedimentation patterns in the watershed, revise the existing land use regulation (POT Planes Especiales).	Obj. 4 (A2.3)		•	•	•	
Proj. 19. Detect and eliminate illicit discharges & combined sewers			•	•	•	
Proj. 20. NE Reserves land-use and marine habitat baseline mapping.	Obj. 5 (A1.5)		•		•	
Proj. 21. Alliance between state and federal agencies for the effective application of laws and regulations. (2 phases: Organization and Implementation)	Obj. 6 (A3.9) Obj. 9 (C2.3)			•		



PROJECTS	GOALS & OBJECTIVES	CULEBRA	NORTH EAST RESERVES	CABO ROJO	GUANICA	ALL AREAS
Proj. 22. Water quality monitoring and inspection of septic and sewer systems at the Watershed scale. Design of onsite treatment alternative using appropriate technologies as well as recommendation of measures to repair and maintain sewer systems in collaboration with State and Federal agencies.	Obj.11 (A2.1)		•		•	
Proj. 23. Assessment and simulation of land-use effects and BMP practices on water quality in the reef watersheds within the NE Reserves.			•			
Proj. 24. Development and implementation of BMPs programs and technology available for land development and agricultural activities.				•		•
Proj. 25. Establish sampling stations to monitor water quality.				•	•	
Proj. 26. Water quality monitoring and inspection of septic and sewer systems at the Watershed scale. Design of onsite treatment alternative using appropriate technologies as well as recommendation of measures to repair and maintain sewer systems in collaboration with State and federal agencies.						
Proj. 27. Evaluate water quality standards for the protection of coral reefs and marine life in other jurisdictions for possible adoption in Puerto Rico.						•
Proj. 28. Gap Analysis of Coastal Planning in Puerto Rico						•
Proj. 29. Reduction of wastewater discharges to rivers and coastal waters.						•

PROJECTS	GOALS & OBJECTIVES	CULEBRA	NORTH EAST RESERVES	CABO ROJO	GUANICA	ALL AREAS
Proj. 30. Fine scale GIS-based mapping of __N isotopic signals for management of eutrophication impacts across the North East Reserve.	Goal 2 (A2 +A3) Obj. 2 (A3.2) Obj. 3 (A3.4)	•	•			
Proj. 31. Assessment of land based sources of pollution affecting the coral reefs of Cabo Rojo through watershed analyses, water quality monitoring, and oceanographic characterization.					•	•
Proj. 32. Create a working group to identify existing regulations that affect coral reef protection.					•	•
Proj. 33. Educational community outreach to prevent septic water sweeps to intermittent water bodies or with runoff water.					•	
Proj. 34. Zoning framework of southwestern submerged areas.					•	
Proj. 35. Asses the state of the water-treatment plants, septic tanks, and hook-ups to sewage plants in areas that already have been identified as having fecal bacteria.				•	•	
Proj. 36. Monitoring of water quality in coastal waters.						•
Proj. 37. Develop a guide/ protocol for action, response and supervision in case of illegal activities such as: deforestation, land removal, erosion, sedimentation (or sediment movement).				•		•
Proj. 38. Training workshops for DNER Rangers on the implementation of CEST Plan.						•
Proj. 39. Establish MOU with State Police / FURA and Municipal Police.		•				

PROJECTS	GOALS & OBJECTIVES	CULEBRA	NORTH EAST RESERVES	CABO ROJO	GUANICA	ALL AREAS
Proj. 40. Implementation of an erosion control and marine turbidity- monitoring plan for the Island of Culebra	Obj.4 (A3.5)	•				
Proj. 41. Administrative order for the creation of a no-take zone around (1.6km) Cayo Lobos, Blanquilla and Cayo Diablo in the Cordillera Reef Reserve.	Obj. 5 (B1.1)	•				
Pro. 42. Determine carrying capacity/limits of acceptable change of the heavily used areas, such as Cayo Icacos.	Obj. 6 (B1.3)	•				
Proj.43. Designation of coral reef recovery areas to support reef ecosystem rehabilitation.		•				
Proj. 44. Develop signage for Ensenada Yegua.		•				
Proj. 45. Zoning area of Cordillera Reef Natural Reserve according to uses.		•				
Proj. 46. Mass media campaign/ social marketing to promote adequate conduct for the protection of the natural resources of the North East.		•				
Proj. 47. Habilitate public sanitary facilities and other services for visitors use in Cayo Icacos, Reserva Natural de La Cordillera, Fajardo.	Obj. 8 (C1.2)	•				
Proj. 48. Build a public information and education center for the Northeast Reserves at Las Croabas, Fajardo	Obj. 9 (C1.3)	•				
Proj. 49. Pollutant transport reduction through social marketing and local action						
Proj. 50. Create an education and outreach Guanica Reserve Website.						

PROJECTS	GOALS & OBJECTIVES	CULEBRA	NORTH EAST RESERVES	CABO ROJO	GUANICA	ALL AREAS
Proj. 51. Design and implement a capacitation course and certification system for the “CEST Plan” and “Best Management Practices” and require it to obtain licenses for Engineers, Inspectors, Authorized Professionals, Architects and any other professional involved or related to construction activities.	Goal 3 Obj. 4 (A3.4)		•			•
Proj. 52. Vessel grounding enforcement & response.	Obj. 3 (A3.3)					•
Proj. 53. Capacity building program for DNER Rangers on coral reefs, other marine ecosystems and related laws and regulations.	Obj. 5 A3.5)		•			•
Proj. 54. Restoration/ improvement of Guánica Lagoon - (CRTF Ongoing efforts)	Obj.4 (C2.3)				•	
Proj. 55. Create an outreach and educational campaign to reduce fishing, recreational and commercial impacts on coral reef ecosystems aimed at the following: a. recreational fishing community, b. commercial fishing community, c. judicial system, d. boat operators (recreational, commercial and maritime).	Goal 4 Obj. 4 (B3.1)					•
Proj. 56. Provide DNER Rangers adequate equipment to undertake enforcement actions and improve results of interventions.			•		•	
Proj. 57. Educational videos on coral reef conservation for the Vieques-Fajardo-Culebra ferries.	Obj.15 (C2.2)	•	•			
Proj. 58. The North East Reserves Marine Ecosystem Inventory: Identification of priority coral reef, seagrass and mangrove areas for conservation, protection and restoration.			•	•		



PROJECTS	GOALS & OBJECTIVES	CULEBRA	NORTH EAST RESERVES	CABO ROJO	GUANICA	ALL AREAS
Proj. 59. Development the management plans for the Natural Reserve of the North East Ecological Corridor, and other North East Natural Protected Areas and creation of advisory board for them.	Obj.16 (C2.3)		•	•		
Proj. 60. Coral reef ecosystem resilience enancement through ecosystem-based landscape level restoration.			•	•		
Proj. 61. Artificial coral reefs and ecosystem-based approaches to enhance coral reef resilience within the North East Reserves.				•		
Proj. 62. Monitoring of water quality in coastal waters.						•
Proj. 63. Develop a guide/ protocol for action, response and supervision in case of illegal activities such as: deforestation, land removal, erosion, sedimentation (or sediment movement).				•		
Proj. 64. Create ID cards with images of fish and reef etiquette messages.	Goal 5 Obj. 3 (CI.3)					•
Proj. 65. Develop and establish a certification process for service providers such that clients receive an orientation regarding best practices to protect the marine ecosystem prior to starting the trip.						•
Proj. 66. Develop and establish a certification process for marina's clients as part of their user contract.						•
Proj. 67. Develop two video-based coral reef etiquette messages –one for SCUBA divers and one for snorkelers, emphasizing proper behavior while visiting coral reefs.						•

PROJECTS	GOALS & OBJECTIVES	CULEBRA	NORTH EAST RESERVES	CABO ROJO	GUANICA	ALL AREAS
Proj. 68. Create PSAs to increase public awareness of the importance of the marine environment (ecological, economical, etc) and of its conservation.						•
Proj. 69. Develop and implement a Vessel Management Plan specific to Culebra, Fajardo, Guánica and Cabo Rojo regions.						•
Proj. 70. Identify areas for Conservation vs areas for recreational activities and establish zoning based on recreational activities.	Obj. 1 (CI.1)					•
Proj. 71. Inventory to determine areas of potential coral reef development and assess the condition of those reefs.	Obj. 2 (CI.2)					
Proj. 72. Demographic monitoring of elkhorn coral.					•	
Proj. 73. Coral reef resiliency monitoring.					•	
Proj. 74. Coral reef farming “heap start”.	Obj.27 DI.1)				•	
Proj. 75. Study the limit of acceptable change to establish the recommended number of visitors per day for the most frequently visited and or utilized sites within the managed areas in Culebra, Guánica, Fajardo and Cabo Rojo.	Obj.28(DI.2)					•
Proj. 76. Identify areas of high diversity and live coral coverage for additional protection and expand existing protected areas to include these areas.	Goal 6 Obj. 3 (C2.3)					•

PROJECTS	GOALS & OBJECTIVES	CULEBRA	NORTH EAST RESERVES	CABO ROJO	GUANICA	ALL AREAS
Proj. 77. Outreach and education campaign to enforce compliance with concession permits to operate in managed areas in Culebra, Guánica, Fajardo and Cabo Rojo.						•
Proj. 78. Development of a Web and Cell phone based mapping interphase for the localization and report of event sites, including coral bleaching, along the Puerto Rico coast and waters.						•
Proj. 79. Inventory of invasive, exotics and native fish species for the promotion of BMPs and education.	Goal 7 (Goal 3+ Goal D1)					•
Proj. 80. Engage tourist service providers, recreational divers and commercial fishers in the location and removal of lionfish through training and special permits (for lionfish removal in no-take Reserves) and create a promotional consumer campaign to market lionfish to restaurants and food stands.	Obj. 2 (C3.2)					•

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# CREDITS

**TEXT** DRA.ALIDA ORTIZ SOTOMAYOR (UMET)

**REVISION** DAMARIS DELGADO AND ANTARES RAMOS

**TRANSLATIONS** MARISOL QUIÑONES VILCHES (UMET)

**PHOTOS** HÉCTOR RUIZ (REEFSCAPE, INC), EFRA FIGUEROA (GEOAMBIENTE), ÁLIDA ORTIZ SOTOMAYOR

**GRAPHIC DESIGN** ANAYARÍ FERNÁNDEZ MARTÍN

For more information on this document visit [www.drna.gobierno.pr](http://www.drna.gobierno.pr).





