



Ministère de l'Environnement République d'Haiti



The Protected Area of Managed Natural Resources of the Three Bays (PA3B)

Management Plan
2017 - 2027



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for

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and
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Cover Photo: Fishermen pole their boats in Baie Liberte. Photo credit: © Tim Calver for The
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LIST OF ACRONYMS

ANAP	Agence nationale des Aires Protégées
BI	Birdlife International
CBD	Convention on Biological Diversity
CEPF	Critical Ecosystem Partnership Fund
CEPROBAC	Coordination Environnementale pour la Protection de la Baie de Caracol
CCVI	Climate Change Vulnerability Index
CMBP	Caribbean Marine Biodiversity Program
CIAT	Comité Interministériel d'Aménagement du Territoire
CITES	Convention on International Trade in Endangered Species of Wild Flora and Fauna
CLME	Caribbean Large Marine Ecosystem Project
CNIGS	Centre National de l'Information Géo-Spatiale
DR	Dominican Republic
EBA	Endemic Bird Area
EBSA	Ecologically or Biologically Significant Marine Area
ESA	U.S. Endangered Species Act
FoProBiM	Fondation pour la Protection de la Biodiversité Marine
GDP	Gross Domestic Product
GEF	Global Environment Facility
IBA	Important Bird Area
IDB	Inter-American Development Bank
ICCF	International Conservation Caucus Foundation
ICRI	International Coral Reef Initiative
IPCC	International Panel on Climate Change
ISPAN	Institut de Sauvegarde du Patrimoine National
IUCN	International Union for Conservation of Nature
KBA	Key Biodiversity Area
LDC	Least Developed Country
MIDA	Multi-International Designated Areas
MMA	Marine Managed Area
MOE	Ministry of Environment
MOT	Ministry of Tourism
MPA	Marine Protected Area
NBSAP	National Biodiversity Strategy and Action Plan
NGO	Non-Governmental Organisation
PA3B	Protected Area of Managed Natural Resources of the Three Bays
PIC	Parc Industriel de Caracol
PMA	PA3B Management Authority

PPT	Parts Per Thousand
SCUBA	Self Contained Underwater Breathing Apparatus
SEMANAH	Service Maritime et de Navigation d'Haïti (SEMANAH)
SIDS	Small Island Developing State
SPAW	Specially Protected Areas and Wildlife
SAP	Strategic Action Plan
TNC	The Nature Conservancy
UGeBFo	Unité de Gestion de la Baie de Ft. Liberté
UN	United Nations
UNESCO	United Nations Education, Scientific and Cultural Organization
UNEP	United Nations Environment Programme
UNDP	United Nations Development Programme
USAID	United States Agency for International Development
UTE	Unité Technique d'Exécution
WCR	Wider Caribbean Region
WHC	World Heritage Convention
WRI	World Resources Institute

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EXECUTIVE SUMMARY

The Protected Area of Managed Natural Resources of the Three Bays (PA3B) (Aire Protégée de Ressources Naturelles Gérées des Trois Baies - AP3B) was created by Presidential Decree on March 21, 2014 as Haiti's largest marine protected area. Encompassing an area of 75,406 hectares, the PA3B protects a unique marine complex of fringing and barrier coral reefs, seagrass beds, mangrove forests, deep offshore waters, and adjoining coastal plains known for their diverse aquatic and brackish water habitats, and dry tropical forests. The area has witnessed centuries of human activity dating from pre-Columbian times and the occupation of indigenous Taino people, to the arrival of Christopher Columbus and the sequence of world-altering events through Spanish and French colonization and the Haitian Revolution.

These many centuries of human occupation have created a seascape and landscape that are highly altered from their natural state, and as required by the Presidential Decree, the management of the marine and terrestrial environments of PA3B will focus on the maintenance and restoration of their biodiversity and ecological integrity while responding to the needs of the communities within the protected area's borders. Therein lies the central challenge of this management plan – to guide the transition from a highly and unsustainably utilized environment, with its attendant poverty and poor living conditions, to a protected area characterized by sound environmental management, economic viability, and social balance.

In its description of the regional, national, and international context for PA3B, this plan emphasizes the need for the protected area to 'find its place' among a host of pre-existing conditions, not the least of which are the presence of several communities and a range of economic activities that have existed for long periods of time. These conditions create challenges with respect to uncertainty about ongoing resource use, land ownership and boundary delineation, and an appropriate form of governance. In addition to the PA3B's regional and national significance, the area's international importance is recognized as is its potential to become a natural and cultural resource of global renown through possible designation as a national park and/or a World Heritage Site.

This plan progresses through a description of the physical environment and biological resources of PA3B, both marine and terrestrial, noting, in particular, the special and unique features and those of conservation concern that will require directed management attention over the coming years and decades. The extensive and often unrecognized cultural resources of PA3B are also described with the view of increasing their profile in the management framework for PA3B and in accordance with their international caliber and significance.

The management plan directly addresses all of the threats and issues that had previously been identified through a comprehensive analysis of conditions that may constrain or compromise PA3B's management into the future. As an overarching concern, the plan addresses the need to prepare for what now appears to be the inevitable impacts of climate change. Within that context, a number of threats and issues are described and 'key findings' identified that, in turn, form the basis of both the Vision and the Zoning Plan, and drive the development of nine management programs and their goals, objectives, and strategic actions.

A long-term Vision is presented for PA3B that is a reflection of both the Decree and the management of PA3B as an IUCN Category VI protected area. Accordingly, PA3B will provide for a range of levels of protection and conservation as well as sustainable human uses and activities that are compatible with the conservation of nature. The Vision is:

The ecologically rich and fragile marine, coastal, and terrestrial resources in the PA3B, most notably the complex of coral reefs, seagrass beds, mangrove forests, aquatic habitats and tropical dry forests, with their associated archaeological and historic features, are assured their long-term protection and the maintenance of their biological diversity in perpetuity, while, in this spirit, providing for the sustainable use of select resources in support of local communities.

The plan presents a Zoning System for the management of PA3B that includes five zones. The resulting zoning plan seeks a balance between the conservation and protection of natural resources and their continued sustainable use and includes:

- Regeneration Zones
- Conservation Zones
- Sustainable Use Zones
- Community Management Zones
- Cultural Conservation Zones

The Regeneration and the Conservation zones, will apply equally in both the marine and terrestrial environments. The other three zones, Sustainable Use, Community Management and Cultural Conservation, are solely terrestrial. Much of the terrestrial Restoration Zone is dedicated to the protection of the coastal fringe adjacent to fragile marine environments and to the recovery of the Tropical Dry Forest. In the marine environment, the Restoration Zone includes the mangrove forests, most seagrass beds and a significant portion of the nearshore marine waters and coral reefs. A relatively small portion of the offshore waters will also be placed in the Restoration Zone. The remaining portions of the marine waters within PA3B are included in the Conservation Zone where limited fishing can continue to occur.

The Sustainable Use Zone is restricted to the agricultural lands and the salt pans along the coast to provide for their continued use but with limits on their expansion and the scope of activities and management practices to ensure sustainability. The Community Development Zone recognizes those communities within PA3B's boundaries and the need for their ongoing management, especially given the possible impacts of climate change and sea level rise. The Cultural Conservation Zone contains significant cultural resources and are identified as 'spot zones' to recognize specific features, such as the fortifications at Fort Liberté, pre-Columbian archaeological sites or shipwreck sites on the coral reef. The table below illustrates the size and relative proportion of the zones within the whole of PA3B.

Size and Proportion of Zones Within PA3B*	
Total Size	75,405 (100%)
Marine Environment	57,930 (77%)
Terrestrial Environment	17,475 (23%)
Zoning Proportions – Marine Environment	
Marine Regeneration Zone	25,560 (45%)
Marine Conservation Zone	31,380 (55%)
Zoning Proportions – Terrestrial Environment	
Terrestrial Regeneration Zone	7,815 (45%)
Terrestrial Conservation Zone	2,600 (15%)
Sustainable Use Zone	6,640 (38%)
Community Management Zone	375 (2%)

* Size and proportion figures are approximate. The spot zones in the Cultural Conservation Zone are not included.

The plan presents a total of nine management programs with approximately 120 specific actions to be implemented, to the extent possible, over the life of the plan. The nine management programs include:

1. Biodiversity Conservation
2. Environmental Education and Awareness
3. Sustainable Resource Use
4. Cultural Resource Conservation
5. Ecotourism
6. Community Management
7. Governance, Co-management and Enforcement
8. Infrastructure
9. Monitoring

Through these programs, the plan presents an assembly of management actions necessary to realize the ultimate goal of achieving the recovery and restoration of the PA3B's ecosystems, as well as the many ancillary goals of effectively recognizing its cultural resources, creating the means for a cooperative management regime with stakeholders and

communities, promoting ecotourism and others. The plan has a time horizon of ten years (2017-2027) with an interim five-year review, but it is recognized that the successful implementation of a number of programs and actions will extend well into the future.

The plan will be undertaken in phases based on continued consultations with communities and stakeholders and the availability of human, technical and financial resources. An implementation plan for Phase I (2017-2022) is provided that targets those actions that should be initiated immediately and over the first five years at an estimated cost of approximately US\$12.5 million.

1.0 INTRODUCTION

Haiti is an active participant in a regional initiative designed to improve the conservation and protection of the marine environment in the wider Caribbean. The 5-year, US\$12.5 million Caribbean Marine Biodiversity Program (CMBP) was announced by the United States Agency for International Development (USAID) in 2015 with the overall objective of reducing threats to marine and coastal biodiversity in seven priority marine managed areas (MMAs) in four priority seascapes located in Haiti, the Dominican Republic, Grenada, St. Vincent and the Grenadines and Jamaica. These seascapes are recognized as the “jewels in the crown of marine resources in the Caribbean” and feature high biodiversity ecosystems such as coral reefs, mangroves and seagrass beds. CMBP supports the effective governance of these marine resources in order to: achieve sustained biodiversity conservation; maintain critical ecosystem services; strengthen fisheries management; maintain economic benefits and sustainable livelihoods derived from a healthy marine environment; and realize tangible improvements in human wellbeing for communities adjacent to and dependent on these marine managed areas (USAID, 2015).

In Haiti, the priority seascape is known as the “Protected Area of Managed Natural Resources of the Three Bays” (PA3B) on Haiti’s north-east coast. The Government of Haiti created the PA3B, the largest protected area in its history, by Presidential Decree on March 21, 2014 (see Appendix 1). The PA3B is 75,406 ha in size, and contains some of the most extensive and healthiest fringing and barrier coral reefs, seagrass beds, mangrove forests and other marine coastal habitats in the country. Many of the fish and other marine life in this area serve as critically important sources of protein for local communities. The marine habitats also provide local communities with critical coastal protection.

While the CMBP is primarily funded by USAID (US\$10 million), The Nature Conservancy (TNC) is also a major funder, contributing US\$2.5 million, and serves as the leader of a non-government (NGO) consortium to implement the Program. Also providing support is the local implementing partner in Haiti, the *Fondation pour la Protection de la Biodiversité Marine (FoProBiM)*, which, with the assistance of the US-based International Conservation Caucus Foundation and its affiliate Global Parks, was charged with the responsibility of preparing this management plan for the PA3B. Global Parks is a volunteer organization based in Washington, DC providing protected area experts to assist government and non-government organizations on protected area issues. The plan is prepared for Haiti’s National Agency of Protected Areas (ANAP) which will be responsible for the ongoing management and administration of PA3B.

1.1 Purpose and Scope of the Management Plan

The management of PA3B as a protected area will represent dramatic change for Haiti's north-east coast and for its communities and ecosystems. The purpose of this management plan is to facilitate that change over the next decade and beyond by guiding the transition from a coastal and marine ecosystem that has been settled for centuries and that is in continuing ecological decline with communities facing a fragile and uncertain future, to a protected area characterized by sound environmental management, economic viability and social balance.

This mission is mandated by the Presidential Decree to create the PA3B, Article 1 of which outlines in specific terms what is expected:

“The marine complex, coastal and terrestrial, located in the eastern half of the northern coast of Haiti is declared a protected area under the name of "protected area of managed natural resources of the Three Bays" (*Aire Protégée de Ressources Naturelles Gérées des Trois Baies*). It is composed of natural systems for which the long-term protection must be ensured and the biological diversity maintained, while responding to the needs of the communities dependent on these systems.”

Fulfilling this vision is a significant conservation challenge. The management of PA3B needs to lead the restoration and regeneration of Haiti's environment in the north-east region, and in so doing, help to alleviate poverty, improve living conditions, support alternative livelihoods and provide improved governance, administration and financial sustainability. As an overarching concern, it also needs to prepare for what now appears to be the inevitable impacts of climate change.

Accordingly, the management plan pursues the implementation of a number of initiatives simultaneously, all of which are necessary for long-term environmental and social health of PA3B. There are numerous threats to coastal and marine ecosystems that threaten their long-term ecological integrity. There are economic activities, in particular fishing and agriculture, that are not sustainable as currently practiced. Community development and growth are unregulated, living conditions are poor, security of food and water is low and prospects for future livelihoods are uncertain. The local governance regime lacks strength and leadership, there is little or no law enforcement, and little coordination exists among the various communities and levels of government. The effective management of PA3B needs to address all of these issues and more, and be a cooperative effort among ANAP, local stakeholders and potential NGO partners to strengthen the management of PA3B and the conservation of its natural resources.

While generally following the IUCN's Guidelines for Management Planning of Protected Areas (Thomas and Middleton, 2003), the structure of this management plan is a close reflection of the structure preferred by ANAP (ANAP, 2016). The timeframe for this management plan is for a ten-year period – 2017 to 2027 – with a five-year review. The purpose of the five-year review is to re-visit the management plan with an in-depth consultation program to review progress on the plan's implementation and revise direction as necessary without undertaking a full management planning process.

The plan presents a comprehensive assembly of management programs and actions necessary to achieve the ultimate goal of achieving the recovery and restoration of the PA3B's ecosystems. It is recognized that all cannot be accomplished during the ten-year timeframe of the plan and that its implementation will likely extend well into the future. The plan should be undertaken in phases based on continued consultations with communities, stakeholders and government officials and on the availability of human, technical and financial resources. The full effect of the plan will likely take decades to emerge and strategies for implementation will evolve over time as conditions change. A plan for the implementation of Phase I (2017-2022), for those programs and actions that should be initiated immediately and over the first five years, is outlined in Section 8.

1.2 The Management Planning Process and Methodology

In 2012 a process for developing a management plan for the area which would become the PA3B began with the formation of a Steering Committee (Comité de Suivi) in Port-au-Prince among agencies of the Government of Haiti and the main donors involved in the funding and implementation of PA3B. This committee met regularly and provided senior level guidance for the management planning process and coordination of preliminary initiatives that would lead to the management of the PA3B. This committee is composed of representatives of key entities, chaired by the National Agency of Protected Areas (ANAP), and includes the United States Agency for International Development (USAID), the Inter-American Development Bank (IDB), the Ministry of Environment (MOE), the United Nations Development Programme (UNDP), Marine and Navigational Services of Haiti (SEMANA), the Technical Execution Unit (UTE) of the Ministry of Economy and Finance, and Haiti's Inter-ministerial Committee for Territorial Planning (CIAT). Other institutions and government departments occasionally participate depending on the agenda to be addressed.

In 2014 and 2015, with the inception of the USAID-sponsored CMBP and the IDB-sponsored ecological baseline assessment ANAP, in collaboration with TNC, FOPROBIM and members of the Steering Committee held consultations with local stakeholders in an attempt to create a local Stakeholder's Committee for the park (Comite d'Appui).

The process has been assisted through the completion of a number of studies by TNC and financed by USAID and the IDB during 2015 and early 2016. These include:

- Baseline Ecological Inventory (Kramer et al., 2016a)
- Threat Assessment (Schill et al., 2016)
- Fisheries Sector Assessment (Miller, 2015)
- Fisheries Sector Action Plan (Miller, 2016)
- Stakeholders' Assessment (TNC, 2015)
- Ecological Monitoring Plan (Kramer et al., 2016c).

In early 2016, arrangements were made with Global Parks to initiate the management planning process beginning with a desktop review of these and other background materials and an initial field visit during the week of April 4-9 to understand context and the needs of local communities and stakeholders. Information gaps were identified and information gathered, to the extent possible, to fill these gaps. An interim report and background materials were prepared for stakeholder consultations and meetings with the Steering Committee held in May and early June 2016.

A stakeholder workshop was held in Caracol, Haiti on May 31, 2016; and attracted 71 participants representing a number of economic sectors from several local communities, including fishers, merchants, charcoal producers, salt producers, religious leaders and government officials. The focus of the workshop was to continue to inform participants about the establishment of PA3B and to introduce a draft vision and management objectives including a proposed zoning system and proposed targets for resource conservation. The management objectives addressed the topics of Resource Conservation and Protection; Sustainable Resource Use; Heritage (Cultural) Conservation and Presentation; Recreation and Tourism; Collaboration with Local Communities; and Governance and Law Enforcement. Five group sessions were held to further define the vision for the Park where the stakeholders outlined what they deemed important to be actualized in PA3B. They also raised concerns, offered suggestions and prioritized the principles within the management objectives. Participants found the workshop to be highly relevant and useful and an essential step in the development of the management plan. Highlights from this workshop are provided in Appendix 2 and a detailed report on the outcomes of the workshop is available from TNC (Simon, 2016a).

The meeting with government agencies and partners (Comite de Suivi) was held in Port-au-Prince on June 2, 2016; and was attended by 11 participants from Haiti's Ministry of Environment, the Technical Execution Unit of the Ministry of Economy and Finance, and key institutions including the United Nations Environment Programme and the Inter-American Development Bank. The meeting addressed the same material as was discussed

at the stakeholders' workshop as well as provided a brief summary of the results of the workshop. It adopted a round table approach that allowed participants to ask questions for clarification, provide constructive criticism and suggest amendments. Highlights from this workshop are provided in Appendix 2 and a detailed report on the outcomes of the meeting is available from TNC (Simon, 2016b).

In late 2016, ANAP established the local stakeholder's committee. However, this committee has yet to become fully functional.

The first draft of the plan was completed in September, 2016. Further inter-agency reviews and meetings with local stakeholders were held by through the autumn months leading to the preparation of a revised version of the plan. for further consultation with stakeholders and community organizations and the Steering Committee. A meeting was held on January 25, 2017 hosted by FoProBiM and TNC at the Université d'Etat d'Haiti Campus du Limonade with approximately 120 people, representing numerous stakeholders, communities and organizations as well as ANAP. A report on the outcomes of this meeting has been prepared; the highlights of concerns presented during the meeting and discussion are provided in Appendix 2.

1.3 Key Indicators of Success

The Presidential Decree for PA3B and the Vision that is derived from it (see Section 6) clearly outline the conditions upon which the success of this and subsequent management plans can be determined, through asking two key questions:

- Are the fragile resources of PA3B being managed to ensure their long-term protection and the maintenance of their biological diversity in perpetuity?
- Are the resources of PA3B continuing to provide for the support of local communities in a sustainable way?

The timeframe for this management plan is ten years, with a five-year review, and over that time, a monitoring program will be put in place designed to inform protected area managers about trends in the use and condition of natural resources in PA3B that, in turn, will provide guidance in answering these questions (see Section 6.3.9). The monitoring program will not only assist protected area managers in measuring resources' response to management initiatives, but also raise awareness among the communities and stakeholders about the importance of PA3B and measure changes in their attitudes on specific issues such as management of fisheries, the protection of mangroves or community planning.

The key indicators for monitoring the marine, freshwater and terrestrial environments in PA3B are outlined in the Ecological Monitoring Plan for PA3B (Kramer et al, 2016b). In the marine environment, they include monitoring for water quality, the quality and health

of shallow marine environments including such parameters as habitat loss, coral cover, seagrass productivity and the health of marine species, especially reef fish species and their abundance, diversity and size. In freshwater environments, monitoring focuses on hydrology, water quality, sediment quality and aquatic biology. The monitoring of terrestrial ecosystems, where the greatest losses in habitat and species has occurred, measures climatic factors, habitat health and species presence and absence for flora and fauna. It is here where the monitoring plan needs to pay particular attention to measuring stakeholder's awareness of the importance of the remaining terrestrial resources and any changes in their attitudes about specific management initiatives to help restore terrestrial ecosystems.

2.0 REGIONAL, NATIONAL AND INTERNATIONAL CONTEXT

2.1 Location and Administrative Boundary

The PA3B is located on the north-east coast of Haiti with the boundary and local communities illustrated in Figure 1 (see Appendix 1—Article 3 for boundary coordinates). The PA3B has a boundary perimeter of approximately 170 kilometers (km) encompassing 75,406 hectares (ha) (Section 3.2—Table 3). The east-west boundary extends for over 40 km from Rivière du Massacre (bordering the Dominican Republic border, where it is known as 'río Dajabón') to the Grande Rivière du Nord to the west. The north-south boundary extends from the 12-mile (19.3 km) territorial sea limit inland to the 10-metre topographic contour line.



Figure 1: PA3B boundary limits and communities.

The western boundary is near Cap-Haïtien, Haiti's second largest city and capital of the Département du Nord, served by Hugo Chávez International Airport and the Port international du Cap-Haïtien. The eastern boundary includes Fort Liberté, the capital of the Département du Nord-est, and is directly adjacent to the 'Parque Nacional Manglares de Estero Balsa' in the Dominican Republic (DR), near the city of 'San Fernando de Monte Cristi', national parks 'Parque Nacional Submarino de Monte Cristi', Parque Nacional el Morro, 'Parque Nacional Manglares del Estero Balso', marine refuge 'Cayos Sietes Hermanos' and wildlife refuge 'Laguna Saladilla'.

2.2 Socio-Economic Context of the Region and Local Communities

PA3B spans across the administrative boundaries of the Department du Nord-est and the Department du Nord whose combined population is approximately 500,000. With Haiti's population growth rate of 2.5%, this population is anticipated to increase to 600,000 – 800,000 people by 2030 (ERM, 2015; IDB, 2012b), depending on development scenarios (see Section 2.2.3). Most of this growth would occur around the Caracol Industrial Park (PIC) and in Limonade, Trou-du-Nord, Terrier Rouge and Fort Liberté, and could have significant implications for the management of PA3B. Several regional plans have been prepared to attempt to guide this impending population growth in Haiti's north-east in a rational manner and will be an important ally to this management plan as PA3B copes with the impacts of rapidly increasing development around its boundaries (IDB, 2012b; ERM, 2015).

2.2.1 Economic Activities

Overall, the area within the region surrounding PA3B is rural, exhibiting mostly traditional land use patterns of small to medium-sized family farming operations combined with larger plantations. These rural areas are supported by the four main towns of Limonade, Trou-du-Nord, Terrier Rouge and Fort Liberté, the largest communities within the region, along with smaller, mostly coastal fishing communities of Bord de Mer de Limonade, Caracol, Madras, Jacquезy, Phaeton and Derac. A total of 25.5% of the population are involved in the 'informal employment sector', 18% in agriculture, 13.4% in fishing, 12.5% raising livestock, 11.5% in formal employment (including in the PIC), 9.4% in the trade of charcoal and wood and 0.8% in salt production (unpublished BRL, 2016).

Within the protected area, approximately 3,000 fishers use the waters for their daily subsistence and almost 1,000 fishers live in the protected area. Some 800 boats, most propelled by oar and sail, provide access to the fishing grounds. Another 233 boats and 480 fishers occur in the neighboring province of Monte Cristi (Dominican Republic), with occasional reports of fishing within territorial waters of Haiti. The waters of PA3B are

heavily overfished by net, line, traps and spear and the species caught are generally undersized. However, the need for subsistence fishing continues to exist. In addition, other species such as the American eel and sea cucumbers are being harvested for offshore markets and a tilapia aquaculture project initiated in Lagon aux Boeufs in the past could happen again in the near future (Miller, 2015).

Overfishing has affected the seagrass, coral reef, and mangrove ecosystems of the PA3B and has resulted in the depletion of the fisheries including macro-invertebrate species such as conch, lobster, and sea cucumbers. All of these impacts will need to be addressed, likely through enforced selected area, species and/or time closures, gear restrictions and alternative fish production, including mariculture and aquaculture, if the protected area is to meet basic conservation goals and continue to provide livelihoods for the communities. There are 12 fishing associations operating in the protected area and FoProBiM has established two stakeholder groups (CEPROBAC and UGeBFo) to provide oversight to their fishing activities, to build capacity, and to provide input into the protected area's management (Miller, 2015).

With respect to agriculture, much of the terrestrial component of the protected area is or has been devoted to agriculture over many decades. Figure 2 shows the extent of the agricultural area within and adjacent to the protected area.

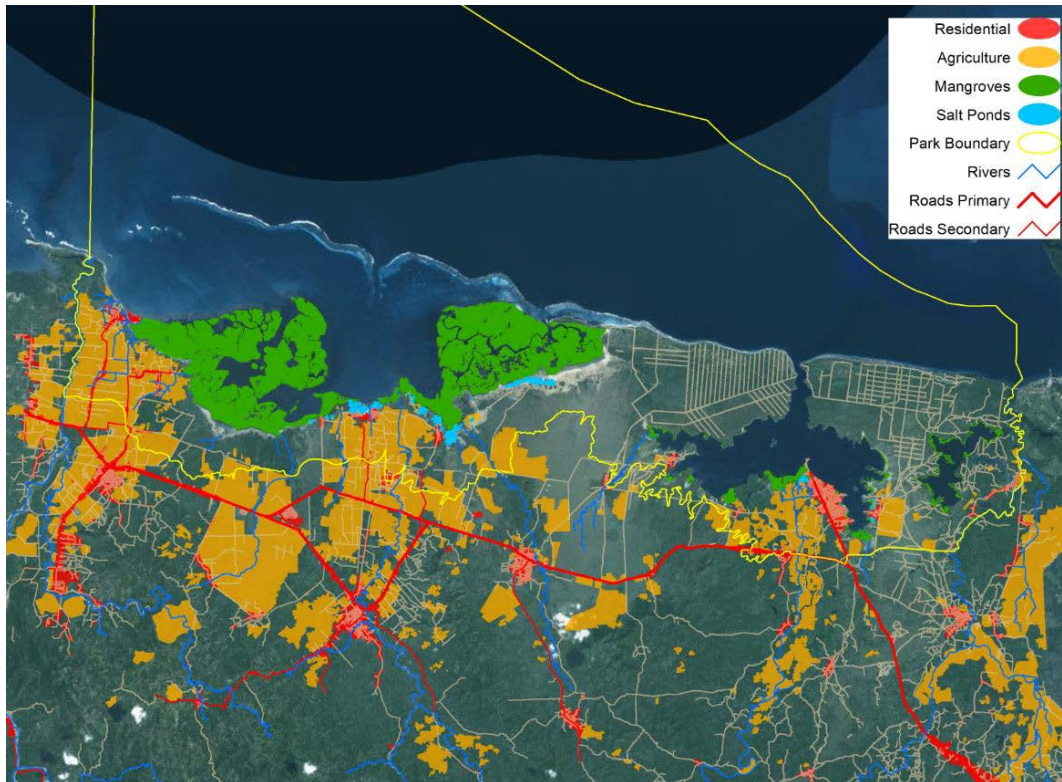


Figure 2: Agricultural lands within PA3B and within watershed drainages that flow into PA3B (Kramer et al., 2016b)

Most of the agriculture practiced in the protected area is subsistence in nature where fruits and vegetables (e.g. plantain, cassava) and livestock are produced primarily for personal and local consumption. There are also commercial scale operations in the form of larger plantations of sisal, banana, citrus fruits and sugar cane. The majority of farmers are reported to own their land (ERM, 2016). The grazing of cattle and goats primarily occurs on the areas that were once used for sisal production, mostly on the two peninsulas that form the northern part of Fort Liberté Bay.

Charcoal production within the protected area focuses on the mangroves and the upland species, primarily the aggressive successional needle bush (*Acacia farnesiana*) that has rapidly spread across much of the area formerly used for sisal production. Botanists at this time are actively debating whether *A. farnesiana* is native or an introduced invasive species. Regardless, its aggressive nature is of concern and may hinder the restoration of a more heterogeneous native vegetation over the short term. The harvesting of mangroves is prohibited by the Arrêté Ministériel of July, 2013 and will be reinforced within PA3B by zoning, access restrictions and enforcement as the protected area becomes managed on a day-to-day basis. Charcoal production using the rapid growing woody species *Acacia farnesiana* in appropriately zoned areas may be considered in an effort to support livelihoods and communities as well as managing local biodiversity.

Relatively few households are involved in salt production, with most activity occurring in Madras, Caracol, Jacquozyl and Derac. Salt ponds, occupying some 140 ha, are constrained by climatic conditions and flooding, poor prices, and an unskilled labour force (ERM, 2015).

The Caracol Industrial Park (PIC) is anticipating the need for about 20,000 workers once it reaches full capacity in 2020. Presently, approximately 9,000 people are employed in the garment, sisal and paint industries in the PIC. The potential impact of the industrial park on PA3B as it relates to the liquid and solid wastes generated by the industrial park has been assessed in the past and will continue to be monitored into the future (Koios Associates LLC, 2011; ENVIRON, 2011; Wiener et al., 2013; Titan Engineering Inc., 2013).

Tourism presently plays a minor role in the protected area but the very designation of the protected area and the significant natural and cultural values, coupled with the international air access to Cap Haitian, will focus attention and interest in the future. The potential role of tourism, in both type and location, as well as recreation for the local communities is addressed in the management plan.

2.2.2 Transportation Infrastructure

The protected area is accessed by the National Road #6 (RN6) paved highway from Cap Haitian on the west to the DR border to the east as shown in Figure 3. Currently Cap Haitian can be accessed by air with American Airlines from the east coast of the United States and from other regional airlines in the Caribbean. Paved roads lead to the main villages and gravel roads to various other areas along the coast, including the beach access at the mouth of Rivière du Massacre at the eastern end of the protected area to the Grande Rivière du Nord at the western end. There are many kilometers of tertiary roads on either side of the sea entrance to Fort Liberté Bay that resulted from the former sisal operation.

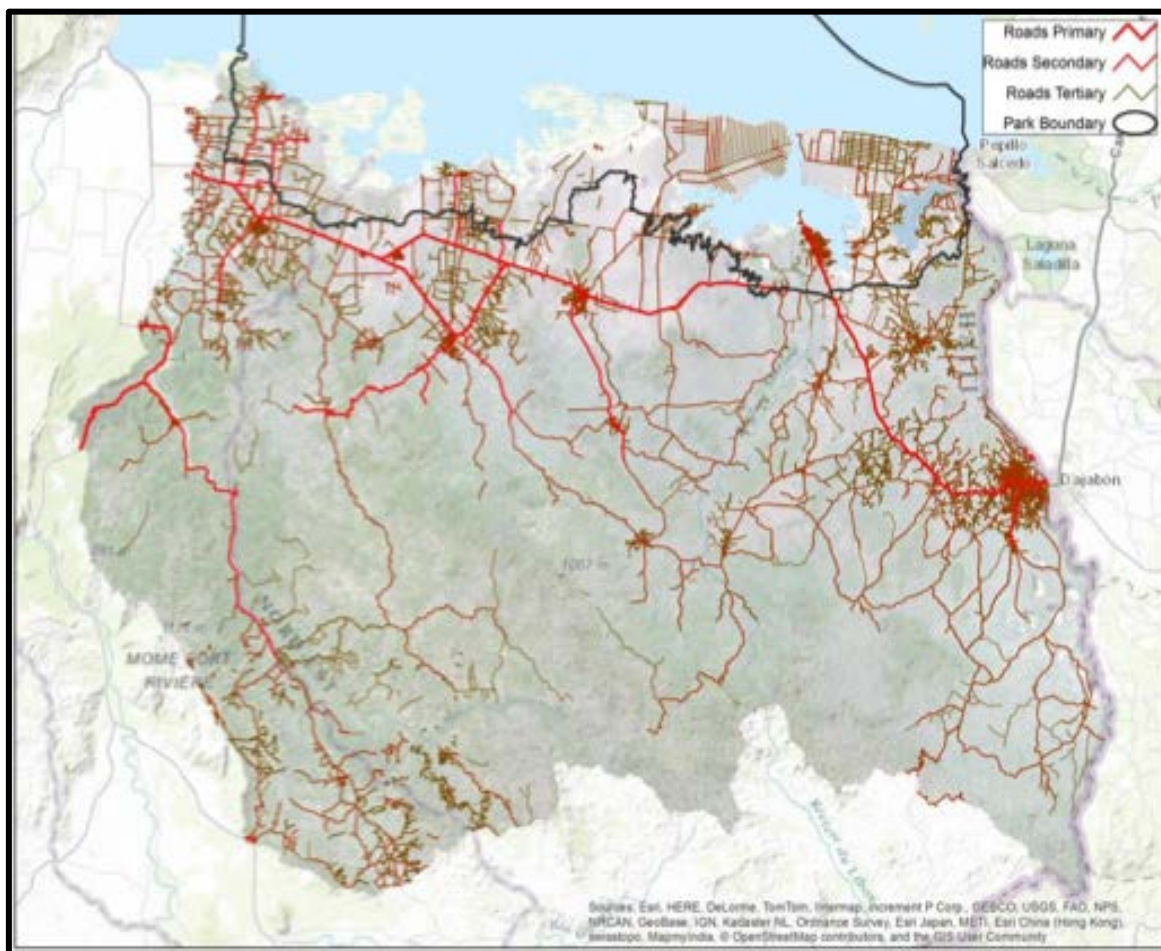


Figure 3: Existing road network in PA3B and the surrounding region (Schill et al 2016).

2.2.3 Demographic Trends

Demographically, Haiti has a very young population with 50% of the population under 20 and 40% below 15 years of age. The population is becoming increasingly clustered in urban settlements where 40% of Haitians now live. Rural poverty is driving urban migration and rapid urbanization. This trend is reflected in local communities in the north-east, with most migration to urban areas from local rural areas rather than other parts of Haiti (ERM, 2015). Most local communities have seen dramatic growth since 1985, led by Bord de Mer de Limonade, Caracol and Jacquezy. Caracol tripled in size over the 25 years between 1985 and 2010. The development of the PIC has had a marked impact on this growth where almost 20% of PIC employees live in Caracol and the local housing project, whereas the remaining 80% live in other towns throughout the two departments (IDB, 2012b).

Detailed population projections have been made for these communities using ‘slow growth’ and ‘high growth’ scenarios, depending on the progress of several development projects. The results of these projections are found in Figure 4 below. Population projections for the communities within PA3B are particularly alarming, especially given the anticipated impacts of climate change and the associated risk of inundation (see Section 5.1.1) (IDB, 2012B).

Nom	Current 2012	AIA/ CIAT 2030 (Slow)	ESCI Projections (Slow Growth)		Nom	Current 2012	AIA/ CIAT 2030 (High)	ESCI 2040 Projections (High Growth)
			2030	2040				
Quartier de Bord de Mer de Limonade	1,319	1,728	3,799	5,350	Quartier de Bord de Mer de Limonade	1,319	4,617	7,589
Quartier de Grand Bassin	8,379	12,156	15,449	19,702	Quartier de Grand Bassin	8,379	32,482	27,949
Quartier de Petite Anse	93,586	137,779	118,636	132,666	Quartier de Petite Anse	93,586	181,779	188,199
Ville de Trou-du-Nord	24,154	33,697	44,534	56,792	Ville de Trou-du-Nord	24,154	57,535	80,564
Ville de Caracol	2,979	4,157	5,494	7,007	Ville de Caracol	2,979	7,098	9,940
Ville de Derac	1,839	3,162	3,737	4,765	Ville de Derac	1,839	4,172	6,760
Ville de Ferrier	8,165	11,391	15,054	19,198	Ville de Ferrier	8,165	15,029	27,234
Ville de Fort Liberte	20,399	28,461	41,448	52,857	Ville de Fort Liberte	20,399	48,596	74,982
Ville de Limonade	17,556	23,005	50,569	71,205	Ville de Limonade	17,556	39,279	101,010
Ville de Ouana-minthe	64,524	90,018	118,995	151,721	Ville de Ouana-minthe	64,524	118,767	215,229
Ville de Quartier Morin	4,125	5,409	11,886	16,737	Ville de Quartier Morin	4,125	7,136	23,743
Ville de Terrier Rouge	13,876	18,894	25,585	32,627	Ville de Terrier Rouge	13,876	32,260	46,285
Ville du Cap Haitien	163,222	240,315	206,911	231,381	Ville du Cap Haitien	163,222	317,061	328,235
Ville de Sainte Suzanne	1,712	2,300	2,277	2,320	Ville de Sainte Suzanne	1,712	3,034.00	3,290
Total	425,835	612,472	664,373	804,326	Total	425,835	868,846	1,141,008

Figure 4: Projections of the population base for slow and high growth scenarios (IDB, 2012b)

2.3 Land Tenure and Ownership

Most of the land designated within the PA3B is public, however, there are many hectares of private land. The Presidential Decree ensures that public lands within the PA3B cannot be sold or otherwise disposed of and that any interventions for land use change must be approved by the Minister of the Environment. The Decree also guarantees that those private lands within the Protected Area will remain in the possession of their owners, although they do remain subject to defined public rights-of-way and the management plan (see Appendix 1).

To date, however, there is little detailed information currently available on the distribution of public and private lands within PA3B. This remains an important data gap and one that should be filled during the first five-year period of this management plan through the ongoing work of Haiti's National Centre of Geographic and Spatial Information (CNIGS).

2.4 Boundary Related Issues

The terrestrial boundary for PA3B follows the 10-metre topographic contour in a deliberate effort to encompass lands adjacent to the more natural and high biodiversity components of PA3B to enable more effective management of the impacts that may come from these lands. These impacts primarily include, but are not limited to, land-based sources of water pollution from sewage, chemicals and pesticides (see sections 5.2.3 and 5.2.4). As discussed in Section 2.3, some of these lands are privately owned although the distribution of private and public lands is not known.

The boundary for the PA3B also includes a small portion of the PIC and seven small communities, including Bord de Mer de Limonade, Caracol, Jacquely, Phaeton, Fort Liberté, Dérac and Gillote-Meillac-Nan Contrée. The management of these communities, even though shared with local governments, may take too much time and energy away from managing PA3B, and it may be useful to consider the possible removal of these communities and the included portion of the PIC from the protected area.

Further, as the boundary follows a contour line, it becomes quite convoluted and difficult to identify on the ground, thereby possibly encumbering effective management and law enforcement. It will likely become necessary within the first decade of this management plan to undertake a review of the terrestrial boundary, in accordance with ANAP's manual for boundary delineation (ANAP, 2016), with the view of: 1) incorporating only those lands necessary for effective management of the Protected Area; 2) demarcating a simpler boundary using identifiable straight lines and landscape or man-made features where possible; and 3) properly posting the boundary for enforcement and management purposes.

2.5 Legal and Policy Framework and Management Authority

The PA3B exists by virtue of the Presidential Decree creating The Protected Area of Managed Natural Resources of the Three Bays, adopted at the National Palace in Port-au-Prince, Haiti on February 13, 2014 (see Appendix 1). The subsequent declaration by Order in the Official Journal of the Republic of Haiti was published on March 21, 2014.

The ongoing management and administration of the Protected Area falls under the jurisdictional authority of Haiti's National Agency of Protected Areas (ANAP), itself

created through the General Decree on Environmental Management in 2005. ANAP will exercise its authority directly and in collaboration with its local partners, authorities and municipal governments. A PA3B Management Authority (PMA) will be created to provide a local governance and administrative structure for PA3B and will establish a warden service, enforce regulations and carry out monitoring and surveillance. A proposed governance structure is outlined in Section 7.0 of this plan. In time, the 1978 Fisheries Law may be revised to support new initiatives in the management of fisheries within PA3B.

2.6 Regional and Global Biological Significance

The PA3B area is recognized by the Critical Ecosystem Partnership Fund (CEPF) as being among the most biologically diverse and productive marine and coastal ecosystems in Haiti, and is included within the top five global biodiversity hotspots in the world (CEPF, 2010). This international recognition is summarized in Table 1 below.

Table 1: International Recognition of the PA3B Area

Agency	Program	Justification
CEPF	Caribbean Islands Biodiversity Hotspot—Key Biodiversity Areas (KBA)	<ul style="list-style-type: none"> • The north-east coast of Haiti is included in the Caribbean Islands Biodiversity Hotspot recognized as part of one of the world’s greatest centers of biodiversity and endemism. • The entire PA3B area is identified as a CEPF high-priority KBA within the Caribbean Islands Biodiversity Hotspot (CEPF, 2010). • The Côtes du Nord to the west of PA3B and the Massif du Nord corridor to the south are identified as an important conservation corridor and KBA, respectively. • Parque Nacional Manglares del Estero Balso, contiguous to the east (DR), is also identified as a KBA (Anadón-Irizarry et al., 2012).
UNEP	Caribbean Biological Corridor	<ul style="list-style-type: none"> • Recognizes ecological links among Haiti, Cuba and the Dominican Republic, including the PA3B area, to facilitate collaboration among related initiatives for the integration of long-term conservation actions. • Provides a framework for cooperation among the countries of the insular Caribbean for protecting and reducing the loss of biodiversity, by rehabilitating the environment, developing livelihood alternatives, particularly in Haiti, and alleviating poverty as a means to reduce the pressure on biological resources (UNEP, 2016).
UNEP, CBD	Ecologically or Biologically Significant Marine Area (EBSA)	<ul style="list-style-type: none"> • EBSAs are identified as among the most important marine areas in the world according to criteria such as uniqueness or rarity, biological diversity, importance to species’ life cycles, productivity and vulnerability. • The area of Caracol Bay, Fort Liberté and Monte Cristi (the Northern Hispaniola Binational Area) in the DR has been identified as an EBSA, recognized for its complex of mangroves, coral reefs and seagrass beds, important spawning areas for fish and important habitat for turtles and manatees (CBD, 2014).
BI	Important Bird and Biodiversity Area (IBA)	<ul style="list-style-type: none"> • Hispaniola is recognized as one of the world’s Endemic Bird Areas (EBA) for its particularly distinct avifauna. • The 450-ha Lagon aux Boeufs (within this EBA) is one of 10 areas recognized in Haiti as an IBA giving it international recognition as a priority site for bird conservation. • Bird diversity is far higher than any other area in the coastal plain of the Northeast, and together with the Fort-Liberté Bay and the Massacre River delta, forms part of an ecoregion of outstanding value for waterfowl and marine birds. • The Lagon-aux-Boeufs IBA provides feeding grounds for Caribbean Flamingoes and to an important population of the Vulnerable West Indian Whistling-duck, as well as potential habitat for the Near Threatened Caribbean Coot and Piping Plover.

2.7 International Agreements and Obligations

The implementation of the management plan will be cognizant of the obligations that Haiti has accepted by virtue of being a signatory nation to international conventions or regional agreements, including the World Heritage Convention and the Convention on Biological Diversity. Of equal importance is awareness of the environment-oriented international and regional arrangements such as the Caribbean Challenge Initiative of which Haiti is a signatory member and other regional arrangements that Haiti is *not* a signatory to, including the International Coral Reef Initiative (ICRI) (although FoProBiM is a member), the Cartagena Convention, the Convention on Wetlands of International Importance especially as Waterfowl Habitat (RAMSAR) and the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES). Over the course of the implementation of this management plan, Haiti may wish to consider the merits of becoming a signatory nation to these conventions. The details of the implications of these conventions and agreements to the management of PA3B are found in Appendix 3.

2.8 The Implications of IUCN Category VI

As a matter of policy, ANAP has made the decision that PA3B will be managed as a Category VI protected area according to the IUCN's system of protected area categories. Since most of the PA3B is marine and considered a marine protected area (MPA), the IUCN guidelines specifically designed for Category VI MPAs will have implications for the planning and management of PA3B.

The IUCN defines an MPA as “a clearly defined geographical space, recognized, dedicated and managed, through legal or other effective means, to achieve the long-term conservation of nature with associated ecosystem services and cultural values” (Day et al, 2012). According to the IUCN and its “Guidelines for Applying the IUCN Protected Area Categories to Marine Protected Areas” (2012), a Category VI protected area is defined as follows:

“Category VI protected areas conserve ecosystems and habitats, together with associated cultural values and traditional natural resource management systems. They are generally large, with most of the area in natural condition, where a proportion is under sustainable natural resource management and where low-level non-industrial use of natural resources compatible with nature conservation is seen as one of the main aims of the area” (Day et al, 2012).

As such, Category VI areas have as their primary objective: “To protect natural ecosystems and use natural resources sustainably, when conservation and sustainable use can be mutually beneficial” (Day et al, 2012). Other objectives can include:

- to promote low-level and sustainable use of natural resources that is compatible with nature conservation, considering ecological, economic and social dimensions;
- to promote social and economic benefits to local communities where relevant, whilst conserving biodiversity;
- to facilitate inter-generational security for local communities' livelihoods – therefore ensuring that such livelihoods are sustainable (Day et al, 2012).

This definition and these objectives are compatible with the Presidential Decree.

The IUCN guidelines also state that “areas which may *incidentally appear* [author's italics] to deliver nature conservation but **DO NOT HAVE STATED** nature conservation objectives should **NOT** automatically be classified as MPAs, as defined by IUCN”. These include, among others:

- fishery management areas with no wider stated conservation aims;
- community areas managed primarily for sustainable extraction of marine products;
or
- marine and coastal management systems managed primarily for tourism, which also include areas of conservation interest.

In summary, Category VI protected areas must have nature conservation as their primary management objective with sustainable use being clearly secondary. The guidelines include “the 75% rule” where the primary objective of the protected area should apply to at least three quarters of its area and the remaining 25% of can be managed for other essential and unavoidable purposes so long as these uses are compatible with the definition of a protected area (Day et al, 2012). Given the clear direction of the Presidential Decree, and in order for the PA3B to be recognized as an MPA within the IUCN system, the management plan will need to provide clear direction on the priority of conservation in tandem with the types and extent of sustainable use that enables long-term conservation in perpetuity.

3.0 PHYSICAL ENVIRONMENT AND BIOLOGICAL RESOURCE DESCRIPTIONS

3.1 Physical Environment

3.1.1. Climate, Weather Systems and Trends

PA3B is classified as having a dominant Tropical Savanna Climate (e.g. Fort Liberté, Terrier Rouge, Meillac) and a Tropical Monsoon Climate to a lesser degree (e.g. Trou-du-Nord). Annual average rainfall is ~1600 mm, with rainfall increasing from north to south and from east to west, with the west side of PA3B receiving about 25% more rainfall than the east side. Generally, all months receive some precipitation, but two rainy seasons occur from September to January and from April to June, with drier periods occurring from December to March and from July to August. Average annual temperature is reported to be between 25-26° C, with temperatures ranging from 23° to 35°C. The hottest months are July through August and the coolest months are December through January.

Typical to the Greater Antilles and the Caribbean, northeasterly trade winds prevail across the region. Wind speed averages 3.3 m/s and wind direction is almost always from the north to northeast. Winds rise in the morning around 10:00 and come down at night after 21:00. Hurricane season occurs from June through November.

Recent climate change models for Haiti predict increases of 0.9° C by 2020 and 1.8°C by 2050. Other climate models for the greater region (including PA3B) for the period 2046-2065 predict maximum and minimum yearly average temperatures to increase 1.5 to 2°C (Eitzinger et al., 2013). Rainfall projections due to climate change have been difficult to assess for the region because of its topography. Projections predict that the average annual rainfall will decrease anywhere from 0 to 33 mm in total annual rainfall, with an average rainfall for January increasing 12 to 16 mm, and an average rainfall for July decreasing 16 to 22 mm. A decrease in rainfall along with increases in temperature would adversely effect vegetation and agricultural yields, as well as impact groundwater recharge through increased evapotranspiration. The likelihood of temperature increases over time, potential drought, and increased rainfall variability highlight the need for more efficient water management.

PA3B is one of the more significant areas at risk of flooding related to climate change. General circulation models predict a mean sea level rise (MSLR) of 6-8 cm by 2020 and 23-25 cm by 2050 for the region (El Fouladi, 2012). Up to an estimated 7% of the Departement du Nord-Est (11,294 ha) could be directly impacted by a rise in sea level along with increases in storm surges and other extreme meteorological phenomena. These

impacts would include reductions in mangrove cover affecting fisheries, salinity intrusion affecting available freshwater resources, and the inundation of homes and agricultural lands affecting human settlements within PA3B.

3.1.2. Geology, Relief and Soils

The terrestrial area of PA3B is characterized as a lowland coastal plain (0 to 10-m elevation; <4% slope) and is located north of more upland and mountainous terrain. PA3B is part of the *Pleine du Nord* (between Cap Haïtien and Monte Cristi in the DR), which formed over geological time from deposits of siliciclastic detritus coming from the *Massif du Nord*, the longest mountain range in Haiti. The current terrestrial geology of the greater region can be roughly characterized as 60% sedimentary with a limestone or alluvial base, and 40% igneous (e.g. basalt, andesite). In general, alluvial detrital soil in the PA3B is characterized as fine-grained and fertile. It is rich in iron, often with significant organic matter and considered a rich farming soil, particularly around rivers. Areas around Fort Liberté and Lagon aux Boeufs have distinctly different soils than the soils generally encountered across the rest of the *Pleine du Nord*. These areas are uplifted terraces of coral reef limestone and are characterized by loosely cemented coral fragments that on occasion include red siliclastic clay.

Mornes Deux Mamelles is the highest point in PA3B at 33 metres and occurs along a secondary fault line. These formations are characterized as igneous intrusions (andesite, granite). A deep paleoriver channel (Caracol Channel) bisects the PA3B barrier reef, which consists of different coral reef formations typical of windward island shores. For example, deep forereefs vary along the platform shelf edge in response to differences in geo-morphology and wave energy that have formed reefs with high structural complexity (dominated by star coral *Orbicella* formations). Seabed topography within the bays is also relatively complex with frequent occurrences of karst depressions and deep water in close proximity to the coastline. More offshore, the seafloor includes deep canyons greater than 1000 metres in depth associated with the tectonically active Septentrional fault, which has shaped the geomorphology of Haiti's north coast. Figure 5 shows bathymetric values across PA3B and the greater region.

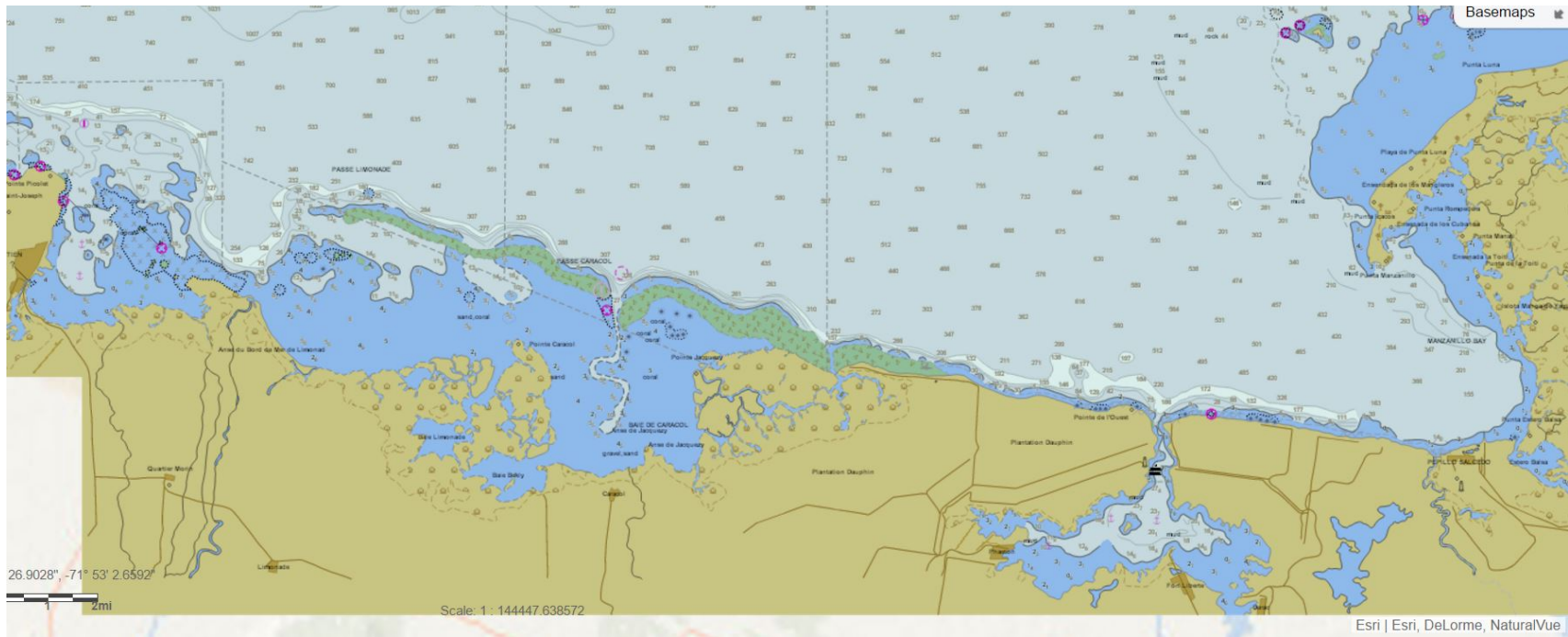


Figure 5: Bathymetric map of PA3B.

Source: ESRI

3.1.3. Hydrology and Oceanography

Four watersheds covering an area of 1,708 km² drain into PA3B (Figure 6). Table 2 shows reported drainage basin characteristics. The lower reaches of the watershed are dynamic with shifting riverbeds and river mouths, and create deltas where they enter the bays. River flow is bi-modal (similar to precipitation) with high flows during rainy seasons and low flows during drier periods. High rainfall can cause hazardous flash floods and large volumes of sediment runoff.

The Grande Rivière du Nord accounts for nearly two-thirds of the total freshwater discharge and flows year-round, whereas the other watersheds are smaller and may run completely dry towards their lower reaches. This has had a significant impact on aquatic flora and fauna, and may likely increase in the future as the demand for water increases.

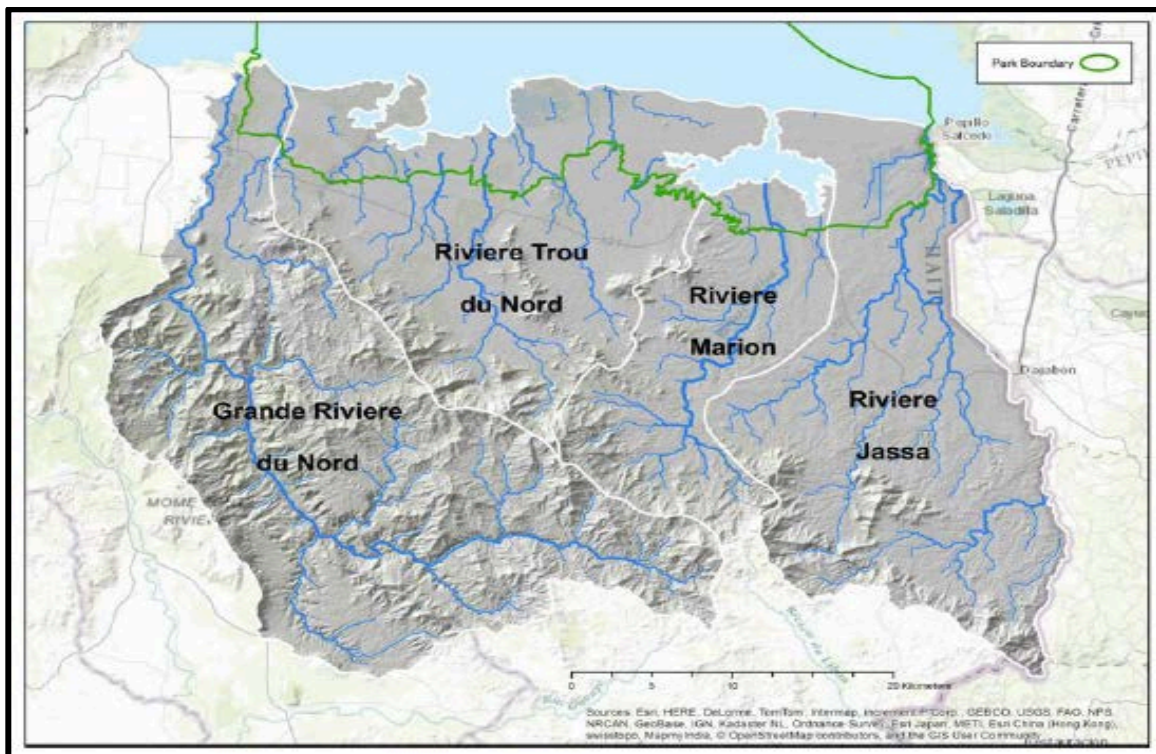


Figure 6: The four watersheds of PA3B, each drained by a primary river of the same name (Schill et al, 2016).

Table 2: Principle watersheds and their characteristics

Primary River	Drainage area (ha)	Average annual precipitation (mm)	Average flow (discharge) (m³/s)
Grande Rivière du Nord	62,746	1,743	17
Rivière Jassa	43,421	1,350	9
Rivière Trou-du-Nord	42,830	1,217	8
Rivière Marion	21,803	1,361	5

(Kramer et al., 2016a)

The major groundwater in the region (including PA3B) is from an unconfined alluvial aquifer composed primarily of sands and gravels. The aquifer flows and grows in thickness from south to north, reaching nearly 300 m near the ocean. It is recharged from rainfall from the nearby mountains and from bi-annual floods over the plains. The aquifer is productive with a sustained yield estimated at 685,000 m³/day (~8 m³/s) (AVANSE, 2015). Baseline conditions around PIC, indicated groundwater transmissivity values ranging from 5x10⁻⁴ m²/s to 2x10⁻³ m²/s and salinity values between 0.25 to 0.28 ppm (ENVIRON, 2011).

The oceanography of PA3B is influenced by the Antilles Current (an arm of the North Atlantic Gyre). It is characterized as a highly variable, generally weak surface current containing rich-nutrient warm waters flowing northwesterly, and connects to the Gulf Stream at the intersection of the Florida Straight. In deeper offshore waters, the upper 600 m of the water column moves at 0.1-0.2 m/s with a net transport from east to west, whereas the lower layer of the water column (>600 m) tends to move at 0.2-0.4 m/s in the opposite direction, which results in a large southward transport for the entire water column.

Nearshore and in the shallower waters of PA3B, water circulation is mainly driven by daily tides in Fort Liberté, whereas in Caracol Bay it is influenced by tides as well as daily northeasterly winds. Water flows westward along the shore near Limonade Bay, but shifts eastward and out through the Caracol Channel further to the east. Water clarity examined by Secchi disk methods indicates visibility decreases from east to west along the coast (concomitant with rainfall; see Section 3.1.1). Visibility is generally less than 15 m within Fort Liberté and Caracol bays. In Lagon aux Boeufs, visibility is less than 1 m due to high concentrations of algae.

Annual sea surface temperatures (SST) and seawater levels are highest in the Fall (October to November) and are lowest in the Spring (March to April). Water temperatures for Caracol Bay range from 24.5° C to 30.6° C. Slight local and regional variations in SST and water temperatures will occur, often influenced by wind direction, heavy rains and river outputs. Tides are characterized as mixed-semidiurnal tides, where high and low tides

differ significantly in height. Tides in Lagon aux Boeufs are nearly absent (~10 cm daily variation) and may lag up to a 3-hour difference from tides occurring on the coast. Ocean salinity values are typically stable at around 36 parts per thousand (ppt). Bay salinity values are generally near ocean salinity values, but with daily variability recorded to range from 16 ppt (after heavy rains) to 40 ppt. Dissolved oxygen values in the bays range from 3.6 to 6.3 milligrams per litre (Rust et al., 1986).

3.1.4. Natural Hazards

Haiti is ranked as the 10th most vulnerable state in the world in terms of natural hazards. This is largely because of Haiti's lack of coping capacity. In general, major natural disasters such as cyclones, floods and droughts affect Haiti every 5-7 years. The country is rated to be at the highest relative vulnerability to tropical cyclones amongst the Small Island Developing States (SIDS), with Hispaniola being the most susceptible island to hurricanes in the Caribbean. While there is still debate on the effects of climate change on the number of hurricanes and storms that are likely to strike the island, there is widespread agreement that the intensity of these storms and accompanying rainfall will increase.

The major natural hazards in Haiti include hurricanes and associated major floods and landslides, tropical storms and associated flash floods, earthquakes and droughts. Flooding is a common occurrence throughout the island, and PA3B is especially vulnerable due to its location, topography, and insufficient infrastructure to respond to high surface water flows. Moreover, the PA3B offshore seafloor includes deep canyons associated with the tectonically active Septentrional fault, which imposes a significant seismic hazard, with resulting tsunamis that could cause severe coastal flooding, salinization and impact a highly-populated coast.

3.2 Biological Resources

The PA3B is primarily a marine protected area (MPA), with its deep marine (>30 metres), shallow marine (<30 metres) and mangrove forest environments comprising 77% of the total protected area, but there are also significant terrestrial and freshwater components as described below (Table 3).

Table 3: PA3B habitat types and area

Major Habitat Type	Area (ha)
Deep Marine >30 m	43,386
Shallow Marine <30 m	10,657
Mangrove Forest	4,274

Terrestrial	16,677
Freshwater	412
Total	75,406

Schill et al 2016

3.2.1. Overview of Terrestrial and Freshwater Habitats and Ecosystems

PA3B is situated in the most extensive Tropical Dry Forest in Haiti. Second to Cuba, it is among the largest remaining Tropical Dry Forest Ecoregion in the Caribbean (contiguous with northwestern Dominican Republic). Acacia and shrubland are the dominant vegetation types in PA3B, where the aggressive successional needle bush *Acacia farnesiana* is widespread, spreading, and its rapid colonization outcompeting much of the native flora. A total of 235 plant species have been confirmed in PA3B (Appendices 4 and 5). Much of the existing native vegetation has been displaced due to agricultural conversion, ranching, and development.

The important terrestrial habitats in PA3B include scrubland (mostly Acacia and Dry Broadleaf Evergreen Formations—DBEF), saline mudflats (transitional areas between mangrove), and scrubland riparian vegetation along rivers and lagoons. Terrestrial habitat types and other land classification information across PA3B, including land-use areas, are shown in Figure 7. Table 4 further shows land area and percent cover.

PA3B comprises important freshwater ecosystems and habitats, including permanent rivers, seasonal streams, wetlands, and the large brackish Lagon aux Boeufs (450 ha), which is linked hydrologically to Rivière du Massacre to the east on the Haitian-Dominican border. Rivière du Massacre, as well as both Grande Rivière du Nord and Rivière Trou-du-Nord to the west, also provide important estuarine ecosystems, which comprise distinct habitats with corresponding floral and faunal assemblages. Estuarine river mouths and freshwater portions of permanent riverine habitats have the highest freshwater vertebrate and invertebrate diversity, whereas seasonal streams and the brackish lagoons show the lowest diversity.

Table 4: Detailed land cover within PA3B

Land Cover	Hectares	% Cover
Deforested 2000-2014	175.68	0.82
Forested Other	322.83	1.51
Scrub/Shrub	34.11	0.16
Grasslands	498.06	2.33
Barren	641.43	3.00

Acacia Shrubland	3,094.83	14.49
Agriculture	3,611.43	16.91
DBEF* Acacia	3,420.90	16.01
DBEF* Shrubland	2,282.76	10.69
Mangroves	4,274.28	20.01
Dwellings	191.43	0.90
Mining	2.97	0.01
Salt Ponds	140.04	0.66
Dirt Roads	2,235.06	10.46
Paved Roads	25.20	0.12
Fresh water	411.57	1.93
TOTAL	21,362.58	

* DBEF: Dry Broadleaf Evergreen Formation (Schill et al 2016)



Figure 7: Land cover and land use within PA3B (Schill et al 2016).

3.2.1.1 Freshwater Fauna

A total of 26 fish have been identified across freshwater habitats of PA3B (Appendix 6), including amphidromous and brackish species. A total of 4 invasive species have been confirmed. Invasive tilapia *Oreochromis* spp. are widespread due to past introductions from aquaculture. The endemic Few-rayed *Limia pauciradiata*, is only known to occur in Grande Rivière du Nord and the Rivière Trou du Nord.. The transoceanic migratory American eel *Anguilla rostrata* (IUCN Endangered) is commonly found in PA3B and considered an important socioeconomic species in the region and around the world.

A total of 30 freshwater invertebrates have been identified across PA3B including 3 invasive snails (Appendix 6). Prawns, shrimp, and snails are the most common freshwater invertebrates in PA3B. The freshwater associated blue land crab *Cardisoma guanhumi* is also widely distributed and commercially important for the region.

3.2.1.2 Avian Species

A total of 95 birds, including 71 breeding residents have been identified in PA3B (Appendix 7). The inland Lagon aux Boeufs (450 ha) is classified as an international Important Birding Area (IBA). Lagon aux Boeufs, along with Fort Liberté, Rivière du Massacre, the Cayos Sietes Hermanos and the wildlife refuge of Laguna Saladilla in the DR form an ecoregion of outstanding value for waterfowl and marine birds.

3.2.1.3 Terrestrial Reptiles and Amphibians

A total of 4 amphibians and 11 reptiles have been identified in PA3B. The dominant amphibians are the invasive Cane toad *Rhinella marina* and the invasive American bullfrog *Lithobates catesbeianus* (Appendix 8). A low amphibian diversity is likely the result of heavy contamination and eutrophication in the majority of inland bodies of water. Reptiles such as lizards are more frequently encountered in lowland areas with large trees and agricultural fields.

3.2.1.4 Terrestrial Mammals

The most dominant mammals in PA3B are invasive species such as the Small Indian mongoose *Herpestes auro punctatus*, feral cats, rats and mice. The Solenodont *Solenodon paradoxus* and the Hutia *Plagiodontia aedium* are species endemic to Haiti and the Dominican Republic, but no recent evidence exists of their occurrence in PA3B. Riverine corridors would be the most likely places to survey for these animals because of the availability of food and shelter. This habitat would also be the most prospective place to survey for bats.

3.2.2 Overview of Marine Habitats and Ecosystems

The PA3B is reported as high priority for biological resource conservation in Haiti. Ecosystems within its boundaries are of significant regional importance with Lagon aux Boeufs, and the bays of Caracol, Bord de Mer de Limonade, and Fort Liberté showing high indices of biodiversity and productivity. PA3B includes one of the two largest contiguous mangrove habitats in Haiti and a significant coral reef complex, including the largest barrier reef nationwide protecting its northern shoreline and fringing reefs occurring near continuously along the coast. More than 3,000 fishers depend directly on aquatic resources within PA3B where its large bays, extensive mangroves, seagrass beds, and reefs also provide nurseries, spawning grounds, and important organic input to other marine areas

offshore and outside its boundaries.

3.2.2.1 Mangroves, Seagrass and Coastal Wetlands

The mangroves of the northern coast of Haiti comprise 18% (5250 ha) of all mangrove forests in the country. A total 4,274 ha of mangrove forests and associated coastal wetlands occur in PA3B (Figure 8). Mangrove stands are typical of the region, including black mangrove *Avicennia germinans*, red mangrove *Rhizophora mangle*, white mangrove *Laguncularia racemosa*, buttonwood *Conocarpus erectus*, and saltwort *Batis maritima* occurring at the drier and higher elevations. Caracol Bay harbors an estimated 4,030 ha of mangrove with an extensive network of channels occurring throughout.

The seaward fringe and hammock mangroves of Caracol Bay experience regular tidal action, whereas its landward basin mangroves only experience periodic flooding. The mangrove of Bord de Mer de Limonade is predominantly comprised of shrubs within a fairly protected inland basin. It is influenced by tides affecting the Grande Rivière du Nord and two other freshwater drainages. Fort Liberté Bay harbors an estimated 168 ha of mangrove. Its discontinuous narrow bands of fringing mangrove are within a relatively well-flushed marine system. In contrast, Lagon aux Boeufs has limited tidal influence/exchange and is dominated by narrow bands of tall fringing mangroves. This brackish embayment provides a unique mangrove habitat with some of the tallest mangroves in the country.

Adjacent to most mangrove stands, are varied and highly productive seagrass beds including turtlegrass *Thalassia testudinum*, manatee grass *Syringodium filiforme*, and shoalgrass *Halodule wrightii*. PA3B has large expanses of habitat with seagrasses across its shallow marine waters (< 30 m) (Figure 9). Table 5 shows the surface area of seagrass and other benthic habitat types identified in PA3B. The largest seagrass beds are generally found in Caracol Bay, where over 25% of its area is covered in seagrasses. Seagrass beds in PA3B likely serve as important nurseries and feeding grounds for many species and overall are in good condition. Nonetheless, Caracol Bay does appear to be impacted by somewhat heavy sediment loads. Other more minor impacts stem from shoreline seine nets that are repeatedly deployed by fishers over the same seagrass areas.

A total of 38 wetland plant species have been identified in PA3B (Appendix 5). The coastal wetland at the outlet of Rivière du Nord (Bord de Mer de Limonade) is likely the most botanically diverse area in PA3B. Even though few mangroves occur in this area and the floodplain has been converted to agriculture, small discontinuous brackish tidal patches of vegetated banks and fluvial delta remain. The area contains typical herbaceous species, including widgeon grass *Ruppia maritima*, cattail *Typha domingensis*, yellow burhead *Limncharis flavis*, and several species of spikerush (*Eleocharis* spp.), and represents a critical diversity hotspot for native species (Schill et al 2016).



Figure 8: Vegetation types in PA3B (Schill et al 2016)

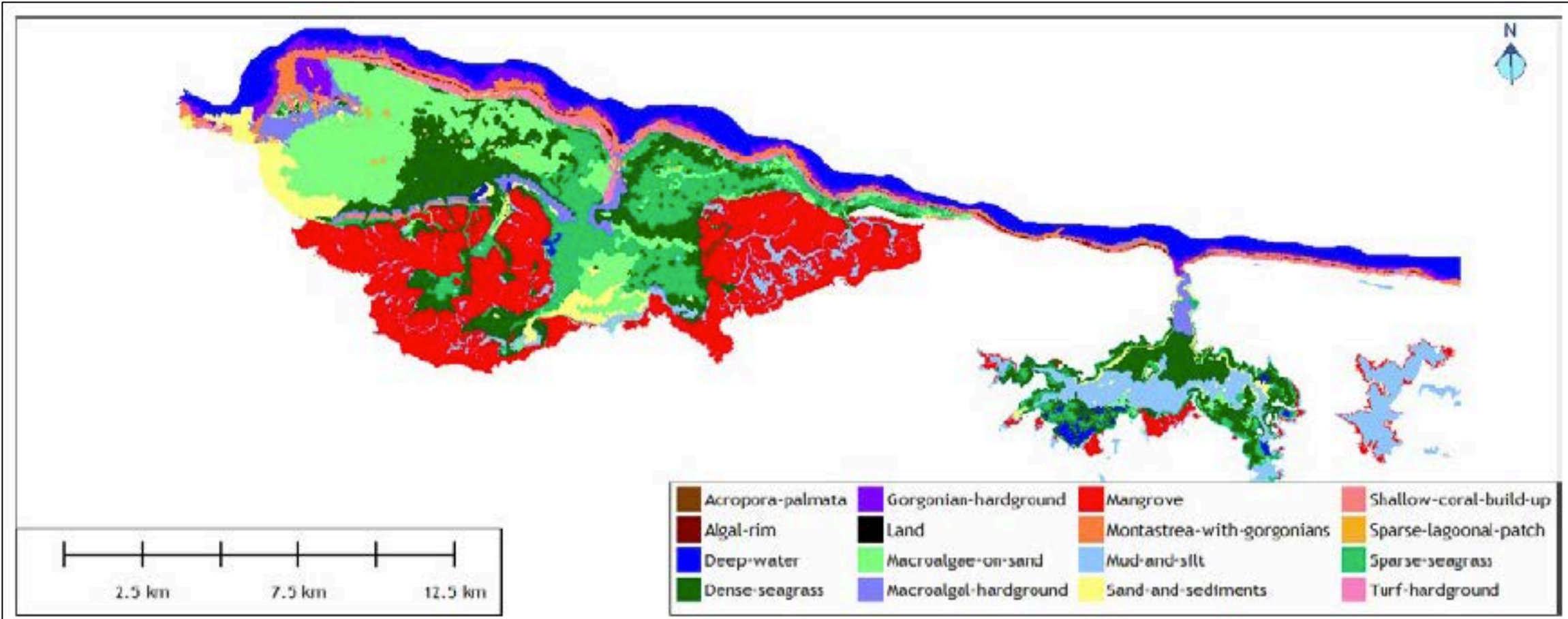


Figure 9: Aquatic and benthic habitats in PA3B (Schill et al 2016)

Table 5: Marine classification and estimated benthic habitat area in PA3B.

Classification	Benthic habitat type	Area (ha)
Seagrass	Dense seagrass beds	62
	Sparse seagrass beds	259
Coral reef	Lagoonal patch reef	62
	Algal rim	75
	Shallow coral build-up	446
	Orbicella forereef	551
Gorgonian / Macroalgae	Hardground with gorgonians	501
	Hardground with macroalgae	3,036
Sand	Bare sand	794
	Sand with sparse macroalgae	2,510
Mud / Silt	Mud / Silt	1,678

Schill et al 2016

3.2.2.2 Coral Reefs

A 20-km fringing and barrier reef complex spreads across to the outer limits of Caracol and Fort Liberté bays. This reef complex is estimated at 1100 ha (see Table 6) and covers about 10% of the shallow shelf area within PA3B (< 30 m in depth). Surveys have identified a number of distinct coral reef zones, including reef crests, backreefs, reef walls, patch reefs, deep forereefs, and spur-and-groove reef habitats. Spur-and-groove reefs (2-4 metre high coral ridges separated by sand channels) are typically found in front of Caracol Bay. Forereefs are typical at Bord de Mer de Limonade and consist mostly of flat hardgrounds with low topographic relief dominated by seafans (i.e. gorgonian plains) and are subject to discharges from Grande Rivière du Nord and Cap Haïtien rivers. Deep forereefs found mostly near Fort Liberté to the east of the bay opening show the highest structural complexity and are dominated by the star coral *Orbicella*. Live coral cover is generally low across PA3B with the exception of the Fort Liberté area, where *Orbicella* reefs show the highest coral diversity, with corals being relatively healthy, and the highest species richness of any other habitat found in PA3B. In Caracol and Limonade, outer coral reefs show a high fleshy macroalgal cover and considered in an unhealthy state.

A total of 51 coral species, 43 octocoral species, and over 140 species of sponge comprise the main living structural components of PA3P reef habitats (Appendix 9), with the most frequent corals identified as mustard hill coral *Porites astreoides*, lettuce coral *Agaricia agaricites*, brain coral *Pseudodiploria strigosa*, and star coral *Montastraea cavernosa*.

3.2.2.3 Marine Benthic Invertebrates

Over 300 marine benthic invertebrates have been identified in PA3B, with ~85% of invertebrate species identified found within coral reef habitats (Appendix 9). Sponges show the highest species richness in PA3B, followed by corals, and octocorals. Total benthic invertebrate species richness is found to vary significantly between coral reef sites surveyed ranging from 23 to 123 species. The outer forereefs of Fort Liberté are identified as having the highest invertebrate diversity of PA3B.

3.2.2.4 Marine Fish and Megafauna

Over 180 marine fish have been identified within PA3B (Appendix 11), including a potential endemic hamlet (family Serranidae: *Hypoplectrus* sp.) that has only been found in Fort Liberté Bay. The outer forereefs of Fort Liberté also show some of the highest fish diversity surveyed in PA3B, with 71 species of fish encountered at the deep forereef site FL-26 (coordinates 19.72742, -71.90593) and 69 species at the hardground wall site FL-13 (coordinates 19.71123, -71.84519) (see Schill et al 2016). The most frequent fish species identified at coral reef sites are parrotfish (*Scarus iseri*, *Sparisoma viride*, *S. aurofrenatum*) and the blue tang *Acanthurus coeruleus*. Over 60 species of fish found in reefs of PA3B also use mangroves and adjacent seagrass beds during some stage of their life.

Fish richness and biomass is low in PA3B. There is also a near complete absence of typical large top predators (e.g. sharks, groupers). Top predator roles in PA3B have cascaded down the foodweb and have been filled by Coneys (*Cephalopholis fulva*), Graysbys (*C. cruentatata*), and Red hinds (*Epinephelis guttatus*).

Marine megafauna, such as manatees, dolphins, whales, sea turtles, sharks, rays, and larger-bodied groupers and snappers are reported as rarely occurring in PA3B. However, sightings of dolphins, whales and captures of sea turtles and some large-bodied fishes (e.g., Nurse sharks, Nassau groupers, Black groupers, Tarpons) indicate these species do currently enter PA3B waters and highlight important habitat occurring within PA3B for these species of conservation concern. For example, inshore waters of PA3B harbor some of the more important sea turtle foraging and developmental habitats reported in Haiti (Ottenswalder 1987). Sea turtle surveys in neighbouring Monte Cristi (DR) indicate that mostly juvenile and sub-adult hawksbills and green turtles frequent these inshore waters (León et al., 2008), whereas loggerhead and leatherback turtles tend to occur further offshore (Wiener and Deloire 2014). Many beaches within PA3B provide adequate nesting habitat for hawksbills and green turtles, but historical and current information indicating the extent of potential nesting turtles within PA3B is lacking.

Most of the megafaunal species are considered ecologically extinct (i.e. non breeding populations) most likely as a result of long-term heavy overfishing and hunting pressures in the region. For example, hunted manatees are reported to occur more in PA3B than elsewhere in the country (out of nine Departments surveyed) (Kiszka 2014). Interestingly, these fisher surveys also indicate that manatees occur relatively more in PA3B waters than elsewhere in the country. Indeed, recent surveys indicate the region as one of three identified Antillean manatee hotspots occurring in Haiti (Dominguez Tejo 2016). Marine mammals and sea turtles occurring or expected to occur within PA3B waters are shown in Appendix 10.

3.3 Unique, Rare and Species at Risk

Of the possible 30 species of marine mammals (see Whitt et al., 2011; Ward et al., 2001) and 4 known sea turtles identified to frequent the waters of Haiti, 21 species have been evaluated under the IUCN Red List criteria. Appendix 10 lists these species and their known conservation statuses. Table 6 shows the mammal and turtle species mostly occurring within inshore waters of PA3B that are at risk. Little or no information exists on the other species of megafauna potentially using more offshore waters of PA3B.

Table 6: Coastal marine mammals and sea turtles at risk known to occur in inshore waters of PA3B

Manatee within PA3B assessed under IUCN criteria	
<i>Trichechus manatus</i>	Vulnerable
Sea turtles within PA3B assessed under IUCN criteria	
<i>Eretmochelys imbricata</i>	Critically Endangered
<i>Chelonia mydas</i>	Endangered

(Dominguez Tejo, 2016; León et al, 2007)

Of the 51 hard coral species surveyed in PA3B, 43 species have been evaluated under the IUCN Red List criteria. Appendix 9 shows all coral species identified in PA3B and their known conservation statuses. Table 7 shows the 9 known coral species at risk in PA3B.

Table 7: Surveyed coral species at risk in PA3B

Coral species	IUCN status	ESA status
<i>Acropora cervicornis</i>	Critically Endangered	Threatened
<i>Acropora palmata</i>		
<i>Orbicella annularis</i>	Endangered	Threatened

<i>Orbicella faveolata</i>		
<i>Agaricia tenuifolia</i>	Near Threatened	NE
<i>Agaricia lamarcki</i>	Vulnerable	NE
<i>Dendrogyra cylindrus</i>		
<i>Mycetophyllia ferox</i>	Vulnerable	Threatened
<i>Orbicella franksi</i>		

IUCN: Red List of Threatened Species 2015-4. ESA: U.S. Endangered Species Act; NE: not evaluated.

The *Orbicella* reef at site FL-12 (coordinates 19.71582, -71.83204) (see Schill et al 2016) is of particular conservation importance since all corals listed under the U.S. Endangered Species Act (ESA) are found on its reef crest or deeper (Table 7). The FL-12 reef is also reported as having the highest fish richness (87 species), the highest coral diversity surveyed, high live coral cover (>60 %) and relatively healthy corals.

Interestingly, the cup coral *Cladopsammia manuelensis*, which is more typical of deep reefs (>50 m) in the Straits of Florida and the Gulf of Mexico, also occurs in the shallow reefs of PA3B. Its presence in PA3B is the only known occurrence of its kind in the central Caribbean.

The only known occurrence of a serranid of the genus *Hypoplectrus* has also been identified in PA3B and may be an endemic fish to Fort Liberté Bay. Of the 504 marine fish reported from Haiti (Fishbase, 2016), Schill et al 2016 recently surveyed 187 marine fish species in PA3B. Of these 187 marine fish, 175 species have been evaluated under the IUCN Red List criteria. Appendix 11 shows all marine fish species identified in PA3B and their known conservation statuses. Table 8 shows the 7 known marine fish species at risk in PA3B (excluding the Endangered America eel *Anguilla rostrata*; see Table 9).

Table 8: Surveyed marine fish species at risk in PA3B

Marine fish species	IUCN status*
<i>Lutjanus analis</i>	Near Threatened
<i>Lutjanus synagris</i>	
<i>Coryphopterus eidolon</i>	Vulnerable
<i>Coryphopterus lipernes</i>	
<i>Coryphopterus personatus/hyalinus</i>	
<i>Megalops atlanticus</i>	

*IUCN Red List of Threatened Species 2015-4

Of the 22 freshwater fish species surveyed in PA3B, 9 species have been evaluated under the IUCN Red List criteria. Appendix 6 shows all freshwater fish species identified in PA3B and their known conservation statuses. Table 9 shows species of conservation

concern. The Few-rayed limia *Limia pauciradiata* is endemic and only known to occur in Grande Rivière du Nord and the Rivière Trou du Nord. The Mozambique tilapia *Oreochromis mossambicus* is considered Near Threatened in its native habitat, but it is widespread and considered a highly invasive species across PA3B that is extremely harmful to native species.

Table 9: Surveyed freshwater fish species at risk in PA3B

Freshwater fish species	IUCN status*	
<i>Anguilla rostrata</i> **	Endangered	
<i>Oreochromis mossambicus</i>	Near Threatened	Invasive
<i>Limia pauciradiata</i>	Not Evaluated	Endemic

*IUCN Red List of Threatened Species 2015-4; **amphidromous

Of the 15 terrestrial reptile and amphibian species surveyed in PA3B, 7 species have been evaluated under the IUCN Red List criteria. Recent surveys did not confirm the presence of rhino iguanas *Cyclura cornuta* (IUCN Vulnerable), but it is more than likely that they are found in the eastern reaches of PA3B as they are protected in neighbouring Monte Cristi parks. The American crocodile *Crocodylus acutus* (IUCN Vulnerable) has also recently been reported to occur in the nearby Saladilla lagoon in the Dominican Republic. Within PA3B, the last official sighting of *C. acutus* was reported from a short one-night survey conducted in 1981 at Rivière du Massacre (Throbajarnanson 1984). It is likely that night surveys in Rivière du Massacre and Lagon aux Boeufs could reveal small remnant crocodile populations. Appendix 8 shows reptiles and amphibians identified in PA3B and their known conservation statuses. Table 10 shows species at risk in PA3B.

Table 10: Surveyed terrestrial reptile and amphibian species at risk in PA3B

Reptiles /Amphibians	IUCN status*
<i>Anolis cybotes</i>	Near Threatened
<i>Bufo guentheri</i>	
<i>Cyclura cornuta</i> **	Vulnerable
<i>Crocodylus acutus</i> **	

*IUCN Red List of Threatened Species 2015-4;

**confirmed in neighboring Monte Cristi parks

Of the 197 terrestrial plants, trees and cacti surveyed in PA3B, 18 species have been evaluated under the IUCN Red List criteria (Appendix 4). The Endangered holywood bush *Guaicum sanctum* is known to be harvested for charcoal. Four more species at risk are likely to occur within PA3B boundaries, but have yet to be confirmed (Table 11).

Table 11: Surveyed terrestrial plant species at risk and expected to occur in PA3B

IUCN assessed species* occurring in PA3B	
<i>Guaiacum sanctum</i>	Endangered
<i>Guaiacum officinale</i>	
IUCN assessed species* occurring in Haiti and expected to be found in PA3B	
<i>Magnolia emarginata</i>	Critically Endangered
<i>Copernicia ekmanii</i>	Endangered
<i>Tillandsia paniculata</i>	Near Threatened
<i>Melocactus lemairei</i>	

*IUCN Red List of Threatened Species 2015-4

Of the 38 floral species (excluding seagrasses) surveyed in saline, brackish and freshwater environments in PA3B, 23 species have been evaluated under the IUCN Red List criteria, but are mostly classified as Least Concern (Appendix 5). Interestingly, an additional black mangrove, Mangle negro (*A. schaueriana*), typically found in the lower Lesser Antilles and South America also occurs in PA3B and likely represents the northern most limit of this species or it may be an undocumented hybrid species.

Of the 95 bird species surveyed in PA3B, 92 species have been evaluated under the IUCN Red List criteria. Resident rare birds observed include the Hispaniolan Parrot *Amazona ventralis* (Vulnerable), Roseate Spoonbills *Platalea ajaja* (Least Concern) and White Ibises (*Eudocimus albus* - Least Concern). Lagon aux Bouefs also hosts a small flock of flamingos *Phoenicopterus ruber* (Least Concern) as well as large numbers of migratory ducks and shorebirds. Appendix 7 shows all bird species identified in PA3B and their known conservation statuses. Table 12 shows the 6 known bird species at risk in PA3B.

Table 12: Surveyed birds at risk in PA3B

Bird species	IUCN status*
<i>Charadrius nivosus</i>	Near Threatened
<i>Corvus palmarum</i>	
<i>Patagioenas inornata</i>	
<i>Patagioenas leucocephala</i>	
<i>Amazona ventralis</i>	Vulnerable
<i>Corvus leucognaphalus</i>	

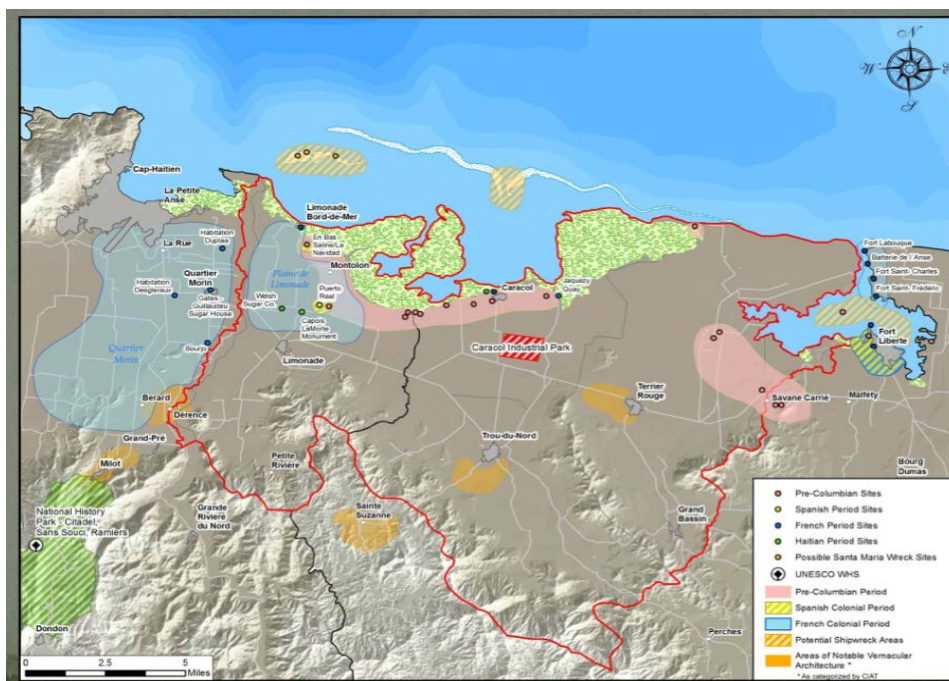
*IUCN Red List of Threatened Species 2015-4

4.0 Historical and Cultural Values

It is said that the north coast of Haiti is where its history happened. The cultural heritage in northern Haiti is extensive and highly representative of cultural eras and events from pre-Columbian times, the Taino occupation, the 15th century arrival of the Spanish to the New World, the 16th-17th century Spanish and French colonial settlement to the slave rebellion in the late 18th century, culminating in the declaration of Haiti's independence in Fort Liberté in 1804 and the creation of the world's first Black Republic.

4.1 Features of Historical and Cultural Interest

Northern Haiti may have the earliest pre-Columbian sites in all the Caribbean dating to the early lithic period, perhaps to 4000 BC (IDB, 2012). Cultural sites of the Taino, dating to as early as 2,500 BC, are distributed along the shorelines and nearshore inland sites of PA3B where they lived a subsistence lifestyle from the sea and from crops such as cassava, corn and sweet potato. The Taino lived mostly in the vicinity of present-day Caracol, Bord de Mer de Limonade and Fort Liberté. Their main village of Cacique Guacanagari was settled about 1200 AD, 300 years before the arrival of Columbus, and is located about one kilometre inland from Bord de Mer de Limonade in what is now known as En Bas Saline. This site was the regional capital for the Taino and was one of the largest



and most important Taino village sites in Haiti (CIAT, nd) (Figure 10).

The history of human occupation in Haiti took a dramatic turn with the arrival of Christopher Columbus in 1492. Having survived the wreck of his flagship, the Santa Maria, on the reefs near En bas Saline (between Bord de Mer de Limonade and Caracol),

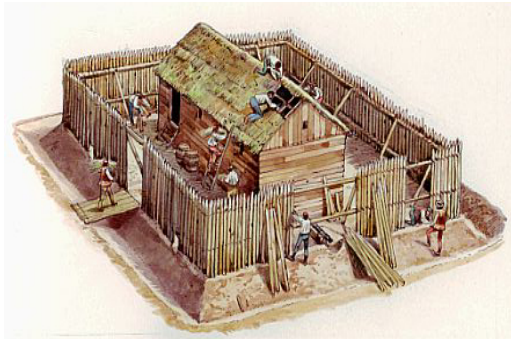


Figure 11: Depiction of the construction of La Navidad from the recovered timbers of the Santa Maria (Holloway, 2014).

Columbus built what is considered to be the first known European community in the Americas at La Navidad in 1493. La Navidad was essentially a fort surrounded by a moat (Figure 11), and while it's exact location is still uncertain, it would appear to have been either part of or in close proximity to En bas Saline.

An early map places La Navidad very close to Bord de Mer de Limonade (Figure 12). The wreck site of the Santa Maria is also uncertain but the ship is thought to have foundered on the reefs off the shoreline between Bord de Mer de Limonade and Caracol (Figure 12).

Figure 10: Cultural sites in Northern Haiti (CIAT, nd).

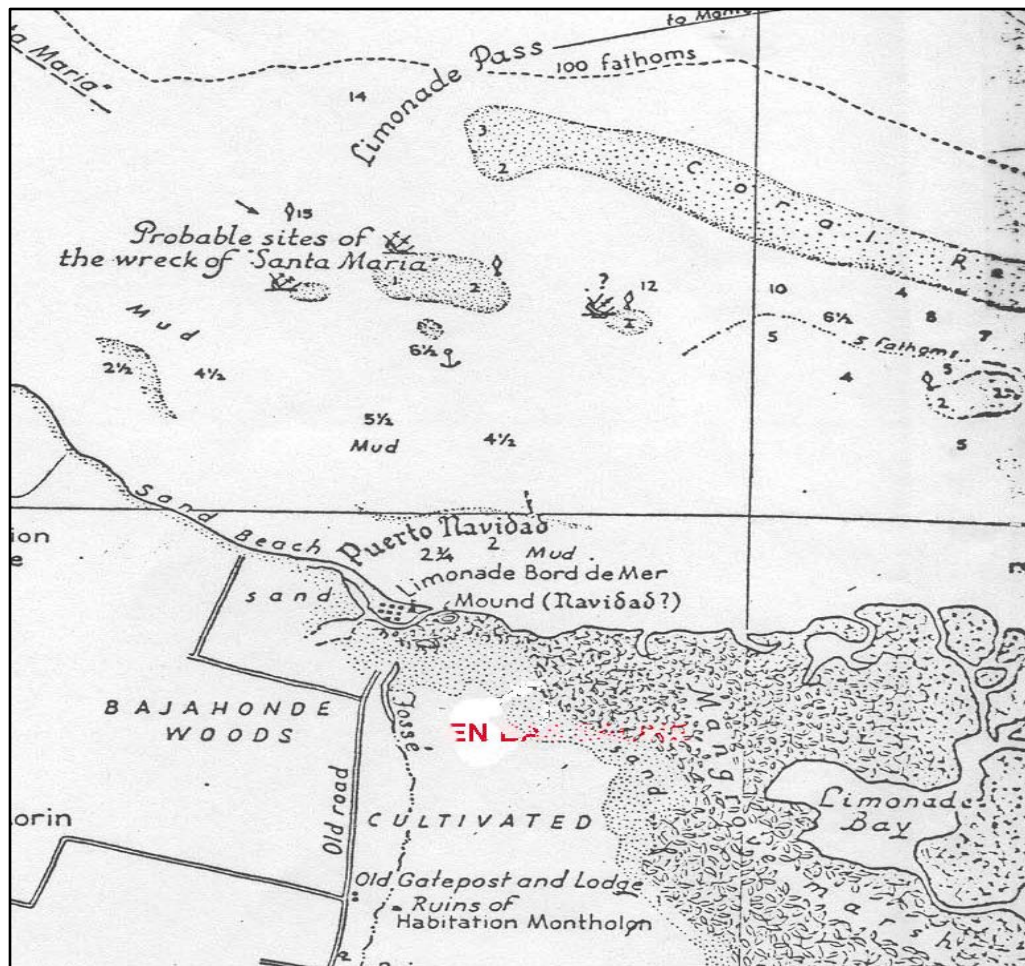


Figure 12: An early map (date unknown) showing the possible location of La Navidad and wreck site of the Santa Maria. Source: Florida Museum of Natural History, nd)

The European influence took hold and grew. During the Spanish period in the 16th century, permanent settlements were established at Puerto Real (midway between Caracol and Bord de Mer de Limonade) in 1503 and Bayaha (now Fort Liberté) in 1578. Puerto Real was abandoned in 1578 in favour of Bayaha, and now lies almost invisibly in agricultural and grazing fields near the town of Limonade, just inland from En bas Saline. Bayaha was abandoned three decades later in 1605 after being destroyed by the Spanish. The site was then occupied by buccaneers in the mid 1600's, then by the French in the early 1700's, recaptured by the Spanish in the late 1700's and then restored to the French just before the Haitian Revolution.

In the 1700's, the French began establishing an agricultural economy, including sugar, coffee and sisal. By the end of the 18th century, the colony was the wealthiest in the



Figure 13: Fort La Bouque built by the French in 1736 at the entrance to Fort Liberté Bay.

Caribbean and the world with almost 3,000 plantations for sugar, coffee, cotton and sisal, all dependent on slave labour for their production. The remains of several French plantations lie within PA3B and are still visible today. In keeping with colonial tradition, the French renamed Bayaha to Fort Dauphin, building the fort in 1731 under the directive of Louis XV, King of France to defend Haiti against further invasions. The French also constructed numerous colonial defense fortifications in the mid 1700's along the coast from Rivière du Massacre at the eastern boundary of PA3B to the entrance of Fort Liberté Bay. Five of these fortifications are designated as national monuments (Figures 13 & 14).



Figure 14: A French fortification at the mouth of the Massacre River. By the late 18th century, 90% of the population of the colony was comprised of slaves from Africa, among the largest in the Caribbean, and in 1791 they rose up in one of the earliest slave revolts in the New World. The Haitian Revolution saw Fort Dauphin and the surrounding area seized in 1793, renaming the fortress to Fort Liberté. Ultimately, the rebellion led to the creation of the first Black Republic in the Americas and the world in 1804 and the newly independent nation adopted the original Taino name 'Haiti', meaning the '*mountainous land*'.

5.0 Threats and Issues Analysis with Key Findings

Notwithstanding the rich resource values in PA3B, the area is beset with numerous threats that have, and unless addressed, will continue to impact upon its ecological integrity. A

Threat Assessment was undertaken for the PA3B in 2015 by TNC, the purpose of which is to inform the preparation of this management plan and to guide future management and monitoring (TNC, 2015). The assessment recognizes that climate change is an overarching threat to PA3B, and indeed all of the specific and local threats assessed and reviewed below must all be understood in the context of the risks associated with climate change. Section 5.1 below provides a prognosis for the likely impacts of climate change and their implications for community growth and development within PA3B. Section 5.2 then addresses each specific threat directly.

5.1 Prognosis for Climate Change Related Impacts for PA3B

The anticipated impacts of a changing climate will be significant for Haiti and PA3B. Over and above the actual physical and ecological impacts is the uncertain capacity of governments and communities to address them. A 2011 study that combines measures of the risk of climate change with the social and financial ability of communities and governments to cope, known as the Climate Change Vulnerability Index (CCVI), found that Haiti is *the* most at risk nation in the world from the impacts of climate change (Verisk Maplecroft, 2016; Slagle and Rubenstein, 2012).

The impacts of climate change will manifest themselves through increasing temperatures, decreasing precipitation, more frequent and extreme weather events and sea level rise. It is probable that average temperatures in Haiti will increase by 0.8-1°C by the year 2030 and by 1.5-1.7°C by 2060, with the highest increases in June and July. Precipitation is expected to decrease by 5.9-20% by 2030 and 10.0-35.8% by 2060, with the greatest decreases also expected in June and July. The coincidental occurrence of these two climatic shifts is expected to cause even more exacerbated stresses on agricultural production and on a range of ecosystems (GEF, 2013).

Haiti is already subject to extreme weather events including hurricanes, tropical storms, floods and droughts. Extreme storm events are also often accompanied by strong storm surges that flood coastal agricultural areas with salt water, ruining crops and salinizing soils and fresh water supplies. Haiti is among the most hurricane-prone areas in the world, although it is not among the most frequently hit islands in the Caribbean. Nevertheless, the Food and Agriculture Organization (FAO) reports that Haiti has been hit by 47 tropical storms and hurricanes between 1909 and 2004, with several since then, especially devastating in 2008 and 2016 (see Figure 15) (IDB, 2012b). According to the International Panel on Climate Change (IPCC), the Caribbean is likely to be exposed to more intense and frequent storm events in the future (Simspon et al., 2010; IPCC, 2016).



Figure 15: Hurricane Matthew in 2016. This category 4 hurricane killed up to 1,600 people with damage estimated in the order of USD\$2.25 billion (Mühr et al., 2016).

The coastal plains on the north shore of Haiti are vulnerable to storm surges associated with major storm events. The towns of Bord de Mer de Limonade, Caracol, Jaquezy and Phaeton are particularly susceptible to coastal flooding under these conditions (see Section 5.1.1) (IDB, 2012b; ERM, 2015). The extent of coastal flooding from wave and storm surge heights during a 50-

year return storm event is illustrated in Figure 16.

With respect to sea level rise and coastal flooding, and the accelerated coastal erosion that accompanies it, this impact of climate change will likely become the most problematic issue for both the ecosystems and communities within PA3B. A 2010 study by UNDP and Caribsave, based on an estimated sea level rise of one to two metres during the 21st century, suggests that even a one metre rise in sea level would have a significant impact on Haiti through the inundation of its coastal plains, mangroves and seagrass beds. The greatest impacts to Haiti would be on tourism where 46% of existing resort facilities would be inundated (61% with a two metre rise), and the loss of 44% of its turtle nesting beaches (53% with a two metre rise) (Simpson et al., 2010).

Agriculture was found to be less vulnerable than tourism with a 3% loss of agricultural land (5% with a two metre rise and up to 9% when combined with a storm surge). However, given Haiti's very high reliance on agriculture (over two-thirds of its population is dependent on agriculture and it accounts for 28% of GDP), the potential impacts on this sector are considered the highest of all Caribbean nations. Haiti was also found to be among the most affected nations regarding the potential for population displacement and associated relocation costs (Simpson et al., 2010).

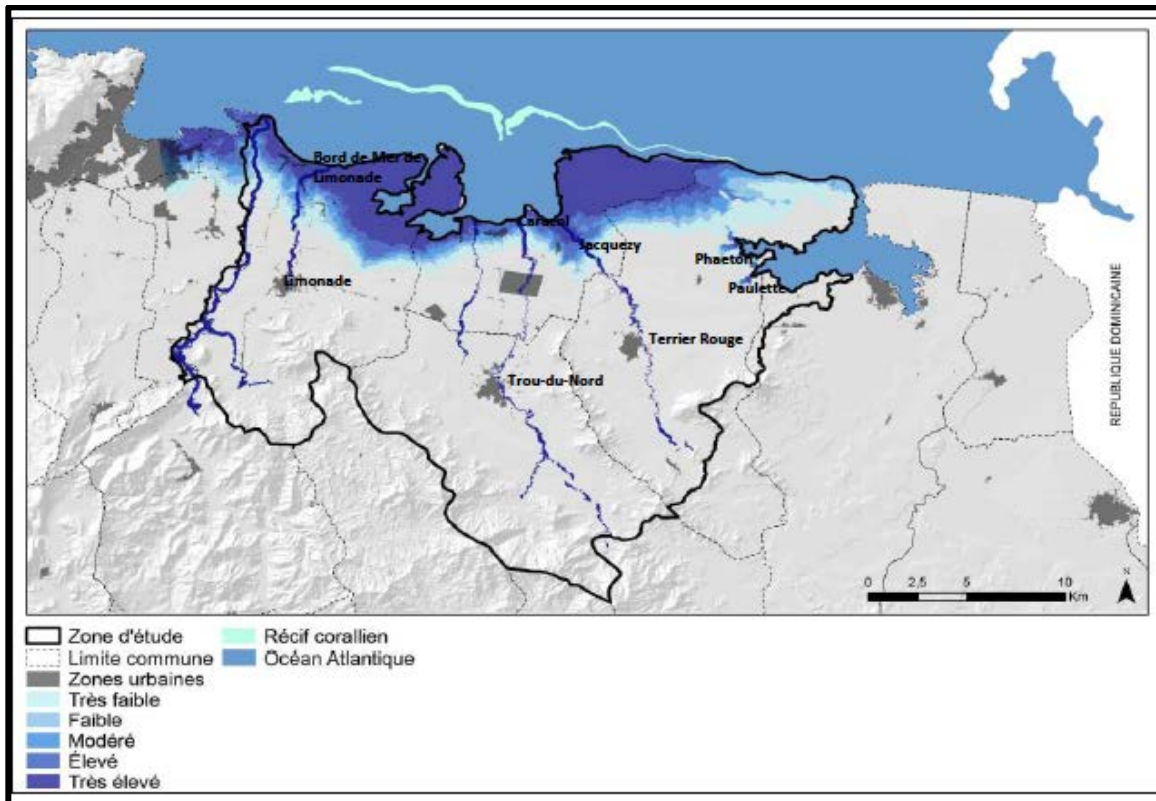


Figure 16: Coastal flooding with climate change projections for a 50-year return storm event (IDB, 2012b).

Sea level rise will also have significant repercussions for the marine environment, including the flooding and consequent recession of the seaward edges of mangrove forests, coral mortality due to reduced light penetration and coral bleaching due to higher water temperatures (GEF, 2010). Mangroves are susceptible to a number of interrelated factors in addition to sea level rise, including changing ocean currents, increases in storminess, temperature and CO₂ and changes in precipitation (Ward et al., 2016). It is anticipated that mangrove forests will try to ‘keep up’ with sea level rise by migrating landward and possibly occupying and displacing coastal wetlands in certain locations. Rising temperatures and decreasing precipitation may hinder this ability to migrate. Coastal populations and development may also present barriers to this migration.

Climate change threats are projected to push the proportion of coral reefs at risk in the Caribbean to 90% by 2030 and up to 100% by 2050 (UN, 2016). The Reefs at Risk Revisited report by the World Resources Institute (WRI) used a similar index to the CCVI incorporating highest threat exposure, strongest reef dependence and lowest adaptive capacity. The index placed Haiti’s coral reefs among the most threatened in the world (WRI, 2011). Haiti is a global priority for concerted efforts to reduce immediate threats to the reefs, reduce social reliance on reefs and build adaptive capacity (WRI, 2011). This will be an important role for the management of PA3B.

Key Findings

- **There is reasonable certainty that Haiti will need to prepare for and adapt to a sea level rise of at least one metre by the end of the 21st century;**
- **The low lying coastal plains of Haiti’s north-east, including PA3B, will be especially vulnerable and the inundation of coastal communities can be expected;**
- **Under this scenario, the mangrove forests will likely begin to migrate landward and it will be important to provide space to enable this migration to occur so as to maintain healthy coastal mangrove forests;**
- **Concerted efforts will need to be taken to reduce dependency of local communities on reef ecosystems and maximize the resiliency of coral reefs to withstand the effects of sea level rise and warmer waters, primarily through the restoration of healthy populations of herbivorous reef fishes and top predators;**
- **Plans will need to be developed for the ‘managed retreat’ of coastal communities landward, potentially including the removal of infrastructure, homes and salt pans in vulnerable areas, combined with the restoration of mangroves and seagrass beds and possibly the armoring of portions of the coast with ‘living shorelines’ where relocation is not possible.**

5.1.1 Implications for Community Growth and Development within PA3B

As noted above, of the coastal communities located within PA3B, Bord de Mer de Limonade, Caracol, Jaquezy and Phaeton are at particular risk from climate change, especially from sea level rise and storm surges. These communities have all expanded rapidly in the years prior to the establishment of PA3B, and now that they are located within PA3B, strategies are required to guide their development and management into the future. Generally speaking, it is recommended that in order to protect marine and coastal ecosystems and their cultural heritage, development should be restricted to the footprints of the existing coastal communities with any expansion directed to inland communities near the PIC and along the highway RN6 corridor (ERM, 2015).

Three of these communities have been assessed through the Emerging Sustainable Cities Initiative (ESCI). The study identified those areas within these communities that are at risk from flooding and identified strategies for mitigating the effects over the longer term (ERM, 2015). In the community of Bord de Mer de Limonade, for example, of the 52 ha within town limits, 47 ha, or 90% of the total urban area, are at high risk of flooding (Figure 17). The study presents five options for a management response to this dilemma:

- prohibit any further spatial expansion of the town;

- develop and implement incentives for new settlers to locate elsewhere outside of PA3B in areas not prone to natural hazards;
- reallocate lands within the community to increase the proportion assigned to less vulnerable uses such as roads, institutional buildings or open space, with only 22 ha or 42% available for residential purposes;
- develop housing models for the 22 ha available for housing that adapt to the flooding hazard by being elevated above flood levels, and aggressively converting all existing housing to this model;
- increase housing density in residential areas to 80 homes per hectare (ERM, 2015).

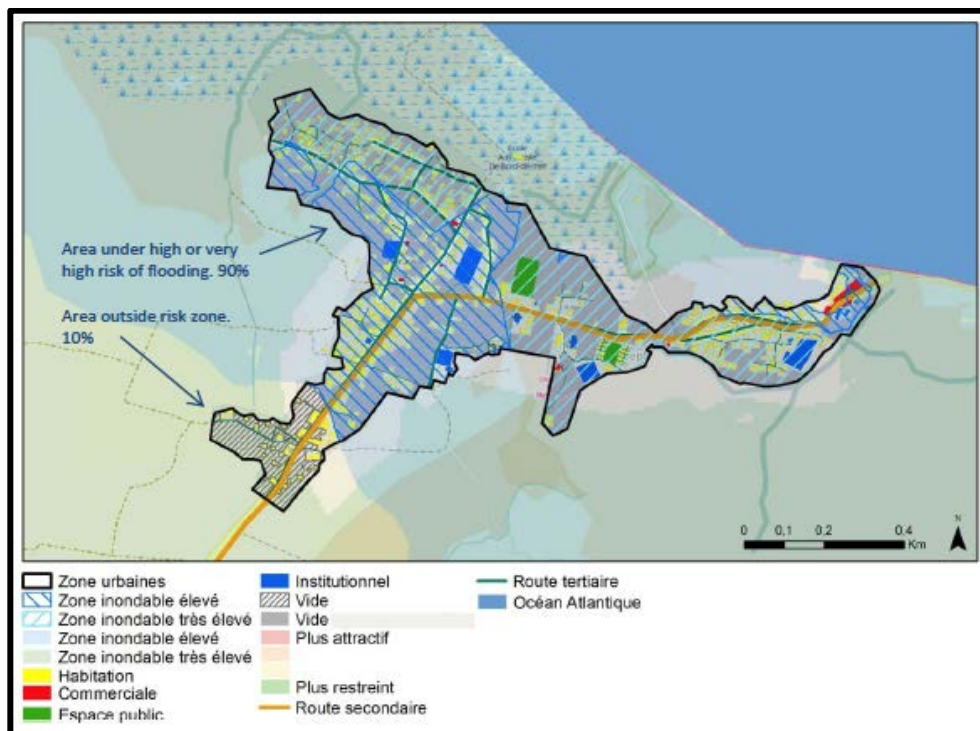


Figure 17: Main land uses and areas of high risk of flooding in Bord de Mer de Limonade (ERM, 2015).

Caracol and Jacquezy are also similarly at risk from flooding. In Caracol, 49% of its area is subject to flooding, whereas 8% of the area in Jacquezy is at risk. In both cases, the ESCI's study recommendations are the same as those for Bord de Mer de Limonade, the most significant of which is prohibiting any further expansion of these communities beyond, and potentially reducing, their current footprint (ERM, 2015). Figures 18 and 19 below, illustrate the current situation in Caracol and Jacquezy.

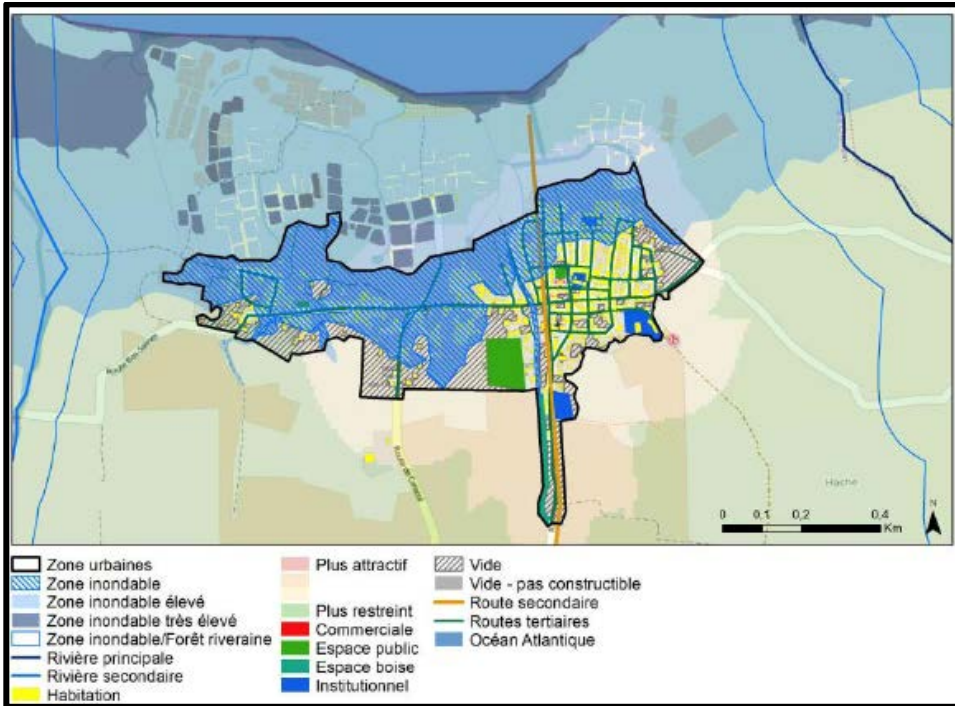


Figure 18: Main land uses and areas of high flooding risk in Caracol (ERM, 2015).

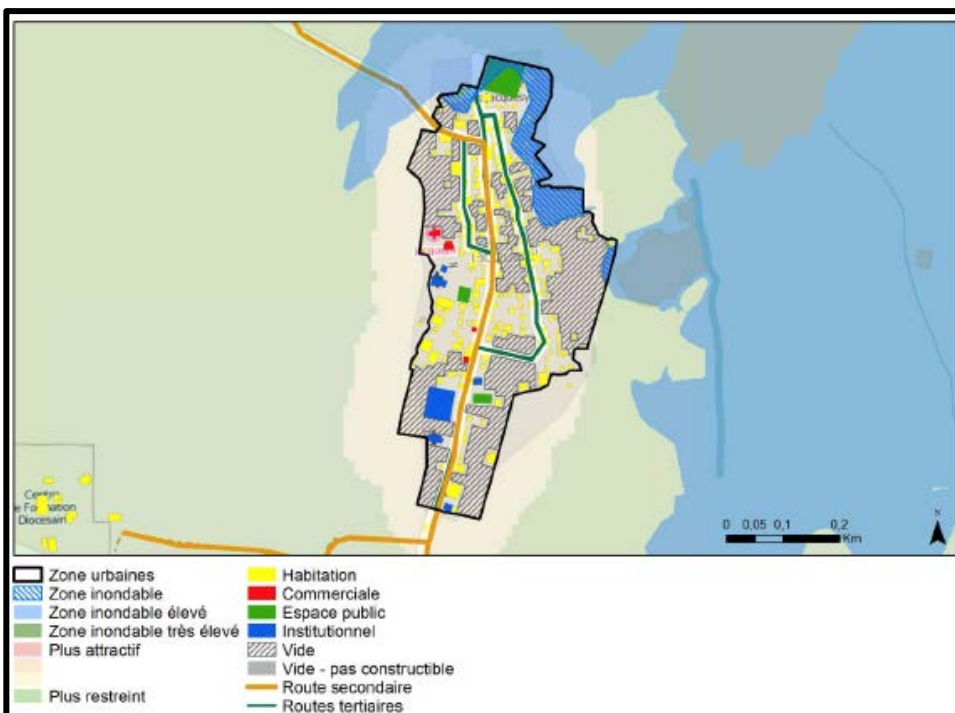


Figure 19: Main land uses and areas of high flooding risk in Jacquezyl (ERM, 2015).

Key Findings

- **In accordance with the ESCI study’s Smart Growth Scenario proposed for the Northern Development Corridor, the urban footprints of Bord de Mer de Limonade, Caracol and Jacquézy should, at a minimum, be limited to their current dimensions, or reduced through relocation programs in accordance with the presence of natural hazards and/or the need to protect areas of high biodiversity;**
- **While the ESCI study did not assess Phaeton or Fort Liberté, these communities should be subject to similar limitations as the others, recognizing that there may be potential and the need for growth in Fort Liberté to support an emerging tourism destination;**
- **Initiate a process of resettlement wherein population growth pressures are directed to communities outside PA3B in the surrounding region, including Trou-du-Nord, Limonade and Terrier Rouge, as well as to possible new communities in the Champin-Jesus area and the University of Limonade – EKAM area in association with the PIC;**
- **The urban boundaries of those communities within PA3B should be clearly and legally defined and incorporated into the protected area’s zoning plan wherein expansion of these communities beyond these boundaries should not be permitted.**

5.2 Description of Major Threats to PA3B

The Threat Assessment undertaken for PA3B in 2015-2016 by TNC identified a total of ten local threats to the biodiversity of PA3B, the most significant being overfishing, mangrove cutting for charcoal production and coastal development (Schill et al 2016). In terms of their impacts on biodiversity, the assessment found that the “...remaining biodiversity which is most at risk are freshwater fish, mangroves, native terrestrial plants, birds, and coral reefs and their associated fish and invertebrates. Marine mammals and reptiles appear to be currently locally extinct but their reintroduction would also be highly threatened’ (Schill et al 2016). These threats are addressed below in addition to three other potential threats recently recognized including a proposed dump site in Limonade, the proposed sisal plantations and the activity of sport fishing:

- Overfishing
- Wood Harvesting and Charcoal Production
- Land-based Sources of Pollution
- Unsustainable Coastal Development
- Agriculture
- Aquaculture and Caged Fish Farming

- Invasive Species
- Salt Production
- Hunting
- Sport Fishing
- Mining
- Proposed Sisal Plantation
- Proposed Dump Site in Mouchinette, Limonade

While not listed as a specific threat to PA3B, the potential impacts of the Caracol Industrial Park are also addressed below.

5.2.1 Overfishing

The most significant threat and priority for resource management in the PA3B is overfishing and the need to reform the local artisanal fishery. The overfishing problem in PA3B is a microcosm of what is happening throughout Haiti, where high levels of poverty and unemployment have caused many to turn to fishing as a means of survival. Consequently, fisheries are over-subscribed everywhere and fish catches have been declining for decades. Today, the fisheries in PA3B are highly unsustainable where small-scale subsistence artisanal fisheries primarily utilize illegal, small-mesh seine nets catching immature juvenile fish. Other gear types include gill and trammel nets, traps and varying hook-and-line methods. All fishing activity is unmanaged and unregulated with no limits enforced. Fishers themselves know this cannot continue, and have clearly expressed the desire for change. They see the establishment of PA3B as an opportunity to effect meaningful change through reducing the overfishing and improving their standards of living, thereby benefitting both the local communities and the marine ecosystem (Miller, 2015, 2016).

In terms of overall fishing effort, it is evident there are too many fishers chasing too few fish, and when this is combined with the use of gear that is both non-selective and destructive of habitat, a decline in productivity is inevitable. There is universal agreement among the fishers that the use of small-mesh seine nets is one of the most destructive types of fishing gear currently in use. Fish traps and bottom nets are also non-selective and are often lost or abandoned, and continue to fish and disrupt habitat. Recent surveys indicate that many of the larger fishes, including species of sharks and groupers are locally extinct, and that sea turtles and manatees are rarely encountered. Reef fishes have also experienced serious declines leading to alterations in reef trophic structure. The almost complete absence of the larger bodied reef fishes, especially the parrotfish and other herbivorous fishes, that play such a key role in the grazing of macroalgae, has led to decreased herbivory and a potentially deadly increase in algae growth. This will significantly reduce the reefs' resilience to withstand the impacts of climate change. Even though coral reefs make up

only 2% of PA3B and 3% of its marine area, the reefs have been the most heavily fished, having significant effects on production, abundance and diversity that cascade through the entire marine ecosystem.

The ongoing loss of biodiversity and degradation of habitats will continue unless significant changes are made to the existing fisheries management regime, particularly with respect to the overall fishing effort and the development and enforcement of fisheries regulations regarding zoning, catch limits and gear restrictions. Further, there is evidence to suggest that future trends toward increased mechanization, less biodegradable materials and newly emerging markets from Asia could exacerbate current challenges with fishing effort.

With effective reforms, the highly productive waters and depleted fish stocks of PA3B should recover relatively quickly, and perhaps be able to support a smaller scale sustainable fishery in the future as an ongoing component of local economies. It will be essential for fisheries management in a future PA3B to be driven by the ecological capacity of its ecosystems rather than by market forces.

Key Findings

- **It will be essential as an immediate management priority to eliminate the use of the illegal small-mesh seine nets through a compensation program and replacement with larger mesh size nets upon the future recovery of fish stocks;**
- **As an accompanying measure, it will also be essential to reduce the overall fishing effort within PA3B in cooperation with local communities, working groups and Fishing Associations and to seek alternative livelihoods for displaced fishers;**
- **The Park Management Authority, in coordination with the Fisheries Directorate, will need to develop a comprehensive fisheries management plan and new regulatory framework, a strong enforcement presence and education programs for training and to raise awareness of the issues and the new regulations.**

5.2.2 Wood Harvesting and Charcoal Production

Even though mangrove forests are legally protected in Haiti (by the Arrêté Ministériel interdisant l'exploitation des mangroves, 10 juillet, 2013), the cutting of mangroves and the subsequent production of charcoal as a source of firewood and cooking fuel is occurring in PA3B. Overall, the cutting of mangroves occurs on a fairly small scale and the coverage of mangroves within PA3B remains fairly high. It often takes place as a substitute when fishing is poor, and could affect as many as 60 species of fish that utilize mangroves during

a portion of their life cycle, as well as birds, mammals and invertebrates. Ancillary impacts include the reduction in primary production that supports fish production, coastal protection and tourism services.

With the establishment of PA3B, and more stringent enforcement of the law protecting mangroves, it is anticipated that harvesting patterns will decrease in the short term, in particular if programs are implemented to raise awareness and educate local communities regarding illegal harvesting. Programs promoting the use of more sustainable species such as the often problematic and fast growing Acacia for charcoal production, along with efforts to use sugar cane and other plant material for fuel, will further assist to curb illegal harvesting. Finally, economic development in and around 3BNP will increase demand for cleaner energy, and make it more viable for utilities and suppliers to invest in the infrastructure necessary to provide electricity, natural gas, and water to developing communities over time. All of these factors should reduce and eventually eliminate the demand for charcoal, as has occurred in other places that have modernized in the past century.

Key Findings

- **The illegal harvesting of mangroves needs to cease and the law protecting mangroves vigorously enforced while providing viable alternatives for cooking fuels incorporating the use of the fast growing Acacia harvested under sound silvicultural practices, the provision of natural gas, the use of more efficient stoves and access to renewable energy.**
- **Small-scale restoration of degraded areas is necessary to return forest structure and help build resilience in advance of coming climate change impacts, particularly along coastal fringing mangrove, where natural recruitment potential is most hindered. Opportunities for mangrove restoration have been identified in each of the Bays.**

5.2.3 Land-based Sources of Pollution

In addition to the possible sources of pollution from the PIC, as discussed above, there are other potential land-based sources of pollution that could impact upon the biodiversity and ecological integrity of the PA3B. Such sources of pollution can include sediments eroded from hillsides, nutrients, pesticides, plastics, sewage and a variety of chemicals derived from human activities within the watersheds. Freshwater ecosystems and nearshore marine ecosystems are most at risk but the mobile nature of pollutants potentially puts the entire PA3B at risk.

The greatest risk for external sources of pollution from watersheds draining into PA3B arise in Grande Rivière du Nord, Rivière Trou-du-Nord, and Rivière du Massacre. The potential for sediments, nutrients and other pollutants to enter these rivers and hence downstream estuaries and marine environments may grow given increased development pressures around PA3B and throughout these watersheds.

Key Findings

- **Effective management measures, including monitoring programs, by both local municipalities and the PA3B Management Authority will be necessary to ensure these external impacts are minimized;**
- **The implementation of a ‘ridge to reef’ approach (GEF, 2013) for the watersheds draining into the bays of PA3B will assist in the restoration of ecologically sensitive parts of these watersheds and in soil and water conservation projects to reduce communities’ vulnerability to climate change.**

5.2.4 Unsustainable Coastal Development

Potential issues associated with coastal development primarily relate to the ongoing development and growth of the seven coastal communities within PA3B, as well as the development of the PIC (see Section 5.2.3). Technically, these communities are located within the boundaries of PA3B, and conflicts may arise between PMA objectives to protect mangroves and other coastal habitats and community desire to promote coastal development, in particular for tourism purposes. Unplanned and unregulated development can have significant impacts on coastal scenery, especially in such beautiful locations as the largely undeveloped shoreline of Fort Liberté Bay and its outside beaches. Such pressure for residential development on the coast is already quite evident in Fort Liberté, and it is also occurring in Caracol and Bord de Mer de Limonade.

The most direct impacts are the loss of coastal vegetation and nearshore marine habitats through land clearing, filling and dredging during construction. Ongoing impacts can include sedimentation, sewage and pollution. Planning and zoning restrictions, including coastal setbacks, are required to mitigate these types of impacts. Appropriate development can have a positive effect by supporting activities that are compatible with the goals of PA3B such as nature-based tourism that, in turn, support less destructive livelihoods thereby lowering overall threats.

Key Findings

- **The need for proper planning and zoning to constrain coastal development and direct development to compatible areas is urgent; it is essential for the PA3B**

Management Authority to have the mandate to regulate and control coastal development;

- **Given the close proximity to the Dominican Republic and its active tourism industry, similar tourism development is likely and desired in the Fort Liberté area so long as it is planned and regulated appropriately.**

5.2.5 Agriculture

The boundaries of PA3B have been drawn to include a number of agricultural areas where crops include banana, rice, sugar cane and sisal. Some production is on an industrial scale such as the banana plantation near the University of Haiti campus and various sugar cane fields, but most are subsistence and small scale such as rice, corn, beans, cacao, peanuts, peppers and pineapple. While most farming is organic, and so minimize potential impacts due to pesticide runoff, they can still contribute to negative environmental effects including soil erosion and nutrient depletion, as well as disrupting water regimes and the flow of key nutrients downstream. Most impacts on PA3B are outside the boundaries, but there are secondary impacts including sedimentation and limited nutrient loading and chemical dispersion.

Of significant concern is the recent announcement of the placement of a new and large sisal plantation within PA3B in an area previously used for sisal production decades ago . This situation will need to be monitored carefully, and if it proceeds, assurances made that impacts would be minimal and amenities secured to assist in the management of PA3B.

Key Findings

- **As food security is a major emphasis of the Haitian government, and there is a high degree of dependence by local communities on locally produced food, this activity should continue within PA3B and be zoned accordingly.**
- **The PA3B Management Authority will need to work closely with farmers and other agricultural operators to ensure sustainable practices are followed at all times.**
- **Zoning through the management plan needs to clearly delimit the area that shall be used for agricultural purposes and confine agriculture to this area, recognizing that there may be areas removed from agricultural use if the needs for biodiversity conservation prevail.**
- **Cattle and goats that are currently being grazed illegally in the dry forest region should be removed to enable the restoration of this ecosystem.**

5.2.6 Aquaculture and Caged Fish Farming

There have been recent and past attempts to cultivate various species for food through aquaculture; notably, the culture of Red tilapia (a hybrid of the Mozambique tilapia *Oreochromis mossambicus* and the Nile tilapia *O. niloticus*) in floating cages in Lagon aux Boeufs and in some of the small inland waterways (Schill et al 2016). Other raised species reported are mollusks, eels, and ornamental fish. There may also be a growing capture of wild ornamental fish in the vicinity of Caracol and Fort Liberté. Potential impacts include the risk of introducing invasive species that could be detrimental to native and especially endemic species, the risk of depleting native populations of utilized species and impairing coastal water quality.

Given the ongoing need for increasing food production in Haiti, fish farming and aquaculture is expected to grow. Under effective management, there may be a place for aquaculture operations in PA3B, possibly utilizing land-based options. Using existing natural bodies of water, especially the Lagon aux Boeufs that is internationally recognized for its high biodiversity, and other waterways known to support endemic species, may not be appropriate in PA3B. If growth trends were to continue without adequate regulation or conservation measures, it would pose a significant risk to the future of PA3B.

Key Findings

- **Given the international recognition of the Lagon aux Boeufs for its biodiversity, and the presence of endemic species in other waterways, these natural water bodies should not be used in the future for aquaculture operations.**
- **In the interest of increasing local and national food supplies, the PA3B Management Authority should work with the Fisheries Directorate and potential aquaculture operators to find best practice production facilities for which there is now considerable international experience.**

5.2.7 Invasive Species

In the marine environment, lionfish *Pterois volitans* is an invasive species of critical concern. It is a highly predatory fish that is known to have significantly depleted reef fishes in other parts of the Caribbean and has been reported in the PA3B area. In freshwater environments, introduced ciclids, more commonly known as tilapia, occur in fresh water streams and in Lagon aux Beoufs and may be having an impact on native, and in particular, endemic species.

On land, the needle bush *Acacia farnesiana* is now the dominant vegetation type surrounding PA3B. It has extensively colonized past agricultural lands (e.g. sisal

plantations) and impeded the establishment of the more heterogeneous native dry forests that once occupied much of the area in the eastern portions of PA3B. Botanists at this time are actively debating whether *A. farnesiana* is native or an introduced invasive species. Its status must be defined, and if left unchecked, there is a risk that this species could eventually supplant all native species.

Key Findings

- **The ongoing monitoring and systematic removal of lionfish from the coral reef ecosystems in PA3B, as well as surrounding waters, should be a management priority.**
- **The introduction of tilapia into natural freshwater systems within PA3B pose a considerable risk to native and endemic species, thus should be discontinued; opportunities for fish cage aquaculture for existing tilapia or other species within PA3B may be pursued in appropriately zoned areas.**
- **The status of *Acacia farnesiana* as a potential invasive species in the region needs to be resolved.**
- **The selective removal of *Acacia* should be pursued as a management objective in re-establishing the more heterogeneous dry forests of the past; the removal of this species under sound silvicultural strategies could expedite the restoration of native forests and become part of the management program to eliminate the illegal harvesting of mangroves for charcoal production.**

5.2.8 Salt Production

Salt ponds are found primarily in former mangrove areas that have been cleared and diked to exploit tidal waters. Most ponds are found in the vicinity of the populated Caracol area where many fishers pursue salt production, as well as agriculture, as alternative sources of income. The construction of these salt ponds has significant impacts on transitional mangrove communities, fish nursery habitats and associated fauna due to habitat conversion. They also contribute to destabilizing shorelines and increase groundwater salinities. The greatest future risk is the unregulated expansion of these ponds into virgin mangrove areas, salt marshes and wetland areas.

Key Findings

- **Existing salt ponds should remain in production, but a moratorium on the development of any new salt ponds and the clear delimitation of where salt ponds are permitted is needed.**
- **Where possible and as they are retired, old ponds should be restored back to mangrove habitats.**

- **With effective planning, zoning and regulation, the ongoing operation of existing salt ponds should be manageable without incurring further threats to biodiversity.**

5.2.9 Hunting

Hunting occurs sporadically around PA3B both at the subsistence level by local residents and also as sport by wealthy Haitians. The main species hunted are larger birds such as ducks and pigeons, but may also include mammals and larger reptiles when they are found. Most bird hunting is concentrated around Lagon aux Beoufs and the former agricultural area around Fort Liberté. The overall level of hunting is low and sporadic, partially due to the low numbers of targeted species. The recovery of targeted species will continue to be limited until hunting within PA3B is regulated and enforced. It is likely that continued hunting is suppressing bird populations within PA3B, and is a particular concern for larger species including flamingos, herons, ducks and pigeons. There is also evidence that marine mammals such as whales, dolphins, manatees and sea turtles are taken on occasion and is no doubt having an impact on their recovery.

Key Findings

- **The management of PA3B must provide for the restriction and regulation of all hunting and be a high priority for implementation and enforcement during the first decade of the management plan.**
- **Given the high level of international recognition for Lagon aux Boeufs and the dry forests in the eastern portion of PA3B as priority areas for bird conservation, bird hunting should not be permitted there; a limited sustainable harvest for subsistence could potentially continue in the agricultural areas on the periphery of PA3B.**
- **Given critically low numbers of native and/or endemic mammals and reptiles in PA3B, in particular the *Hispaniola solenodon*, the *Hispaniola hutia* and the rhino iguana *Cyclura cornuta*, which are all endemic to the island and of high conservation concern, all hunting for these animals should cease at the earliest opportunity.**
- **The continued control of introduced predators, in particular feral cats and mongoose, should be encouraged as a strategy to eradicate these populations within PA3B.**
- **The hunting of all marine mammals and sea turtles should cease immediately.**

5.2.10 Sport Fishing

While there is little information available about sport fishing in the PA3B area, sport fishing charters are offered out of Labadee and Cap Haitien in deeper offshore waters with the most popular target species being wahoo, blue marlin, dorado (mahi-mahi) and tuna.

Key Findings

- **Sport fishing in offshore waters for certain species may become a popular sport in the future if offered from coastal towns such as Caracol or Fort Liberté and suitable boats were made available.**
- **Any sport fishing undertaken within PA32B would need to be properly regulated and consistent with the zoning plan for PA3B.**
- **Regular monitoring of fishing activity and the population levels of target species would be required to ensure sustainability.**

5.2.11 Exploitation of Non-Renewable Resources

The exploitation of non-renewable resources refers to the exploration for and development of mining for sand, minerals, aggregates and rock for construction purposes, and the extraction of coal, lignite, and oil and/or natural gas, or other non-renewable fuel sources both on land and on the seafloor. Also, due to the long period of time required for their growth, for the purposes of this management plan, corals are considered a non-renewable resource.

While mining is not a serious or pervasive issue in PA3B, it does occur in limited areas in the form of rock quarrying on the peninsulas east and west of Fort Liberté Channel, and the occasional removal of sand from river courses. There may also be the potential for the mining of rock, sand or minerals (such as manganese nodules) from the seafloor. Further, despite its illegality, there is a history of the removal of live and dead coral from reefs for construction purposes, aquaria (including “live-rock”), and curio in Haiti. Also, there is increasing interest in Haiti’s possible reserves of oil and natural gas on land and offshore, although there appears to be limited potential on Haiti’s northern coast and offshore areas.

Key Findings

- **The exploration for and exploitation of non-renewable resources almost inevitably comes with immediate environmental impacts and significant potential for future and long-term risks for ecosystem alteration that are incompatible with management objectives for PA3B. The extraction of non-renewable resources, in all its forms, should not be permitted within PA3B.**

5.2.12 The Proposed Sisal Plantation

During the preparation of this management plan, the Government of Haiti, through the Ministry of Environment, entered into a 25-year agreement with SISALCO to develop a sisal plantation on approximately 2,000 ha of leased land within the boundaries of PA3B. While the agreement asserts the compatibility between the development of these lands for sisal production and the ‘needs of preservation, protection and conservation’ of PA3B, there are significant concerns over the potential impacts of this development and its associated infrastructure on the sustainable use of resources within PA3B and on the viability of conservation and protection programs as outlined in this management plan.

Key Findings

- **The proposed sisal plantation development, and the process through which it was approved, is an unfortunate occurrence and not in keeping with the air of openness and transparency that the planning process for PA3B is attempting to demonstrate.**
- **Notwithstanding the above, the PMA for PA3B will need to work in cooperation with Sisalco and seek its logistical and financial assistance in the implementation of PA3B’s management programs.**

5.2.13 The Proposed Dump Site in Mouchinette, Limonade

The proposed dump site intended to accept solid waste from Cap Haitien is located near the community of Mouchinette in Limonade. The dump site lies either directly adjacent to, or in places may actually cross, the boundary of PA3B. While the dump site does not appear to be in close proximity to surface drainage flowing north into PA3B, the authorities responsible for the management of the site will need to work in close collaboration with PA3B and local communities to ensure there are minimal external impacts arising from the use of the site.

Key Findings

- **The Limonade dump site could potentially be a source of point or non-point pollution for PA3B and should be carefully monitored over the course of time to ensure any external impacts on PA3B are minimized.**

5.2.14 Other Risks: The Caracol Industrial Park (PIC)

The Caracol Industrial Park (PIC) was constructed in 2012 near the fishing community of Caracol in a location that straddles Rivière Trou-du-Nord approximately three kilometers

from where it drains into Caracol Bay. While the Park currently has aspirations of providing employment for about 20,000 people, it currently only employs about 9,000 in several garment, sisal and paint factories. The Park has provided electricity to some local communities and now serves 43,000 homes. The Park does have a waste water treatment facility, but there are ingering concerns "...about the potential risks to the fisheries on which they rely when wastewater is released by the industrial park authorities. Since this industrial park features apparel manufactures, they fear that chemicals and dyes used in treating cloth could harm the environment. Impacts of the industrial park may include soil and water contamination (freshwater, underground water, ocean/coastal waters), and these pollutants could threaten the marine and coastal ecosystems" (Schill et al 2016).

While the impacts on terrestrial biodiversity through the construction of the PIC were relatively minimal, there is the potential for the PIC to disrupt local species' migrations, and interfere with the flow regime of Rivière Trou-du-Nord and its subsidiaries. Generally, it is regarded that if a high quality environmental management and monitoring plan is put in place these impacts can be mitigated. Of greater concern are the impacts that the PIC is having through the migration and settlement of people to neighbouring communities (such as Caracol) in the hope of finding work, while increasing demands for water, charcoal, fish, agricultural products, housing, and the generation of greater volumes of solid waste and sewage occur. Growth and land conversion in and around Caracol is already evident, and if these trends continue within PA3B, there is a high likelihood that local mangroves and nearshore water quality will be at risk of declining (Schill et al 2016; ERM, 2016).

The planned and orderly future development of the region to accommodate the anticipated rise in population, largely drawn to the area by the PIC, can be achieved through the design of a new neighbourhood centered on the PIC and the highway RN6 corridor, as espoused

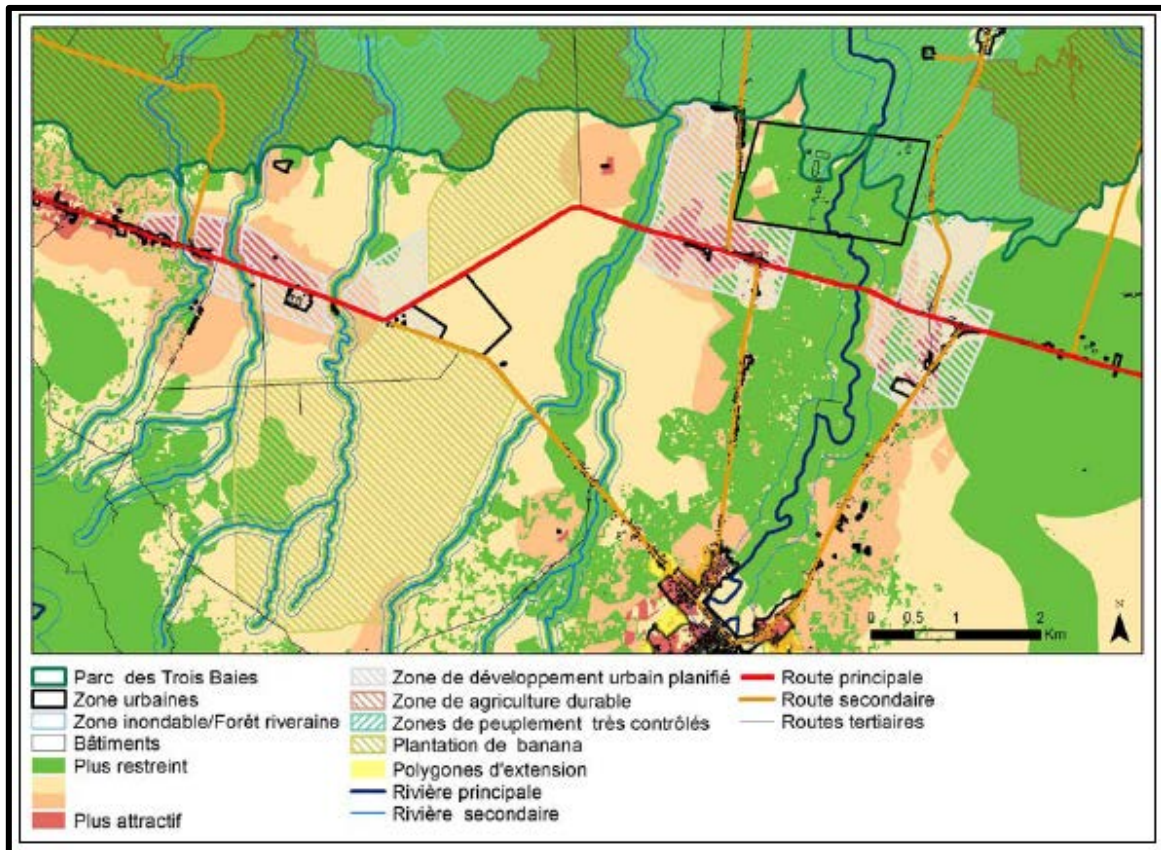


Figure 20: Preferred locations for consolidating new urban development in the PIC area (ERM, 2015)

through the ESCI proposals for the Northern Development Corridor (Figure 20) (ERM, 2015). Such a development, combined with the proposed development restrictions for coastal communities within PA3B (see Section 5.1.1), could lead to the evolution of a more balanced landscape in the region featuring a number of sustainable communities, viable agricultural production and effective environmental protection.

Key Findings

- **It is necessary that PIC authorities implement a high quality environmental management and monitoring plan to ensure negative impacts on rivers, estuaries, coral reefs and other fragile environments are minimized as required by the Presidential Decree.**
- **Development controls and community neighbourhood plans need to be developed to regulate and constrain land conversion, settlement and growth in the region surrounding the PIC and to direct such development in a planned and orderly fashion to appropriate areas and minimize impacts on coastal and marine ecosystems.**

5.3 Toward an Ecotourism Development Strategy for PA3B

Haiti is the least developed for tourism of all Caribbean island nations. The CBD's Country Profile completed for Haiti in 1997 began to address this in urging Haiti to embrace ecotourism as a key strategy for the country, to specifically integrate biodiversity conservation into a tourism strategy for the north-east region and to better integrate coastal zone and watershed management with the DR (CBD, 2001, 2016). Since then, the Ministry of Tourism (MOT) has reinforced a tourism priority for the north-east and expressed the desire to "capture some of the benefits of the tourism trade" in the DR. The MOT has also cautioned to avoid reliance on large-scale resort-based tourism, favouring a priority on adventure tourism, ecological tourism, cultural tourism and social tourism (living and working in rural communities) (CBD, 2016).

PA3B is well suited to make a significant contribution to these objectives in north-east Haiti, both in terms of integrating biodiversity conservation with adventure, ecological and culture based tourism, as well as combining initiatives in Haiti with those in the DR. In 2014 the World Bank initiated the Cultural Heritage Preservation and Tourism Support Project (known as PAST) in northern Haiti (P144614), scheduled for completion in 2020, with \$45US million in funding and a focus on Cap Haïtien and the National Historic Park and World Heritage Site including the Citadel, Sans Souci and Ramiers. As part of the Project, a 2015 study undertaken for the Ministry of Tourism (MOT) identified a number of tourism destinations and circuits, one of which proposes to expand the tourism offer to encompass a broader view of the coastal defense system while integrating this experience with the natural and cultural environment of the north-east (Chauvel, 2015). One of the proposed circuits would expose tourists to the rural character of the northern plains in the vicinity of Quartier Morin, an area near PA3B's boundary that includes a number of historic sites and plantation ruins dating to colonial times, the shorelines of the Baie de l'Acul and Fort Liberté.

5.3.1 An Initial Focus on Fort Liberté

With its rich history combined with its exceptional natural values, the study regarded Fort Liberté, as the origin of Haiti's independence, as an 'incredible and undiscovered' place with a 'prestigious past' that could be an ideal ecotourism destination in north-east Haiti, one with direct access to the DR and only 50 km from Cap Haïtien. The study emphasizes that any development would have to respect its natural surroundings and the fact that it is located within PA3B (Chauvel, 2015). Some of the specific features of interest to tourists in Fort Liberté and its surrounding area include:

- The colonial defensive fortifications that are still in relatively good condition, five

- of which were declared national monuments in 1985;
- The many colonial buildings that remain in Fort Liberté amenable to a tour of the colonial town;
- The close proximity to Lagon aux Boeufs and an expansive area of Tropical Dry Forest with their internationally recognized birdlife;
- The close proximity to marine life in the Bay as well as the coral reefs and seagrass beds in the ocean beyond the entry channel;
- Direct access to excellent opportunities for SCUBA diving, snorkeling, kayaking, pleasure boating, bird watching and beach camping while touring the coastal fortifications;
- The configuration of Fort Liberté Bay for the potential development of a marina destination catering to the yachting community;
- Unparalleled opportunities for an integrated transboundary multi-site tourism destination with other nearby historical sites and national parks in the DR (Chauvel, 2015).

The potential constraints to tourism development in Fort Liberté are also well recognized, and include:

- The advanced degradation of the community, its access road and its historic buildings, including Fort Dauphin, a central attraction;
- The lack of some form of legal protection and maintenance standards for the historic town and its buildings, such as a National Historic Park designation;
- Virtual absence of infrastructure, facilities and services to support tourism;
- Extensive pollution, lack of sanitation and accumulation of solid waste; and
- The accelerated degradation of mangroves and associated ecosystems (Chauvel, 2015).

Fort Liberté and its environs can become the hub of a major tourism destination focused on the vast and diverse natural and cultural values of PA3B. Such a development could provide significant income generating opportunities and alternative livelihoods for many people. Initial steps toward making this a reality include:

- Ensuring the management plan and zoning for PA3B supports the development of an ecotourism hub in Fort Liberté;
- Conduct a comprehensive feasibility study and development/management plan for ecotourism development in Fort Liberté and its surroundings;
- The rehabilitation and enhancement of natural and historical sites of interest, in particular the coastal fortifications;
- Ongoing archaeological research and excavations of the many pre- and post-Columbian sites;

- Depending on the results of the feasibility study and development planning, the construction of the necessary infrastructure, tourism facilities and services, including eco-hotels and a marina, all built to the highest of environmental standards;
- Develop an integrated transboundary approach to nature- and culture-based tourism with the Monte Cristi province in the DR.

Currently, there appears to be no funding in the PAST project’s budget for an ecotourism feasibility study for Fort Liberté, although such a need is referenced in the MOT study (Chauvel, 2015). A 2016 evaluation of the World Bank project suggests the entire Project is not performing well and may warrant “adjustments and flexibility in implementation”. With the PA3B management plan expressing a clear interest in an ecotourism focus for Fort Liberté and its environs, there may be opportunity to have funding directed toward this area (Chauvel, 2015; Keane, 2016). UNESCO and the Smithsonian Institution have also expressed keen interest in providing better protection for Fort Liberté’s cultural assets and using them to support a tourism industry (Phys.org, 2014).

5.3.2 Benefits of Multiple National and International Designated Areas

At the national and international levels, Multi-International Designated Areas (MIDA) are well-known to provide a platform for strengthened inter-institutional cooperation and may provide many more advantages (Schaaf and Rodriguez, 2016). Having multiple forms of international recognition for PA3B is feasible and eventual multiple designations could facilitate:

- fundraising efforts for management at the national level and also contribute to securing financial resources from international donors;
- raising national visibility and global prestige, which in turn may bolster the economic base of PA3B and the surrounding region through tourism, related visitor spending and the marketing of locally branded products and services;
- increasing the resilience of PA3B conservation areas to external pressures as they underline the exceptional and diverse values of the area at the global level;
- accentuating the scientific significance of PA3B for research, education and public awareness and help to foster transboundary collaboration, global knowledge sharing, and partnership programmes.

Linking conservation with sustainable development is common to designations such as the Ramsar Convention, the Man and Biosphere Programme, the International Geoscience and Geoparks Programme and the World Heritage Convention and thus may further facilitate the engagement of local communities.

There is also merit in considering the designation of a portion of PA3B as a national park to raise its profile both within Haiti and around the world and augment its appeal as a tourism destination.

5.3.3 Consideration of a World Heritage Site

Haiti is a signatory nation to the World Heritage Convention (WHC), and the National History Park comprising the Citadel, Sans Souci and Ramiers, inscribed in 1982, is Haiti's sole World Heritage Site. The historic centre of Jacmel is on Haiti's Tentative List for future consideration. Haiti is being encouraged by UNESCO to update its WHC Tentative List giving specific consideration to 'underwater cultural heritage' in connection with the still unknown location of the wreck site of the *Santa Maria* (UNESCO, 2015).

It is not inconceivable that the rich and internationally significant complex of archaeological and historic resources within PA3B, both terrestrial and marine, combined with the high natural resource values of the PA3B, could warrant World Heritage Site status as a mixed natural/cultural site. Such a designation would help immeasurably in supporting ecotourism in PA3B. Since Haiti's Tentative List may be revised, the PA3B could be considered, either as a stand-alone site or as an additional component of the Citadel, Sans Souci and Ramiers site. Further, the DR has placed the city and surrounding natural environment of Monte Cristi on its Tentative List, raising the potential for regional collaboration. Since UNESCO recognizes Haiti as both a Small Island Developing State (SIDS) and a Least Developed Country (LDC), it has programs in place to provide assistance (see Appendix 3).

Key Findings

- **The PA3B is well positioned to support Haiti's desire to embrace ecotourism, as well as adventure, cultural and social tourism, as a key pillar in its overall development strategy;**
- **PA3B can lead the integration of biodiversity conservation into a tourism strategy for Haiti's north-east coast;**
- **The extraordinary mix of archaeological, historical and natural resources found in Fort Liberté and its environs makes it ideally positioned to become a central hub of this tourism strategy, especially given its close proximity to both Cap Haïtien and the Monte Cristi region in the DR;**
- **There are serious constraints to the ability of Fort Liberté to serve this role, with advanced degradation of the community and its historic buildings, poor infrastructure, the absence of facilities and services, excessive pollution and solid waste and the degradation of surrounding natural environments;**

- **With proper planning, development controls and improvements in infrastructure, along with the appropriate types of development, these constraints can be overcome and Fort Liberté can become a significant tourism destination;**
- **ANAP and the PA3B Management Authority may wish to consider approaching the World Bank about possible funding for an ecotourism feasibility study as part of its ongoing Project P144614;**
- **Haiti should give consideration to adding PA3B to its revised WHC Tentative List and, with UNESCO's assistance, assessing its potential for a mixed natural/cultural World Heritage Site.**
- **Haiti should also give consideration to designating a portion of PA3B as a national park.**

6.0 VISION, ZONING AND MANAGEMENT PROGRAMS

Based on the above resource descriptions; the assessment of threats, issues and key findings; a review of Haiti's international obligations and opportunities; and given the direction of the Presidential Decree, the Vision statement and a portfolio of nine management programs, objectives and actions for PA3B is outlined below.

6.1 A Vision for PA3B

The following is the proposed Vision for the PA3B:

The ecologically rich and fragile marine, coastal, and terrestrial resources in the PA3B, most notably the complex of coral reefs, seagrass beds, mangrove forests, aquatic habitats and tropical dry forests, with their associated archaeological and historic features, are assured their long-term protection and the maintenance of their biological diversity in perpetuity, while, in this spirit, providing for the sustainable use of select resources in support of local communities.

6.2 The Zoning Plan

Consistent with this Vision, and as is characteristic of IUCN Category VI protected areas, PA3B will provide for a range of levels of protection and conservation as well as sustainable human uses and activities. Zoning is a classification tool that spatially recognizes these differences in management focus and objectives, and guides the application of appropriate management strategies. Within a geographic area identified by a zone, the management emphasis will be applied equally where the levels of resource protection are consistent throughout the zone and similar levels and types of uses are allowed or not allowed as the case may be. In this way, zoning is primarily intended to achieve an appropriate balance between the conservation and protection of natural resources and the degree and types of human use (Henwood and Otuokon, 2015).

In accordance with Articles 1 and 2 of the Presidential Decree, zoning in PA3B must provide for the protection of natural systems and their biodiversity while responding to the needs of local communities that depend upon those resources and that are compatible with nature conservation. The Decree also declares that 'different categories of protected areas', or zones, will be specifically 'identified and boundaries determined', with each zone subject to different protection status according to scientific information (see Appendix 1). Zones in PA3B will, therefore, have the following purposes:

- create core conservation areas for strict protection and/or scientific research;
- identify areas with significant conservation, recreation and cultural values;
- focus visitor use or other types of human use into certain areas and control the provision of services (e.g. water, electricity), and conversely, disperse or prohibit use in fragile areas, to minimize their environmental effects;
- isolate areas requiring restoration from select or all activities;
- partition areas to separate incompatible or conflicting uses; and
- identify areas for the exclusion of certain inappropriate activities.

A description of the portfolio of management zones proposed for PA3B is found below in Table 12 and the zoning map is found below in Figure 21.

6.2.1 Description of and Rationale for the Zoning Plan

The following zones are proposed for the management of PA3B (Table 13). This zoning system is relatively simple with only five zones, two of which, the Restoration and the Conservation zones, will apply equally in both the marine and terrestrial environments. The other three zones, Sustainable Use, Community Management and Cultural Conservation, are solely terrestrial.

6.2.1.1 The Restoration Zone

The Restoration Zone is central to implementing the Decree and to achieving the Vision for PA3B. In the marine environment, the zoning plan recognizes the long-standing and ongoing decline in the health of the marine environment and its flora and fauna, primarily due to overfishing and the harvesting of mangroves for charcoal production. Therefore, all of the mangrove forests (in accordance with Haitian law), most seagrass beds and a significant portion of the nearshore marine waters and coral reefs within PA3B are placed within the Restoration Zone. Further, this zone spans the breadth of the marine environment east and west of Caracol Bay from the high tide line through all of the representative habitats of this marine ecosystem, including mangroves, seagrass, hard and soft bottom areas, the fringing and barrier coral reefs and their seaward slope into deeper waters.

This action will cease the harvesting of mangroves, marine mammals, sea turtles and marine invertebrates (including the Queen conch *Strombus gigas* in recognition of the CITES moratorium) and curtail or cease (depending on location) the harvesting of fish. The closure of harvesting for marine mammals and sea turtles is permanent, but given the ten-year time frame of this management plan, there may be sufficient time for the recovery of fish populations and some invertebrates to enable a sustainable fishery to resume. In the

interim, the plan includes proposals for alternative livelihoods to enable displaced fishers to provide for their families.

A relatively small portion of the offshore waters will be placed in the Restoration Zone in the interest of providing a high level of protection for an area that would not encroach on local fishermen and may encompass significant habitat for a range of deep-water species. Ongoing research and monitoring will be required to assess the significance of these waters to offshore species.

Much of the terrestrial Restoration Zone is dedicated to the protection of the coastal fringe in an approximately 100 metre band adjacent to fragile marine environments, in particular the mangrove forests and the beaches and riparian forests west of Bord de Mer de Limonade, and to the recovery of the Tropical Dry Forest that occurs on the peninsulas east and west of the Fort Liberté Channel. As noted in Section 3.2.1, PA3B contains one of the most extensive examples of the Tropical Dry Forest Ecosystem in Haiti, and is only second to Cuba in the Caribbean. This forest also contains many of the IUCN red-listed species found in PA3B, including important habitat for the endemic Hispaniolan Parrot (IUCN Vulnerable), and is consequently a high priority for protection. This forest is also found in close association with the internationally recognized Lagon aux Boeufs known to be a globally significant priority for bird conservation. The plan provides for the removal of the greatest sources of impact in this forest and the lagoon, mostly the free-ranging cattle and goats, artisanal fishing and aquaculture for tilapia.

6.2.1.2 The Conservation Zone

To complement the Restoration Zone in the marine environment, portions of the nearshore waters inside the reef, and parts of the reef itself, are included in the Conservation Zone where, in accordance with the recommendations in the Fisheries Sector Action Plan (Miller, 2016), limited fishing can continue to occur with fishing effort substantially reduced through the regulation of the number of fishers and gear type. The closure of much of the reef and seagrass beds to fishing in the Restoration Zone should result in higher recruitment of many species and spillover into areas where limited harvesting can continue. It may also be possible over the decade-long period of this management plan to rotate closed versus open portions of the reef and inside waters depending on rates of recovery. At this time, no portion of the marine environment is included in the Sustainable Use Zone. The zoning plan continues to provide limited access for fishers in the Conservation Zone to portions of the nearshore waters inside the reef and the reef itself to fishers from Bord de Mer de Limonade, Caracol, Jacquezil, Phaeton, Fort Liberté, Derac, and, depending on agreements to use the Conservation Zone, fishers from outside the PA3B.

Most of the deeper offshore waters extending from the seaward slope of the coral reef out to the limit of territorial waters will also be managed as part of the Conservation Zone, wherein the limited and regulated harvest of fish, including artisanal and sport fishing, can occur.

The terrestrial Conservation Zone encompasses those lands where limited agricultural activity has occurred over time, but where there may still remain some degree of natural values worth conserving or giving the opportunity for recovery and restoration. A more thorough assessment is required to determine future management priorities. The Conservation Zone to the north and west of Phaeton is intended to accommodate the proposed sisal plantation in this area, and if or when developed, the zoning for the plantation should be revised to Sustainable Use.

6.2.1.3 The Sustainable Use Zone

As an imperative directed by the Presidential Decree the plan recognizes existing types and levels of human use while guiding the transition of, and placing limits on, future use and activity to achieve sustainability. The plains along the southern limits of PA3B, for example, are largely in agricultural use, and have been for centuries, and local communities continue to rely on this food production for their sustenance. Also, the salt pans near the communities of Caracol and Jacquezil will remain in production. These agricultural lands and salt pans are contained within the Sustainable Use Zone which, while providing for the continued use of these lands for these purposes, will also place limits on the expansion of these uses and the scope of activities and management practices that may impact resource quality in the more fragile natural ecosystems adjacent to or downstream from them.

6.2.1.4 The Community Management Zone

The Community Development Zone the zoning plan recognizes the seven main communities within PA3B's boundaries but places limits on their expansion beyond their current footprint. This direction is principally in response to the severe risk of flooding posed by climate change, in particular from sea level rise and stronger storm surges, but also the potential to threaten nearby areas of high biodiversity through community expansion. Placing spatial limitations on these communities will help direct future population growth to more appropriate locations to the south of the PA3B boundary, in association with the PIC and along the highway RN6 corridor as recommended in recent regional planning initiatives (ERM, 2015).

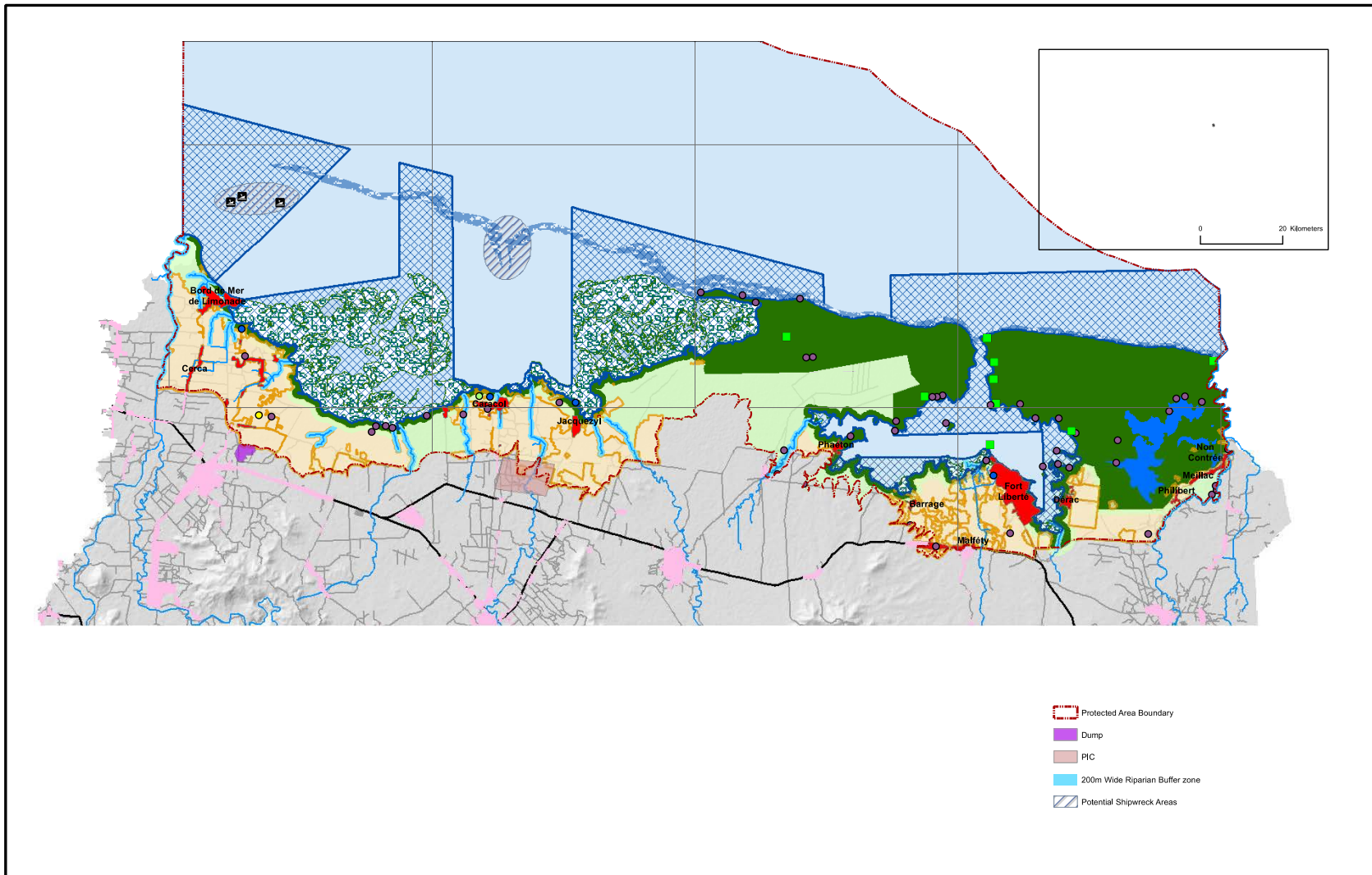
Table 13: The Proposed Zoning System for PA3B

Zone	Purpose	General Policies
Restoration	To provide the highest level of protection to terrestrial and marine species, habitats and ecosystems due to their unique, rare, threatened or endangered status, and/or their high representation values, special features or critical wildlife habitat.	<ul style="list-style-type: none"> • The restoration and recovery of species, habitats and ecosystems, and the maintenance of ecosystem health and ecological services, are the management priorities; • The regeneration of at risk species, habitats and ecosystems, supported by scientific research, including nursery programs for mangroves, corals, spawning fishes and critical terrestrial habitats are encouraged; • Motorized access is generally not permitted or tightly regulated for research purposes only; • Limited non-motorized recreational or tourism use may be possible where resource concerns permit; • No other forms of human access or disturbance are permissible without a permit.
Conservation	To provide for the conservation of the natural and cultural characteristics of the landscape and/or seascape while providing for modest levels of subsistence, tourism or recreational use and providing a buffer adjacent to Restoration zones.	<ul style="list-style-type: none"> • In terrestrial areas, resource conservation, species and habitat recovery with limited but non-consumptive human use is the management priority; • In marine areas, resource conservation, species and habitat recovery with limited human use is the management priority; • Limited fishing is permitted constrained by regulations and strict limitations on the numbers of participating fishers, target species, seasonality and gear type; • In marine areas, motorized access can be permitted for regulated fishing, non-consumptive recreational activity (i.e. SCUBA-diving), tourism and to facilitate research; • In terrestrial areas, motorized access to periphery trailheads is permitted but not within the zone.

Zone	Purpose	General Policies
Sustainable Use	To provide for the continuation of select and environmentally sustainable terrestrial resource use practices that are compatible with nature conservation, primarily sustainable agriculture.	<ul style="list-style-type: none"> • Providing the essential management direction for the sustainable continuation of existing uses, such as agriculture, is the management priority; • The nature and scope of all sustainable activities are clearly defined and spatially delimited with detailed management prescriptions of what is or is not permitted, prepared in consultation with affected stakeholders.
Cultural Conservation	To protect the archaeological, historical and cultural resource features of PA3B, to conduct research and, where appropriate and feasible, to present interpretive programs to the visiting public.	<ul style="list-style-type: none"> • The protection, and where feasible, the restoration of the historical and cultural resources of PA3B, and their interpretation to the public, is the management priority; • Research programs to identify and confirm the presence of archaeological and historic features are encouraged; • Facilities, services and infrastructure for visitors including interpretation programs, exhibits and visitor centers can be located in this zone when appropriate, subject to site design.
Community Management	To provide for the collaborative management of lands within PA3B occupied by communities, industries and rural land-owners, guided by and in cooperation with local governments.	<ul style="list-style-type: none"> • The management of community growth and development, in collaboration with local governments, is the management priority; • The provision of facilities, services and infrastructure for tourism, including accommodation, museums and visitor centres, is a compatible use in this zone subject to site design and community development priorities; • Where feasible, zone boundaries will delimit the maximum spatial extent of existing communities beyond which they will not expand while directing population growth to take place in communities outside of PA3B;

Zone	Purpose	General Policies
		<ul style="list-style-type: none">• Where feasible, the provision of land- or marine-based facilities to support protected area operations and administration can occur in this zone.

Figure 21: Conceptual Zoning Plan for PA3B



Management plan of the Three Bays Protected Area

6.2.1.5 The Cultural Conservation Zone

As discussed in Section 4.0, the PA3B contains significant cultural resources representing all of the major historical eras and events over past centuries. These resources are recognized in the plan in the Cultural Conservation Zone, and are identified as ‘spot zones’ to recognize specific features, such as the fortifications at Fort Liberté and its channel, the site of La Navidad, pre-Columbian archaeological sites west of Caracol or shipwreck sites on the coral reef.

6.2.3 Implementation of the Zoning Plan

The most important step in implementing the zoning plan is, as required by the Decree, the identification of the boundaries of the zones by applying the best science available. The zoning plan is conceptual in nature and the zone boundaries have not yet been finalized; this will be an early priority for ANAP and the PA3B Management Authority in consultation with stakeholders. Wherever possible, the terrestrial zone boundaries should reflect recognizable features on the ground, such as a watercourse (or a fixed distance from it) or a height of land, or man-made features such as roads or fencing. In many instances this is not possible and boundaries will need to be identified by posting. In the marine environment, these methods of boundary identification are rarely possible and other means such as the placement of buoys and shoreline signage will be necessary.

Table 14 below is an approximate estimate of the size and relative proportion of the zones as they appear in the Conceptual Zoning Plan in Figure 21 (the ‘spot zones’ in the Cultural Conservation Zone are not included). With the insight of management experience and boundary refinement, these figures will likely change over time.

Table 14: The Size and Relative Proportion of Zones Within PA3B

PA3B Total Size	75,405 (100%)
Marine Environment	57,930 (77%)
Terrestrial Environment	17,475 (23%)
Zoning Proportions – Marine Environment	
Marine Restoration Zone	25,560 (45%)
Marine Conservation Zone	31,380 (55%)
Zoning Proportions – Terrestrial Environment	
Terrestrial Restoration Zone	7,815 (45%)
Terrestrial Conservation Zone	2,600 (15%)
Sustainable Use Zone	6,640 (38%)
Community Management Zone	375 (2%)

Since zoning is essentially a spatial representation of what human use or activity can or cannot occur in a particular area, the key to effective zone management is the control of access: whether there is or is not access, and if so, how. In the final identification of zone boundaries, the control of access is fundamental, either through the provision of roads, trails or boat launching facilities, for example, or by controlling the number of users, as is contemplated in PA3B through a register of approved fishers. It is easier on land to clearly delineate the protected area and zone boundaries through signage or fencing, but in the open water surface in marine protected areas, the control of access to both the protected area and to the zones within it can be much more challenging. Access by boat can be difficult to control, boundaries are difficult to identify, maintenance of buoys is expensive and the enforcement of infractions can become legally untenable.

In addition to identifying zones spatially, there are other considerations, especially in the marine environment, that can affect the implementation of a zone's management policy. These relate to resource mobility and multiple dimensions. With respect to mobility, there are considerably fewer challenges due to the mobility of ecosystem elements in terrestrial environments than in marine. Surface vegetation on land is static, and while birds and animals are mobile, the ecosystem is essentially stationary and easier to manage. In the marine environment, the primary medium – the water – is constantly moving due to wind, tides and currents. This mobility of the water column makes marine protected areas more vulnerable to external influences such as water-borne pollution. Fish and marine mammals are also constantly moving, often in and out of protected area boundaries, especially the larger species such as dolphins and other cetaceans, manatees, sea turtles and large migratory fish. In these cases, zoning can apply seasonally to protect critical habitats for breeding, feeding, resting or the rearing of young.

Terrestrial ecosystems are primarily two dimensional, whereas marine environments are virtually unique in being three dimensional. Most management issues in the marine environment, in one way or another, are three dimensional in scope: fishing, most recreational activity, sub-surface impacts from boating such as anchoring, and dredging, among others. This multi-dimensional aspect is further complicated by the water being constantly in motion, but some stability in the approach to management is derived from the *immobile* physical substrate on the seabed. Thus, the protection of seabed habitat is often a driving force in marine zoning. Also, the concept of “vertical zoning” can be employed where different zones, or management policy within a zone, can apply to the seabed, the water column and the surface in the same place at the same time. It is possible, for example, to provide complete protection (such as from harvest or anchoring) to seabed habitats such as seagrass beds or coral reefs, apply fishing or other use restrictions in the water column, while managing access on the surface to minimize conflict among user groups. This approach can, however, complicate management, and can be a difficult concept to convey to the public and stakeholders and to illustrate on maps and signage.

Finally, the effective implementation of zoning will depend on the clarity of management policies that area to apply in each zone. The descriptions of each zone and applicable management policy for the proposed zoning system in PA3B in Table 13 is a beginning, and experience gained in the implementation of the management plan will no doubt lead to greater definition of policy for each zone, or perhaps the need for more or different zones.

6.3 Management Programs, Goals and Objectives and Actions

The following portfolio of nine management programs with goals, targets and objectives are designed to implement, or to make demonstrable progress on, the Decree and the Vision for PA3B over the first ten years of management plan implementation. The management programs include the following:

- Biodiversity Conservation Program
- Sustainable Resource Use Program
- Environmental Education and Awareness Program
- Cultural Resource Conservation Program
- Ecotourism Program
- Community Management Program
- Governance, Co-management and Enforcement Program
- Infrastructure Program
- Monitoring Program

6.3.1 The Biodiversity Conservation Program

Goal: To manage PA3B with priority on the protection and maintenance of marine and terrestrial biodiversity of resources and habitats of particular ecological importance: coral reefs, seagrass beds, mangroves, aquatic habitats, tropical dry forests and their associated wildlife.

The high priority targets for the Biodiversity Conservation Program are:

High Priority Targets for Biodiversity Conservation
1. Provide a high level of protection for Coral Reefs.
2. Provide a high level of protection for Seagrass Beds.
3. Provide a high level of protection for Mangrove Forests.
4. Provide a high level of protection for Riparian Habitats.
5. Provide a high level of protection for Freshwater Habitats.
6. Provide a high level of protection for Unique, Rare and Species at Risk.
7. Provide a high level of protection for Tropical Dry Forests.

These targets correspond to the objectives discussed below.

6.3.1.1 Objectives and Actions for Biodiversity Conservation

Objective 1: Provide a high level of protection for Coral Reefs				
	Strategic Actions	Responsibility	Priority	Timeframe
1a.	Protect at least 75% of the fringing, patch and barrier coral reefs from all forms of fishing in the Restoration Zone to enable fish populations and live coral to recover.	PMA Ministry of Agriculture/Fisheries	Very high	Years 1-5

1b.	As an immediate priority, undertake actions to protect the inshore patch reefs near Limonade on the western edge of PA3B and the coral reefs close to Fort Liberté Channel and outside Fort Liberté Bay.	PMA Ministry of Agriculture/Fisheries	Very high	Years 1-5
1c	Engage in coral reef restoration activities, including coral reef nurseries.	PMA Ministry of Agriculture/Fisheries	Very high	Years 1-5
1d.	Provide for ongoing but limited fishing opportunities in the Conservation Zone over the remaining 25% of the reef in accordance with the reformed regime for fisheries management in PA3B with respect to limited entry and gear restrictions (see Section 6.3.2.1).	PMA Ministry of Agriculture/Fisheries	Very high	Years 1-5
1e.	Develop and enforce regulations and management measures for the protection of ornamental aquarium fish.	PMA Ministry of Agriculture/Fisheries	High	Years 1-5
1f.	Encourage the fishing for and consumption of lionfish (<i>Pterois volitans</i>), and the eradication or control of other introduced species if deemed problematic (e.g. tube coral <i>Tubastrea faulkneri</i> , seagrass <i>Halophila stipulacea</i>).	PMA Ministry of Agriculture/Fisheries	High	Years 1-10
1g.	Undertake regular monitoring of coral reef fish populations to assess overall reef health, in particular herbivorous fish (<i>scarids</i> and <i>acanthurids</i>), changes to food-web interactions, live coral cover and disease and the extent of macroalgal growth.	PMA Ministry of Agriculture/Fisheries	High	Years 1-10
Objective 2: Provide a high level of protection for Seagrass Beds				
	Strategic Actions	Responsibility	Priority	Timeframe
2a.	Protect at least 75% of seagrass beds from all forms of fishing in the Restoration Zone to enable fish populations and seagrass to recover.	PMA Ministry of Agriculture/Fisheries	Very high	Year 1-5

2b.	Provide for ongoing but limited fishing opportunities in the Conservation Zone over the remaining 25% of seagrass beds in accordance with the reformed regime for fisheries management in PA3B with respect to limited entry and gear restrictions (see Section 6.2.2.1).	PMA Ministry of Agriculture/Fisheries	Very high	Years 1-5
2c.	Undertake regular monitoring of seagrass beds and associated fish and invertebrate populations, including the Queen conch (<i>Strombus gigas</i>), to assess overall seagrass health.	PMA Ministry of Agriculture/Fisheries	Very high	Years 1-5
Objective 3: Provide a high level of protection for Mangrove Forests				
	Strategic Actions	Responsibility	Priority	Timeframe
3a.	Enforce existing Haitian law providing total protection to all mangroves, with an immediate priority on the mangrove forests around Lagon aux Boeufs and Fou Lasho, among the tallest in Haiti.	PMA Government of Haiti	Very high	Year 1-5
3b.	To identify and promote methods and potential partners to reduce demand for charcoal, assess the feasibility of securing access to alternative fuels such as solar and natural gas, more efficient types of stoves and local sources of electricity.	PMA Government of Haiti	Very high	Years 1-5
3c.	Encourage the selective harvesting of Acacia (<i>Acacia farnesiana</i>) and identified invasive species to provide an alternative source of fuel while helping to restore the indigenous Dry Tropical Forest.	PMA	High	Years 1-10
3d.	Provide programs for local communities to increase awareness and understanding and the illegality of mangrove harvesting.	PMA	High	Years 1-5
3e.	Continue the restoration of degraded areas of mangrove forest.	PMA	High	Years 1-10
Objective 4: Provide a high level of protection for Riparian Habitats				
	Strategic Actions	Responsibility	Priority	Timeframe
4a.	Establish a Conservation Zone encompassing all lands, whether public or private, within a 100-metre corridor on both sides of all water-courses to restore native riparian habitat structure.	PMA	Very High	Years 1-10

4b.	Develop land use guidelines for vegetation harvesting and animal husbandry to be applied in this zone to protect water quality, mitigate flood damage and enable opportunities for the recovery of indigenous riparian species such as the Hispaniola solenodon and hutia.	PMA Local Governments Government of Haiti	High	Years 1-5
Objective 5: Provide a high level of protection for Freshwater and Brackish Habitats				
	Strategic Actions	Responsibility	Priority	Timeframe
5a.	Establish as immediate priorities the protection of the internationally recognized Lagon aux Boeufs, and the tidal brackish community near the mouth of the Grande Rivière du Nord, Grand saline and similar ephemeral ponds and lagoons by providing signage, fencing and other methods as deemed necessary.	PMA	Very high	Year 1-5
5b.	Develop and enforce regulations to protect native and endemic aquatic species to restore natural ecosystems and to evaluate potential methods to control existing tilapia populations.	PMA	Very high	Year 1-5
5c.	Monitor discharge and flow regimes into all freshwater and brackish water bodies, with an immediate priority on ensuring the PIC puts in place a high quality environmental management and monitoring system for Rivière Trou-du-Nord and Caracol Bay.	PMA	High	Years 1
5d.	Ensure adequate environmental flow and that any freshwater diversions do not significantly affect flow discharges and/or impact marine ecosystems downstream (e.g. through PIC water consumption, farm irrigation, dams, etc.).	PMA	High	Years 1-5
Objective 6: Provide a high level of protection for Unique, Rare and Species at Risk				
	Strategic Actions	Responsibility	Priority	Timeframe
6a.	Identify the principal locations and habitats of the unique, rare and species at risk in PA3B, particularly in the coral reefs, seagrass beds, freshwater systems and the Dry Tropical Forest, and ensure their protection in the Restoration Zone.	PMA	Very high	Year 1-5

6b.	Reduce the populations and mitigate the impacts of invasive species, both faunal and floral, and marine and terrestrial, on indigenous and endemic species.	PMA	Very high	Year 1-10
6c.	Assess the feasibility of re-introducing locally extirpated species, notably the <i>Hispaniola solenodon</i> , hutia, and other endemics.	PMA	High	Year 1-10
Objective 7: Provide a high level of protection for Tropical Dry Forests				
	Strategic Actions	Responsibility	Priority	Timeframe
7a.	Place at least 75% of the remaining intact Dry Broadleaf Evergreen forest in the Restoration Zone, with an immediate priority for protection on the eastern and western portions of the Fort Liberté Peninsula, les Deux Mammelles and the forest surrounding Lagon aux Boeufs.	PMA	Very high	Year 1-5
7b.	Encourage the selective harvesting of the fast growing <i>Acacia</i> (<i>Acacia farnesiana</i>) and other potentially detrimental species to assist the restoration of the indigenous Dry Tropical Forest.	PMA	Very high	Years 1-10

6.3.2 The Sustainable Resource Use Program

Goal: To reduce the dependency of local communities on resources within PA3B and to promote types of development and sustainable resource uses that are not harmful to fragile environments within PA3B while continuing to respond to the needs of local communities.

The high priority targets for the Sustainable Resource Use Program are:

High Priority Targets for Sustainable Resource Use
1. Reform fisheries management by significantly reducing fishing pressure in PA3B and eliminating destructive fishing practices.
2. Manage agriculture through sustainable and non-polluting land use practices.

3. Limit aquaculture and caged fish farming to appropriately zoned areas where necessary, and encourage sustainable aquaculture outside of PA3B.
4. Manage salt pond production to remain within its existing footprint.
5. Eliminate hunting throughout the terrestrial and marine environments of PA3B, with the exception of hunting to eliminate introduced species.
6. Regulate and control coastal development through planning, zoning and permitting to mitigate impacts from inappropriate development.

These targets correspond to the objectives discussed below.

6.3.2.1 Objectives and Actions for Sustainable Resource Use

Objective 1: Reform Fisheries Management				
	Strategic Actions	Responsibility	Priority	Timeframe
1a.	Reduce overall fishing effort by creating a Closed Access fishery, phased in over the first five years, comprised of a reduced number of licensed fishers from local communities.	PMA Ministry of Agriculture/Fisheries	Very high	Years 1-5
1b.	Complete a census and register of licensed local fishers, their boats and gear types.	PMA Ministry of Agriculture/Fisheries	Very high	Year 1
1c.	Eliminate destructive fishing practices including the use of small-mesh seine nets, fish traps and the herding of juvenile fish, and promote the use of more ecologically benign gear types such as hand lines and regulation gillnets.	PMA Ministry of Agriculture/Fisheries	Very high	Year 1-5
1d.	Develop and rigorously enforce new fisheries regulations regarding target species, size, gear specifications and seasonality.	PMA	Very high	Years 1-5

		Ministry of Agriculture/Fisheries		
1e.	Develop exchange or compensation programs to facilitate the necessary reforms in fishing gear, particularly the elimination of small-mesh seine nets.	PMA Ministry of Agriculture/Fisheries	Very high	Year 1-5
1f.	Develop robust alternative livelihood programs for displaced fishers related to their existing skill sets and knowledge in such areas as marine guides, tourism and sustainable aquaculture (outside of PA3B) as well as through increased employment in the Caracol Industrial Park (PIC) and in the proposed sisal plantation.	PMA Ministry of Agriculture/Fisheries	Very high	Years 1-5
1g.	Develop an education, training and leadership program for the new fisheries management regime to build understanding, capacity and leadership among the fishers and their communities.	PMA Ministry of Agriculture/Fisheries	Very high	Year 1-5
1h.	Promote increased involvement in a local tourism industry among community fishers, or former fishers, that demonstrates traditional fishing methods, including the use of traditional, non-motorized boats, supplemented by other activities such as snorkeling and SCUBA diving.	PMA Ministry of Agriculture/Fisheries	High	Years 1-5
1i.	Seek greater and more diverse opportunities for the involvement of women in the fishery.	PMA Ministry of Agriculture/Fisheries	High	Year 1-5
1j.	Encourage the ongoing harvesting and consumption of the invasive lionfish to reduce and hopefully eliminate its impact on coral reef fish recruitment.	PMA Ministry of Agriculture/Fisheries	Very high	Year 1-10

1k.	Conduct a 'fish marketing study' to better understand the current Value Chain, new and emerging markets and the potential for branding of 'sustainably harvested fish' from PA3B.	PMA Ministry of Agriculture/Fisheries	High	Year 1-5
1l.	Develop a network of proper fish landing sites providing facilities for improved fish handling with flake ice and standardized hygienic storage.	PMA Ministry of Agriculture/Fisheries	High	Year 1-5
1m.	Develop and enforce new regulations to carefully manage the harvesting of sea cucumbers, urchins, mollusks and other invertebrate communities in appropriately zoned areas of PA3B.	PMA Ministry of Agriculture/Fisheries	Medium	Year 1-5
1n.	Assess the feasibility of and the potential for strictly regulated mariculture within the PA3B for such species as bivalves, sea cucumbers, urchins, conch, lobster and oysters.	PMA Ministry of Agriculture/Fisheries	High	Year 1-5
Objective 2: Promote Sustainable Agriculture				
	Strategic Actions	Responsibility	Priority	Timeframe
2a.	Limit ongoing agricultural production to its existing footprint within appropriately zoned areas of PA3B, and if deemed necessary guide future agricultural operations/expansion to sustainable-use zones.	Ministry of Agriculture PMA	Very High	Year 1-5
2b.	Manage agricultural land use practices sustainably to mitigate potential impacts to the natural hydrological regime, soil fertility and from nutrient loading and chemicals from pesticides.	Ministry of Agriculture PMA	High	Year 1-10
2c.	Consider the possibility of creating an external buffer zone adjacent to PA3B boundaries to help mitigate potential impacts on PA3B resources from agricultural and other land uses.	Ministry of Agriculture PMA	High	Year 1-10
2d.	Eliminate the free-ranging of cattle and goats in PA3B, in particular throughout the dry forests of the eastern Fort Liberté peninsula.	Ministry of Agriculture PMA	Very high	Year 1-5

Objective 3: Manage Aquaculture and Fish Cage Farming				
	Strategic Actions	Responsibility	Priority	Timeframe
3a.	Develop and enforce new regulations to prohibit the introduction and farming of invasive species of fish, especially tilapia, in freshwater and brackish aquatic ecosystems within PA3B, with an immediate priority on removing or controlling exotic fish species in Lagon aux Boeufs.	PMA Ministry of Agriculture/Fisheries	Very high	Year 1-5
3b.	Develop and enforce regulations to prohibit the capture of ornamental/aquarium fish in fresh water and marine ecosystems within PA3B.	PMA Ministry of Agriculture/Fisheries	High	Year 1-5
3c.	Manage the potential for growth in aquaculture operations by limiting such growth within appropriately zoned areas of PA3B, and encouraging sustainable aquaculture outside of PA3B.	PMA Ministry of Agriculture/Fisheries	High	Year 1-5
Objective 4: Manage Salt Production				
	Strategic Actions	Responsibility	Priority	Timeframe
4a.	Develop and enforce new regulations to restrict the spatial extent of salt ponds and salt production to their existing footprint, which would be clearly delimited and zoned accordingly, and prohibit the development of new ponds.	PMA Ministry of Agriculture/Fisheries	Very high	Year 1-5
4b.	Develop and enforce new regulations regarding the potential conversion of salt ponds into aquaculture operations.	PMA Ministry of Agriculture/Fisheries	High	Years 1-5
4c.	Reverse the impacts of habitat conversion by rehabilitating retired salt ponds back to the salt marsh or mangrove habitat that preceded their development.	PMA Ministry of Agriculture/Fisheries	High	Years 1-10
Objective 5: Eliminate Hunting for Native Species				

	Strategic Actions	Responsibility	Priority	Timeframe
5a.	Develop and enforce new regulations to prohibit the hunting of all native and endemic species in both the terrestrial and marine environments of PA3B.	PMA	Very high	Year 1-5
5b.	Develop programs and alternative livelihood opportunities for the targeted hunting of introduced species within PA3B, especially feral cats and mongoose.	PMA	Very high	Year 1-5
5c.	Develop programs for the education and training for, and consistent monitoring of, all hunting activity in PA3B and the recovery of native and endemic species.	PMA	Very high	Year 1-5
Objective 6: Regulate and Control Coastal Development				
	Strategic Actions	Responsibility	Priority	Timeframe
6a.	Develop new regulations, zoning and planning controls to regulate community, and especially coastal, development to mitigate impacts from inappropriate coastal development and dredging, infilling and shoreline hardening.	PMA Local Governments	Very high	Years 1-5
6b.	Recognize coastal communities, especially Fort Liberté, Caracol, Bord de Mer de Limonade and Phaeton as communities at risk and develop specific regulations to regulate, control and effectively manage coastal development.	PMA Local Governments	Very high	Year 1-5

6.3.3 The Environmental Education and Awareness Program

Goal: To increase the level of awareness and knowledge of the residents and stakeholders of local communities of the ecological, social and economic values of PA3B, and the role of protected area management in ensuring sustainability and stable livelihoods.

The high priority targets for the Environmental Education and Awareness Program are:

High Priority Targets for Environmental Education and Awareness
1. Provide environmental education programs to highlight the ecological, social and economic values of PA3B.
2. Build awareness of the benefits of protected areas for local communities, for providing sustainable livelihoods and facilitating appropriate socio-economic development.
3. Build local community and political support for protected areas.
4. Alter land and resource use practices that have a negative effect on the health and integrity of PA3B ecosystems.

These targets correspond to the objectives discussed below.

6.3.3.1 Objectives and Actions for the Environmental Education and Awareness Program

Objective 1: Provide environmental education programs to highlight the ecological, social and economic values of PA3B.				
	Strategic Actions	Responsibility	Priority	Timeframe
1a.	Develop outreach materials to disseminate information on the high biodiversity values of PA3B ecosystems at the national, regional and community levels.	PMA Local Governments	High	1-5
1b.	Build awareness of the role and importance of protected areas and PA3B in the conservation of biodiversity.	PMA Local Governments	High	1-5
1c.	Incorporate outreach materials into local school curriculums and provide for PA3B staff presentations in schools.	PMA Local Governments	High	1-5

Objective 2: Build awareness of the benefits of protected areas for local communities, for providing sustainable livelihoods and facilitating appropriate socio-economic development.				
	Strategic Actions	Responsibility	Priority	Timeframe
2a.	Engage local communities through training and capacity building workshops, community meetings and presentations to educate the full range of stakeholders on the ecological values of PA3B and their contribution to socio-economic sustainability.	PMA Local Governments	High	1-5
Objective 3: Build local community and political support for protected areas.				
	Strategic Actions	Responsibility	Priority	Timeframe
3a.	Engage community and stakeholder leaders and national politicians in the process of managing PA3B to showcase the benefits of protected areas to local communities.	PMA Local Governments Government of Haiti	High	1-5
Objective 4: Alter land and resource use practices that have a negative effect on the health and integrity of PA3B ecosystems.				
	Strategic Actions	Responsibility	Priority	Timeframe
4a.	Develop training and community education programs to raise awareness about the impacts of inappropriate or illegal activities on PA3B ecosystems and on the sustainability of communities and livelihoods.	PMA Local Governments	High	1-5
4b.	Engage community leaders in the development of rules and regulations, in accordance with Haitian law, regarding the use and management of PA3B resources.	PMA Local Governments Government of Haiti	High	1-5

6.3.4 The Cultural Resource Conservation Program

Goal: To research, protect and present the rich cultural heritage of PA3B and the north coast of Haiti.

The high priority targets for the Cultural Resource Conservation Program are:

High Priority Targets for Cultural Conservation
1. Research, recognize and protect evidence of pre-Columbian and Taino cultures.
2. Address the regional and international implications of Columbus' arrival and settlement.
3. Protect and present evidence of 15 th -17 th century Spanish Settlement.
4. Protect and present evidence of 18 th century French Fortifications and Plantation Era.
5. Address the regional role in, and the national and international implications of, the Haitian Revolution.
6. Describe and present traditional Haitian livelihoods and customs.

These targets correspond to the objectives discussed below.

6.3.4.1 Objectives and Actions for the Cultural Resource Conservation Program

Objective 1: Research, recognize and protect evidence of pre-Columbian and Taino cultures				
	Strategic Actions	Responsibility	Priority	Timeframe
1a.	Prepare a comprehensive archaeological resource assessment plan for PA3B and seek partnerships with educational institutions to implement excavations where warranted.	ISPAN PMA	Very high	Years 1-2
1b.	Confirm the location, conduct conclusive on-site research and provide formal recognition of and protection for pre-Columbian and Taino sites, with an immediate priority for the Taino village at En Bas Saline.	ISPAN PMA	Very high	Years 1-2
1c.	Provide protected area zoning protection around all known and suspected archaeological sites and have the most significant sites designated as monuments under the 1985 National Heritage Decree.	ISPAN PMA	Very high	Year 1

1d.	Develop and establish interpretation signage, educational material, programs and live events to celebrate this cultural heritage.	ISPAN PMA	High	Years 1-5
1e.	Develop and encourage the accurate restoration and preservation of historical sites.	ISPAN PMA	High	Years 1-5
Objective 2: Address the regional and international implications of Columbus' arrival and settlement				
	Strategic Actions	Responsibility	Priority	Timeframe
2a.	Confirm the location, conduct conclusive on-site research and provide formal recognition and protection of Columbus' settlement at La Navidad and the wreck of the Santa Maria.	ISPAN PMA	High	Year 1-5
2b.	Protect, stabilize and conserve marine areas associated with the coral reefs with potential for historic shipwrecks, most notably the possible site of Christopher Columbus' Santa Maria, wrecked in 1492.	ISPAN PMA	High	Years 1-5
2c.	Provide protected area zoning protection around all known and suspected archaeological sites and have the most significant sites designated as monuments under the 1985 National Heritage Decree.	ISPAN PMA	Very high	Year 1-5
2d.	Encourage and establish interpretation signage, educational material, programs and events to celebrate this cultural heritage.	ISPAN PMA	High	Years 1-5
Objective 3: Protect and present evidence of 15th-17th Century Spanish Settlement				
	Strategic Actions	Responsibility	Priority	Timeframe
3a.	Confirm the location, conduct conclusive on-site research and provide formal recognition and protection of and protection for the Spanish settlement sites at Puerto Real and Bayaha.	ISPAN PMA	High	Year 1-5
3b.	Provide protected area zoning protection around all known and suspected archaeological sites and have the most significant sites designated as monuments under the 1985 National Heritage Decree.	ISPAN PMA	Very high	Year 1
3c.	Encourage and establish interpretation signage, educational material, programs and events to celebrate this cultural heritage.	ISPAN PMA	High	Years 1-5
Objective 4: Protect and present evidence of 18th Century French Colonization and the Plantation Era				
	Strategic Actions	Responsibility	Priority	Timeframe

4a.	Encourage further research on the French fortifications and provide live interpretation as part of alternative livelihood opportunities associated with PA3B.	ISPAN PMA	High	Year 1-5
4b.	Prepare an assessment and rehabilitation and/or stabilization plan for all the fortifications, but especially Fort Liberté, and ensure the most significant sites have designation as monuments under the 1985 National Heritage Decree.	ISPAN PMA	High	Year 1-5
4c.	Conduct further research on the French plantations found within or in close proximity to PA3B and encourage and establish interpretation signage and programs.	ISPAN PMA	High	Year 1-5
4d.	Provide protected area zoning protection around all known and suspected archaeological sites and have the most significant sites designated as monuments under the 1985 National Heritage Decree.	ISPAN PMA	Very high	Year 1
4e.	Encourage and establish interpretation signage, educational material, programs and events to celebrate this cultural heritage.	ISPAN PMA	High	Years 1-5
Objective 5: Address the regional role of PA3B in, and the national and international implications of, the Haitian Revolution.				
	Strategic Actions	Responsibility	Priority	Timeframe
5a.	Incorporate the history of the Haitian Revolution as it evolved within PA3B into the protected area's interpretive plan for presentation to visitors, particularly at Fort Liberté.	PMA ISPAN Ministry of Culture Ministry of Tourism	High	Year 1-5
Objective 6: Describe and present traditional Haitian livelihoods and customs				
	Strategic Actions	Responsibility	Priority	Timeframe
6a.	In collaboration with local communities, determine whether or not, and if so, how, the lifestyles, customs and harvesting activities of local communities can be explained and understood by visitors to PA3B.	PMA ISPAN Ministry of Culture Ministry of Tourism	Moderate	Year 5-6

6.3.5 The Ecotourism Program

Goal: To ensure PA3B leads the integration of biodiversity conservation into a tourism strategy for Haiti's north-east coast, and embraces ecotourism, including adventure, cultural and social tourism, as a key pillar in its overall development and management strategy.

The high priority targets for the Ecotourism Program are:

High Priority Targets for Ecotourism
1. Promote the appropriate integration of ecotourism into the management of PA3B.
2. Promote cultural tourism as a driver of revenue generation and a source of alternative livelihoods for local communities.
3. Encourage the development of Fort Liberté as a major ecotourism destination.
4. Facilitate improvements in local infrastructure and tourism facilities and services in other PA3B communities.
5. Assess the potential for PA3B to be designated a mixed natural/cultural World Heritage Site.
6. Develop an integrated, transboundary, multi-site tourism destination with the Monte Cristi region in the DR.

These targets correspond to the objectives discussed below.

6.3.5.1 Objectives and Actions for the Ecotourism Program

Objective 1: Promote the appropriate integration of ecotourism into the management of PA3B.				
	Strategic Actions	Responsibility	Priority	Timeframe
1a.	Integrate ecotourism objectives into biodiversity conservation initiatives in PA3B <i>where possible</i> , given constraints with carrying capacity and resource sensitivities to disturbance.	Ministry of Tourism PMA	High	Years 1-10
1b.	Ensure ecotourism objectives, marketing and promotion, especially from the private sector, properly reflect biodiversity conservation initiatives in PA3B, particularly as they relate to fisheries and wildlife management.	Ministry of Tourism PMA	High	Years 1-10

1c.	Ensure that ecotourism initiatives are responsible, are sensitive to the needs of local communities and the environment, enhance the quality of life and do not further contribute to resource depletion, pollution and solid waste.	Ministry of Tourism PMA	High	Years 1-10
Objective 2: Promote cultural tourism as a driver of revenue generation and a source of alternative livelihoods for local communities.				
	Strategic Actions	Responsibility	Priority	Timeframe
2a.	In collaboration with local communities, and as key opportunities for revenue generation and providing alternative livelihoods, enable community members to participate in delivering activities such as snorkeling and SCUBA diving on the coral reefs and touring the mangroves and dry forests for bird watching and other nature-based activities.	Ministry of Tourism PMA	Very High	Years 1-10
2b.	Solicit community members to participate in cultural tourism to enable visitors to experience local villages and gain an understanding of Haitian lifestyles, customs and harvesting activities.	Ministry of Tourism PMA	High	Years 1-10
2c.	Provide training in community workshops and other forms of assistance to help local families understand the needs of visitors, how to manage a business and how to create and manage opportunities in agri-tourism such as vending, homestays and volunteer farm workers.	Ministry of Tourism PMA	High	Years 1-10
2d.	Encourage community participation in global events such as World Environment Day, Water Day, Oceans Day and the Coastal Cleanup Day.	Ministry of Tourism PMA	High	Years 1-5
Objective 3: Encourage the development of Fort Liberté as a major ecotourism destination.				
	Strategic Actions	Responsibility	Priority	Timeframe
3a.	As an immediate priority, undertake a study to assess the feasibility of developing Fort Liberté as an ecotourism destination and prepare a tourism development plan for the community, and the Bay and its environs.	Ministry of Tourism PMA	Very High	Year 1

3b.	Assuming feasibility is affirmative, immediately undertake detailed studies and designs for infrastructure improvements including roads, parking, sanitation and solid waste management.	Ministry of Tourism PMA	Very High	Year 2
3c.	Assuming feasibility is affirmative, immediately undertake detailed studies and designs for the rehabilitation and enhancement of, and undertake any necessary research and excavations in, historic sites of interest both in the community and the coastal fortifications.	Ministry of Tourism PMA	Very High	Year 2
3d.	Invite tenders from private investors for the development of commercial tourism facilities and services such as an international standard visitor centre and museum, eco-hotels, docks and a marina.	Ministry of Tourism PMA	Very High	Years 2-3
3e.	As studies are ongoing, immediately undertake modest improvements to local infrastructure, parking, sanitation, solid waste management, visitor communications and site restoration.	Ministry of Tourism PMA	Very High	Years 1-3
3f.	Seek the appropriate form of legal protection and the application of maintenance and development standards that would ensure the longevity of historic buildings and fortifications.	Ministry of Tourism PMA	High	Years 3-4
Objective 4: Facilitate improvements in local infrastructure and tourism facilities and services in other PA3B communities.				
	Strategic Actions	Responsibility	Priority	Timeframe
4a.	Undertake improvements in select PA3B communities to local infrastructure, signage, parking, roads, sanitation, solid waste management, visitor communications and other site improvements and restoration.	Ministry of Tourism PMA Local Governments	Very High	Years 1-2
4b.	All unused and unnecessary roads throughout PA3B shall be closed to all vehicular traffic, with gates where necessary, and allowed to rehabilitate naturally.	Ministry of Tourism PMA	High	Years 1-10
4c.	Prepare a feasibility study, including a development plan and a business plan, for the construction of a replica Taino Village at En Bas Saline.	Ministry of Tourism PMA Local Governments	High	Years 1-2

4d.	Encourage the development of private support facilities, such as vending and a variety of accommodations, including homestays, in the PA3B and gateway communities to service visitors.	Ministry of Tourism PMA Local Governments	High	Years 1-5
Objective 5: Assess the potential for PA3B to be designated a mixed natural/cultural World Heritage Site.				
	Strategic Actions	Responsibility	Priority	Timeframe
5a.	In cooperation with UNESCO and the Government of Haiti, facilitate the review of Haiti's WHC Tentative List with the aim of adding PA3B to the list as a proposed mixed natural/cultural World Heritage Site.	ISPN Ministry of Tourism PMA	High	Years 3-4
5b.	If approved, participate in the preparation of the nomination document, potentially in cooperation with the government of DR, supporting this recommendation and follow through with the WHC review and approval process.	ISPN Ministry of Tourism PMA	High	Years 3-4
5c.	Consider the additional designation of a portion of PA3B as a national park to heighten its exposure and appeal as a tourism destination.	Ministry of Tourism PMA	High	Years 3-4
Objective 6: Develop an integrated, transboundary, multi-site tourism destination with the Monte Cristi region in the DR.				
	Strategic Actions	Responsibility	Priority	Timeframe
6a.	Prepare a strategy in cooperation with the Government of DR for an integrated, transboundary and multi-site ecotourism destination with the Monte Cristi region in western DR.	Ministry of Tourism PMA	High	Years 3-4

6.3.6 The Community Management Program

Goal: To manage the coastal communities of PA3B to mitigate the impacts from climate change, primarily flooding from sea level rise and storm surges, and to limit the expansion of these communities by directing future population growth in the region to communities outside of PA3B.

The high priority targets for the Community Management Program are:

High Priority Targets for Community Management
1. Limit the spatial extent of coastal communities in PA3B and direct future population growth to communities outside PA3B.
2. Regulate and control coastal development to protect nearshore marine habitats.
3. Work collaboratively with the PIC to manage settlement pressure and decrease land conversion.
4. Identify and map the distribution of privately owned lands and those in the public domain.

These targets correspond to the objectives discussed below.

6.3.6.1 Objectives and Actions for the Community Management Program

Objective 1: Limit the spatial extent of coastal communities in PA3B and direct future population growth to communities outside PA3B.				
	Strategic Actions	Responsibility	Priority	Timeframe
1a.	Clearly describe, legally define and zone the outer boundaries of the coastal communities of PA3B, including Bord de Mer de Limonade, Caracol, Jacquely, Phaeton and Derac to limit their spatial extent to their existing footprint.	PMA Local Governments	Very High	Years 1-5
1b.	Clearly describe, legally define and zone the outer boundary of Fort Liberté to limit its future spatial extent following development of the community as an ecotourism destination.	PMA Local Governments	Very High	Years 1-5
1c.	Work with local government and communities to encourage some residents to relocate, to reallocate lands within communities to reduce housing density and develop new housing models to avoid the flooding risk.	PMA Local Governments	High	Years 1-10
1d.	In accordance with recent regional planning initiatives, direct future population growth and development pressure to communities	PMA Local Governments	High	Years 1-10

	outside PA3B, including Trou-du-Nord, Limonade and Terrier Rouge, as well as to possible new communities in the Champin-Jesus area and the University of Limonade – EKAM area in association with the PIC.			
1e.	As part of a broader reassessment of the boundaries for PA3B, determine whether these communities should remain within the protected area.	PMA Local Governments	Moderate	Years 1-10
Objective 2: Regulate and control coastal development to protect nearshore marine habitats.				
	Strategic Actions	Responsibility	Priority	Timeframe
2a.	Develop the necessary legal authorities to enable the regulation and control of coastal development in all coastal communities within PA3B to protect vulnerable and nearshore marine habitats, especially Fort Liberté.	PMA Government of Haiti Local Governments	Very High	Years 1-5
2b.	Implement effective planning controls to constrain coastal development, particularly in Fort Liberté Bay in view of growing pressures for coastal housing and tourism related developments.	PMA Local Governments	Very High	Years 1-5
Objective 3: Work collaboratively with the PIC to manage settlement pressure and decrease land conversion.				
	Strategic Actions	Responsibility	Priority	Timeframe
3a.	Work collaboratively with the PIC to manage increased settlement pressure and the threat of land conversion in communities located within PA3B and direct this pressure to new communities centered on the PIC and the highway RN6 corridor.	PMA Local Governments	Very High	Years 1-5
Objective 4: Identify and map the distribution of privately owned lands and those in the public domain.				
	Strategic Actions	Responsibility	Priority	Timeframe
4a.	Develop a detailed registry and map of the distribution of privately owned lands and those lands in the public domain.	PMA Haiti's National Centre of Geographic and Spatial Information (CNIGS) Local Governments	Very High	Years 1-5

6.3.7 The Governance, Co-management and Enforcement Program

Goal: To ensure effective governance, co-management, administration and law enforcement for PA3B through the development of a protected area management authority, thorough laws and regulations, the placement of sufficient planning, management and law enforcement staff and collaboration with government agencies, local governments and communities.

The high priority targets for the Governance, Co-management and Enforcement Program are:

High Priority Targets for Governance, Co-management and Enforcement
1. Establish a PA3B Management Authority (PMA).
2. Enhance cooperative management with local governments and stakeholders.
3. Develop a thorough set of laws and regulations necessary for protected area management.
4. Employ protected area wardens to enforce all laws and regulations.
5. Provide outreach, training and technical support for local community leaders, committees, fishers and fishing associations to improve understanding of PA3B management and existing and new regulations.
6. Prepare a Sustainable Finance Plan.

These targets correspond to the objectives discussed below.

6.3.7.1 Objectives and Actions for the Governance, Co-management and Enforcement Program

Objective 1: Establish a PA3B Management Authority.				
	Strategic Actions	Responsibility	Priority	Timeframe
1a.	Create a PA3B Management Authority (PMA) in collaboration with local governments and committees, defining responsibilities and the legal and administrative authorities necessary for implementing the management plan and enforcing laws and regulations.	ANAP Local Governments Government of Haiti	Very High	Year 1

1b.	Develop the necessary management agreements between ANAP and its partners to clearly assign and delegate management responsibilities and identify clear lines of authority and leadership.	ANAP	Very High	Year 1
Objective 2: Enhance cooperative management with local governments and stakeholders.				
	Strategic Actions	Responsibility	Priority	Timeframe
2a.	Develop a cooperative approach to the management of PA3B through strengthening the role of local governments, fishing associations, local committees including CEPROBAC and UGeBFo and a new multi-sector advisory committee to the PMA.	PMA Local Governments Local Committees	Very High	Year 1
2b.	Provide training for capacity building and leadership development.	PMA Local Governments Local Committees	Very High	Years 1-5
Objective 3: Develop a thorough set of laws and regulations necessary for protected area management.				
	Strategic Actions	Responsibility	Priority	Timeframe
3a.	Develop new laws and regulations to give the PMA the legal authorities it requires to manage PA3B in accordance with the management plan and its zoning plan.	ANAP PMA Government of Haiti	Very High	Years 1-2
3b.	Promote revisions to the 1978 Fisheries Law and Regulations to bring fisheries management up to modern standards.	PMA Ministry of Agriculture/Fisheries Government of Haiti	Very High	Years 1-2
Objective 4: Employ protected area wardens to enforce all laws and regulations.				
	Strategic Actions	Responsibility	Priority	Timeframe
4a.	Employ and properly resource protected area wardens to manage PA3B and enforce all applicable laws and regulations in accordance with the management plan, in collaboration with local governments, committees and associations.	PMA	Very High	Years 1-2
Objective 5: Provide outreach, training and technical support.				
	Strategic Actions	Responsibility	Priority	Timeframe

5a.	On an ongoing basis, provide training and technical support for local community leaders, committees, fishers and fishing associations to improve understanding of PA3B management, zoning and existing and new regulations.	PMA Local Governments Local Committees	Very High	Years 1-10
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Objective 6: Prepare a Sustainable Finance Plan.				
	Strategic Actions	Responsibility	Priority	Timeframe
6a.	Prepare a business plan that will ensure sufficient resources are available on a sustainable basis to enable the PMA to fund core management responsibilities and manage PA3B in accordance with this management plan.	PMA	Very High	Year 1

6.3.8 The Infrastructure Program

Goal: To strengthen the PMA through the development of the necessary infrastructure to facilitate effective protected area management.

The high priority targets for the Infrastructure Program are:

High Priority Targets for Infrastructure
1. Develop centralized infrastructure for protected area administration, management and enforcement, including an office with satellite warden stations.
2. Provide the necessary vehicles and equipment for effective protected area management.

These targets correspond to the objectives discussed below.

6.3.8.1 Objectives and Actions for the Infrastructure Program

Objective 1: Develop centralized infrastructure for protected area administration, management and enforcement, including an office with satellite warden stations.				
	Strategic Actions	Responsibility	Priority	Timeframe
1a.	Develop an office for PA3B administration in a central location, equipped with the necessary furniture and equipment, including a PA3B-wide communications system, to enable effective protected area management.	ANAP Local Governments PMA	Very High	Year 1-2
1b.	Develop a network of warden stations located strategically throughout PA3B to enable effective management and enforcement.	ANAP Local Governments PMA	Very High	Year 1-3
Objective 2: Provide the necessary vehicles and equipment for effective protected area management.				
	Strategic Actions	Responsibility	Priority	Timeframe
2a	To provide the necessary equipment for field operations and law enforcement, including vehicles, boats, uniforms, law enforcement and communications.	ANAP Local Governments PMA	Very High	Year 1-3

6.3.9 The Monitoring Program

Goal: to establish a well funded, long-term monitoring program to inform PA3B managers about trends in the condition of natural resources and about changing attitudes among stakeholders and communities.

The high priority targets for the Monitoring Program are:

High Priority Targets for Monitoring
1. Determine the status and trends of key indicators of the condition of PA3B ecosystems to allow managers to make better informed decisions for the benefit of protected area resources.

2. Provide early warnings of abnormal conditions of selected resources to help develop effective mitigation measures and reduce costs of management.
3. Provide data to meet legal and national commitments related to natural resource protection.

These targets correspond to the objectives discussed below.

6.3.9.1 Objectives and Actions for the Monitoring Program

Objective 1: Determine the status and trends of key indicators of the condition of PA3B ecosystems to allow managers to make better informed decisions for the benefit of protected area resources.				
	Strategic Actions	Responsibility	Priority	Timeframe
1a.	Develop and undertake comprehensive monitoring programs of marine, freshwater and terrestrial environments in PA3B in accordance with objectives and protocols developed in the Monitoring Plan.	PMA	High	Years 1-10
1b.	Provide data to better understand the biophysical processes in PA3B.	PMA	High	Years 1-10
1c.	Provide data to meet legal and national commitments related to natural resource protection.	PMA	High	Years 1-10
Objective 2: Provide early warnings of abnormal conditions of selected resources to help develop effective mitigation measures and reduce costs of management.				
	Strategic Actions	Responsibility	Priority	Timeframe
2a	Develop specific monitoring protocols designed to quickly recognize and highlight changes in environmental conditions that may threaten the ongoing health of ecosystems, habitats and/or species.	PMA	High	Years 1-5
Objective 3: Raise awareness among communities and stakeholders about the importance of PA3B and monitor changing attitudes toward PA3B management programs.				
	Strategic Actions	Responsibility	Priority	Timeframe

3a.	Develop monitoring programs and protocols to measure social acceptance in the communities of PA3B and their compliance with specific management programs that impact upon their use of resources.	PMA	High	Years 1-5
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7.0 A MODEL FOR COOPERATIVE MANAGEMENT OF PA3B

The cooperative management of protected areas is becoming common-place throughout the Caribbean, and that will likely be no less the case in Haiti. Cooperative management, also commonly referred to as co-management, is essentially the sharing of responsibilities and, in some cases the authorities, among government agencies, stakeholders, local governments and other partners for the management of protected area resources (McConney et al., 2003). The Presidential Decree clearly places primary management responsibility with the Department of Environment, and, by extension ANAP, and recognizes the responsibilities of the Ministry of the Interior and Territorial Communities and the departments of Public Works, Transport and Communications; Economy and Finance; Agriculture; Natural Resources and Rural Development; and Energy. There is also a dedicated commitment by the Government of Haiti to cooperate with a wide range of stakeholders, local governments and other partners in the implementation of this management plan.

As displayed graphically in Figure 22, it is proposed that there be a direct line of authority and communication from the Ministry of Environment to 1) ANAP, as the lead agency for protected area management, and 2) to the Direction de l'Inspection et de Surveillance Environnemental (DISE) as the lead agency for the enforcement of all relevant laws and regulations. ANAP appoints the Protected Area Director (Direction du Parc) and the Co-gestionnaire, the primary cooperating partner or partners, who then share the execution of all management responsibilities (except law enforcement) for PA3B through providing direction and guidance to protected area staff: the agents de conservation, the agents d'Administration, the educators and others. The Protected Area Director (Direction du Parc) will play a pivotal role in coordinating the activities of his/her office with those of the Co-gestionnaire and DISE through a central coordinating body, the Park Management Authority (PMA). As noted above, the enforcement of all relevant laws and regulations within PA3B will remain the responsibility of DISE through the Direction de la Protection and its staff of wardens (Agents de Protection) who will maintain a close relationship with and respond to the Protected Area Director and the PMA.

The success of a cooperative management relationship with stakeholders, local governments, community organizations, private operators and other partners, such as the university, will depend primarily on the efforts of the Co-gestionnaire and Protected Area Director (Direction du Parc), through the PMA to seek their involvement in a meaningful, consistent and regular way. The donors will also play an influential role in this respect through their funding initiatives.

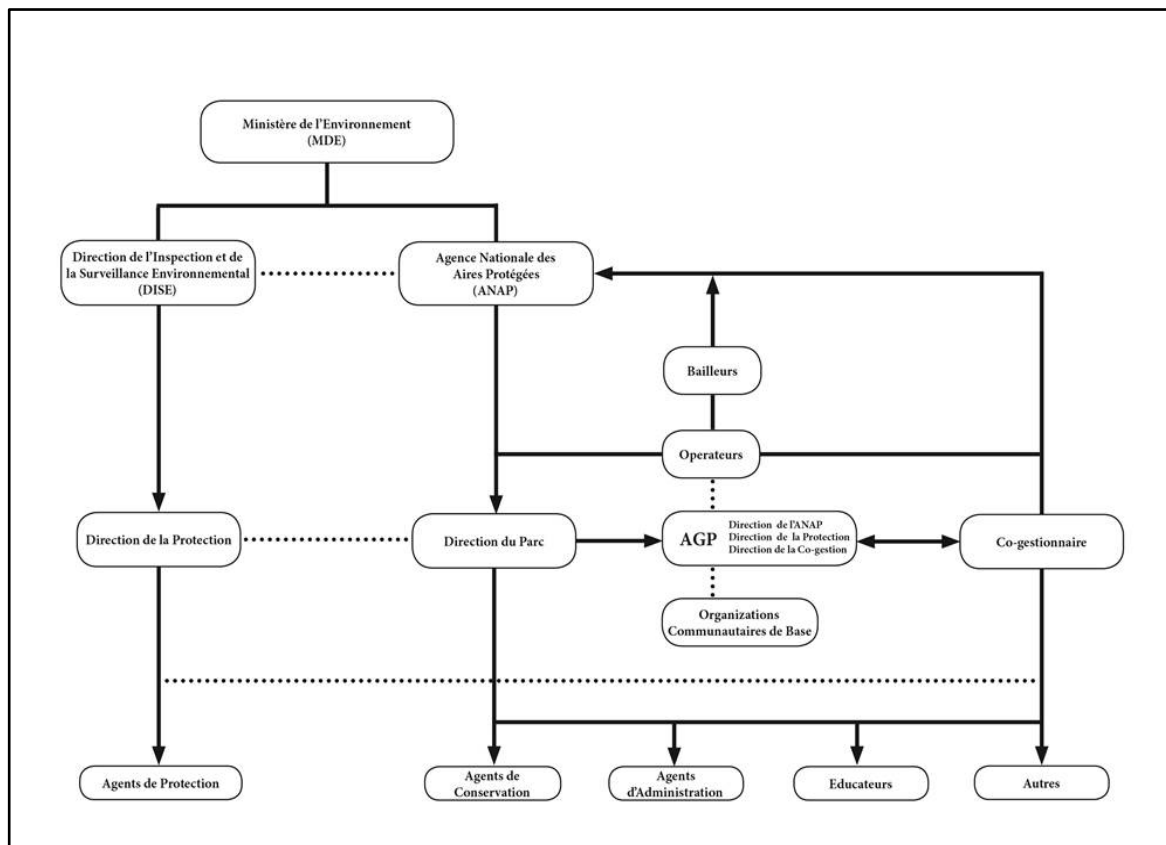


Figure 22: A Proposed Model for the Cooperative Management of PA3B

8.0 AN IMPLEMENTATION PLAN FOR PHASE I (2017-2022)

The timeframe for this management plan is a ten-year period – 2017 to 2027. The actual implementation of the entire plan may extend well beyond this timeframe and will be undertaken in phases based on continued consultations with the Project Management Authority and the availability of human, technical and financial resources. The full effect of the plan will likely take decades to emerge and will evolve over time as conditions change.

Table 15 below outlines the implementation of, and a notional budget for, Phase I over the period of 2017 to 2022, that targets those activities and programs that must be initiated immediately and over the first five years.

Table 15: The Implementation of Phase I (2017-2022)

Management Actions for Biodiversity Conservation

Objective 1: Provide a high level of protection for Coral Reefs		
	Priority Actions	Notional Budget
1a.	Protect at least 75% of the fringing, patch and barrier coral reefs from all forms of fishing in the Restoration Zone to enable fish populations and live coral to recover.	100,000
1b.	Provide for ongoing but limited fishing opportunities in the Conservation Zone over the remaining 25% of the reef in accordance with the reformed regime for fisheries management in PA3B with respect to limited entry and gear restrictions (see Section 6.3.2.1).	50,000
1c.	As an immediate priority, undertake actions to protect the inshore patch reefs near Limonade on the western edge of PA3B and the coral reefs close to Fort Liberté Channel and outside Fort Liberté Bay.	20,000
1d.	Engage in coral reef restoration activities, including coral reef nurseries.	50,000
Objective 2: Provide a high level of protection for Seagrass Beds		
2a.	Protect at least 75% of seagrass beds from all forms of fishing in the Restoration Zone to enable fish populations and seagrass to recover.	50,000
2b.	Provide for ongoing but limited fishing opportunities in the Conservation Zone over the remaining 25% of seagrass beds in accordance with the reformed regime for fisheries management in PA3B with respect to limited entry and gear restrictions (see Section 6.2.2.1).	50,000
2c.	Undertake regular monitoring of seagrass beds and associated fish and invertebrate populations, including the Queen conch, to assess overall seagrass health.	20,000
Objective 3: Provide a high level of protection for Mangrove Forests		
3a.	Enforce existing Haitian law providing total protection to all mangroves, with an immediate priority on the mangrove forests around Lagon aux Boeufs and Fou Lasho, among the tallest in Haiti.	50,000
3b.	To identify and promote methods and potential partners to reduce demand for charcoal, assess the feasibility of securing access to alternative fuels such as solar and natural gas, more efficient types of stoves and local sources of electricity.	100,000
Objective 4: Provide a high level of protection for Riparian Habitats		
4a.	Establish and demarcate a Conservation Zone encompassing all lands, whether public or private, within a 100-metre corridor on both sides of all water-courses to restore native riparian habitat structure.	100,000
4b.	Develop land use guidelines for vegetation harvesting and animal husbandry to be applied in this zone to protect water quality, mitigate flood damage and enable opportunities for the recovery of indigenous riparian species such as the Hispaniola solenodon and hutia.	25,000

Objective 5: Provide a high level of protection for Freshwater and Brackish Habitats		
5a.	Establish as immediate priorities the protection of the internationally recognized Lagon aux Boeufs, and the tidal brackish community near the mouth of the Grande Rivière du Nord, Grand saline and similar ephemeral ponds and lagoons by providing signage, fencing and other methods as deemed necessary.	50,000
5b.	Develop and enforce regulations to protect native and endemic aquatic species to restore natural ecosystems and to evaluate potential methods to control existing tilapia populations.	75,000
Objective 6: Provide a high level of protection for Unique, Rare and Species at Risk		
6a.	Identify the principal locations and habitat of the unique, rare and species at risk in PA3B, particularly in the coral reefs, seagrass beds, freshwater systems and the Dry Tropical Forest, and ensure their protection in the Restoration Zone.	200,000
6b.	Reduce the populations and mitigate the impacts of invasive species, both faunal and floral, and marine and terrestrial, on indigenous and endemic species.	150,000
Objective 7: Provide a high level of protection for Tropical Dry Forests		
7a.	Place at least 75% of the remaining intact Dry Broadleaf Evergreen forest in the Restoration Zone, with an immediate priority for protection on the eastern and western portions of the Fort Liberté Peninsula, les Deux Mammelles and the forest surrounding Lagon aux Boeufs.	100,000
7b.	Encourage the selective harvesting of the fast growing Acacia (<i>Acacia farnesiana</i>) and other potentially detrimental species to assist the restoration of the indigenous Dry Tropical Forest.	100,000
Subtotal for Biodiversity Conservation Program:		\$1,290,000

Management Actions for Sustainable Resource Use

Objective 1: Reform Fisheries Management		
	Priority Actions	Notional Budget
1a.	Reduce overall fishing effort by creating a Closed Access fishery, phased in over the first five years, comprised of a reduced number of licensed fishers from local communities.	100,000
1b.	Complete a census and register of licensed local fishers, their boats and gear types.	30,000
1c.	Eliminate destructive fishing practices including the use of small-mesh seine nets, spear fishing, fish traps and the herding of juvenile fish, and promote the use of more ecologically benign gear types such as hand lines and regulation gill nets.	200,000
1d.	Develop and rigorously enforce new fisheries regulations regarding target species, size, gear specifications and seasonality.	200,000

1e.	Develop exchange or compensation programs to facilitate the necessary reforms in fishing gear, particularly the elimination of small-mesh seine nets.	250,000
1f.	Develop robust alternative livelihood programs for displaced fishers related to their existing skill sets and knowledge in such areas as marine guides, tourism and sustainable aquaculture (outside of PA3B) as well as through increased employment in the Caracol Industrial Park (PIC).	100,000
1g.	Develop an education, training and leadership program for the new fisheries management regime to build understanding, capacity and leadership among the fishers and their communities.	100,000
1j.	Encourage the ongoing harvesting and consumption of the invasive lionfish to reduce and hopefully eliminate its impact on coral reef fish recruitment.	10,000
Objective 2: Promote Sustainable Agriculture		
2a.	Limit ongoing agricultural production to its existing footprint within appropriately zoned areas of PA3B, and if deemed necessary guide future agricultural operations/expansion to sustainable-use zones.	50,000
2b.	Manage agricultural land use practices sustainably to mitigate potential impacts to the natural hydrological regime, soil fertility and from nutrient loading and chemicals from pesticides.	50,000
2c.	Eliminate the free-ranging of cattle and goats in PA3B, in particular throughout the dry forests of the eastern Fort Liberté peninsula.	200,000
Objective 3: Manage Aquaculture and Fish Cage Farming		
3a.	Develop and enforce new regulations to prohibit the introduction and farming of invasive species of fish, especially tilapia, in freshwater and brackish aquatic ecosystems within PA3B, with an immediate priority on removing or controlling exotic fish species in Lagon aux Boeufs.	25,000
Objective 4: Manage Salt Production		
4a.	Develop and enforce new regulations to restrict the spatial extent of salt ponds and salt production to their existing footprint, which would be clearly delimited and zoned accordingly, and prohibit the development of new ponds.	50,000
Objective 5: Eliminate Hunting for Native Species		
5a.	Develop and enforce new regulations to prohibit the hunting of all native and endemic species in both the terrestrial and marine environments of PA3B.	25,000
5b.	Develop programs and alternative livelihood opportunities for the targeted hunting of introduced species within PA3B, especially feral cats and mongoose.	50,000
5c.	Develop programs for the education and training for, and consistent monitoring of, all hunting activity in PA3B and the recovery of native and endemic species.	100,000
Objective 6: Regulate and Control Coastal Development		
6a.	Develop new regulations, zoning and planning controls to regulate community, and especially coastal, development to mitigate impacts from inappropriate coastal development and dredging, infilling and shoreline hardening.	100,000

6b.	Recognize coastal communities, especially Fort Liberté, Caracol, Bord de Mer de Limonade and Phaeton as communities at risk and develop specific regulations to regulate, control and effectively manage coastal development.	100,000
Subtotal for the Sustainable Resource Use Program:		\$2,820,000

Management Actions for Environmental Education and Awareness

Objective 1: Provide environmental education programs to highlight the ecological, social and economic values of PA3B.		
	Priority Actions	Notional Budget
1a	Develop outreach materials to disseminate information on the high biodiversity values of PA3B ecosystems at the national, regional and community levels.	100,000
1b	Build awareness through community meetings of the role and importance of protected areas and PA3B in the conservation of biodiversity.	50,000
1c	Incorporate outreach materials into local school curriculums and provide for PA3B staff presentations in schools.	50,000
Objective 2: Build awareness of the benefits of protected areas for local communities, for providing sustainable livelihoods and facilitating appropriate socio-economic development.		
2a	Engage local communities through regular meetings and presentations to educate the full range of stakeholders on the ecological values of PA3B and their contribution to socio-economic sustainability.	150,000
Objective 3: Build local community and political support for protected areas.		
3a	Engage community and stakeholder leaders and national politicians in the process of managing PA3B to showcase the benefits of protected areas to local communities.	50,000
Objective 4: Alter land and resource use practices that have a negative effect on the health and integrity of PA3B ecosystems.		
4a	Develop training and community education programs to raise awareness about the impacts of inappropriate or illegal activities on PA3B ecosystems and on the sustainability of communities and livelihoods.	100,000
4b	Engage community leaders in the development of rules and regulations, in accordance with Haitian law, regarding the use and management of PA3B resources.	50,000
Total for the Environmental Education and Awareness Program		\$550,000

Management Actions for Cultural Resource Conservation

Objective 1: Research, recognize and protect evidence of pre-Columbian and Taino cultures		
	Priority Actions	Notional Budget

1a.	Prepare a comprehensive archaeological resource assessment plan for PA3B and seek partnerships with educational institutions to implement excavations where warranted.	250,000
1b.	Confirm the location, conduct conclusive on-site research and provide formal recognition of and protection for pre-Columbian and Taino sites, with an immediate priority for the Taino village at En Bas Saline.	250,000
1c.	Provide protected area zoning protection around all known and suspected archaeological sites and have the most significant sites designated as monuments under the 1985 National Heritage Decree.	50,000
Objective 2: Address the regional and international implications of Columbus' arrival and settlement		
2a.	Confirm the location, conduct conclusive on-site research and provide formal recognition and protection of Columbus' settlement at La Navidad and the wreck of the Santa Maria.	300,000
2b.	Protect, stabilize and conserve marine areas associated with the coral reefs with potential for historic shipwrecks, most notably the possible site of Christopher Columbus' Santa Maria, wrecked in 1492.	100,000
2c.	Provide protected area zoning protection around all known and suspected archaeological sites and have the most significant sites designated as monuments under the 1985 National Heritage Decree.	75,000
Objective 3: Protect and present evidence of 15th-17th Century Spanish Settlement		
3a.	Confirm the location, conduct conclusive on-site research and provide formal recognition and protection of and protection for the Spanish settlement sites at Puerto Real and Bayaha.	200,000
3b.	Provide protected area zoning protection around all known and suspected archaeological sites and have the most significant sites designated as monuments under the 1985 National Heritage Decree.	50,000
Objective 4: Protect and present evidence of 18th Century French Colonization and the Plantation Era		
4a.	Encourage further research on the French fortifications and provide live interpretation as part of alternative livelihood opportunities associated with PA3B.	150,000
4b.	Prepare an assessment and rehabilitation and/or stabilization plan for all the fortifications, but especially Fort Liberté, and ensure the most significant sites have designation as monuments under the 1985 National Heritage Decree.	200,000
4c.	Conduct further research on the French plantations found within or in close proximity to PA3B and encourage and establish interpretation signage and programs.	100,000
4d.	Provide protected area zoning protection around all known and suspected archaeological sites and have the most significant sites designated as monuments under the 1985 National Heritage Decree.	50,000
Objective 5: Address the regional role of PA3B in, and the national and international implications of, the Haitian Revolution.		

5a.	Incorporate the history of the Haitian Revolution as it evolved within PA3B into the protected area's interpretive plan for presentation to visitors, particularly at Fort Liberté.	100,000
Subtotal for the Cultural Resource Conservation Program:		\$1,875,000

Management Actions for Ecotourism

Objective 1: Promote the appropriate integration of ecotourism into the management of PA3B.		
	Priority Actions	Notional Budget
1a.	Integrate ecotourism objectives into biodiversity conservation initiatives in PA3B <i>where possible</i> , given constraints with carrying capacity and resource sensitivities to disturbance.	75,000
Objective 2: Promote cultural tourism as a driver of revenue generation and a source of alternative livelihoods for local communities.		
2a.	In collaboration with local communities, and as key opportunities for revenue generation and providing alternative livelihoods, enable community members to participate in delivering activities such as snorkeling and SCUBA diving on the coral reefs and touring the mangroves and dry forests for bird watching and other nature-based activities.	150,000
2b.	Provide training in community workshops and other forms of assistance to help local families understand the needs of visitors, how to manage a business and how to create and manage opportunities in agri-tourism such as vending, homestays and volunteer farm workers.	100,000
Objective 3: Encourage the development of Fort Liberté as a major ecotourism destination.		
3a.	As an immediate priority, undertake a study to assess the feasibility of developing Fort Liberté as an ecotourism destination and prepare a tourism development plan for the community, and the Bay and its environs.	100,000
3b.	Assuming feasibility is affirmative, immediately undertake detailed studies and designs for infrastructure improvements including roads, parking, sanitation and solid waste management.	100,000
3c.	Assuming feasibility is affirmative, immediately undertake detailed studies and designs for the rehabilitation and enhancement of, and undertake any necessary research and excavations in, historic sites of interest both in the community and the coastal fortifications.	100,000
3d.	Invite tenders from private investors for the development of commercial tourism facilities and services such as an international standard visitor centre and museum, eco-hotels, docks and a marina.	50,000
3e.	As studies are ongoing, immediately undertake modest improvements to local infrastructure, parking, sanitation, solid waste management, visitor communications and site restoration.	750,000

Objective 4: Facilitate improvements in local infrastructure and tourism facilities and services in other PA3B communities.		
4a.	Undertake improvements in select PA3B communities to local infrastructure, signage, parking, roads, sanitation, solid waste management, visitor communications and other site improvements and restoration.	500,000
Objective 5: Assess the potential for PA3B to be designated a mixed natural/cultural World Heritage Site.		
5a.	In cooperation with UNESCO and the Government of Haiti, facilitate the review of Haiti's WHC Tentative List with the aim of adding PA3B to the list as a proposed mixed natural/cultural World Heritage Site.	20,000
Objective 6: Develop an integrated, transboundary, multi-site tourism destination with the Monte Cristi region in the DR.		
6a.	Prepare a strategy in cooperation with the Government of DR for an integrated, transboundary and multi-site ecotourism destination with the Monte Cristi region in western DR.	75,000
Subtotal for the Ecotourism Program:		\$2,110,000

Management Actions for Community Management

Objective 1: Limit the spatial extent of coastal communities in PA3B and direct future population growth to communities outside PA3B.		
	Priority Actions	Notional Budget
1a.	Clearly describe, legally define and zone the outer boundaries of the coastal communities of PA3B, including Bord de Mer de Limonade, Caracol, Jacquезу, Phaeton and Derac to limit their spatial extent to their existing footprint.	250,000
1b.	Clearly describe, legally define and zone the outer boundary of Fort Liberté to limit its future spatial extent following development of the community as an ecotourism destination.	50,000
Objective 2: Regulate and control coastal development to protect nearshore marine habitats.		
2a.	Develop the necessary legal authorities to enable the regulation and control of coastal development in all coastal communities within PA3B to protect vulnerable and nearshore marine habitats, especially Fort Liberté.	100,000
2b.	Implement effective planning controls to constrain coastal development, particularly in Fort Liberté Bay in view of growing pressures for coastal housing and tourism related developments.	50,000
Objective 3: Work collaboratively with the PIC to manage settlement pressure and decrease land conversion.		
3a.	Work collaboratively with the PIC to manage increased settlement pressure and the threat of land conversion in communities located within PA3B and	250,000

	direct this pressure to new communities centered on the PIC and the highway RN6 corridor.	
Objective 4: Identify and map the distribution of privately owned lands and those in the public domain.		
4a.	Develop a detailed registry and map of the distribution of privately owned lands and those lands in the public domain.	50,000
Subtotal for the Community Management Program:		\$750,000

Management Actions for Governance, Co-management and Enforcement

Objective 1: Establish a PA3B Management Authority.		
	Priority Actions	Notional Budget
1a.	Create a PA3B Management Authority (PMA) in collaboration with local governments and committees, defining responsibilities and the legal and administrative authorities necessary for implementing the management plan and enforcing laws and regulations.	700,000
1b.	Develop the necessary management agreements between ANAP and its partners to clearly assign and delegate management responsibilities and identify clear lines of authority and leadership.	25,000
Objective 2: Enhance cooperative management with local governments and stakeholders.		
2a.	Develop a cooperative approach to the management of PA3B through strengthening the role of local governments, fishing associations, local committees including the Comite d'Appui, CEPROBAC and UGEBFO and potentially a new multi-sector advisory committee to the PMA.	150,000
2b.	Provide training for capacity building and leadership development.	150,000
Objective 3: Develop a thorough set of laws and regulations necessary for protected area management.		
3a.	Develop new laws and regulations to give the PMA the legal authorities it requires to manage PA3B in accordance with the management plan and its zoning plan.	50,000
3b.	Promote revisions to the 1978 Fisheries Law and Regulations to bring fisheries management up to modern standards.	20,000
Objective 4: Employ protected area wardens to enforce all laws and regulations.		
4a.	Employ and properly resource protected area wardens to manage PA3B and enforce all applicable laws and regulations in accordance with the management plan, in collaboration with local governments, committees and associations.	750,000
Objective 5: Provide outreach, training and technical support.		
5a.	On an ongoing basis, provide training and technical support for local community leaders, committees, fishermen and fishing associations to improve understanding of PA3B management, zoning and existing and new regulations.	100,000

Objective 6: Prepare a Sustainable Finance Plan.		
6a.	Prepare a business plan that will ensure sufficient resources are available on a sustainable basis to enable the PMA to fund core management responsibilities and manage PA3B in accordance with this management plan.	100,000
Subtotal for the Governance, Co-management and Enforcement Program:		\$2,045,000

Management Actions for Infrastructure

Objective 1:		
	Priority Actions	Notional Budget
1a.	Develop an office for PA3B administration in a central location, most likely in Caracol, equipped with the necessary furniture and equipment, including a PA3B-wide communications system, to enable effective protected area management.	300,000
1b.	Develop a network of warden stations located strategically throughout PA3B to enable effective management and enforcement.	200,000
Objective 2: Provide the necessary vehicles and equipment for effective protected area management.		
	Priority Actions	Notional Budget
2a.	To provide the necessary equipment for field operations and law enforcement, including vehicles, boats, uniforms, law enforcement and communications.	500,000
Subtotal for the Infrastructure Program		\$1,000,000

8.3 Budget Summary

Management Program	Notional Budget
Biological Conservation	1,290,000
Sustainable Resource Use	2,820,000
Environmental Education and Awareness	550,000
Cultural Resource Conservation	1,875,000
Ecotourism	2,110,000
Community Management	750,000
Governance, Co-management and Enforcement	2,045,000
Infrastructure	1,000,000
TOTAL:	\$12,440,000

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APPENDIX 1

THE PRESIDENTIAL DECREE

The protected area was declared by Order in the Official Journal of the Republic of Haiti on March 21, 2014 and designated as the Protected Area of Managed Natural Resources of the Three Bays. The Decree establishing the protected area and associated Articles was passed on February 13, 2014.

The Order referenced the following:

- Articles 36-3, 36-5, 136, 253-1 and 254 of the Constitution;
- the Conventions on the Territorial Sea, the Contiguous Zone and the Continental Shelf adopted April 29, 1958 and ratified October 26, 1959;
- Convention on the protection of the archaeological, historical and artistic heritage of the American nations, sanctioned by decree March 14, 1983;
- Convention on the Law of the Sea, adopted December 10, 1982 and ratified July 31, 1966;
- Act of April 23, 1940 authorizing by presidential decree the designation and the delimitation of moveable and immovable property, whose protection is of historical or artistic public interest;
- Act of April 29, 1963 establishing special rules relating to housing and town and country planning to enhance urbanization;
- Rural Code of 1964;
- Decree of March 18, 1968 regarding National Parks, Natural Sites, all tracts of wooded land or not which are established historical or natural monuments;
- Decree of April 6, 1972 laying down the limit of territorial waters of Haiti of 12 nautical miles;
- Decree of March 2, 1977 on boundary marks;
- Decree of April 8, 1977 laying down the limit of the Territorial Sea, the Contiguous Zone and the Exclusive Economic Zone;
- Decree of October 27, 1978 regulating the exercise of the right to fish;
- Decree of October 12, 2005 on the management of the environment and for regulating the conduct of citizens for a sustainable development.

and considering:

- the importance of marine and coastal resources of the Departments of the North and Northeast;
- the ecological interest of natural sites and particularly the marine area of the North and Northeast, the dry forests, coral reefs and associated mangroves;

- the archaeological, historical and tourism importance of sites;
- the need to protect against all development at odds with the principles of proper management of fragile environments.

the following Articles were adopted:

Article 1. The marine complex, coastal and terrestrial, located in the eastern half of the northern coast of Haiti is declared a protected area under the name of "protected area of managed natural resources of the Three Bays" (Aire Protégée de Ressources Naturelles Gérées des Trois Baies). It is composed of natural systems for which the long-term protection must be ensured and the biological diversity maintained while responding to the needs of the communities dependent on these systems.

Article 2. The different categories of protected areas will be identified and boundaries determined within the "**protected area of managed natural resources**". Each will be subject to different protection status according to scientific information provided by ongoing scientific studies necessary to determine these boundaries and will be subject to a specific order of delimitation.

Article 3. The Managed Protected Area of Natural Resources of the Three Bays is an area of 75,618 hectares and a perimeter of 170 kilometres. It is bounded in accordance with the map annexed to the present order following the coordinates listed in the following table:

Points	Latitude	Longitude	y_proj	x_proj
A	19.75171606	72.13275592	2186549.0114	800493.6045
B	19.69919615	72.14297179	2180713.6152	799520.2548
C	19.63937488	71.84849735	2174632.8000	830537.7909
D	19.63544854	71.82641352	2174240.8566	832863.9458
E	19.64041659	71.78641915	2174869.9900	837051.8079
G	19.70210530	71.75893086	2181759.4102	839806.9781
I	19.94716924	72.12890379	2208205.3872	800528.9010
H	19.94626485	72.06955946	2208212.6613	806746.5984
F	19.64040079	71.78236164	2174876.2821	837477.7558

Starting from point A located on the coast at 30 metres to the axis and on the left bank of the North Great River (la Grande Rivière du Nord), the boundary goes south following the left bank of the river at a constant distance of 30 metres from the river bed axis until point B, where the boundary meets the 10-m contour line. From there, the boundary

continues east following the 10-m contour line until point C, which is the intersection of the 10-m contour line and the national road no. 6. The boundary then follows the national road no. 6 to point D, which is the crossroads Chévry (Carrefour Chévry). From there, the boundary follows east along the road leading to Meillac and continues east to meet the River Lamatry at point F. From there, the boundary follows the axis of the Lamatry River until the confluence of the Lamatry and Massacre rivers, and then follows the Massacre River bed axis northward to the country border limit located on the left bank of the river, which constitutes point G. At point G, the boundary continues northwest following the maritime border of Haiti, until point H, representing the northern limit of the territorial waters of Haiti, 22.2 kilometres from the base of the coastal line. From there, the limit runs straight west along the limit of the territorial waters to the point I, perpendicular to the point of departure of the protected area boundary (Point A). Finally, the boundary runs straight south to the coast to the point of departure (Point A).

Article 4. This delimitation will be materialized, on land, by the installation of numbered markers every 400 m bearing the inscription AP-TB and at sea by phosphorescent surface marker buoys every 500 metres and also bearing the inscription AP-TB.

Article 5. The lands of the private domain of the state included in the area cannot be sold/transferred by the Director-General for Taxation (la Direction Générale des Impôts) in any capacity or for any reason whatsoever. Any intervention on these lands and any use of the latter must be submitted to the approval of the Ministry of the Environment and be strictly controlled by them (Ministry of the Environment).

Article 6. The private properties included in the protected area are recognized as such and will remain in the possession of their owners. These properties will be subject to the public rights-of-way defined by the Act and the management plan of the said protected area.

Article 7. The Department of the Environment, the Ministry of the Interior and Territorial Communities as well as the Department of Public Works, Transport and Communications are responsible for the implementation of this Order.

Article 8. The order dated 9 October 2013 published in the Official Journal “The Monitor” No 230 of Wednesday, 11 December 2013, creating a national marine park called “Park of the Three Bays and Lagoons of Oxen” (Parc des Trois Baies et des Lagons aux Boeufs) is hereby repealed.

Article 9. This Order will be printed, published and executed by the Ministers of the Interior and Territorial Communities, Economy and Finance, Agriculture, Natural

Resources and Rural Development, Public Works, Transport, Energy and Communications, and the Environment, each in accordance with those matters that concern them.

Finding: All of the stipulations referenced in the Decree will need to be considered and addressed in the preparation of the management plan. Some Articles in the Decree, including boundary, boundary marking and inclusion of villages, should be reviewed for potential amendments.

APPENDIX 2

Summary of Results of Community, Stakeholder and Government Consultations Regarding The Draft Management Plan for the PA3B

Stakeholders Workshop, Caracol, Haiti, May 31, 2016			
Objectives	<ol style="list-style-type: none"> 1. To increase awareness and understanding of the Protected Area; 2. To document the issues and concerns regarding the potential implications of the Protected Area to their interests and communities; and 3. To document suggestions on how the management of the Protected Area, and their involvement in it, can maximize benefits for both conservation and the sustainable use of resources. 		
Participants	Eighty stakeholders, including local association leaders which use the protected area, municipal officials, civil leaders, international non-governmental association leaders, and government ministry departmental leaders.		
Outcomes:			
Awareness and Understanding	Leaders commented on how this workshop was a positive step in community partnership/involvement to lead to effective management during the implementation stage.		
Issues, Concerns and Suggestions	<table border="0" style="width: 100%;"> <tr> <td style="width: 50%; vertical-align: top;"> <p>Issues and Concerns:</p> <ul style="list-style-type: none"> • Many groups and individuals concerns were of the actual applications of the management plan <ul style="list-style-type: none"> ○ Will the plan actually be implemented? ○ How long will it take for actual implementation to occur? ○ Will the community actually be able to participate? • What role does the State play in this management plan? What roles so the NGOs leading the initiatives play? • How will managing committees and regulation enforcement groups be formed? • Will there be livelihood options that can meet their demands the way the different types fishing currently does? </td> <td style="width: 50%; vertical-align: top;"> <p>Suggestions:</p> <ul style="list-style-type: none"> • The community must assist in decision making in order for it to effectively be implemented. • Participants suggested that the local organizations and stakeholders get copies of all drafts as they are published. • FoProBiM and TNC should be the organizations continually doing follow up with the community. • Overall the group believe that training and outreach programs will be necessary for the community to fully understand the need and participate. • Alternative livelihoods and technical support needs to be prioritized for sustainable use. Historical sites and artifacts as well as tourism can help develop alternative livelihoods. • Government needs to be the lead in regulations and any managing groups should consist of residents of the area for maximum protection and effectiveness. </td> </tr> </table>	<p>Issues and Concerns:</p> <ul style="list-style-type: none"> • Many groups and individuals concerns were of the actual applications of the management plan <ul style="list-style-type: none"> ○ Will the plan actually be implemented? ○ How long will it take for actual implementation to occur? ○ Will the community actually be able to participate? • What role does the State play in this management plan? What roles so the NGOs leading the initiatives play? • How will managing committees and regulation enforcement groups be formed? • Will there be livelihood options that can meet their demands the way the different types fishing currently does? 	<p>Suggestions:</p> <ul style="list-style-type: none"> • The community must assist in decision making in order for it to effectively be implemented. • Participants suggested that the local organizations and stakeholders get copies of all drafts as they are published. • FoProBiM and TNC should be the organizations continually doing follow up with the community. • Overall the group believe that training and outreach programs will be necessary for the community to fully understand the need and participate. • Alternative livelihoods and technical support needs to be prioritized for sustainable use. Historical sites and artifacts as well as tourism can help develop alternative livelihoods. • Government needs to be the lead in regulations and any managing groups should consist of residents of the area for maximum protection and effectiveness.
<p>Issues and Concerns:</p> <ul style="list-style-type: none"> • Many groups and individuals concerns were of the actual applications of the management plan <ul style="list-style-type: none"> ○ Will the plan actually be implemented? ○ How long will it take for actual implementation to occur? ○ Will the community actually be able to participate? • What role does the State play in this management plan? What roles so the NGOs leading the initiatives play? • How will managing committees and regulation enforcement groups be formed? • Will there be livelihood options that can meet their demands the way the different types fishing currently does? 	<p>Suggestions:</p> <ul style="list-style-type: none"> • The community must assist in decision making in order for it to effectively be implemented. • Participants suggested that the local organizations and stakeholders get copies of all drafts as they are published. • FoProBiM and TNC should be the organizations continually doing follow up with the community. • Overall the group believe that training and outreach programs will be necessary for the community to fully understand the need and participate. • Alternative livelihoods and technical support needs to be prioritized for sustainable use. Historical sites and artifacts as well as tourism can help develop alternative livelihoods. • Government needs to be the lead in regulations and any managing groups should consist of residents of the area for maximum protection and effectiveness. 		

	Will quality of water be addressed.	
Vision		
Vision: Protection	<p>The groups envision a beautification of the 3 Bay National Park area and changing the community's attitude towards preservation in the areas of</p> <ul style="list-style-type: none"> ○ Mangroves ○ Fishing calendar ○ Forests ○ National heritages ○ Fishing methods 	
Vision: Structure	The groups see the need for a governing body to oversee good management practices in the 3 Bay area. This overseeing entity must include local members of the community and work closely with local state representatives. Its members must be filled with integrity and committed to sustainable development of the area.	
Vision: Education	Training of best practices and awareness raising of the community on the need to protect natural resource uses was requested by all present. One particular idea presented is to organize such activities around a center.	
Vision: Livelihood Development	The groups see the development of the 3 Bay National Park as an opportunity to improve livelihoods, particularly around fisheries.	
Resource Conservation and Protection/Sustainable Resource Use		
Protect	Protection of the biodiversity and the mangroves were documented by the groups. For protection of biodiversity of both terrestrial and marine types. Some mentioned specific animal with one group being particular attention to birds. One particular groups (group 3) mentioned threaten animals such as the sea cucumbers as needing protection.	
Managed areas	Three of the groups mentioned the need for management. Two specifically stated the protection of young fishes or nurseries while groups two mentioned that some areas should be considered reserved areas or zoned.	
Water	Good quality water is important to the groups. Four of the five groups stated that the water/ water shed needs protecting. This is one of their present challenges as their quality of water is degrading for various reasons.	
Reform Fisheries-	The groups' overall believe there is a need for restructuring the management of the fisheries. Some stakeholders call for a need for policies and regulations, some have stated that defining the fishing limitations and one group asked for a complete reform of the industry	
Livelihoods	As fishing is the form of economic means for many in the community, alternative livelihoods that meet or exceed each individuals needs are important for consideration of fishery reform or other changes. One group also mentioned the need for technical support in their trade or new trades.	
Training/ Education	All groups agreed that educating the community of the importance of the managed areas and the need for protecting the marine and terrestrial biodiversity.	

Tourism	
Infrastructure	All of the groups stated that tourism cannot happen if proper infrastructure to provide basic needs (such as water and lighting), allow access, and provide comfort is needed to make tourism more feasible.
Kinds of Tourism	Tourism to the community members was having outsiders spending time within their community. Four out of five of the groups felt that local production and the culture (music and dance). Other attractions included enjoying the natural beauty and resources (beaches) as well enjoying their history and heritage.
Maintenance	Maintenance was very important to the groups. Sanitation management included both trash and human waste. Keeping areas that are visited by tourists clean was mentioned as important by most groups.
Community	Some ideas were to involve the local community, whether as vendors, employees, managers within a governing body. Others felt that the community should be educated on tourism and how they can benefit from it.
Security	Security was found to be very important for the groups. Especially with stigmas of insecurity (personal and infrastructure) surrounding Haiti, it was found important for the groups to include.
Heritage	
Outreach and Education	To encourage the community to hold artifacts and sites with value, the groups found that having awareness raising campaigns is very important.
Protection and conservation of sites	In general, the groups felt that protection is necessary for conserving national heritage. Protection is found in various forms, rehabilitation of the heritage sites and artifacts, display artifacts, cultural music and dance, management committees and government regulations, and securing the space.
Protect and conserve marine areas	Protection and conservation of marine areas is found in the form of protecting these spaces with wardens and management structures.
Livelihood development	The groups see the development of the 3 Bay Park as an opportunity to improve livelihoods, particularly taking advantage of the heritage and artifacts as forms to draw tourists.
Infrastructure	Infrastructure improvement in the form of roads was found to be necessary by two groups because a way to allow these sites to be used for tourism.
Collaboration with Community	
Outreach and Training	Four of the groups suggested community outreach and training is necessary for the members to be a part of the management plan. Two suggested that technical support for fishermen is necessary as a form of collaboration in their support in the management plan.
Enforce	Majority of the groups believed that the community should be a part of the implementation process. One way they identified was actually being a part of enforcing the law or providing action.
Communication	Three of the groups felt that communication and dialog about the management plan with the community is important is an important form of collaboration for the plans implementation and success.
Industrial Park	Three groups agreed that Caracol industrial Park needs to be a part of the conversation in order to minimize the impact on the water and land.

Define Coastal Communities	Three groups agreed that the community should be involved in defining future developments. This is a great indicator that the community prioritizes being involved in the process.	
Land ownership	Two groups believed that the community can help identify both private and state owned land.	
Governance		
Community	Community involvement is seen as part of the solution for government laws being applied in the 3 Bay National Park. All of the groups identified that the community members should serve in collaboration with law enforcement to help enforce laws. Group 1 believes that community members should be involved throughout the law process ("ideas to decisions") in order to make enforcement smoother.	
Education and Outreach	All five groups believed that the Haitian laws are more effective if the community receives educational and outreach on the fishing laws in order for them to be respected. One group also believes that technical support for fishermen are important.	
Communal Decree	No group mentioned existing laws (1978 Fisheries Laws) but two groups suggested that local communal decrees are necessary for the laws to be applied. It was not specified on what the laws were about besides protection of the area in general. Another group prioritized enforcing the laws in general as important.	
Wardens	Three groups suggested that wardens are used to secure that protected area (coastal agents and park wardens). Group three believes it will be best if conducted by the government. Group 4 suggests that 15 rangers and three supervisors will be best for this initiative.	
Government and Partners Meeting, Port au Prince, Haiti, June 2, 2016		
Objectives	<ol style="list-style-type: none"> 1. To increase awareness and understanding of the Protected Area; 2. To document the issues and concerns regarding the potential implications of the Protected Area to their interests and communities; and 3. To document suggestions on how the management of the Protected Area, and their involvement in it, can maximize benefits for both conservation and the sustainable use of resources. 	
Participants	At ANAP's invitation, the meeting was well attended with 11 participants from pertinent ministry departments such as Ministry of Environment, Unite de Technique d'Execution of the Ministry of Economy and Finance and key institutions including United Nations of Environment Program and International Development Bank.	
Outcomes		
Issue, Concerns and Suggestions	<p>Issues and Concerns:</p> <ul style="list-style-type: none"> • What is the level of synergy that is being used with the project that ensures coordination. • Why include cities within the protected areas? Mayors and park authorities will clash. The mayor will want to increase city (people and space) which park authority will want to increase the park. So the question becomes, what's more important, the people or the conservation effort. • M. Louis of ANAP stated that the zones are not what was talked about, though similar, and will respond about this later. 	<p>Suggestions:</p> <ul style="list-style-type: none"> • The management plan should include a process of encouraging fishermen outside of the protected area. • Ensure that the population targeted in this work is from throughout the area and at different levels. <ul style="list-style-type: none"> ○ Have different meetings for these different groups identified • Responsibility of the business to the environment needs to be addressed • The targets need to be more diverse and should include culture <p>Limit the amount of social structures in the areas that are not large cities in order to limit population growth.</p>

	<ul style="list-style-type: none"> • An observation was made that the strategies and techniques seem to be geared to mostly to fishing and need to emphasize other types users as well. • How do we see reintroducing species that are extirpated but not extinct? 	
Vision		
	Add fighting against invasive species to the vision.	
Resource Conservation and Protection/Sustainable Resource Use		
	<ul style="list-style-type: none"> • The approach being used may be limited to fisheries. Needs to be more diverse. 	
	<ul style="list-style-type: none"> • Plan should adapt to climate change 	
	<ul style="list-style-type: none"> • The social responsibility of businesses to the environment should be considered. 	
	<ul style="list-style-type: none"> • Salt community is one way of looking at alternate livelihoods 	
Heritage		
	<ul style="list-style-type: none"> • Lots of focus on Physical Heritage 	
	<ul style="list-style-type: none"> • Research on discovering new species 	
	<ul style="list-style-type: none"> • A look at showcasing cultural heritage in this rich cultural community 	
Collaboration with Community		
	<ul style="list-style-type: none"> • Caracol Industry's goals are contrary to conservation goals 	
	<ul style="list-style-type: none"> • Ensure collaboration with Caracol Industry in order to understand impact within community. To do this, Caracol Industrial Park should set up an independent monitoring process that helps calculate population growth and limit harm to resources. 	
	<ul style="list-style-type: none"> • Access to SONAPI by community members to help with transparency. Community should help with statistic gathering so any potential harm from Industrial Park is managed 	
	<ul style="list-style-type: none"> • Use the industrial park to help with longer lasting funding through a partnership. 	
Governance		
	<ul style="list-style-type: none"> • Sustainability of projects after project funds complete; add sustainable financing and an objective 	
	<ul style="list-style-type: none"> • Careful not to create obstacles for sustainability of plan; Co-management of Protected Area: ANAP and Funder/NGO since ANAP cannot afford to pay for initiative. 	
	<ul style="list-style-type: none"> • ANAP wants to ensure that they play a leading role in the management plan. 	
	<ul style="list-style-type: none"> • Must target funders and private stakeholder with funds for sustainability of project 	

**Comments and Feedback from Stakeholder Consultations, Universite d’Etat d’Haiti Campus du Limonade
January 25, 2017**

Objectives	<ul style="list-style-type: none"> • Present the final draft PA3B management plan to the stakeholders, including the zoning system, the Fisheries Sector Action Plan and the Monitoring Plan; • Identify gaps that can affect the development of an effective management plan; • Collect stakeholders feedback in order to complete the final editing prior to publishing the management plan.
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Participants	The Nature Conservancy (TNC) led a presentation with its consultants, ANAP, and it's local partner, FoProBim on the management plan for PA3B. During this meeting, approximately 120 stakeholders had the opportunity to comment, ask questions, and most importantly provide feedback to the information discussed.
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Outcomes (early results pending preparation of final report)

	<p>There were a few concerns presented numerous times during the session.</p> <ul style="list-style-type: none"> • When will implementation begin? Many stakeholder are concerned that the time for the plan to be in place and implementation is taking too long since degradation is increasing in the region. • The need for the initiative to be emphasized on a local level. This includes training and involvement of local government and local constituents involved in the process as employees. There was great concern that outside hires would not be a durable solution. • Alternative livelihoods was mentioned by many stakeholders. There is a hope that the management plan will diversify jobs for the population. This is an important point which needs to be addressed and assessed. • Several women were concerned that they were being left out in the process because they are not fishermen. They believed that there needs to be more support for the work they do and include alternative livelihoods. One women's group suggested that they were prepared and ready for training on how to protect The Three Bay National Park. • Many stakeholders felt that the University was not being used to its greatest capacity. This was an interesting concern. Students of the Planning department expressed interest in helping provide research and serving as a form of human resource to be trained in preserving the park. This and any relationship would help establish a long standing and durable relationship in preserving the parks alongside of government. • Finally, an important issue expressed was the financing of this endeavor outside of donors and projects. How will the government continue to manage the park area? <p>Pending issues</p> <ul style="list-style-type: none"> • Financial development plan to support the management plan • Role of women in the plan (economic alternatives, sexual reproduction awareness programs, direct participation in economic opportunities, merchant trainings, etc) • An increase in valuing local capacity. More expectations of using local knowledge and expertise (residents, university, and local government). • An analysis of recent and current government approved projects that may impact the area indirectly (gold mining, sisal plantation, tourism, etc).
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APPENDIX 3

INTERNATIONAL AGREEMENTS AND OBLIGATIONS

The implementation of the management plan will be cognizant of the obligations that Haiti has accepted by virtue of being a signatory nation to international conventions or regional agreements, including the World Heritage Convention and the Convention on Biological Diversity. Of equal importance is awareness of the environment-oriented international and regional arrangements that Haiti is *not* a signatory to, including the Caribbean Challenge Initiative, the International Coral Reef Initiative (ICRI), the Cartagena Convention, the Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar) and the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES). Over the course of the implementation of this management plan, Haiti may wish to consider the merits of becoming a signatory nation to these or other conventions.

The Convention on Biological Diversity

Haiti became party to the Convention on Biological Diversity (CBD) by ratification in December, 1996. To meet this obligation, Haiti began the process of preparing a National Biodiversity Strategy and Action Plan (NBSAP) in 1997 whose major objective was to capture views on the main biodiversity issues and to gain a clear sense of the measures for the sustainable management and conservation of the country's biodiversity (UNDP, 2012). Although never completed, the NBSAP profile that was prepared established as a 1st priority "to increase the number of protected areas to cover all major ecosystems in Haiti" and the declaration of PA3B is a significant contribution to this objective. The profile also sought "...a vision that links the future of the Haitian nation with the way the local population plans to use the diversity of biological resources. This future, to become sustainable, needs to integrate a management approach that reconciles Haitian people with their environment and satisfies their present needs without compromising the well-being of future generations" (CBD, 2001). In the absence of a completed NBSAP, the management plan for PA3B aspires to implement this vision in the PA3B area.

The Convention Concerning the Protection of the World Cultural and Natural Heritage (World Heritage Convention)

Haiti has been a member of the World Heritage Convention (WHC) since 1980 and currently has one World Heritage Site, a cultural site at the National History Park - the Citadel, Sans Souci, Ramiers, inscribed in 1982. In addition, the Historic Centre of Jacmel has been on Haiti's Tentative List since 2004. Following little activity since then, the Director of the UNESCO World Heritage Centre met with the Haitian Minister of Culture in November 2015 and discussed the need to revise the country's Tentative List and to address "critical issues related to the 2001 Convention on the Protection of the Underwater Cultural Heritage, including work on inventories in the northern part of the country" (UNESCO, 2015).

This interest by UNESCO is in part due to the 2014 private mission that initially thought it had discovered the infamous *Santa Maria*, Christopher Columbus' flagship from his maiden trip to the new world, now since disproven. This event raised concerns over measures to recognize and protect the significant underwater cultural heritage on Haiti's north-east coast according to UN convention standards. It is not inconceivable that the rich and internationally significant complex of archaeological and historic resources within PA3B, both terrestrial and marine, combined with the high natural resource values of the PA3B, could warrant World Heritage Site status. Since Haiti's WHC Tentative List may be revised, the management plan supports this possibility.

UNESCO recognizes Haiti as both a Small Island Developing State (SIDS) and a Least Developed Country (LDC). The UNESCO SIDS Program specifically provides support for new nominations from SIDS nations to the World Heritage List, now a point of focus for World Heritage identification and protection. UNESCO's Caribbean Action Plan for World Heritage 2015-2019, while not specifically mentioning opportunities in Haiti, has a number of objectives that complement potential opportunities in the PA3B, including improving the conservation and management of World Heritage resources, updating the Tentative Lists and supporting nominations, reducing the impacts of climate change, strengthening the role of local communities, creating employment through sustainable tourism and strengthening capacity and partnerships (UNESCO, 2014). Further, one of the 13 sites on the DR's Tentative List is the city and natural environment of Montecristi, raising the potential for regional collaboration between Haiti and the DR in both protected area and World Heritage Site management.

The Convention on the Protection of the Underwater Cultural Heritage

Haiti ratified this Convention in 2009 when it was formally entered into force. This Convention aims to “ensure and strengthen the protection of underwater cultural heritage” and commits member states to “preserve underwater cultural heritage for the benefit of humanity” and to “...take all appropriate measures...to protect cultural heritage...” (UNESCO, 2016).

There is a common understanding that numerous shipwrecks lie on or near the coral reefs adjacent to Caracol Bay, possibly including the *Santa Maria*. There is also likely as yet undiscovered submerged cultural heritage associated with the numerous fortresses and other fortifications from the colonial eras of Spanish and French settlement in the 17th and 18th centuries. Considering the transformative global impacts of the events that are represented by this complex of underwater cultural heritage, they may be worthy of international recognition under this Convention.

The Convention for the Protection and Development of the Marine Environment in the Wider Caribbean

In the marine and coastal environment of the Caribbean, one of the primary vehicles for the regional implementation of the CBD is the 1983 Convention for the Protection and Development of the Marine Environment in the Wider Caribbean Region (WCR), often referred to as the Cartagena Convention. The Cartagena Convention is the only legally binding regional environmental treaty for the wider Caribbean and it, along with its Protocols, “...constitute a legal commitment by these countries to protect, and manage their common coastal and marine resources individually, jointly, and in a sustainable manner” (UNEP, 2015). Unfortunately, Haiti is the only island nation in the Caribbean to not be a member state.

Even as a non-member, however, Haiti can potentially benefit from one of the Convention's three Protocols, the Specially Protected Areas and Wildlife (SPAW) Protocol. The SPAW Protocol has as a specific objective to “significantly increase the number, and improve the management of, protected and/or managed areas in the Wider Caribbean Region (WCR), including support to national and regional conservation management strategies and plans” (UNEP, 2015). SPAW is supporting two initiatives that involve Haiti: the UNDP/GEF's Caribbean Large Marine Ecosystem Project (CLME) and the Caribbean Biological Corridor project.

The original CLME project, which terminated in 2013, seeks to assist Caribbean countries to improve the management of their shared living marine resources through an ecosystem-based approach (EBA) to “improve the conservation and effective management of coral reef ecosystems and their resources in order to maintain their functional and structural integrity and biodiversity, and to ensure economic and social benefits for local communities and the region as a whole” (CLME, 2016). Although the project originally targeted four sites including Caracol Bay in Haiti

(as well as Montecristi National Park in the DR, Pedro Bank in Jamaica and the Seaflower Biosphere Reserve in Colombia), the final Strategic Action Plan (SAP) for the project does not make any site-specific recommendations (UNDP, 2013).

The Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES)

Haiti is one of the few countries in the world to not be a signatory nation to the CITES convention. Haiti has, however, been affected by the convention through a recommended boycott since 2003 by CITES member states on the importation of Haitian Queen Conch (*Strombus gigas*). The Queen Conch is an Appendix II species under CITES and is a species of concern throughout the Caribbean. Haiti has not yet implemented the CITES recommendations for conservation of the species, and, as of 2015, CITES has continued the recommended suspension in trade.

APPENDIX 4 - PLANTS SURVEYED

Terrestrial plant species	IUCN Status
<i>Abutilon</i> sp.	-
<i>Acacia macracantha</i>	-
<i>Acacia farnesiana</i> *	-
<i>Acalypha</i> sp.	-
<i>Achyranthes aspera</i>	-
<i>Adiantopsis reesii</i>	-
<i>Agave antillarum</i>	-
<i>Agave intermixta</i>	-
<i>Agave sisilana</i>	-
<i>Aloe vera</i>	-
<i>Alternanthera caracasana</i>	-
<i>Andropogon</i> sp.	-
<i>Amaranthus</i> sp.	-
<i>Ambrosia peruviana</i>	-
<i>Ambrosia velutina</i>	-
<i>Amyris elemifera</i>	-
<i>Angadenia</i> sp.	-
<i>Antigonon leptopus</i>	-
<i>Artemisia absinthium</i>	-
<i>Arythmania candidans</i>	-
<i>Azadirachta indica</i>	-
<i>Bambusa vulgaris</i>	-
<i>Batis maritima</i>	-
<i>Bucida buceras</i>	-
<i>Bursera simaruba</i>	-
<i>Boerhavia coccinea</i>	-
<i>Borreria laevis</i>	-
<i>Bothriochloa saccharoides</i>	-
<i>Bouyeria succulenta</i>	-
<i>Bromelia pinguin</i>	-
<i>Broughtenia domingensis</i>	-
<i>Bunchosia nitida</i>	-
<i>Bursera simaruba</i>	-
<i>Caesalpinia bonduc</i>	-
<i>Calliandra haematomma</i>	-
<i>Calotropis procera</i>	-
<i>Capparis flexuosa</i>	-
<i>Capraria biflora</i>	-
<i>Cassytha filiformis</i>	-
<i>Casuarina equisetifolia</i>	-
<i>Catharanthus roseus</i>	-
<i>Cecropia peltata</i>	-
<i>Centrosema angustifolia</i>	-
<i>Chaemacyste mesembrianthemifolia</i>	-
<i>Chenopodium</i> sp.	-
<i>Chiococca alba</i>	Least Concern
<i>Chromolaena</i> sp.	-
<i>Cissus sicyoides</i>	-
<i>Cissus trifoliata</i>	-
<i>Cleome pilosa</i>	-
<i>Clitoria ternatea</i>	-
<i>Cypselea humifusa</i>	-
<i>Clusea</i> sp.	-
<i>Coccoloba uvifera</i>	-
<i>Codium varigaetum</i>	-
<i>Colubrina arborescens</i>	-
<i>Commelina erecta</i>	Least Concern
<i>Comocladea cuneata</i>	-
<i>Conocarpus erectus</i>	Least Concern
<i>Consolea picardae</i>	Data Deficient
<i>Conzva canadensis</i>	-
<i>Corchorus hirsutus</i>	-
<i>Corchorus siliquosus</i>	-
<i>Cordia globosa</i>	-
<i>Crossopetalum</i> sp.	-
<i>Crotalaria incana</i>	-

Terrestrial plant species	IUCN Status
<i>Croton flavens</i>	-
<i>Croton humilis</i>	-
<i>Croton linearis</i>	-
<i>Croton</i> sp.	-
<i>Cryptostegia madagagascariensis</i>	-
<i>Dalbergia ecastophyllum</i>	-
<i>Echites umbellata</i>	-
<i>Erithalis fruticosa</i>	-
<i>Erythroxylum rotundifolium</i>	-
<i>Eugenia axillaris</i>	-
<i>Eugenia foetida</i>	-
<i>Eugenia</i> sp.	-
<i>Euphorbia cyathophora</i>	-
<i>Euphorbia hyssopifolia</i>	-
<i>Euphorbia lactea</i>	-
<i>Euphorbia</i> sp.	-
<i>Euphorbia tirucalli</i>	Least Concern
<i>Evolvulus alsinoides</i>	-
<i>Evolvulus convolvuloides</i>	-
<i>Evolvulus</i> sp.	-
<i>Exostema</i> sp.	-
<i>Ficus aurea</i>	-
<i>Ficus</i> sp.	-
<i>Fimbristylis spadiacea</i>	-
<i>Galactia</i> sp.	-
<i>Guaiaacum officinale</i>	Endangered
<i>Guaiaacum sanctum</i>	Endangered
<i>Guapira discolor</i>	-
<i>Guettarda</i> sp.	-
<i>Haematoxylon campechianum</i>	-
<i>Hamelia patens</i>	-
<i>Harrisia nashii</i>	-
<i>Helicteres jamaicensis</i>	-
<i>Helicteres semitriloba</i>	-
<i>Heliotropium curassavicum</i>	Least Concern
<i>Heliotropium</i> sp.	-
<i>Herissantia crispa</i>	-
<i>Hibiscus</i> sp.	-
<i>Hura crepitans</i>	-
<i>Hylocereus triangularis</i>	Least concern
<i>Indigofera tinctoria</i>	-
<i>Ipomoea pes-capre</i>	-
<i>Jacquemontia havanensis</i>	-
<i>Jasminum fluminense</i>	-
<i>Jatropha curcas</i>	-
<i>Jatropha gossypifolia</i>	-
<i>Kalstroemia maxima</i>	-
<i>Lantana involucrata</i>	-
<i>Lasiacis</i> sp.	-
<i>Leuceana leucocephala</i>	-
<i>Leptochloa filiformis</i>	-
<i>Ludwigia erecta</i>	-
<i>Lysiloma latissiliquum</i>	-
<i>Malpighia polytricha</i>	-
<i>Mammillaria ekmanii</i>	-
<i>Maytenus</i> sp.	-
<i>Melinis repens</i>	-
<i>Melochia pyramidata</i>	-
<i>Melochia tomentosa</i>	-
<i>Melochia tomentosa</i>	-
<i>Metastelma</i> sp.	-
<i>Metopium brownei</i>	-
<i>Mimosa pudica</i>	Least Concern
<i>Momordica charantia</i>	-
<i>Moringa oleifera</i>	-

Terrestrial plant species	IUCN Status
<i>Muntingia calabura</i>	-
<i>Oplonia spinosa</i>	-
<i>Opuntia antillana</i>	-
<i>Opuntia taylorii</i>	Data Deficient
<i>Parthenium hysterophorus</i>	-
<i>Paspulum</i> sp.	-
<i>Petitia domingensis</i>	-
<i>Phragmites australis</i>	Least Concern
<i>Phyla nodiflora</i>	Least Concern
<i>Pilocereus polygnous</i>	-
<i>Pisonia aculeata</i>	-
<i>Pisonia rotundata</i>	-
<i>Pithecellobium unguis-cati</i>	-
<i>Pluchea symphytifolia</i>	-
<i>Plumeria obtusa</i>	-
<i>Plumeria tuberculata</i>	-
<i>Polygonum</i> sp.	-
<i>Portulaca oleracea</i>	-
<i>Portulaca</i> sp.	-
<i>Pouteria dictyoneura fuertesii</i>	-
<i>Prosopis juliflora</i>	-
<i>Pseudocarpidium</i> sp.	-
<i>Psychotria ligustrifolia</i>	Least Concern
<i>Phyllostylon brasiliensis</i>	-
<i>Randia aculeata</i>	-
<i>Rhabdadenia biflora</i>	-
<i>Ricinus communis</i>	-
<i>Ritterocereus</i> sp.	-
<i>Roystonea hispaniola</i>	-
<i>Ruellia brittoniana</i>	-
<i>Schaefferia frutescens</i>	-
<i>Selenicereus pteranthus</i>	Data Deficient
<i>Senna bicapsularis</i>	Least Concern
<i>Senna siamea</i>	-
<i>Sesuvium portulacastrum</i>	-
<i>Setaria</i> sp.	-
<i>Sida acuta</i>	-
<i>Sida acutifolia</i>	-
<i>Sida ciliaris</i>	-
<i>Sideroxylon celestrina</i>	-
<i>Solanum</i> sp.	-
<i>Spondias mombin</i>	-
<i>Sporobolus virginicus</i>	-
<i>Stachytarpheta jamaicensis</i>	-
<i>Stemodia maritima</i>	-
<i>Stenostomum lucidum</i>	Least Concern
<i>Stylosanthes hamata</i>	-
<i>Suriana maritima</i>	-
<i>Thespesia populnea</i>	-
<i>Tillandsia balbisiana</i>	-
<i>Tillandsia fasciculata</i>	-
<i>Tillandsia recurvata</i>	-
<i>Tournefortia gnaphalodes</i>	-
<i>Tournefortia</i> sp.	-
<i>Tradescantia spathacea</i>	-
<i>Tridax procumbens</i>	-
<i>Turnera diffusa</i>	-
<i>Typha domingensis</i>	Least Concern
<i>Vanilla poitaei</i>	-
<i>Vernonia cinerea</i>	-
<i>Waltheria indica</i>	-
<i>Weinmannia</i> sp.	-
<i>Wedelia trilobata</i>	-
<i>Yucca aloifolia</i>	-
<i>Zanthoxylon fagara</i>	-
<i>Zanthoxylon flavum</i>	-

*The status of *A. farnesiana* is currently undecided between Native or Invasive

APPENDIX 5 - WETLAND PLANT SPECIES SURVEYED
(excluding seagrasses)

Wetland plant species	IUCN Status
<i>Avicennia germinans</i>	Least Concern
<i>Avicennia schaueriana</i>	Least Concern
<i>Conocarpus erectus</i>	Least Concern
<i>Laguncularia racemosa</i>	Least Concern
<i>Rhizophora mangle</i>	Least Concern
<i>Acrosticum aureum</i>	-
<i>Bacopa monnieri</i>	Least Concern
<i>Chara</i> sp.	-
<i>Najas marina</i>	Least Concern
<i>Rhabdadenia biflora</i>	-
<i>Ruppia maritima</i>	Least Concern
<i>Commelina diffusa</i>	Least Concern
<i>Cyperus compressus</i>	Least Concern

Wetland plant species	IUCN Status
<i>Cyperus esculentus</i>	Least Concern
<i>Cyperus luzulae</i>	-
<i>Cyperus polystachyos</i>	Least Concern
<i>Cyperus rotundus</i>	Least Concern
<i>Echinochloa colona</i>	Least Concern
<i>Eclipta prostrata</i>	Data Deficient
<i>Eleocharis equisetoides</i>	-
<i>Eleocharis flavescens</i>	Least Concern
<i>Eleocharis geniculata</i>	Least Concern
<i>Eleocharis interstincta</i>	-
<i>Eleocharis mutata</i>	-
<i>Eragrostis hypnoides</i>	Least Concern
<i>Fimbristylis quinqueangularis</i>	Least Concern

Wetland plant species	IUCN Status
<i>Heteranthera reniformis</i>	-
<i>Limnocharis flavis</i>	-
<i>Ludwigia octovalvis</i>	Least Concern
<i>Ludwigia peruviana</i>	-
<i>Marsilea</i> sp.	-
<i>Panicum hemitomon</i>	-
<i>Pluchea caroliniana</i>	-
<i>Polygonum punctatum</i>	Least Concern
<i>Rotala ramosoir</i>	-
<i>Saccharum gigantum</i>	-
<i>Sagittaria latifolia</i>	Least Concern
<i>Typha domingensis</i>	Least Concern

APPENDIX 6 - FRESHWATER FAUNA SURVEYED

Fish species	IUCN Status
<i>Anguilla rostrata</i> *	Endangered
<i>Awaous banana</i>	-
<i>Bothidae</i> sp.	-
<i>Centropomus</i> sp. 1*	-
<i>Centropomus</i> sp. 2*	-
<i>Cyprinus carpio</i>	INVASIVE (Vulnerable)
<i>Dormitator maculatus</i> *	Least concern
<i>Eleotris amblyopsis</i> *	Least concern
<i>Eleotris perniger</i> *	Least concern
<i>Eucinostomus</i> sp.*	-
<i>Gambusia affinis</i>	INVASIVE (Least Concern)
<i>Gambusia hispaniolae</i>	-
<i>Gambusia nicaraguensis</i>	-
<i>Gobiidae</i> sp.	-
<i>Gobiosox</i> sp.	-
<i>Hemiramphus balao</i> *	Least concern
<i>Limia pauciradiata</i>	ENDEMIC (-)
<i>Limia tridens</i>	-
<i>Mugil</i> sp.*	Least concern
<i>Oreochromis aureus</i>	INVASIVE (-)
<i>Oreochromis mossambicus</i>	INVASIVE (Near Threatened)
<i>Poecilia dominicensis</i>	-
<i>Poecilia hispaniolana</i>	-
<i>Rivulus roloffii</i>	-
<i>Sparisoma</i> sp.*	-
<i>Sphoeroides testudineus</i> *	Least concern

*amphidromous, brackish, or marine

Decapod species	IUCN Status
<i>Jonga serrei</i>	Least concern
<i>Macrobrachium acanthurus</i>	Least concern
<i>Macrobrachium crenulatum</i>	Least concern
<i>Macrobrachium faustinum</i>	Least concern
<i>Micratya poeyi</i>	Least concern
<i>Palaemon pandaliformis</i>	-
<i>Palaemonetes</i> sp.	-
<i>Penaeus</i> sp.	-
<i>Potimirim mexicana</i>	Data Deficient
<i>Potimirim</i> sp.	-
<i>Xiphocaris elongata</i>	Least concern

Annelid species	IUCN Status
<i>Spirorbis</i> sp.	-

Insect species	IUCN Status
<i>Abedus herberti</i>	-
<i>Dineutus</i> sp.	-
<i>Lethocerus indicus</i>	-
<i>Libellulidae</i> sp.	-
<i>Tramea</i> sp.	-

Mollusk species	IUCN Status
<i>Biomphalaria</i> sp.	-
<i>Cerithium</i> sp.	-
<i>Chione cancellata</i>	-
<i>Crassostrea rhizophorae</i>	-
<i>Lucina pectinata</i>	-
<i>Melanoides tuberculata</i>	INVASIVE (Least Concern)
<i>Melanoides turricula</i>	INVASIVE (-)
<i>Neritidae</i> sp. 1	-
<i>Neritidae</i> sp. 2	-
<i>Pinctada</i> sp.	-
<i>Pomacea</i> sp.	-
<i>Tarebia granifera</i>	INVASIVE (Least Concern)
<i>Thais rustica</i>	-

APPENDIX 7 - BIRDS SURVEYED

Bird species	IUCN Status
<i>Actitis macularius</i>	Least Concern
<i>Amazona ventralis</i>	Vulnerable
<i>Ammodramus savannarum</i>	Least Concern
<i>Anas bahamensis</i>	Least Concern
<i>Anas discors</i>	Least Concern
<i>Anthracothorax dominicus</i>	Least Concern
<i>Ardea alba</i>	Least Concern
<i>Ardea herodias</i>	Least Concern
<i>Arenaria interpres</i>	Least Concern
<i>Aythya affinis</i>	Least Concern
<i>Bubulcus ibis</i>	Least Concern
<i>Butorides virescens</i>	Least Concern
<i>Calidris minutilla</i>	Least Concern
<i>Charadrius nivosus</i>	Near Threatened
<i>Charadrius semipalmatus</i>	Least Concern
<i>Charadrius vociferus</i>	Least Concern
<i>Charadrius wilsonia</i>	Least Concern
<i>Chlorostilbon swainsonii</i>	Least Concern
<i>Chordeiles gundlachi</i>	Least Concern
<i>Coccyzus longirostris</i>	Least Concern
<i>Coccyzus minor</i>	Least Concern
<i>Coereba flaveola</i>	Least Concern
<i>Columba livia</i>	Least Concern
<i>Columbina passerina</i>	Least Concern
<i>Corvus leucognaphalus</i>	Vulnerable
<i>Corvus palmarum</i>	Near Threatened
<i>Crotophaga ani</i>	Least Concern
<i>Cypseloides niger</i>	Least Concern
<i>Dulus dominicus</i>	Least Concern
<i>Egretta caerulea</i>	Least Concern
<i>Egretta thula</i>	Least Concern
<i>Egretta tricolor</i>	Least Concern

Bird species	IUCN Status
<i>Elaenia fallax</i>	Least Concern
<i>Eudocimus albus</i>	Least Concern
<i>Falco sparverius</i>	Least Concern
<i>Fregata magnificens</i>	Least Concern
<i>Fulica caribaea</i>	Least Concern
<i>Gallinago delicata</i>	Least Concern
<i>Gallinula galeata</i>	Least Concern
<i>Gelochelidon nilotica</i>	Least Concern
<i>Geothlypis trichas</i>	Least Concern
<i>Himantopus mexicanus</i>	Least Concern
<i>Leucophaeus atricilla</i>	Least Concern
<i>Limnodromus griseus</i>	Least Concern
<i>Lonchura malacca</i>	Least Concern
<i>Lonchura punctulata</i>	Least Concern
<i>Loxigilla violacea</i>	Least Concern
<i>Megaceryle alcyon</i>	Least Concern
<i>Melanerpes striatus</i>	Least Concern
<i>Mellisuga minima</i>	Least Concern
<i>Mimus polyglottos</i>	Least Concern
<i>Molothrus bonariensis</i>	Least Concern
<i>Myiarchus stolidus</i>	Least Concern
<i>Numenius phaeopus</i>	Least Concern
<i>Numida meleagris</i>	Least Concern
<i>Nyctanassa violacea</i>	Least Concern
<i>Nycticorax nycticorax</i>	Least Concern
<i>Pandion haliaetus</i>	Least Concern
<i>Parkesia noveboracensis</i>	Least Concern
<i>Passer domesticus</i>	Least Concern
<i>Patagioenas inornata</i>	Near Threatened
<i>Patagioenas leucocephala</i>	Near Threatened
<i>Pelecanus occidentalis</i>	Least Concern
<i>Petraelidion fulva</i>	Least Concern

Bird species	IUCN Status
<i>Phaenicophilus palmarum</i>	Least Concern
<i>Phoenicopterus ruber</i>	Least Concern
<i>Platalea ajaja</i>	Least Concern
<i>Plegadis falcinellus</i>	Least Concern
<i>Plouceus cucullatus</i>	Least Concern
<i>Pluvialis squatarola</i>	Least Concern
<i>Podilymbus podiceps</i>	Least Concern
<i>Quiscalus niger</i>	Least Concern
<i>Rallus crepitans</i>	Least Concern
<i>Setophaga caerulescens</i>	-
<i>Setophaga palmarum</i>	-
<i>Setophaga petechia</i>	-
<i>Setophaga ruticilla</i>	Least Concern
<i>Setophaga striata</i>	Least Concern
<i>Sternula antillarum</i>	Least Concern
<i>Tachybaptus dominicus</i>	Least Concern
<i>Thalasseus maximus</i>	Least Concern
<i>Thalasseus sandvicensis</i>	Least Concern
<i>Tiaris bicolor</i>	Least Concern
<i>Tiaris olivaceus</i>	Least Concern
<i>Todus subulatus</i>	Least Concern
<i>Tringa flavipes</i>	Least Concern
<i>Tringa melanoleuca</i>	Least Concern
<i>Tringa semipalmata</i>	Least Concern
<i>Tyrannus caudifasciatus</i>	Least Concern
<i>Tyrannus dominicensis</i>	Least Concern
<i>Vireo altiloquus</i>	Least Concern
<i>Vireo flavifrons</i>	Least Concern
<i>Zenaida asiatica</i>	Least Concern
<i>Zenaida aurita</i>	Least Concern
<i>Zenaida macroura</i>	Least Concern

APPENDIX 8 - REPTILES AND AMPHIBIANS SURVEYED

Amphibian species	IUCN Status
<i>Rhinella marina</i>	INVASIVE (Least Concern)
<i>Bufo guentheri</i>	Vulnerable
<i>Lithobates catesbeianus</i>	INVASIVE (Least Concern)
<i>Osteopilus dominicensis</i>	Least Concern

Terrestrial reptile species	IUCN Status
<i>Anolis chlorocyanus</i>	-
<i>Ameiva chrysoleama</i>	Least Concern
<i>Anolis cybotes</i>	Near Threatened
<i>Anolis distichus</i>	-
<i>Chilabothrus fordii</i>	-
<i>Chilabothrus striatus</i>	-
<i>Hemidactylus mabouia</i>	(-)
<i>Leiocephalus personatus</i>	-
<i>Leiocephalus schreibersii</i>	Least Concern
<i>Uromacer catesbyi</i>	-
<i>Uromacer oxyrhynchus</i>	-

APPENDIX 9 - MARINE BENTHIC INVERTEBRATES SURVEYED
(excluding mollusks)

Coral species	IUCN Status
<i>Acropora cervicornis</i>	Critically Endangered
<i>Acropora palmata</i>	Critically Endangered
<i>Agaricia agaricites</i>	Least Concern
<i>Acropora prolifera</i>	-
<i>Agaricia agaricites</i>	Least Concern
<i>Agaricia fragilis</i>	Data Deficient
<i>Agaricia humilis</i>	Least Concern
<i>Agaricia lamarcki</i>	Vulnerable
<i>Agaricia tenuifolia</i>	Near Threatened
<i>Cladocora arbuscula</i>	Least Concern
<i>Cladopsammia sp.</i>	-
<i>Colpophyllia natans</i>	Least Concern
<i>Dendrogyra cylindrus</i>	Vulnerable
<i>Dichocoenia stokesi</i>	-
<i>Diploria clivosa</i>	Least Concern
<i>Eusmilia fastigiata</i>	Least Concern
<i>Favia fragum</i>	Least Concern
<i>Isophyllia rigida</i>	-
<i>Isophyllia sinuosa</i>	Least Concern
<i>Helioseris cucullata</i>	Least Concern
<i>Madracis auretenra</i>	Least Concern
<i>Madracis decactis</i>	Least Concern
<i>Madracis formosa</i>	Least Concern
<i>Madracis pharensis</i>	Least Concern
<i>Manicina areolata</i>	Least Concern
<i>Meandrina jacksoni</i>	-
<i>Meandrina meandrites</i>	Least Concern
<i>Millepora alcicornis</i>	Least Concern
<i>Millepora complanata</i>	Least Concern
<i>Montastraea cavernosa</i>	Least Concern
<i>Mussa angulosa</i>	Least Concern
<i>Mycetophyllia aliciae</i>	Least Concern
<i>Mycetophyllia ferax</i>	Vulnerable
<i>Mycetophyllia lamarckiana</i>	Least Concern
<i>Orbicella annularis</i>	Endangered
<i>Orbicella faveolata</i>	Endangered
<i>Orbicella franksi</i>	Vulnerable
<i>Phyllangia americana</i>	-
<i>Porites astreoides</i>	Least Concern
<i>Porites divaricata</i>	Least Concern
<i>Porites furcata</i>	Least Concern
<i>Porites porites</i>	Least Concern
<i>Pseudodiploria labyrinthiformis</i>	Least Concern
<i>Pseudodiploria strigosa</i>	Least Concern
<i>Scolymia cubensis</i>	Least Concern
<i>Scolymia lacera</i>	Least Concern
<i>Siderastrea radicans</i>	Least Concern
<i>Siderastrea siderea</i>	Least Concern
<i>Stephanocoenia intersepta</i>	Least Concern
<i>Stylaster sp.</i>	-
<i>Tubastraea coccinea</i>	-

Carallimorph species	IUCN Status
<i>Discosoma carlgreni</i>	-
<i>Discosoma neglecta</i>	-
<i>Rhodactis osculifera</i>	-
<i>Ricordea florida</i>	-

Octocoral species	IUCN Status
<i>Allogorgia acerosa</i>	-
<i>Allogorgia americana</i>	-
<i>Allogorgia elisabethae</i>	-
<i>Allogorgia rigida</i>	-
<i>Allotogorgia bipinnata</i>	-
<i>Briareum asbestinum</i>	-
<i>Ellisella barbadensis</i>	-
<i>Erythropodium caribaeorum</i>	-
<i>Eunicea asperula</i>	-
<i>Eunicea calyculata</i>	-
<i>Eunicea clavigera</i>	-
<i>Eunicea colombiana</i>	-
<i>Eunicea flexuosa</i>	-
<i>Eunicea fusca</i>	-
<i>Eunicea laciniata</i>	-
<i>Eunicea laxispica</i>	-
<i>Eunicea mammosa</i>	-
<i>Eunicea pallida</i>	-
<i>Eunicea sp.</i>	-
<i>Eunicea succinea</i>	-
<i>Eunicea tournefort</i>	-
<i>Gorgonia mariae</i>	-
<i>Gorgonia ventalina</i>	-
<i>Muricea atlantica</i>	-
<i>Muricea laxa</i>	-
<i>Muricea muricata</i>	-
<i>Muricea pinnata</i>	-
<i>Muriceopsis bayeriana</i>	-
<i>Muriceopsis flavida</i>	-
<i>Plexaura homomalla</i>	-
<i>Plexaura kuekenthali</i>	-
<i>Plexaurella dichotoma</i>	-
<i>Plexaurella fusifera</i>	-
<i>Plexaurella nutans</i>	-
<i>Plexaurella sp. 1</i>	-
<i>Plexaurella sp. 2</i>	-
<i>Pseudoplexaura flagellosa / wagenarii</i>	-
<i>Pseudoplexaura purosa</i>	-
<i>Pseudoplexaura sp.</i>	-
<i>Pterogorgia anceps</i>	-
<i>Pterogorgia citrina</i>	-
<i>Pterogorgia guadalupensis</i>	-

Tunicate species	IUCN Status
<i>Ascidia sydneyensis</i>	-
<i>Botrylloides nigrum</i>	-
<i>Botrylloides sp. 1</i>	-
<i>Botrylloides sp. 2</i>	-
<i>Clavelina picta</i>	-
<i>Distaplia corolla</i>	-
<i>Gray tunicate sp.</i>	-
<i>Pink tunicate sp.</i>	-
<i>Polyandrocarpa tumida</i>	-
<i>Polycarpa spongiabilis</i>	-
<i>Rhopalaea abdominalis</i>	-
<i>Symplegma viride</i>	-
<i>Trididemum solidum</i>	-

Anemone species	IUCN Status
<i>Actinoporus elegans</i>	-
<i>Aiptasia tagetes</i>	-
<i>Bartholomea annulata</i>	-
<i>Bartholomea lucida</i>	-
<i>Cassiopea frondosa</i>	-
<i>Condylactis gigantea</i>	-
<i>Lebrunia coralligenes</i>	-
<i>Lebrunia danae</i>	-
<i>Phymanthis crucifer</i>	-
<i>Stichodactyla helianthus</i>	-
<i>Telmatactis americana</i>	-
<i>Viatrix globulifera</i>	-

Hyroid species	IUCN Status
<i>Halocordyle disticha</i>	-
<i>Sertularella speciosa</i>	-
<i>Cnidocyphus marginatus</i>	-
<i>Halocordyle disticha</i>	-

Echinoderm species	IUCN Status
<i>Actinopygia agassizii</i>	-
<i>Analcidometra armata</i>	-
<i>Astichopus multifidus</i>	Least Concern
<i>Clypeaster subdepressus</i>	-
<i>Davidaster rubiginosa</i>	-
<i>Diadema antillarum</i>	-
<i>Echinometra lucunter</i>	-
<i>Echinometra viridis</i>	-
<i>Eucidaris tribuloides</i>	-
<i>Holothuria mexicana</i>	Least Concern
<i>Holothuria thomasi</i>	Least Concern
<i>Isostichopus badionotus</i>	Least Concern
<i>Linckia guildingii</i>	-
<i>Luidia sp.</i>	-
<i>Lyechinus variegatus</i>	-
<i>Mellita sexiesperforata</i>	-
<i>Meoma ventricosa</i>	-
<i>Oreaster reticulatus</i>	-
<i>Tripneustes ventricosus</i>	-

Bryozoan species	IUCN Status
<i>Bugula minima</i>	-

Zooanthid species	IUCN Status
<i>Palythoa caribaeorum</i>	-
<i>Zoanthus pulchellus</i>	-
<i>Palythoa caribaeorum</i>	-
<i>Zoanthus pulchellus</i>	-
<i>Parazoanthus parasiticus</i>	-
<i>Palythoa caribaeorum</i>	-
<i>Palythoa grandis</i>	-
<i>Zoanthus pulchellus</i>	-
<i>Parazoanthus parasiticus</i>	-

APPENDIX 9 - MARINE BENTHIC INVERTEBRATES SURVEYED (CONT'D)

Sponge species	IUCN Status
<i>Aaptos</i> sp. (brown)	-
<i>Aaptos pernucleata</i>	-
<i>Aaptos tuberculata</i>	-
<i>Agelas citrina</i>	-
<i>Agelas clathrodes</i>	-
<i>Agelas conifera</i>	-
<i>Agelas dilatata</i>	-
<i>Agelas dispar</i>	-
<i>Agelas schmidti</i>	-
<i>Agelas</i> sp.	-
<i>Agelas tubulata</i>	-
<i>Agelas wiedenmayeri</i>	-
<i>Aialochoria crassa</i>	-
<i>Aialochoria</i> sp.	-
<i>Amphimedon compressa</i>	-
<i>Amphimedon viridis</i>	-
<i>Amphimedon</i> sp.	-
<i>Aplysina archeri</i>	-
<i>Aplysina cauliformis</i>	-
<i>Aplysina fistularis</i>	-
<i>Aplysina fulva</i>	-
<i>Aplysina insularis</i>	-
<i>Aplysina lacunosa</i>	-
<i>Batzella rubra</i>	-
<i>Biemna caribea</i>	-
<i>Chalinula molitba</i>	-
<i>Chalinula pseudomolitba</i>	-
<i>Callyspongia armigera</i>	-
<i>Callyspongia fallax</i>	-
<i>Callyspongia pallida</i>	-
<i>Callyspongia plicifera</i>	-
<i>Callyspongia strongylophora</i>	-
<i>Callyspongia tenerima</i>	-
<i>Callyspongia vaginalis</i>	-
<i>Chalinula molitba</i>	-
<i>Chalinula pseudomolitba</i>	-
<i>Chondrilla caribensis</i>	-
<i>Chondrosia collectrix</i>	-
<i>Chondrosia reniformis</i>	-
<i>Chondrosia kuekenthali</i>	-
<i>Cinachyrella apion</i>	-
<i>Cinachyrella kuekenthali</i>	-
<i>Clathria curacaoensis</i>	-
<i>Clathria echinata</i>	-
<i>Clathria faviformis</i>	-
<i>Clathria minuta</i>	-
<i>Clathria</i> sp. (subgenus <i>Thalysias</i>)	-
<i>Clathria</i> sp. (black)	-
<i>Clathria</i> sp. (turquoise)	-
<i>Clathria</i> sp. (yellow)	-
<i>Clathria virgultosa</i>	-

Sponge species	IUCN Status
<i>Cliona aprica</i>	-
<i>Cliona caribbaea</i>	-
<i>Cliona delitrix</i>	-
<i>Cliona laticavicola</i>	-
<i>Cliona peponaca</i>	-
<i>Cliona tenuis</i>	-
<i>Cliona varians</i>	-
<i>Desmapsamma anchorata</i>	-
<i>Dictyonella funicularis</i>	-
<i>Dysidea etheria</i>	-
<i>Dysidea janiae</i>	-
<i>Ectyoplasia ferox</i>	-
<i>Erylus formosus</i>	-
<i>Geodia neptuni</i>	-
<i>Geodia papyracea</i>	-
<i>Haliclona ruetzleri</i>	-
<i>Haliclona</i> sp.	-
<i>Haliclona tubifera</i>	-
<i>Halisarca caerulea</i>	-
<i>Hyrtios cavernosus</i>	-
<i>Hyrtios violaceus</i>	-
<i>Igernella notabilis</i>	-
<i>Iotrochota arenosa</i>	-
<i>Iotrochota birotulata</i>	-
<i>Ircinia</i> sp. (black)	-
<i>Ircinia</i> sp. (brown)	-
<i>Ircinia campana</i>	-
<i>Ircinia felix</i>	-
<i>Ircinia strobilina</i>	-
<i>Monanchora arbuscula</i>	-
<i>Mycale laevis</i>	-
<i>Mycale laxissima</i>	-
<i>Mycale microsigmatosa</i>	-
<i>Myrmekioderma gyroderma</i>	-
<i>Myrmekioderma rea</i>	-
<i>Neofibularia nolitangere</i>	-
<i>Neopetrosia carbonaria</i>	-
<i>Neopetrosia proxima</i>	-
<i>Neopetrosia rosariensis</i>	-
<i>Niphates digitalis</i>	-
<i>Niphates erecta</i>	-
<i>Niphates</i> sp. (purple)	-
<i>Niphates recondita</i>	-
<i>Oceanapia bartschi</i>	-
<i>Pandaros acanthifolium</i>	-

Sponge species	IUCN Status
<i>Petrosia pellasarca</i>	-
<i>Petrosia</i> sp.	-
<i>Phorbas amaranthus</i>	-
<i>Placosphaerastra microaster</i>	-
<i>Plakinastrella onkodes</i>	-
<i>Plaktoris angulospiculatus</i>	-
<i>Plaktoris halichondrioides</i>	-
<i>Plaktoris</i> sp.	-
<i>Pieraplysilla</i> sp.	-
<i>Ptilocaulis walpersii</i>	-
<i>Scopalina ruetzleri</i>	-
<i>Siphonodictyon xamaycaense</i>	-
<i>Smenospongia aurea</i>	-
<i>Smenospongia canulosa</i>	-
<i>Sphaciospongia vesparium</i>	-
<i>Spirastrella coccinea</i>	-
<i>Spirastrella hartmani</i>	-
<i>Spongia obscura</i>	-
<i>Spongia</i> sp.	-
<i>Spongia tubulifera</i>	-
<i>Stelletta kallitella</i>	-
<i>Svenzea flava</i>	-
<i>Svenzea zeai</i>	-
<i>Tectitethya crypta</i>	-
<i>Tedania ignis</i>	-
<i>Tedania klausii</i>	-
<i>Tapsentia ophiraphidites</i>	-
<i>Verongula</i> sp. (encrusting)	-
<i>Verongula gigantea</i>	-
<i>Verongula reisiwigi</i>	-
<i>Verongula rigida</i>	-
<i>Xestospongia muta</i>	-
Yellow unknown sp.	-
Black unknown sp. 1	-
Black unknown sp. 2	-
Blue unknown sp.	-
Cream unknown sp.	-
Gray unknown sp. 1	-
Gray unknown sp. 2	-
Green unknown sp.	-
Maroon unknown sp.	-
Orange unknown sp. 1	-
Orange unknown sp. 2	-
Orange unknown sp. 3	-
Pink unknown sp.	-

APPENDIX 10 MARINE MEGAFUNA
(excluding sharks and rays)

Sea turtle	IUCN Status
<i>Eretmochelys imbricata</i>	Critically Endangered
<i>Chelonia mydas</i>	Endangered
<i>Dermochelys coriacea</i>	Vulnerable
<i>Caretta caretta</i>	Vulnerable

Marine mammal	IUCN Status
<i>Balaenoptera acutorostrata</i>	Least Concern
<i>Balaenoptera borealis</i>	Endangered
<i>Balaenoptera edenia</i>	Data Deficient
<i>Balaenoptera. musculus</i>	Endangered
<i>Balaenoptera. physalus</i>	Endangered
<i>Cystophora cristata</i>	Vulnerable
<i>Eubalaena glacialis</i>	Endangered
<i>Feresa attenuata</i>	Data Deficient
<i>Globicephala macrorhynchus</i>	Data Deficient
<i>Grampus griseus</i>	Least Concern
<i>Kogia breviceps</i>	Data Deficient
<i>Kogia sima</i>	Data Deficient
<i>Lagenodelphis hosei</i>	Least Concern
<i>Megaptera novaeangliae</i>	Least Concern
<i>Mesoplodon bidens</i>	Data Deficient
<i>Mesoplodo densirostris</i>	Data Deficient
<i>Mesoplodo europaeus</i>	Data Deficient
<i>Orcinus orca</i>	Data Deficient
<i>Peponocephala electra</i>	Least Concern
<i>Physeter macrocephalus</i>	Vulnerable
<i>Pseudorca crassidens</i>	Data Deficient
<i>Stenella attenuata</i>	Least Concern
<i>Stenella clymene</i>	Data Deficient
<i>Stenella coeruleoalba</i>	Least Concern
<i>Stenella frontalis</i>	Data Deficient
<i>Stenella longirostris</i>	Data Deficient
<i>Steno bredanensis</i>	Least Concern
<i>Trichechus manatus</i>	Vulnerable
<i>Tursiops truncatus</i>	Least Concern
<i>Ziphius cavirostris</i>	Least Concern

APPENDIX 11 MARINE FISH SURVEYED (excluding Chondrichthyes)

Fish species	IUCN Status
<i>Abudefduf saxatilis</i>	Least Concern
<i>Abudefduf taurus</i>	Least Concern
<i>Acanthemblemaria aspera</i>	Least Concern
<i>Acanthemblemaria spinosa</i>	Least Concern
<i>Acanthurus bahianus</i>	Least Concern
<i>Acanthurus chirurgus</i>	Least Concern
<i>Acanthurus coeruleus</i>	Least Concern
<i>Achirus lineatus</i>	Least Concern
<i>Ahlia egmontis</i>	Least Concern
<i>Aluterus scriptus</i>	Least Concern
<i>Amblycirrhitus pinos</i>	Least Concern
<i>Anisotremus virginicus</i>	Least Concern
<i>Anguilla rostrata</i>	Endangered
<i>Apogon binotatus</i>	Least Concern
<i>Apogon lachneri</i>	Least Concern
<i>Apogon maculatus</i>	-
<i>Apogon phenax</i>	Least Concern
<i>Apogon townsendi</i>	Least Concern
<i>Archosargus rhomboidalis</i>	Least Concern
<i>Aulostomus maculatus</i>	Least Concern
<i>Bathygobius soporator</i>	Least Concern
<i>Bodianus rufus</i>	Least Concern
<i>Bothus lunatus</i>	Least Concern
<i>Bothus ocellatus</i>	Least Concern
<i>Coryphopterus glaucofraenum/C. bo/C. tortugae</i>	-
<i>Calamus calamus</i>	Least Concern
<i>Cantherhines pullus</i>	Least Concern
<i>Canthigaster rostrata</i>	Least Concern
<i>Caranx bartholomaei</i>	Least Concern
<i>Caranx crysos</i>	Least Concern
<i>Caranx ruber</i>	Least Concern
<i>Centropomus undecimalis</i>	Least Concern
<i>Cephalopholis cruentata</i>	Least Concern
<i>Cephalopholis fulva</i>	Least Concern
<i>Chaetodon aculeatus</i>	Least Concern
<i>Chaetodon capistratus</i>	Least Concern
<i>Chaetodon ocellatus</i>	Least Concern
<i>Chaetodon sedentarius</i>	Least Concern
<i>Chaetodon striatus</i>	Least Concern
<i>Chloroscobrus chrysurus</i>	Least Concern
<i>Chromis cyanea</i>	Least Concern
<i>Chromis insolata</i>	Least Concern
<i>Chromis multilineata</i>	Least Concern
<i>Clepticus parrae</i>	Least Concern
<i>Coryphopterus dicrus</i>	Least Concern
<i>Coryphopterus eidolon</i>	Vulnerable
<i>Coryphopterus lipernes</i>	Vulnerable
<i>Coryphopterus personatus/hyalinus</i>	Vulnerable
<i>Cosmocampus elucens</i>	Least Concern
<i>Cryptotomus roseus</i>	Least Concern
<i>Cyclichthys antennatus</i>	-
<i>Diodon holocanthus</i>	Least Concern
<i>Echidna catenata</i>	Least Concern
<i>Emblemariopsis signifer</i>	Least Concern
<i>Emblemariopsis sp.</i>	-
<i>Epinephelus guttatus</i>	Least Concern
<i>Equetus lanceolatus</i>	Least Concern
<i>Equetus punctatus</i>	Least Concern
<i>Eucinostomus gula</i>	Least Concern
<i>Eucinostomus jonesii</i>	Least Concern
<i>Eucinostomus lefroyi</i>	Least Concern
<i>Gerres cinereus</i>	Least Concern

Fish species	IUCN Status
<i>Monacanthus ciliatus</i>	Least Concern
<i>Monacanthus tuckeri</i>	Least Concern
<i>Gnatholepis thompsoni</i>	Least Concern
<i>Gobioclinus bucciferus</i>	Least Concern
<i>Gobiosoma evelynae</i>	Least Concern
<i>Gobiosoma harsti</i>	Least Concern
<i>Gobiosoma prochilos</i>	Vulnerable
<i>Gramma loreto</i>	Least Concern
<i>Gramma melacara</i>	Least Concern
<i>Gymnothorax millaris</i>	Least Concern
<i>Gymnothorax moringa</i>	Least Concern
<i>Haemulon auralineatum</i>	Least Concern
<i>Haemulon chrysargyreum</i>	Least Concern
<i>Haemulon flavolineatum</i>	Least Concern
<i>Haemulon parra</i>	Least Concern
<i>Haemulon plumieri</i>	Least Concern
<i>Haemulon sciurus</i>	Least Concern
<i>Haemulon striatum</i>	Least Concern
<i>Haemulon sp.</i>	-
<i>Haemulon vittatum</i>	Least Concern
<i>Halichoeres bivittatus</i>	Least Concern
<i>Halichoeres cyanocephalus</i>	Least Concern
<i>Halichoeres garnoti</i>	Least Concern
<i>Halichoeres maculipinna</i>	Least Concern
<i>Halichoeres pictus</i>	Least Concern
<i>Halichoeres poeyi</i>	Least Concern
<i>Halichoeres radiatus</i>	Least Concern
<i>Hemiemblemaria simulus</i>	Least Concern
<i>Heteroconger longissimus</i>	Least Concern
<i>Heteropriacanthus cruentatus</i>	Least Concern
<i>Holacanthus ciliaris</i>	Least Concern
<i>Holacanthus tricolor</i>	Least Concern
<i>Holocentrus adscensionis</i>	Least Concern
<i>Holocentrus coruscus</i>	Least Concern
<i>Holocentrus rufus</i>	Least Concern
<i>Holocentrus sp.</i>	-
<i>Hypoplectrus (Hybrid)</i>	-
<i>Hypoplectrus chlorurus</i>	Least Concern
<i>Hypoplectrus guttavarus</i>	Least Concern
<i>Hypoplectrus indigo</i>	Least Concern
<i>Hypoplectrus nigricans</i>	Least Concern
<i>Hypoplectrus puella</i>	Least Concern
<i>Hypoplectrus sp.</i>	-
<i>Hypoplectrus unicolor</i>	Least Concern
<i>Labrisomus nuchipinnis/L. conditus/L.cricota</i>	Least Concern
<i>Lactophrys bicaudalis</i>	Least Concern
<i>Lactophrys polygona</i>	Least Concern
<i>Lactophrys triquetra</i>	Least Concern
<i>Liopropoma rubre</i>	Least Concern
<i>Lophogobius cyprinoides</i>	Least Concern
<i>Lucayablennius zingaro</i>	Least Concern
<i>Lutjanus analis</i>	Near Threatened
<i>Lutjanus apodus</i>	Least Concern
<i>Lutjanus griseus</i>	Least Concern
<i>Lutjanus mahogoni</i>	Least Concern
<i>Lutjanus synagris</i>	Near Threatened
<i>Malacanthus plumieri</i>	Least Concern
<i>Malacotenus aurolineatus</i>	Least Concern
<i>Malacotenus macropus</i>	Least Concern
<i>Malacotenus triangulatus</i>	Least Concern
<i>Megalops atlanticus</i>	Vulnerable
<i>Micrognathus ensenadae</i>	Least Concern
<i>Microspathodon chrysurus</i>	Least Concern

Fish species	IUCN Status
<i>Mulloidichthys martinicus</i>	Least Concern
<i>Myrichthys breviceps</i>	Least Concern
<i>Myripristis jacobus</i>	Least Concern
<i>Myrophis sp.</i>	-
<i>Neoniphon marianus</i>	Least Concern
<i>Nes longus</i>	Least Concern
<i>Ocyurus chrysurus</i>	Data Deficient
<i>Odontaspion dentex</i>	Least Concern
<i>Ogcocephalus nasutus</i>	Least Concern
<i>Ophioblennius atlanticus</i>	Least Concern
<i>Opistognathus aurifrons</i>	Least Concern
<i>Opistognathus macroglyphus</i>	Least Concern
<i>Opistognathus maxillosus</i>	Least Concern
<i>Pareques acuminatus</i>	Least Concern
<i>Pempheris schomburgkii</i>	Least Concern
<i>Phaeoptyx pigmentaria</i>	Least Concern
<i>Phaeoptyx xenus</i>	Least Concern
<i>Plectrypops retrospinus</i>	Least Concern
<i>Pomacanthus arcuatus</i>	Least Concern
<i>Priolepis hipoliti</i>	Least Concern
<i>Pseudupeneus maculatus</i>	Least Concern
<i>Ptereleotris calliurus</i>	Least Concern
<i>Ptereleotris helena</i>	Least Concern
<i>Pterois voltans</i>	-
<i>Rypticus saponaceus</i>	Least Concern
<i>Rypticus subbifrenatus</i>	Least Concern
<i>Sardinella aurita</i>	Least Concern
<i>Sargocentron vexillarium</i>	Least Concern
<i>Scarus iseri</i>	Least Concern
<i>Scarus taeniopterus</i>	Least Concern
<i>Scarus vetula</i>	Least Concern
<i>Scomberomorus regalis</i>	Least Concern
<i>Seriola rivoliana</i>	Least Concern
<i>Serraniculus pumilio</i>	Least Concern
<i>Serranus baldwini</i>	Least Concern
<i>Serranus flaviventris</i>	Least Concern
<i>Serranus tabacarius</i>	Least Concern
<i>Serranus tigrinus</i>	Least Concern
<i>Serranus tortugarum</i>	Least Concern
<i>Sparisoma atomarium</i>	Least Concern
<i>Sparisoma aurofrenatum</i>	Least Concern
<i>Sparisoma chrysopterus</i>	Least Concern
<i>Sparisoma radians</i>	Least Concern
<i>Sparisoma rubripinne</i>	Least Concern
<i>Sparisoma viride</i>	Least Concern
<i>Sphaeroides greeleyi</i>	Least Concern
<i>Sphaeroides testudineus</i>	Least Concern
<i>Sphyaena barracuda</i>	Least Concern
<i>Sphyaena picudilla</i>	-
<i>Stegastes adustus</i>	Least Concern
<i>Stegastes diencaeus</i>	Least Concern
<i>Stegastes leucostictus</i>	Least Concern
<i>Stegastes partitus</i>	Least Concern
<i>Stegastes planifrons</i>	Least Concern
<i>Stegastes variabilis</i>	-
<i>Synodus intermedius</i>	Least Concern
<i>Synodus saurus</i>	Least Concern
<i>Synodus synodus</i>	Least Concern
<i>Thalassoma bifasciatum</i>	Least Concern
<i>Urobatis jamaicensis</i>	Least Concern
<i>Xyrichtys martinicensis</i>	Least Concern
<i>Xyrichtys splendens</i>	Least Concern