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COASTAL PARTNERS

APPLYING ECOSYSTEM-BASED DISASTER RISK REDUCTION (ECO-DRR) THROUGH A RIDGE-TO-REEF APPROACH

IN PORT SALUT, HAITI

NORWEGIAN MINISTRY OF FOREIGN AFFAIRS

REEF CHECK WORLDWIDE

SOCIÉTÉ AUDUBON HAÏTI

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EXECUTIVE SUMMARY

Sandra Maurice, 36, General Manager of COPVEPA holding recently harvested vetiver roots. COPVEPA is Port Salut's first sustainable vetiver farmers' cooperative .

2014 © UNEP/Marc Lee Steed

In 2013-2016, the United Nations Environment Programme (UNEP) and the European Commission (EC) implemented a pilot demonstration project on Ecosystem-based Disaster Risk Reduction (Eco-DRR) in Haiti. In partnership with the National Government, the Municipality of Port Salut, and other local partners, the Eco-DRR project aimed to reduce disaster risks in the Municipality of Port Salut through a landscape or ridge-to-reef approach.

The Eco-DRR project was implemented within the Côte Sud (South Coast) Initiative (CSI), a larger program of UNEP and partner organizations in the coastal zone of southern Haiti. The pilot demonstration project in Port Salut provided a practical example of Ecosystem-based Disaster Risk Reduction (Eco-DRR) in a coastal area.

The project had three main components:

1. Undertake field interventions to reduce disaster risk covering the entire landscape from the hills to the sea (i.e. ridge-to-reef), including:
   - Re-vegetation and sustainable vetiver farming to reduce the risk of upland erosion and inland flooding;
   - Coastal re-vegetation as natural buffers against coastal hazards, such as storm surges and coastal flooding;
   - Sustainable and resilient fisheries to increase local resilience to disasters.
2. Develop local and national capacities for implementing Eco-DRR for improved coastal zone management; and
3. Support national advocacy on Eco-DRR through marine protected area management.

The project aimed to demonstrate how Eco-DRR measures could mitigate hazards, and reduce exposure and vulnerabilities to disasters, thereby contributing to disaster risk reduction in Port Salut. However, in addition to field activities, the project also recognized that efforts to reduce disaster risk must also strengthen local and national governance and institutions. Field demonstration activities served as entry points to raise local and national awareness about Eco-DRR and promote improved coastal governance in Haiti.

The Eco-DRR project influenced the designation of Port Salut as one of Haiti's first marine protected areas and incorporated disaster risk considerations in the rationale for designation of marine protected areas in Haiti. The designation offers for the first time the opportunity to establish a coastal and marine governance framework to promote sustainable and disaster-resilient development, currently a major gap in Haiti's coastal areas.

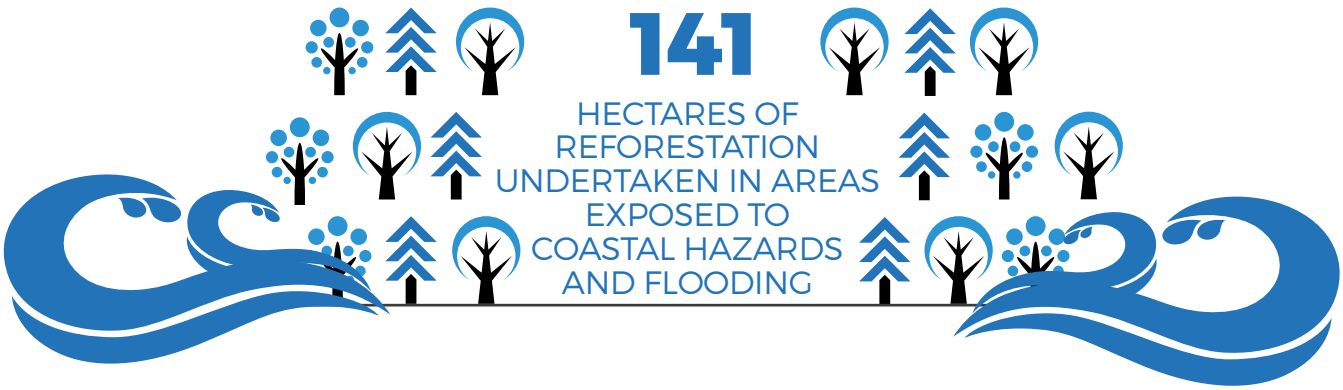
As a result of increased national attention and high level of ownership from local residents as well as local and national authorities, a strong foundation exists for project activities to be continued and expanded through other UNEP projects and initiatives by the Government and other development actors in Haiti.

Key partners included various National Government agencies, namely the Ministry of Environment, the Ministry of Tourism, the Ministry of Planning, as well as the Municipality of Port Salut, and civil society partners such as the Platform for Improving Artisanal Fisheries and Integrated Development (PADI), Audubon Society of Haiti (SAH), Reef Check, the Marine Fishers Association of Port Salut (AMPPOS) and the Cooperative of Vetiver Producers of Port Salut and Arniquet (COPVEPA).

Click above (or visit http://bit.ly/1jv2SCJ) to view a short video on the Eco-DRR project in Haiti

HIGHLIGHTS OF INTERVENTIONS

- **Baseline assessment of coastal and marine habitats completed** and used as a basis for identifying highly exposed and vulnerable areas and selecting appropriate reforestation and re-vegetation interventions
- **Tree nursery established producing 137,000 seedlings of coastal and riparian species and fruit trees,** directly benefiting 200 households
- **Training on coastal species nursery management** delivered to 150 people from the Ministry of Environment and local community
- **141 hectares of reforestation** undertaken in areas exposed to coastal hazards and flooding, comprised of:
  - *54,065 fruit and forestry trees planted on and around the riverbanks to reduce soil and riverbank erosion*
  - *36,300 mangroves and sea grape trees planted on the shoreline and river mouths to mitigate storm surge and flood risk*
- **Sustainable vetiver farms established on 6.5 hectares** directly benefitting 25 households, to demonstrate effective soil erosion control on hillsides and reduce sedimentation rates; **129 people reached in awareness raising and consultations** on sustainable vetiver farming
- **Participatory action plan developed for the fishing community of Port Salut** involving 51 women and men in consultations, to agree on priorities and solutions for sustainable and resilient fisheries
- **Boat repair and fleet improvement** (7 motors, 10 sailboats, 15 sails), enabling local fishermen to head further out to sea and reduce fishing pressure on near shore ecosystems
- **Disaster preparedness plan** (early warning system, emergency equipment, etc.) in place and safe shelters identified for Port Salut fishermen
- **Training delivered to 30 fishermen on disaster preparedness and management**
- **Door-to-door awareness raising on Eco-DRR reaching 200 households**, and eight posters developed and used for public awareness-raising and communications on the role of coastal and marine ecosystems in reducing disaster risk
- **Municipal cash-for-work scheme** promoted through community-led collection of solid waste along the coast in order to reduce marine litter and obstruction of waterways
- **Municipal coordination round-table established** in Port Salut and increased civil society's participation in decision making on coastal zone management



1 INTRODUCTION TO THE ECO-DRR PROJECT IN HAITI

Niken Agette, 31 year old and father of one boy, cultivates vetiver, corn, and other crops, on the steep mountainsides of Port Salut. Because of severe soil erosion, he and his family are unable to produce the same quantities of crop as before. UNEP is supporting vetiver farmers in applying sustainable soil management techniques to reduce erosion.

2014 © UNEP/Marc Lee Steed

The European Commission and UNEP collaborated on a four-year project (2012-2016) to promote, innovate and scale-up ecosystem-based disaster risk reduction (Eco-DRR) in vulnerable countries and to raise greater recognition of Eco-DRR globally. While the project was global in scope, it implemented Eco-DRR demonstrations in four countries: Sudan, Afghanistan, Haiti and the Democratic Republic of the Congo (DRC).

These four countries were selected because they presented four distinct ecosystem zones located in highly vulnerable settings, in which to apply various Eco-DRR approaches. In addition, UNEP has established field presence in all four countries, providing an opportunity to leverage resources and build on UNEP's work in the countries.

In the each of the four countries, the project delivered a common set of interventions, which were then tailored according to local contexts and national priorities.

THESE INTERVENTIONS INCLUDED:

- National and community baseline assessments for mapping Eco-DRR opportunities and challenges;
- Field-based activities to apply and demonstrate the Eco-DRR approach and provide direct benefits to local communities who are vulnerable to disaster and climate risks;
- Local and national capacity building and training workshops to support Eco-DRR implementation and promote replication of similar initiatives around the country;
- Strengthening partnerships and new collaborations on Eco-DRR;
- Policy advocacy to inform national policy and planning processes and promote risk-informed sustainable development.

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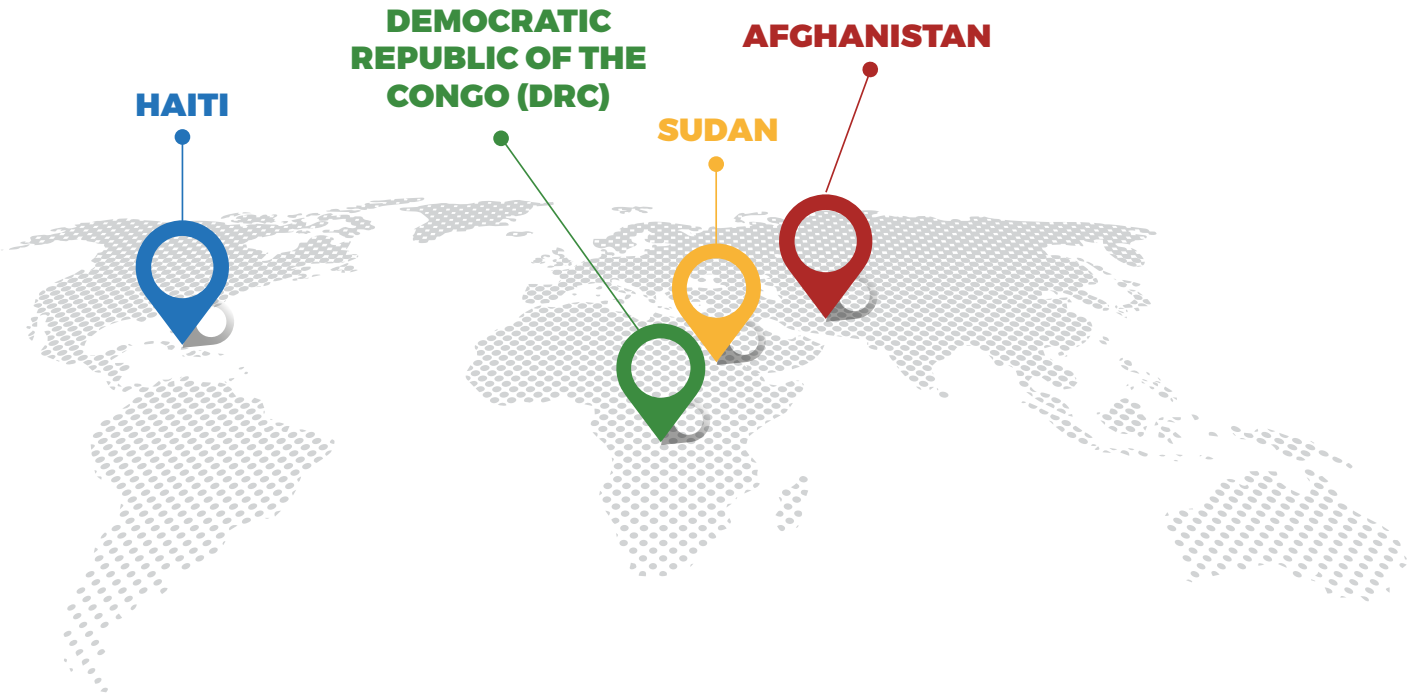

BOX 1. WHAT IS ECOSYSTEM-BASED DISASTER RISK REDUCTION?

Healthy, well-managed ecosystems have long been recognized to deliver multiple services, including for disaster risk reduction (Renaud et al. 2013). However, only over the last decade has the role of ecosystems in disaster risk reduction (DRR) received increased global attention. Sustainable ecosystem management for DRR is now recognized as a priority measure in the Sendai Framework for Disaster Risk Reduction (2015-2030).

Ecosystem-based approaches to disaster risk reduction (Eco-DRR) have been defined as "the sustainable management, conservation and restoration of ecosystems to reduce disaster risk, with the aim of achieving sustainable and resilient development" (Estrella and Saalismaa 2013: 30). With climate change expected to magnify existing disaster risks, Eco-DRR also incorporates climate risk management and climate change adaptation as a core principle (Ibid) and shares common features with Ecosystem-based Adaptation (EbA) (UNEP 2015).

Disaster risk is often understood as a composite of three main elements that must be present: hazards (e.g. flood, storm, landslide), exposure (i.e. people or assets located in hazardous locations) and vulnerability (i.e. the range of factors – social, physical, economic, environmental, cultural and political/institutional, etc. – that shape how hazards affect or impact on people and communities) (UNISDR 2009). Therefore, a reduction in any one of these elements will contribute overall towards DRR.

If managed wisely, ecosystems, such as wetlands, forests, mangroves, reefs, seagrasses and dunes, perform important functions that can influence all three elements of the disaster risk equation – ***by preventing, mitigating or regulating hazards*** (e.g. forests can reduce incidence of landslides and avalanches, wetlands help regulate flooding and droughts), ***by acting as natural buffers and thus reducing people's exposure to hazards*** (e.g. mangroves, coral reefs and seagrasses protect coastal areas from storm surge impacts), and ***by reducing vulnerability to hazard impacts*** through supporting livelihoods and basic needs (food, water, shelter, fuel) before, during and after disasters (PEDRR 2013). In this regard, healthy, well-functioning ecosystems strengthen local resilience against disasters and climate change.

Eco-DRR builds on existing sustainable ecosystem management principles and approaches and includes a range of potential measures, such as: environmental impact assessment tools, integrated water resources management or river basin management, integrated coastal zone management, ridge-to-reef and other landscape-scale approaches, sustainable dryland management, protected area management, integrated forest management, among others (see PEDRR 2010). Eco-DRR should be implemented as part of broader disaster and climate risk management strategies, together with other measures such as engineered infrastructure when appropriate, risk-informed land-use planning, early warning and contingency planning.

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This case study documents the experience, results and lessons of the Eco-DRR demonstration project in Haiti, which was implemented in the Municipality of Port Salut in the South Department. A collaboration between the Government of Haiti, UNEP, and local actors and communities, the project applied a ridge-to-reef (hills-to-ocean) approach to reduce exposure and vulnerability to coastal hazards in Port Salut. Representatives from the National Government such as the Ministry of Environment, Port Salut Municipality, members of various sectors (fishers' association, vetiver cooperative members, women's groups) and non-governmental organizations (NGOs) engaged in the process. The Eco-DRR project is one of the few projects being implemented in Haiti that addresses both disaster risk and environmental issues in the coastal zone.

BOX 2. OVERVIEW OF THE ECO-DRR PROJECT IN HAITI

PROJECT AIMS:

- To demonstrate the effectiveness of Eco-DRR through a ridge-to-reef approach to coastal zone management, in reducing the risks of floods, storms/hurricanes, and soil erosion and providing multiple benefits for local livelihoods;
- To develop local and national capacities for implementing Eco-DRR through a ridge-to-reef approach;
- To inform national policies and planning on Eco-DRR for improved coastal governance

ECOSYSTEMS IN FOCUS: Coastal and marine habitats

MAIN HAZARDS TARGETED: inland and coastal flooding, storms/hurricanes, soil erosion

TARGET BENEFICIARIES: 90 fishermen, 25 farmers, and 350 households

IMPLEMENTING PARTNERS: Ministry of Environment of Haiti (MDE), Civil Protection Directorate (DPC) of the Ministry of Interior and Territorial Communities (MICT), Ministry of Planning (MPCE), Platform for Improving Artisanal Fisheries and Integrated Development (PADI), Audubon Society of Haiti (SAH), Reef Check, Natural Resources Stewardship Circle (NRSC), Botanical Gardens of Les Cayes (JBC), Ayitika.

OTHER KEY PARTNERS: Ministry of Tourism and other National Government Ministries, Municipality of Port Salut; Marine Fishers Association of Port Salut (AMPPOS), Cooperative of Vetiver Producers of Port Salut and Arniquet (COPVEPA), Fédération d'Organisations pour le Développement de Port Salut (FODEP).

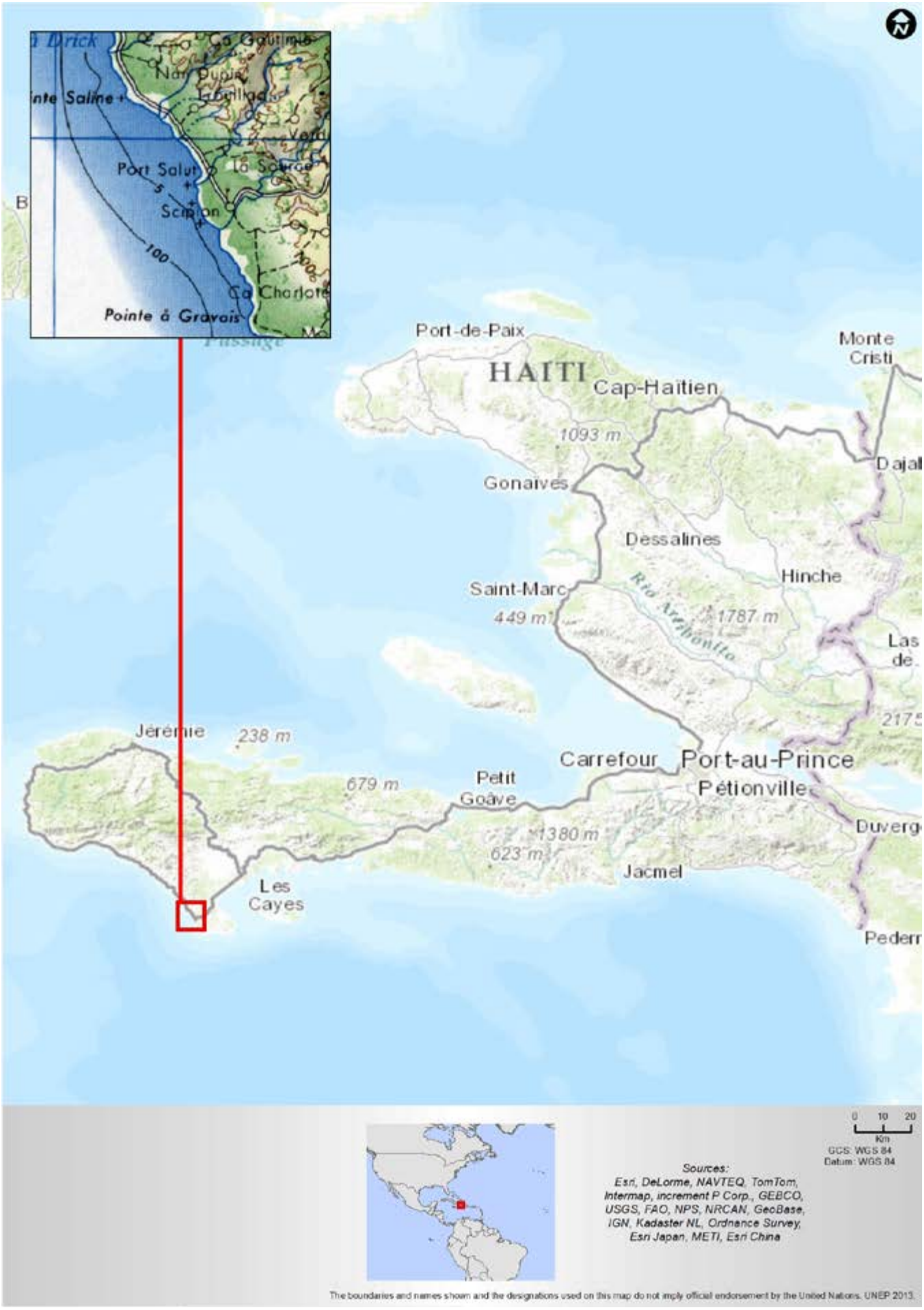
DURATION: May 2012 – December 2015

BUDGET:[i] USD 300,000

OTHER ONGOING PROJECTS/ACTIVITIES LEVERAGED: Funding from the Government of Norway amounting to USD 4.3 million on Côte Sud Initiative Development Cooperation, fisheries, agroforestry and landscape rehabilitation; Global Environment Facility (GEF) funding on marine protected areas, sustainable vetiver production, DRR and reforestation approaches amounting to USD 6.2 million

[i] *This does not include UNEP staff and field office costs.*

MAP 1. Port Salut is a coastal municipality in the South Department of Haiti



LOCAL CONTEXT

Port Salut is a small municipality in the South Department of Haiti [ii] with a population of 18,000 inhabitants, densely concentrated near the shore (**MAP 1**) [1]. The Municipality spans an area of approximately 45 km^2. It has five main rivers - La Source, Port Salut, Trouillac, Claude and Carpentier – and four ravines, which get flooded with rainwater (**MAP 2**). Two markets (Carpentier and Port Salut) located near the shore serve as the economic centres of town.

The most common livelihoods are agriculture, fishing, and tourism related jobs. Tourism is a growing industry, and many beachfront hotels and restaurants have been built, catering to both local and international tourists. Many fishing households have mixed livelihoods and rely on both fishing and subsistence agriculture.

Traditionally in the fisheries sector in Haiti, men are involved in fishing, while women are in charge of processing, marketing and selling. Fishermen work as informal groups in different neighbourhoods, or through the Fishers Association of Port Salut (AMPPOS). Fish vendors (*marchandes*) in local markets are almost exclusively women, and have an association. However, fish sale is generally done individually; therefore, women are less involved in associations, compared to men.[iii]

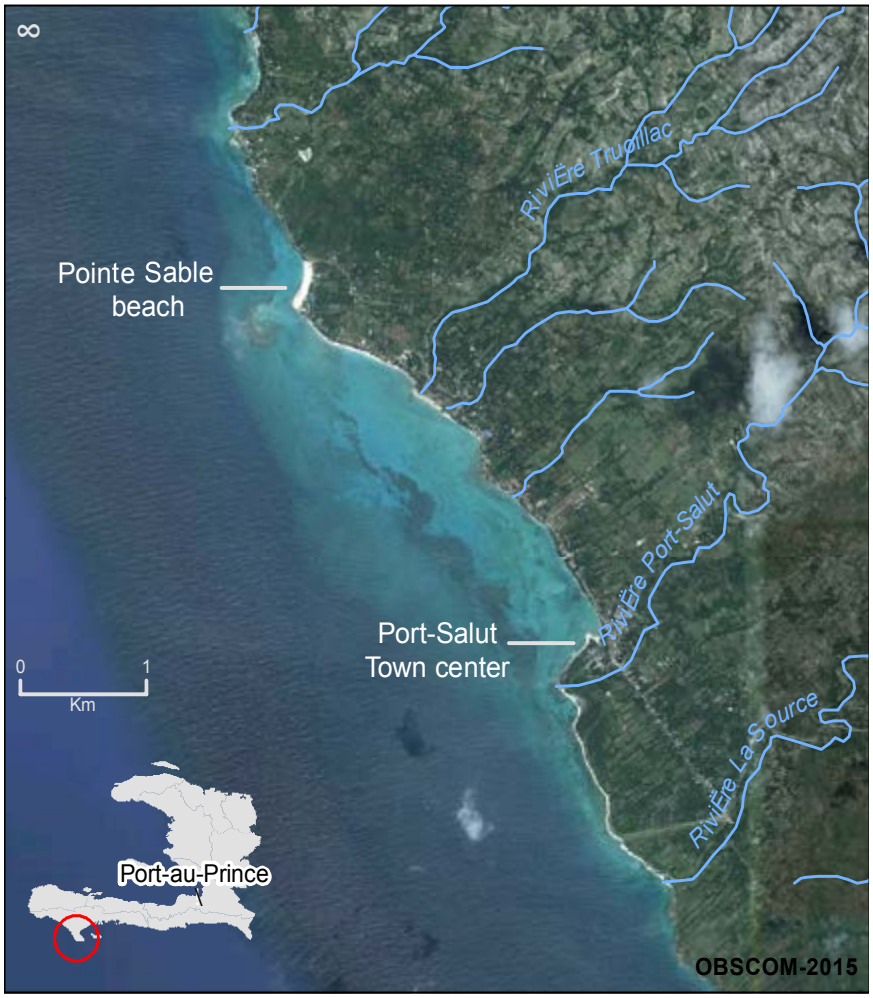
[ii] *In terms of its administrative structure, Haiti is divided into 10 departments, 41 districts (arrondissement) and 140 communes.*

[iii] *In the South Department, only 19% of women participate in community organizations, also referred to as associations. Source: The Earth Institute (2012) Integrated baseline study: ten communes of the southwest coast, South Department of Haiti. September 2012*

Fishermen in Port Salut

Click above (or visit http://bit.ly/2d1IkRI) to watch a short video on the fisheries sector in Port Salut, Haiti.

MAP 2. Port Salut Municipality, South Department of Haiti



SOURCE: GOOGLE EARTH

Small agricultural plots cover the steep hills, while riparian forests are found along the rivers, streams and ravines draining into the ocean. While the majority of the active population and particularly women in Haiti (and in Port Salut) are engaged in subsistence farming, households also cultivate cash crops, most notably vetiver (*Chrysopogon zizanioides*), a perennial grass native to India (discussed further below). Major crops cultivated include beans, corn, sorghum or onions. Landless farmers often work for landowners or as seasonal farm labour.

Port Salut has about 2,500 m of white sandy beaches, which are one of the main tourist attractions in the South Department and some of the most visited beaches in Haiti. The rest of the coastline is made up of sand and cobble beach and rocky shores. The largest and most popular beach is Pointe Sable (**MAP 2**). This beach used to be connected to Ile des Amoureaux, a small sandy tombolo (a bar of sand connecting an island to mainland), which was an emblem of Port Salut. However, as a result of coastal erosion, ecosystem degradation and multiple storms and hurricanes, the tombolo eroded and finally disappeared after Tropical Storm Fay and Hurricane Gustav in 2008 impacted the coast, changing the formation of the beach.

A mangrove forest with an area of approximately 10 ha is located along the coast in the southern part of Port Salut (**FIGURE 1**), although it is likely that the historical extent of the forest was much greater. A large coastal marsh is located north of the mouth of Port Salut River (**FIGURE 2**).[iv]

Algae, seagrass beds and a few, small fringing coral reefs make up most of the nearshore marine ecosystems. These ecosystems are important food sources for a wide variety of marine organisms including fish, invertebrates, and the manatee, a marine mammal still thought to exist in Haiti. There is also some hard rocky seabed with corals, which has been damaged by overfishing, high turbidity and sediment deposition.

[iv] *The deeper water of the marsh is fringed by white mangrove (Languncularia racemosa), cattails, and spikerush, while invasive grass and sedge species dominate the drier areas.*

The sandy beaches of Port Salut are famous in the country for their beauty

Ile des Amoureaux tombolo, before and after disappearance in 2008

FIGURE 1. Rhizophora mangrove forest near the shore

FIGURE 2. Coastal marsh adjacent to Port Salut market (1 ha)

Port Salut is one of the first marine protected areas of Haiti
2012 © UNEP

2 MAIN HAZARDS, DEVELOPMENT TRENDS AND CHALLENGES IN PORT SALUT

Erosion is a key environmental challenge in Haiti's South Department

2014 © UNEP

Community and national baseline assessments (described further in **SECTION 3**), including interviews, multi-stakeholder focus group discussions and participatory mapping, provided the primary basis for obtaining information on the major development trends and challenges related to ecosystems, ecosystem degradation and disaster risk in Port Salut Municipality.

Multi-stakeholder consultation meetings were held with 62 community members (30% women) from various sectors (fishers, market sellers, restaurant and hotel owners and local authorities). The baseline assessments also served as a basis for project design and defining the key components of the Eco-DRR intervention in Haiti. Moreover, the project drew extensively from assessments conducted in 2013 by UNEP and the Earth Institute at Columbia University.[2]

Focus group discussion with fishers' association members, independent fishers and female fish vendors

Participatory mapping of hazards and environmental changes in Port Salut with community members, including female market sellers, restaurant owners and coastal residents

Flood and storm surge in Haiti- 2012. With climate change likely to increase the incidence of weather extremes, building resilience - especially among poor communities - is an urgent priority in Haiti.

2.1. UNDERSTANDING DISASTER RISK IN PORT SALUT

HAZARDS AND EXPOSURE

Although Haiti received global attention after a massive earthquake struck in 2010,[v] hydro-meteorological hazards, such as hurricanes, floods and droughts, are much more frequent (**FIGURE 3**)[3,4], Coastal hazards, particularly floods, hurricanes and tropical storms, bring heavy rainfall and storm surges.[5]

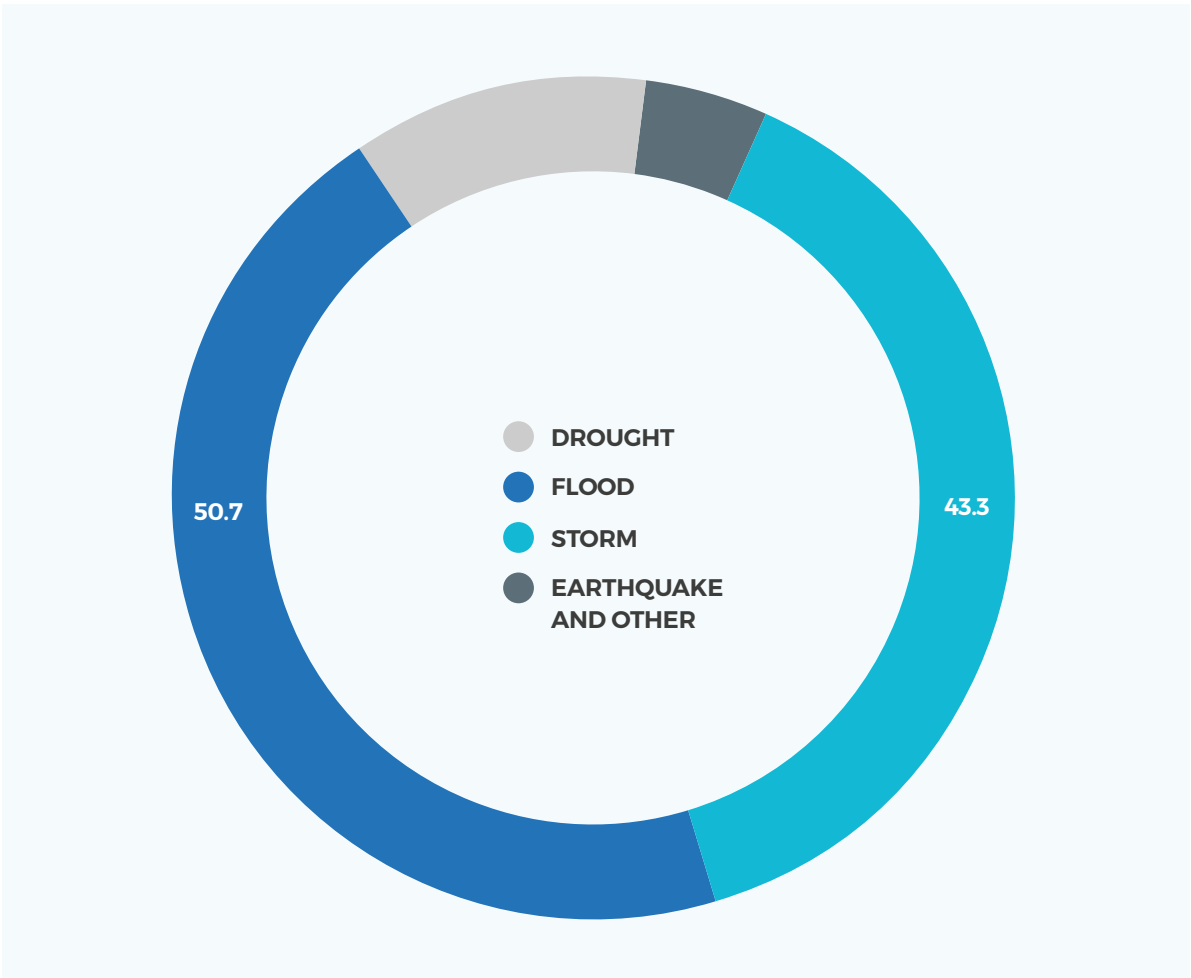
Haiti lies on the pathway of tropical storms that originate in the Atlantic Ocean. On average, one hurricane or tropical depression strikes the country every two years.[6] In the past century, at least 22 tropical storms and hurricanes have made devastating landfalls in the south of Haiti (**FIGURE 4**), many of which directly affected Port Salut. The year 2012 brought a particularly severe storm season in Port Salut, which experienced devastating impacts from Hurricane Isaac (Category 1) in August and the outer bounds of Hurricane Sandy (Category 3 at its peak when it made landfall in Cuba) in October.[vi]

Hurricanes are destructive as a result of both their immediate consequences of intense wind and rain, and indirect consequences such as floods, landslides, and disease outbreaks. The risk of floods is high in coastal areas and on the plains.[7] During storms, coastal flooding is exacerbated around river mouths, when rainwater flowing down from the hills into rivers and into the sea meets high storm surges on the coast.

[v] *The 7.0 magnitude earthquake killed 220,000 people and left 1.5 million homeless*

[vi] *Saffir-Simpson Categories (SSCat) and corresponding sustained winds: Category I (118 – 153 km/h); Category II (154 – 177 km/h); Category III (178 – 210 km/h); Category IV (211 – 249 km/h); Category V (More than 259 km/h).*

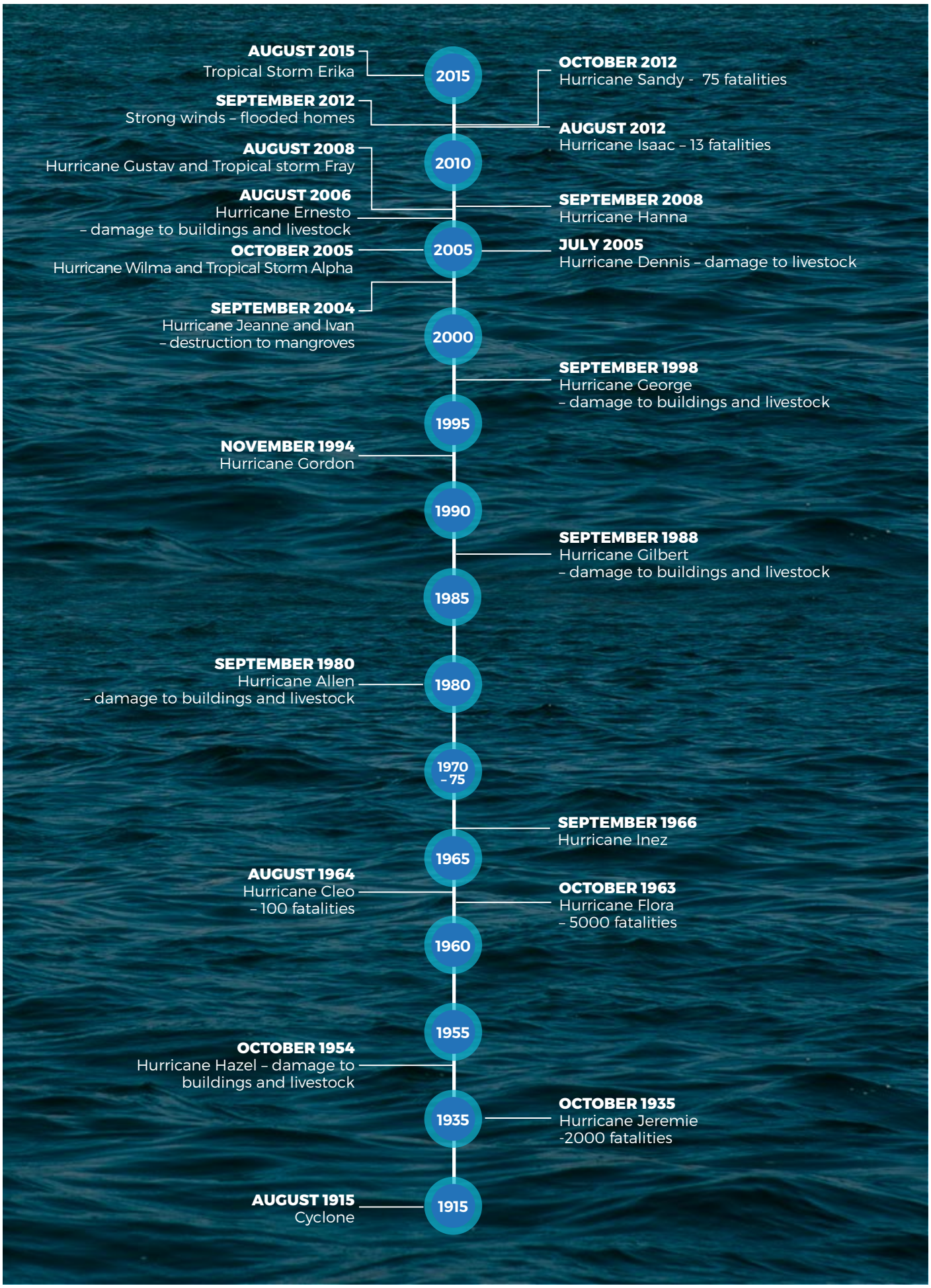
FIGURE 3. Frequency (percentage) of internationally reported disasters in Haiti between 1990 and 2014 categorized by type of hazard. Hydro-meteorological hazards (hurricanes, floods, droughts) are the most frequent hazards in Haiti.



SOURCE: EM-DAT (Feb. 2015) : The OFDA/CRED - International Disaster Database www.emdat.be Université catholique de Louvain Brussels - Belgium.

Standing in front of her storage room at Pointe Sable, Mariame, a vendor of hand-made souvenirs, described the flood damage to her merchandise caused by Hurricane Sandy in 2012

FIGURE 4. Timeline of hurricanes affecting the South Department of Haiti [8]



Pointe Sable beach of Port Salut was flooded during Hurricane Sandy in 2012. The municipality received 700 mm of rain in just four days, which is more than half the national average annual precipitation (1200 mm per year).

Floodwaters from Hurricane Sandy uprooted trees and caused significant damage to roads and bridges, cutting off circulation. The flooding also increased the cases of cholera, a waterborne disease.

Heavy rainfall from tropical storms also results in storms surges and inland flooding in Port Salut, particularly around rivers and ravines, which increase the risk of landslides. Inland floods can occur rapidly and without much warning, as the surrounding steep and mostly barren hills accelerate rainwater towards the coastal areas. Lack of proper drainage and disposal of solid waste in rivers and drainage channels further exacerbate flooding.

The effects of hurricanes and storms are exacerbated by the location of human settlements and physical economic assets, which are concentrated along the coastline, in floodplains and along rivers. In Port Salut, markets, hotels, restaurants, fishing activities, many houses and even farms are located near the sea or by the rivers and are therefore exposed to flooding and storm surges.

Although less frequent, drought triggered by low precipitation events also affects the area. Given the population's heavy reliance on subsistence agriculture, the recent drought in 2014-2015 threatened 272,000 people in the South Department with food insecurity.[9] In combination with slash and burn agriculture, drought can increase the risk of wildfires (e.g. in the case of Parc Macaya in 2015).[10]

Climate change will further exacerbate the impacts of weather extremes due to a likely increase in the maximum wind speed of tropical cyclones in the Caribbean.[11] In addition, projected sea level rise due to climate change, is expected to intensify storm surge impacts, and cause more severe coastal flooding.

Many houses and hotels are built on the shorefront. During Hurricane Sandy, which brought winds of 120 km/h, combined with 3 m high waves and 2 m high storm surges, Port Salut suffered severe flooding and damage to public and private properties, loss and damage of fishing gear, livestock and crops.

The Mayor of Port Salut shows the level of floodwaters in the Port Salut market during Hurricane Sandy.

VULNERABILITY

Being the poorest country in the Western Hemisphere, Haiti is extremely vulnerable to the impacts of natural hazards.[12] Even low intensity hurricanes can cause significant damage and affect the national economy.[13] In Port Salut, economic activities are generally suspended after hurricanes and storms, as a result of damage to houses and infrastructure (e.g. roads, bridges, markets) and loss of livelihood assets (e.g. fishing gear).

The root causes of high disaster vulnerability in Haiti are acute poverty, widespread environmental degradation, unplanned and rapid urbanization, and fragile institutions.[14] Sixty seven percent of the population of the South Department gains less than US$ 1 per day (**FIGURE 5**) and despite the predominance of food crop agriculture, 50% of the population experiences high food insecurity.[15] In addition, the lack of social protection, limited infrastructure (e.g. for irrigation, proper drainage, etc.), combined with limited alternative sources of livelihoods, result in extremely high levels of vulnerability and low coping capacities in case of disasters.

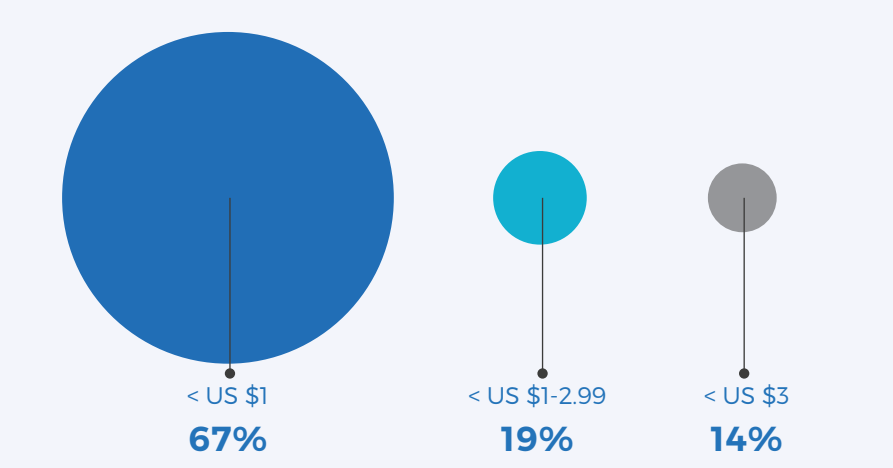
Disasters may cause displacement as people seek alternative sources of livelihood and income. Elder community members in Port Salut recalled the internal displacements caused by Hurricane Hazel in 1954 as well as outmigration to the Dominican Republic as a result of the great drought in 1965 and Hurricane Allen in 1980.

There are three particularly vulnerable socio-economic groups in the South Department, characterized by their limited livelihood options and coping capacities: fishermen, female fish vendors (*marchandes*), and vetiver farmers. Fishermen gain their income on a daily basis; therefore, a disruption in fishing activities means loss of income. The level of entrenched poverty experienced by fishermen is considered one of the highest among socio-professional classes in Haiti, and food insecurity among fishermen is at 30%.[16] This is explained by the lack of alternative sources of livelihoods in the coastal zone, lack of access to credits and in particular, a lack of sustainable investment in their principal natural resources such as marine fisheries. Fishers are also vulnerable due to their weak negotiation power in the fisheries market, as most fishers are not formally organized and middlemen dominate and set fish market prices. Technical and financial support provided to fishermen is insufficient, and fishermen generally have substandard fishing equipment and vessels to expand their fish catch.

For female fish vendors, the loss of fish catch by fishermen also means a loss of their income source. In general, women in Port Salut have few economic options outside of selling fish or other commercial merchandise. Hence, when a disaster disrupts market activities or prevents them from being able to sell, they suffer economically. Local norms are also at play. For instance, each female fish vendor tends to sell only one type of product in the market, as a specialty. If this product is not available, these women will avoid selling a different type of product, as it will put them in direct competition with other women in the community.

Vetiver farmers generally cultivate marginal land and earn meagre incomes from vetiver cultivation (discussed further in **SECTION 2.2**). Most vetiver farmers are not formally organized and lack power in negotiating market prices for their vetiver harvests. As a result, vetiver farmers are poor and lack access to investments in farming and economic safety nets to cope with disasters.

FIGURE 5. Per capita daily income in the South Department of Haiti.
SOURCE: MDE 2014: Rapports Socio-économique du Sud.



2.2. ECOSYSTEM DEGRADATION EXACERBATES DISASTER RISK

Disaster risk in Port Salut, as in the case of Haiti in general, is closely linked to widespread ecosystem degradation spanning from the hills to the coastlines. Port Salut's upland, marine and coastal ecosystems are under numerous pressures linked to human activities. These include the unregulated exploitation of land and marine resources (e.g. overfishing, destructive fishing gear, unsustainable cultivation); lack of solid waste management, which block waterways, heavy river sedimentation, which destroys coastal and marine habitats; and the proliferation of invasive species and loss of flora and fauna, which further weaken remaining ecosystems.

Degraded ecosystems lose their capacity to act as natural buffers against hazard impacts, such as flooding, storm surges and strong winds. They also contribute to increased disaster risks. For instance deforestation and de-vegetation on hills result in increased soil erosion. Soil erosion from bare slopes increases river sedimentation downstream, which in turn exacerbates inland and coastal flooding. Climate change impacts, such as higher intensity storms and sea level rise, will place additional pressures on already vulnerable ecosystems. People and local livelihoods, which depend on these ecosystems, are thus more exposed and vulnerable to hazard impacts.

2.2.1. ON THE HILLS

In Port Salut, small farm plots and agroforestry have replaced most native forest cover. The few remaining areas of secondary forests are harvested for fuelwood or charcoal, and grazed by livestock. A common bird species is the Yellow-faced Grassquit (*Tiaras olivaceus*), an indicator of deforested ecosystems.[17]

Steep slopes and abundant rainfall naturally predispose the hills to soil erosion. Widespread deforestation in the upper reaches of the valleys and extensive cultivation therefore mean that intense rainfall events, even for short periods of time, can quickly saturate the exposed terrain, which coupled with the lack of drainage infrastructure, creates an environment conducive to flash flooding.[18]

Even though 50% of land under cultivation in Port Salut takes place on slopes, 90% of the farm parcels do not apply soil conservation measures (e.g. vegetative or structural barriers) to control erosion and loss of topsoil.[19] The resulting sedimentation in waterways thus further increases flood risk. In addition, given that the majority of farmers lack access to improved farming assets (e.g. irrigation, fertilizers, etc.), farming yields remain low, thus pushing farmers to expand cultivated areas which contribute to the cycle of soil degradation and increased risk of flooding.

Denuded mountains of Port Salut Municipality. Historically, deforestation in Haiti has been the most rapid in the Caribbean – only 1.5% to 2.6% of original forest cover has remained,[20] and only between 19-33% of land has some extent of tree cover.[21]

The overall health of riparian forests is poor also due to extensive deforestation through the use of the upstream ravines for agriculture and the diversion of river waters for irrigation. Most of the adjacent land near rivers is under cultivation, silviculture or grazing. Weedy invasive species are also abundant. Sedimentation and changes in base river flows have deteriorated habitat conditions, causing a decline and likely extirpation of many amphibian, reptile and invertebrate species.[vii] In many places, riparian forests have completely disappeared, exposing the riverbanks to severe erosion and peak storm flows that exacerbate flooding and contribute to landslides.

[vii] *The results of field surveys suggest that the overall level of biodiversity is much reduced compared to natural coastal ecosystems due to habitat loss. For instance only 2 out of the 14 amphibian species known in the area were found, one of which is considered vulnerable, while four out of 28 recorded bird species in riparian forests of Port Salut have been introduced, one of which is an indicator species of deforested conditions.*

VETIVER PRODUCTION

Vetiver processing was introduced in Haiti in the 1940s, and today Haiti is the world's leading producer of vetiver essential oil, responsible for 70% of global production. The fragrant essential oil distilled from vetiver roots is commonly used in fragrances and cosmetic products worldwide. Haiti is widely considered to produce the highest quality vetiver oil in the world. Vetiver oil from Haiti is thus a highly sought product by the global cosmetics industry.

Estimates suggest that vetiver production in Haiti accounts for approximately US$13 million of revenue per year, making it the third most important agricultural and industrial exported product of the country.[22] An estimated 12,000 hectares of land are under vetiver cultivation in the South Department, and at least 30,000 households are involved in the sector. Port Salut, in particular, is renowned for its high quality essential oil.

Vetiver grass is drought tolerant and grows well even in extremely poor soils. Therefore, vetiver cultivation is a favoured and important livelihood source for the local population. Vetiver has roots that grow deep into the soil; hence, if planted and harvested properly, vetiver also serves as an excellent erosion control measure, as demonstrated in many countries and other areas of Haiti.[viii]

However, the unsustainable harvesting methods of vetiver in the South Department, such as uprooting of the plant, can destabilize the soil and result in soil erosion especially during heavy rains. Hence, vetiver harvesting in the uplands, combined with already rampant deforestation, has led to heavy sedimentation and degradation of slopes, contributing to landslide and flood risks especially downstream along the coasts (discussed further below).

[viii] *For more information on vetiver bioengineering for erosion control see: UNEP (2016) River Partners: Applying ecosystem-based disaster risk reduction (Eco-DRR) in integrated water resource management (IWRM) in the Lukaya Basin, Democratic Republic of the Congo. http://postconflict.unep.ch/publications/DRCongo/DR_Congo_Eco_DRR_case_study_2016.pdf*

In Haiti, vetiver oil extraction targets the roots; thus, inappropriate methods of vetiver harvesting can leave the soil vulnerable to erosion, especially when it is cultivated on steep slopes, and result in bare slopes with little top soil for cultivation.

2.2.2. ON THE SHORE

Much of the natural vegetation on the shoreline in Port Salut, such as trees and shrubs along beaches, mangrove forests and sand dunes which provide a natural barrier to storm surges and coastal flooding, have been lost due to removal and/or habitat degradation. Plant diversity on the beaches is poor, and native trees, such as seagrapes (*Coccoloba uvifera*), have been removed to keep the sandy beaches clear and more attractive to visitors. Most of the frontal dune vegetation (e.g. comprised of native grasses that control erosion) has also been eliminated. Introduced ornamental species, such as almond trees [ix], have been planted on the beach, but these species are less resistant to harsh shoreline conditions and seldom withstand the impacts of storms.

Mangrove forests in Port Salut have also been negatively affected by changes in the hydrological balance of the area, encroachment of agricultural lands and continued cutting of mangroves for fuelwood and charcoal. The proximity of the market, dense urban residences, decreased water flows (e.g. due to drainage and the presence of invasive grass and woody tree species), and uncontrolled pollution have all compromised the natural nutrient cycle and water levels, vital to the survival of the marsh lands.

The highly modified structure and composition of plant communities, the paucity of native wild species and the disproportionate number of invasive species (both plants and animals), are reasons to believe that the overall ecosystem health along the beaches of Port Salut is experiencing severe degradation. As a result, the degraded shoreline – and the people who live and work along the coast - have become more exposed and vulnerable to coastal storms, hurricanes and accelerated sea level rise.

Uncontrolled pollution (e.g. from solid waste, sewage) further exacerbates the degradation of coastal and marine ecosystems in Port Salut. Solid waste is often dumped in drainage channels, making its way to the sea, polluting the nearshore waters and degrading coastal and marine ecosystems. Solid waste in rivers and canals blocks drainage areas and causes inland flooding during heavy rains and tropical storms.

In addition, Port Salut appears to be experiencing beach erosion, which further reduces natural barriers to the impacts of coastal hazards (**FIGURE 6**). Although beach erosion in Port Salut warrants further detailed studies, construction of improper drainage canals, roads and buildings directly on sand dunes are known disruptors of natural replenishment of beach sediments, thus contributing to beach erosion. Sand extraction and passage of vehicles on sand dunes could further aggravate the erosion problem in Port Salut.

Nevertheless, the existence of a number of threatened bird species points to the importance of conserving and sustainably managing the remaining habitats in Port Salut. Threatened species observed on the beaches include the Gray-crowned Palm Tanager (*Phaenicophilus poliocephalus*), which is the only remaining endemic bird species in Haiti.

[ix] *Common ornamental species on the beaches of Port Salut are raintree (Albizia saman), tropical almond (Terminalia catappa), flametree (Delonix regia), neem (Azadirachta indica) and seaside mahoe (Thespesia populnea)*

2.2.3. IN THE SEA

Marine ecosystems, including coral reefs and seagrass beds, are under alarming threat, resulting in very low populations of fish and other marine organisms. Severe sedimentation from deforested hills and upland agriculture flows into rivers and washes out into the shallow coastal and marine areas. Sedimentation inhibits coral, algae and seagrass growth and reduces the productivity of marine ecosystems. [23] The coral reefs that remain are for the most part relatively small colonies and species that are resistant to sedimentation. For instance, 17% of the reef area at the fringing shallow reef (1-3 m depth) near Pointe Sable is covered by silt. Nevertheless, the extent of coral cover (14.3%) of this reef is above the average of coral cover in Haiti's reefs, which points to the importance of protecting these remaining marine ecosystems in Port Salut.[x]

Fishing activities are typically artisanal and concentrated in the nearshore. Fishermen fish from the shore using beach seines with very fine mesh nets or in the near shore with small wooden boats. Both practices are destructive to the nearshore marine habitats: beach seines are highly unselective and catch a high quantity of by-catch (unwanted fish or other organisms captured by fishing gear), and can break off corals and damage seagrass beds, while fishing boats can damage shallow marine habitats. Fishing on coral reefs removes herbivorous fish, such as parrotfish, that are essential for controlling algal cover and allowing for coral growth.

Construction of buildings and roads on the sandy beach disrupts the natural replenishment of sand and contributes to beach erosion

Unmanaged solid waste from Port Salut market near the shore

In addition, boats that are locally used in Port Salut are often built by carving out the inside of individual tree trunks using only large old trees. Therefore, fishing is also indirectly linked to deforestation in the uplands. The boats are generally unstable and considered unsafe in choppy waters, such as during storms.

Although very little data is available, the biomass caught by fishermen suggests that the south coast of Haiti is experiencing a high rate of overfishing. The remaining fish are often too small to reproduce. The siltation level and overfishing of predatory and herbivorous fish suggests poor reef health.

Degradation of marine ecosystems reduces the natural infrastructure that provides protection against coastal hazards but also compromises over the long run the sustainability of local livelihoods. Degraded habitats lose their capacity to mitigate the impacts of storms, resulting in higher exposure of the population and becoming even more vulnerable to future storm damage. Moreover, the deterioration of coral reefs and seagrass beds, in particular, will likely exacerbate beach erosion in Port Saut. The predominance of biogenic components in sand samples shows that marine sediments (e.g. calcium carbonate skeletons of corals) have contributed significantly to the formation of the beach. With degraded coral reefs and seagrass beds, erosion processes are thus likely to continue in Port Salut.

[x] *Although a few reefs have been found with up to 70% living coral, most reefs in Haiti now have a coral cover of between 5% and 15%. This is very low compared to other Caribbean reefs where the average is 20 to 30%. Source: Reef Check Foundation (2013) Port Salut Benthic Habitats: Mapping, Assessment and Zoning for Sustainable Coastal Management and Disaster Reduction. 4 November 2013*

2.3. NATIONAL POLICY CONTEXT ON DISASTER RISK REDUCTION AND COASTAL ZONE MANAGEMENT

The pronounced state of ecosystem degradation in Port Salut, and in Haiti in general, has increased local exposure and vulnerability to a range of hazards, as described in the previous section. High disaster risk is in turn exacerbated by the lack of investment in disaster risk reduction at the national level, the limited institutional capacities of Municipal Governments, and the low level of national attention given to the importance of coastal zone management in building resilience against disasters and climate change.

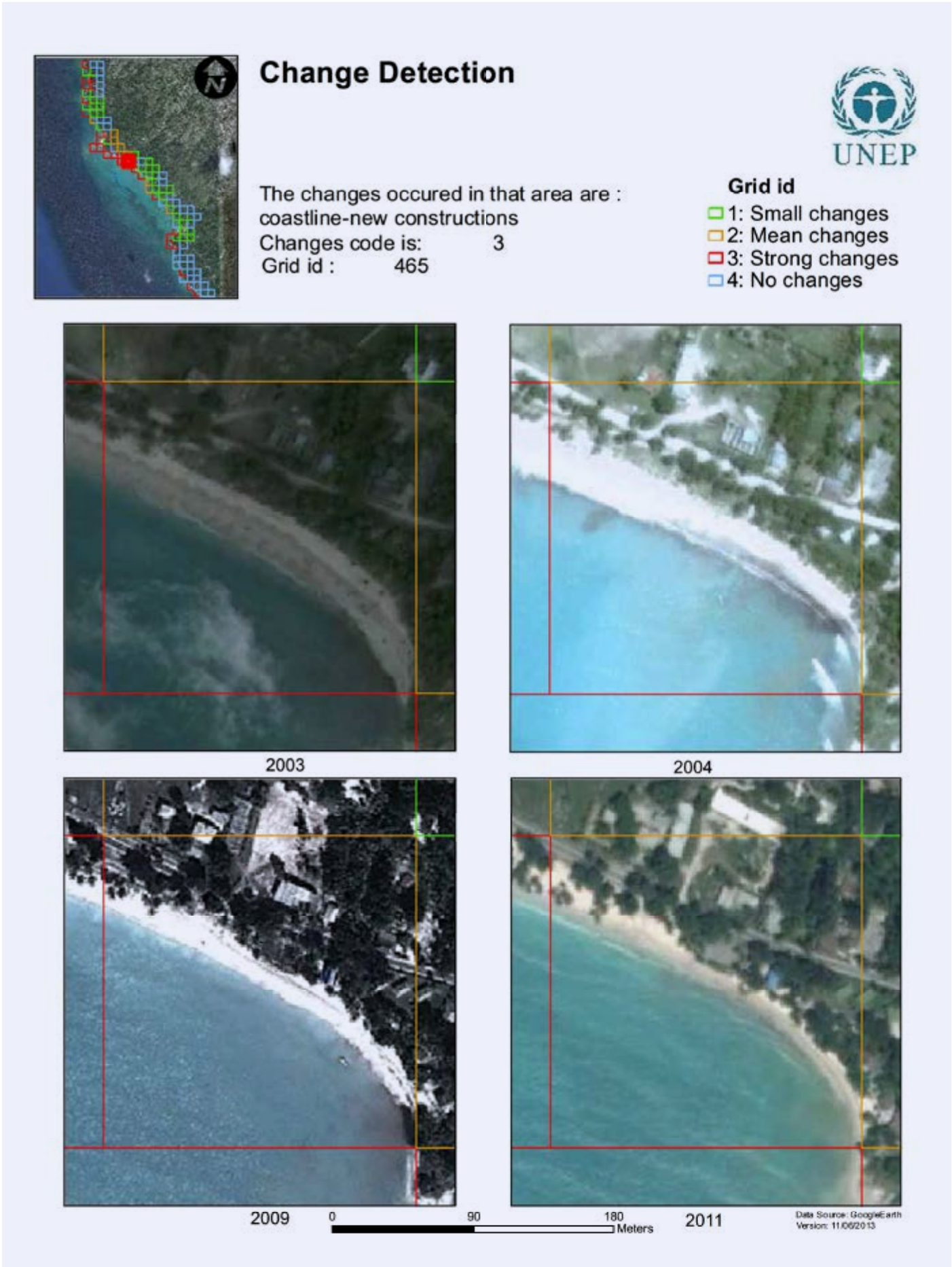
Disaster management at the national level is nascent and remains focused on emergency preparedness, contingency planning and response, with very limited integration of disaster risk concerns in other development sectors. The early warning system is also very weak both at national and local levels. In addition, much of national attention on disaster management is focused inland, with limited priority given to coastal zones. This is in spite of the fact that Haiti has a long coastline (1,771 km)[24] and a high population density near the sea, with 8 out of its 10.57 million inhabitants living on the coast (2014 est.).[25]

While the coastal zone is highlighted in several strategic documents of the Government of Haiti,[xi] the country lacks a comprehensive and integrated coastal zone management policy, or a coastal environmental law. Lack of such policies inhibits sustainable development on the coast. However, the Government's policy has been to strengthen fishing associations in order to improve fisheries governance.

There is also low inclusion of risk management and human security as a cross-sectoral axis in the planning and management of local governments. Despite the decentralized approach to governance promoted by the Government, in reality departmental and local authorities lack strong technical capacities, funding and staff to fulfil their key roles. Coastal governance is therefore weak. The national budget does not provide specific allocations for disaster risk management or coastal zone management at the local level. Coastal zone planning and management are virtually non-existent, and disaster management committees at the departmental, communal and local levels, which are responsible for establishing early warning systems, are under-resourced and lack the necessary skills. As a result, Municipal Governments are often considered by the population as lacking the authority and capacity to respond to local needs.

[xi] *For instance in the Regional Strategy for the Development of the South Peninsula (2012)*

FIGURE 6. Satellite images of the shoreline in Port Salut over the years suggest that the sandy beach is experiencing erosion



3 MAIN COMPONENTS OF THE ECO-DRR PROJECT IN HAITI

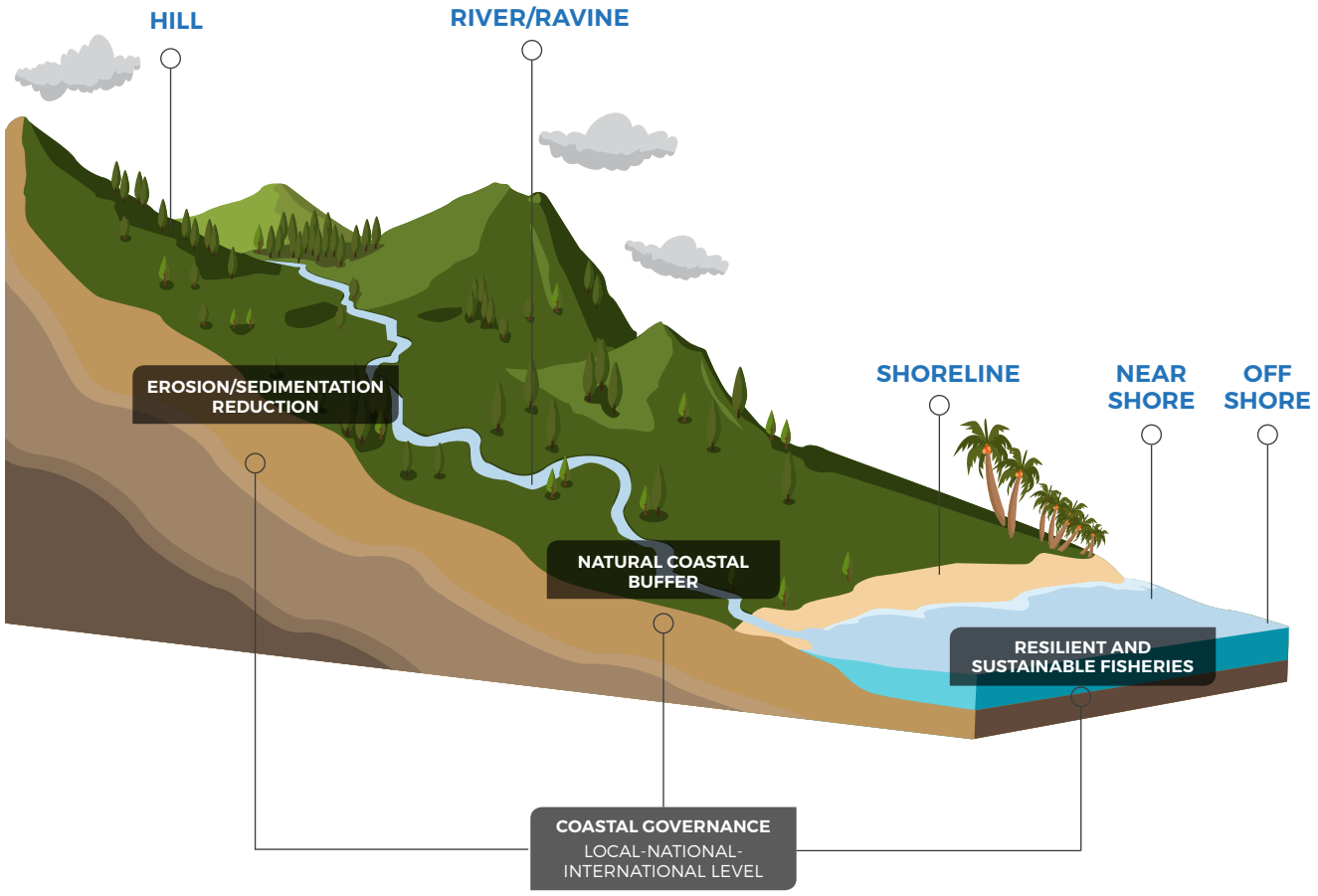
Michel Cantave (born 1980) is a member of a local fishing cooperative that is supported by the Eco-DRR project in Port Salut.

2014 © UNEP/Marc Lee Steed

The Eco-DRR project implemented in Port Salut took into account the key development challenges, as described in **SECTION 2**. The project was cognizant of the interlinkages between upland deforestation, degradation of marine and nearshore ecosystems, increased flood and storm surge risks, and the subsequent impacts on livelihoods. At the same time, it considered Haiti's national policy environment, particularly in view of ongoing advancements in coastal zone management, and the opportunities for promoting Eco-DRR through a ridge-to-reef or hills-to-oceans approach to sustainable coastal zone management.

A unique feature of the project was its focus on the coastal zone. Building on UNEP's presence and ongoing activities particularly in the South Department (**BOX 3**), the Eco-DRR project promoted disaster and climate risk reduction as an integral part of sustainable coastal zone management based on a ridge-to-reef approach (**FIGURE 7**). The project aimed to mitigate storm surges, coastal and inland flooding and reduce people's exposure and vulnerability to these hazards.

FIGURE 7. The Eco-DRR project adopted a ridge-to-reef approach to reducing disaster risk



THE PROJECT HAD THREE MAIN COMPONENTS, WHICH WERE CLOSELY INTERLINKED AND IMPLEMENTED IN PARALLEL:

1. FIELD INTERVENTIONS, INCLUDING SOIL EROSION REDUCTION IN THE UPLANDS, COASTAL REVEGETATION, STABILIZATION OF RIVERBANKS, AND SUSTAINABLE AND RESILIENT FISHERIES

2. LOCAL AND NATIONAL CAPACITY BUILDING ON ECO-DRR FOR IMPROVED COASTAL ZONE MANAGEMENT

3. NATIONAL AWARENESS-RAISING AND ADVOCACY ON ECO-DRR IN MARINE PROTECTED AREA ESTABLISHMENT.

BOX 3. CÔTE SUD INITIATIVE (CSI)

Since 2011, the Côte Sud Initiative (CSI), a coalition of UN agencies and partners has worked to promote sustainable development and vulnerability reduction in the coastal areas of the South Department of Haiti. With the support of international donors, CSI has supported implementation of five thematic programmes, under the auspices of the Government of Haiti:

- **MER SUD:** To regenerate marine ecosystems with the rational use of resources through integrated coastal zone management and marine protected areas
- **TERRE SUD:** To regenerate terrestrial ecosystems with the rational use of natural resources through integrated watershed management and protected areas
- **ROUTE SUD:** To rehabilitate and build primary and secondary roads, bridges and protective infrastructure in order to decrease the isolation of communities, reduce flood risk and facilitate physical access to social services, markets and tourist attractions
- **ENERGY SUD:** To improve access to energy through good governance and education, sale and rental of energy products and renewable energy power generation
- **GOUVERNANCE SUD:** To strengthen governance systems through inter-ministerial and municipal coordination platforms

The Eco-DRR project was implemented in conjunction with other Côte Sud Initiative projects, in order to promote risk-informed, sustainable coastal zone management in Port Salut. The Côte Sud Initiative is currently phasing out and giving way to follow up programs.

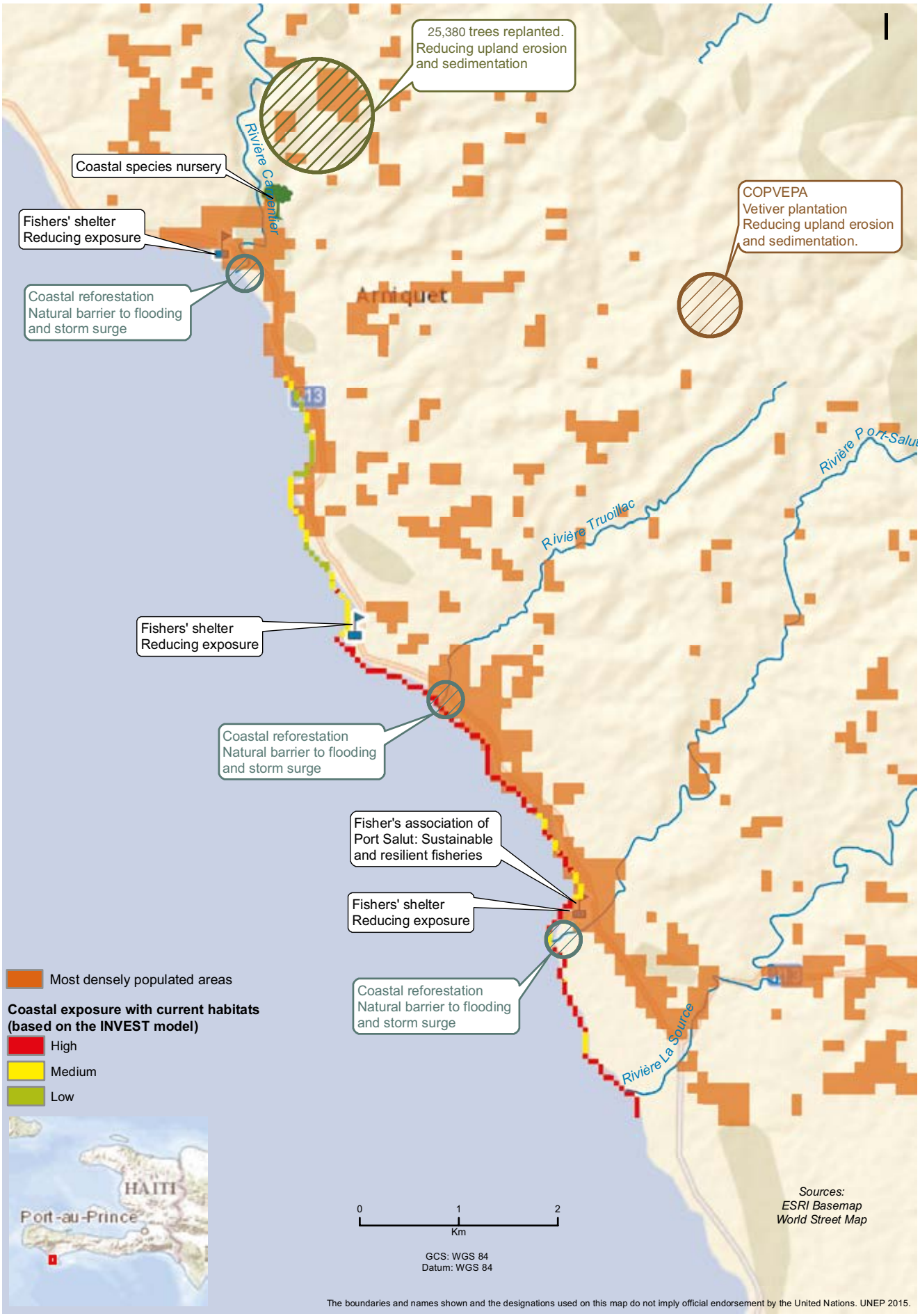
PARTNERS

3.1. ECO-DRR FIELD INTERVENTIONS IN PORT SALUT AND INITIAL RESULTS

The project implemented a number of ecosystem-based measures as pilot demonstrations of Eco-DRR in the Port Salut municipality. Field demonstration sites focused on three geographic areas, following a ridge-to-reef approach (**FIGURE 8**). These field activities had several objectives. In the short-term, these activities aimed to restore vegetation in the upland and near the sea, and reduce pressure on nearshore marine ecosystems, while at the same time provide direct livelihood benefits to targeted households and stakeholders in the project. The different field interventions included promoting sustainable vetiver cultivation in the uplands, rehabilitating coastal vegetation and improving the sustainability and resilience of fishing practices (**MAP 3**). The project also aimed to strengthen local community-based associations in sustainable livelihood activities, in order to support risk reduction and resilience building beyond the project's lifespan. These activities were complemented by awareness-raising events and targeted training on implementation skills (discussed further in **SECTION 3.2**).

FIGURE 8. Summary of Eco-DRR field interventions undertaken in Port Salut

MAP 3. Map of Eco-DRR field interventions in Port Salut



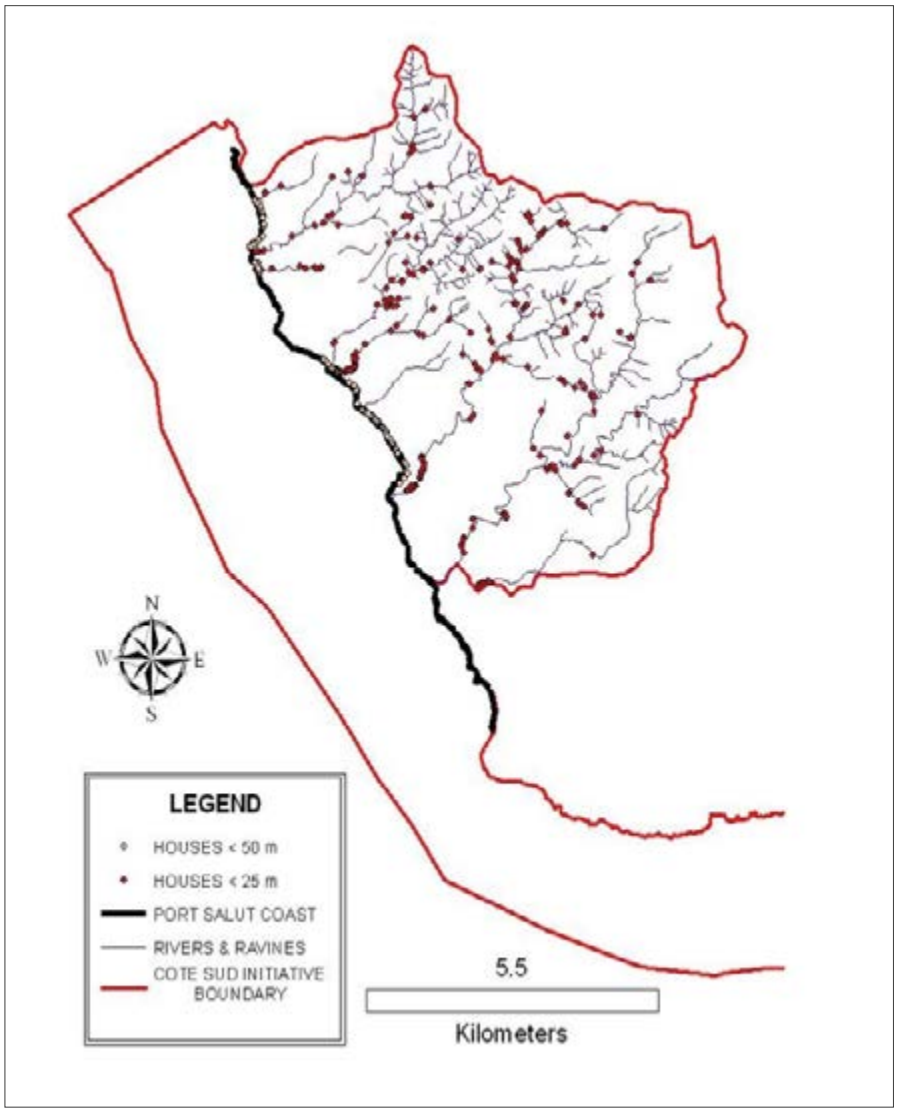
3.1.1. BASELINE ASSESSMENTS

Field surveys, conducted in partnership with the Audubon Society of Haiti (SAH) and Reef Check, served to map the extent and status of marine and terrestrial ecosystems, develop an ecological baseline of Port Salut, identify opportunities for using ecosystems to reduce disaster risk, and select field interventions. In addition, remote sensing and GIS modelling were applied to complement the field surveys and assess exposure of the population to storm surges and flooding. The data was used in combination to develop detailed baseline maps of the ecosystems and geophysical characteristics of Port Salut, as well as model current and future exposure of the coastline to climatic hazards under different ecosystem management scenarios.

MARINE AND TERRESTRIAL FIELD SURVEYS

In July 2013 Reef Check, supported by the UNEP/CSI team, conducted surveys of the marine habitats along a 12.5 km stretch of the coast of Port Salut using the standard Reef Check methodology.[26] A team from SAH also surveyed the terrestrial and intertidal ecosystems in Port Salut to assess the current status of plant communities along a 14km stretch of the coastline and 43 km^2 of inland plains, mountains, and riverbanks (July to August 2013). The coastal surveys also assessed biodiversity (i.e. birds and amphibians). Species diversity and point counts of birds were used as indicators of habitat quality. In addition, geographic and meteorological data, slope, dominant land use categories and soil characteristics were recorded.[27]

Field surveys also identified locations of infrastructure exposed to river flooding. Exposed areas were defined as those located within 50 m from the coast or within 25 m of a major river/ water channel. In total, 135 buildings were identified as directly exposed to coastal flooding, while another 245 buildings were identified as exposed to river flooding (**MAP 4**).



MAP 4. Location of exposed buildings to river flooding (within 25 m of water channels) and coastal flooding (within 50 m of the coastline)

Reef Check and SAH also developed a technical planning and feasibility study (**FIGURE 9**) for coastal restoration, which recommended hybrid measures such as re-vegetation along the shore and riverbanks, zoning of near shore waters and certain engineered infrastructure (e.g. sand nourishment, breakwater, drainage system, etc.) to increase protection of the Port Salut coast from disasters. The revegetation plan recommended planting native species to stabilize the banks of rivers starting from the river-mouths (**FIGURE 10**).

FIGURE 9. Proposed zoning scheme for Port Salut waters and vicinity, developed by Reef Check

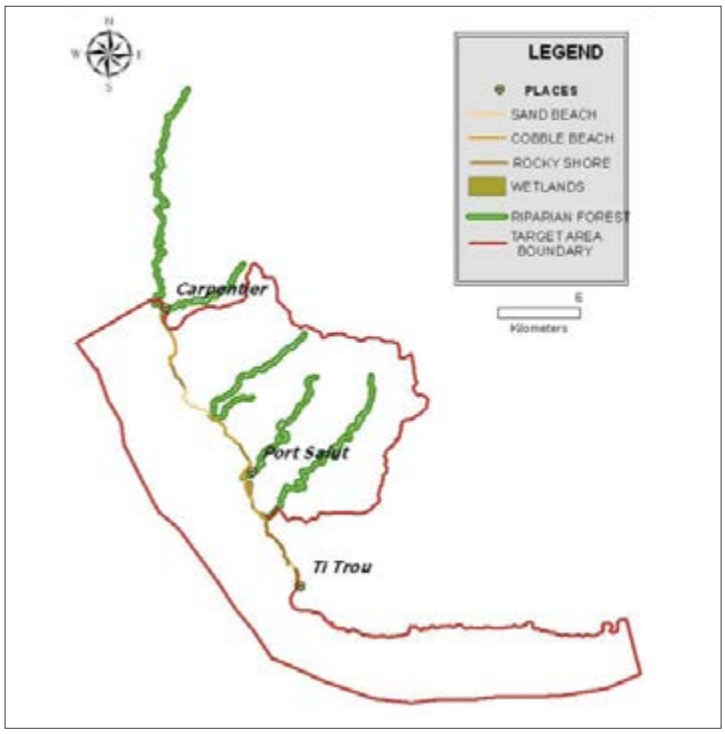


FIGURE 10. Riverbank revegetation plan

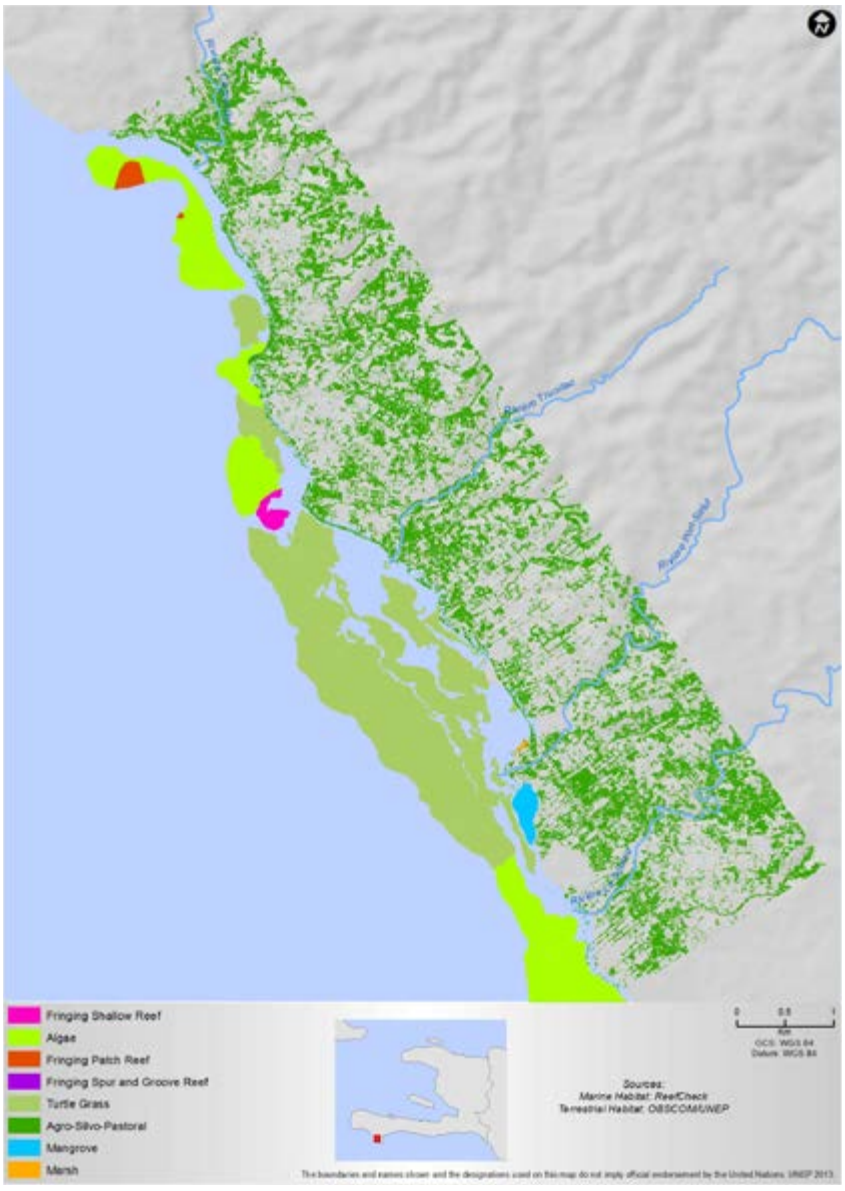
GIS MAPPING AND MODELLING

An initial map of ecosystems and land use types was developed by applying remote sensing on a World View 2 (2011)[xii] satellite image of Port Salut, which was later improved using field survey findings (**MAP 5**). Given that vegetation types of the shoreline (i.e. on beaches, rocky shores and riparian areas) are highly influenced by agroforestry and silvopasture - as determined by field surveys – major habitat/land use types were categorized as:

1. **AGROFORESTRY AND SILVOPASTURE (INCLUDING SECONDARY FOREST),**
2. **MANGROVE,**
3. **COASTAL MARSH,**
4. **CORAL REEF,**
5. **ALGAE,**
6. **SEAGRASS**

A map of coastal geomorphology (i.e. shoreline types) was also developed. The final maps were used as input into the InVEST Coastal Vulnerability model (**BOX 4**, following page).

[xii] *0.5 m panchromatic / 4 m multispectral resolutions*



MAP 5 . Port Salut ecosystem map developed based on remote sensing and ground-truthed through marine and terrestrial field surveys

BOX 4. APPLYING INVEST COASTAL VULNERABILITY MODEL TO ASSESS COASTAL EXPOSURE UNDER DIFFERENT ECOSYSTEM MANAGEMENT SCENARIOS[xiii]

The InVEST (Integrated Valuation of Environmental Services and Tradeoffs)[xiv] Coastal Vulnerability (CV) model (version 2.6) was applied in Port Salut, in order to identify areas exposed to coastal flooding and storm surges and areas where habitats have the greatest potential to protect coastal communities against these hazards.[xv] Designed by The Natural Capital Project, InVEST is an open source toolset of spatial, scenario driven models with relatively low data requirements,[28] which can provide evidence-based information about how changes in ecosystems and land use influence the flow of ecosystem services to people.[29] It includes models to evaluate regulating ecosystem services that contribute to disaster risk reduction.

The model was selected because of its two main advantages compared to other similar tools: **1)** it takes into account both the geophysical and ecological characteristics of the area in measuring coastal exposure, and **2)** it has relatively low data requirements and is therefore suitable for data-poor countries. It assumes that "*more ecosystem*" means "*more protection from storm impacts*" and therefore "*less exposure to storm surge and inundation*".[30] Transient ecosystems such as seagrass beds were considered less effective in attenuating wave energy than fixed and stiff ecosystems such as coral reefs and coastal vegetation.

The goal of the modelling exercise was to identify areas that are highly exposed to coastal hazards, assessing the exposure of each segment (measuring 50 x 50 m) to coastal hazards relative to other segments in the coastline. In addition, exposure was compared under different ecosystem management scenarios to assess the impact of ecosystem management options on coastal exposure in Port Salut:

1) ***Without Ecosystems*** scenario assumes all existing ecosystems are completely degraded, and therefore do not provide protection to the coastal zone; and

2) ***Restored Ecosystems*** scenario assumes all ecosystems are restored to their pristine state and fulfil their full potential in protecting the coastal zone.

Scenarios were not intended to be precise reflections. Instead, the objective was to evaluate where and to what extent ecosystems can play a significant role in protecting the Port Salut community.

HIGHLIGHTS OF RESULTS:

Under current ecosystem conditions in Port Salut, 56% of the coastline is highly exposed to coastal hazards, while 29% is at medium and 15% is at low exposure level. The sandy beaches are the most exposed, while the rocky shores appear to be the least exposed. Densely populated areas, the market and the bridges that connect southern and northern areas of Port Salut are located in some of the most highly exposed areas (**FIGURE 11**).

[xiii] *For a more detailed write up of the InVEST study, see: Bayani N, Barthelemy Y (2016) Integrating Ecosystems in Risk Assessments: Lessons from Applying InVEST Models in Data-Deficient Countries. In: F. Renaud et al. (eds.), Ecosystem-Based Disaster Risk Reduction and Adaptation in Practice, Advances in Natural and Technological Hazards Research 42, Springer International Publishing Switzerland.*

[xiv] *InVEST is available for download at www.naturalcapitalproject.org*

[xv] *It should be noted that while InVEST CV model calculates exposure to coastal flooding and storm surges, it does not measure inland flooding from storm water*

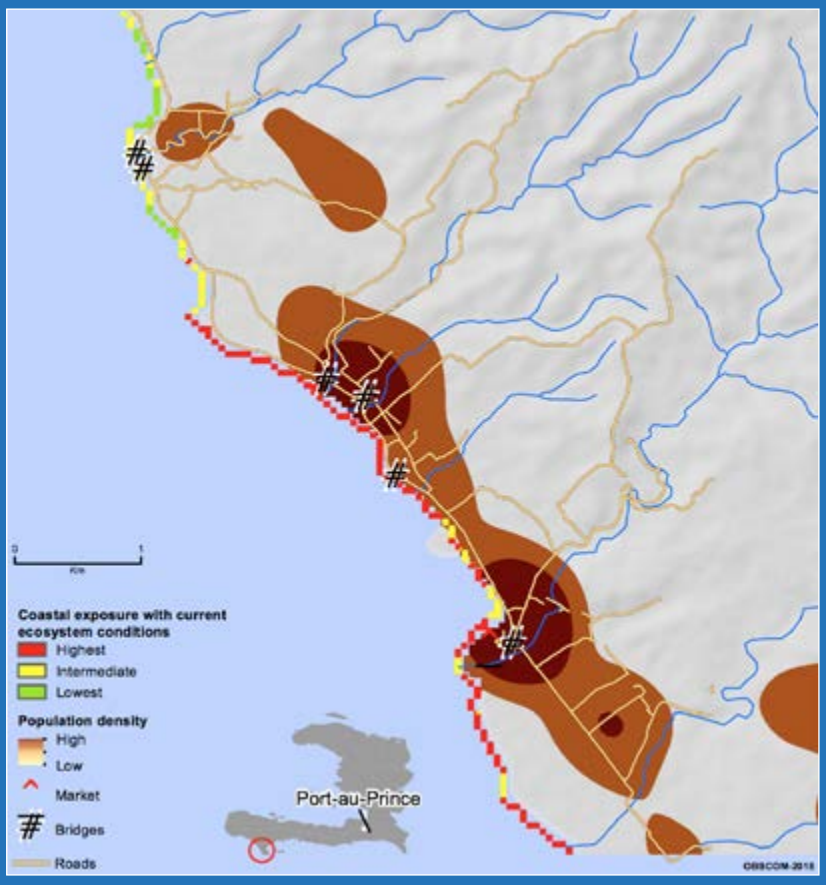


FIGURE 11. Population and infrastructure exposed (population density is based on interpolation from a house-counting study produced by UNDP on a 2010 aerial image)

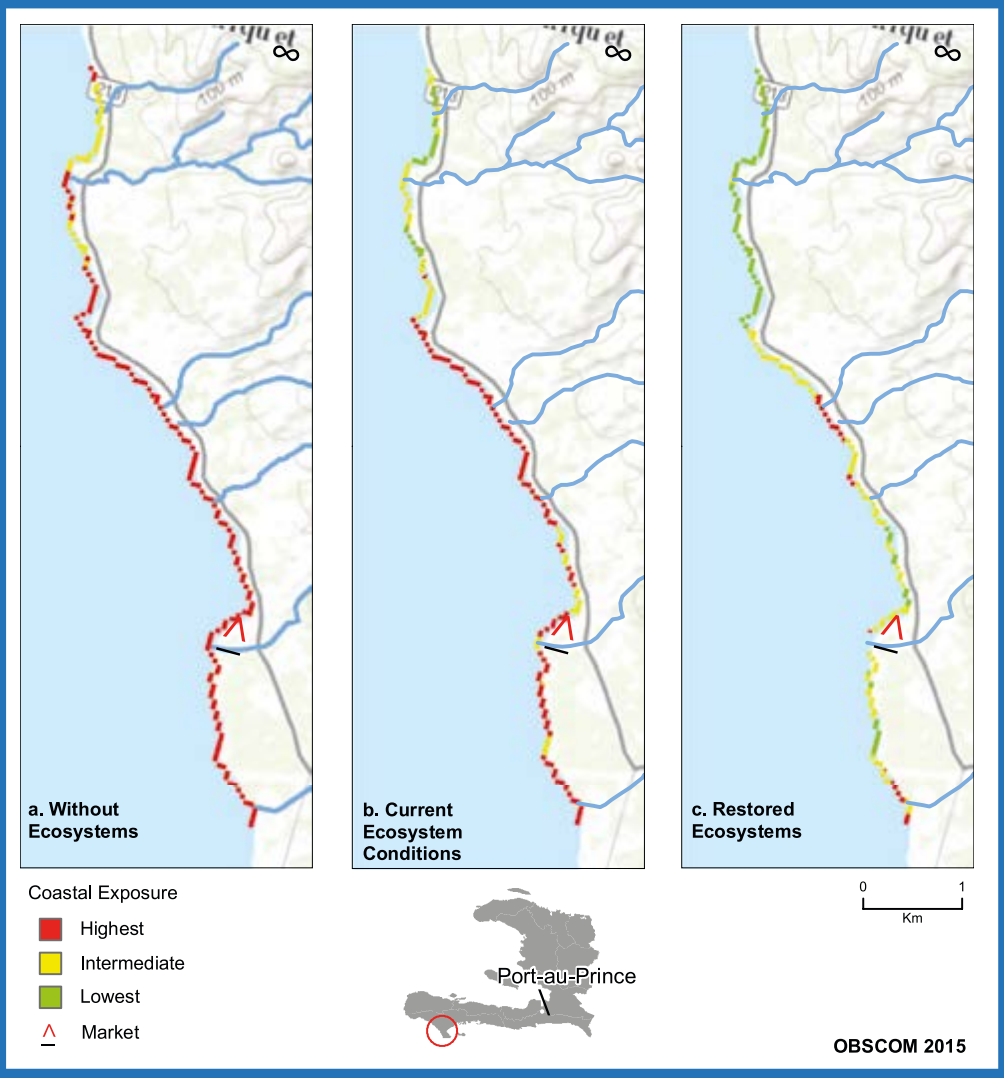


FIGURE 12. Coastal exposure on Port Salut Municipality under three ecosystem management scenarios
(Source: Background Map from ESRI)

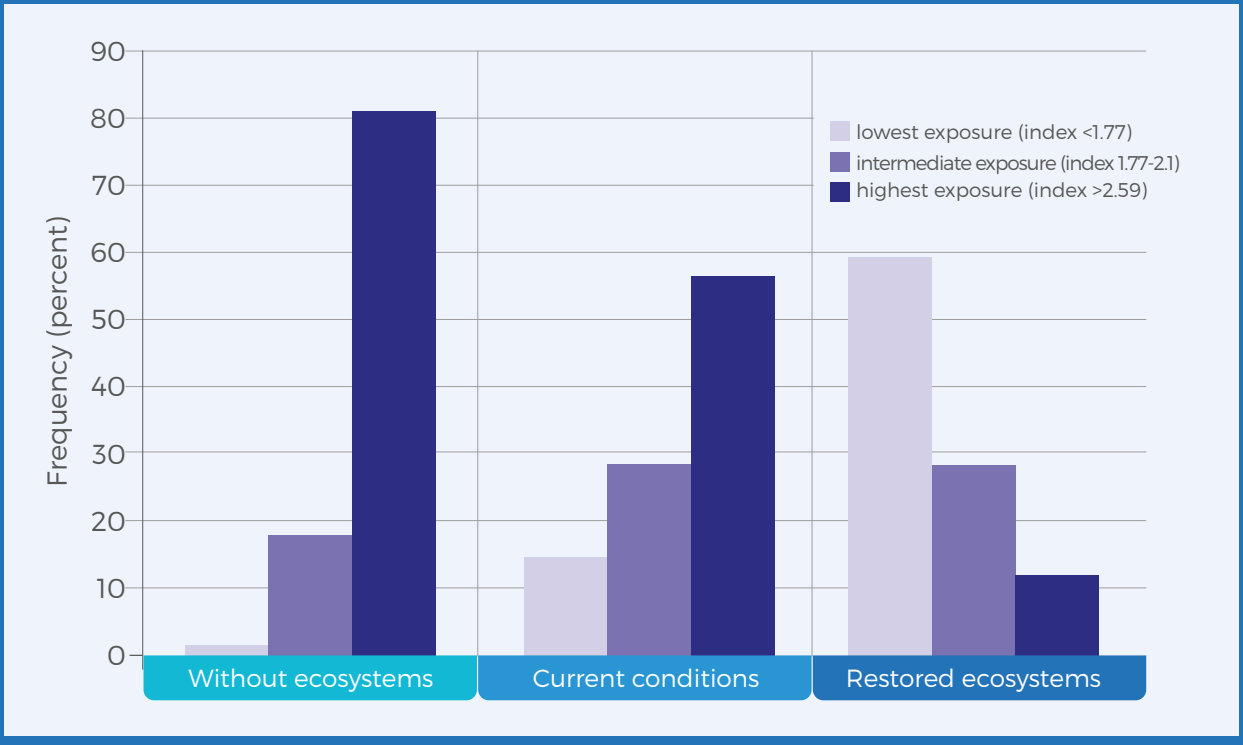
Under the ***Without Ecosystems*** scenario, the entire coastline will experience higher exposure: 81% of shoreline segments will fall in the highest exposure category, in contrast to only 1% in the lowest category (**FIGURE 12**). The centre of town falls into the high exposure category. Under the ***Ecosystem Restoration*** scenario, the entire coastline will experience lower exposure than under current conditions. The areas of lowest exposure increase to 59%, while the areas of highest exposure drop to 12%. Reduced exposure is especially significant at the popular sandy beaches of Port Salut.

Results of InVEST Coastal Vulnerability model indicate that exposure to coastal hazards varies across the shoreline, depending on the type and health status of ecosystems that front the shore as well as the type of shoreline (e.g. sandy beach, rocky shore), topography, location in relation to the direction of winds and waves. The findings are in line with observed patterns of exposure. For instance, areas that are identified by the model as highly exposed to coastal hazards at present were in fact some of the areas that were most impacted by Hurricane Sandy in 2012.

The results also point to the importance of protecting and rehabilitating ecosystems that mitigate hazards, so that they can in turn protect the community. The findings suggest that the ecosystems which play the most important role in disaster risk reduction in Port Salut are mangroves, the marshland near the Port Salut Market and the shallow fringing coral reef fronting the sandy beach, and therefore warrant greater conservation efforts of the remaining habitats.

It should be noted that the ecosystems, especially in their current degradation levels, might not guarantee full protection of the community from coastal hazards, and other disaster management measures are needed, including early warning and preparedness as well as engineered measures (e.g. breakwaters). Rather than prescribing the best decision, the model is mainly used to highlight the trade-offs and potential outcomes of different ecosystem management decisions.[31] While not comprehensive, the InVEST results were considered a first assessment of coastal exposure and shed light on the mitigation role of ecosystems in Port Salut.

FIGURE 13. Exposure of the segments of the shoreline under different ecosystem management scenarios



3.1.2. STRENGTHENING THE SUSTAINABLE VETIVER COOPERATIVE

As discussed in **SECTION 2**, vetiver production is an important source of income to farmers. However, farmers apply unsustainable harvesting practices, which result in significant soil erosion and poor vetiver oil yields.

UNEP supported an ongoing initiative by the Natural Resources Stewardship Circle (NRSC), [xvi] and in close collaboration with Ayitika,[xvii] to transform the vetiver industry in Haiti into a sustainable and fair process throughout the vetiver value chain. NRSC has developed technical specifications for sustainable vetiver cultivation in Haiti [32], which have been applied and tested by six cooperatives with approximately 600 members across Haiti.

The project provided targeted technical assistance to farmers and supported COVEPA (*la cooperative des producteurs de vétiver de Port-Salut et d'Arniquet)*, a newly-formed cooperative of small-scale farmers in Flavette, in the uplands of Port Salut, to promote sustainable vetiver production.

[xvi] *NRSC is a global network of leaders from the aroma, perfume, cosmetic and hygienic products industry, which promotes good practices and responsible sourcing of vetiver material.*

[xvii] *Ayitika is a non-governmental organization in Haiti with extensive experience in sustainable vetiver cultivation.*

Members of COPVEPA, the first vetiver cooperative in Port Salut.

COOPERATIVE MEMBER CARRYING HARVESTED VETIVER ROOTS

When UNEP partnered with NRSC, COPVEPA was in the initial phase of structuring its members. NRSC had facilitated agreements between vetiver farmers and oil producers in order to start sustainable vetiver cultivation for oil production. A female manager had just been recruited and had started geo-referencing the land parcels of members.

The project equipped the office of the cooperative to improve administration capacity, enabling COPVEPA to store and manage archives (e.g. records, contracts, accounts etc.). The office was built within the structure of the existing storage area for harvested vetiver roots. In addition, a small solar-power system was installed in the office to ensure energy independence.

The office of the COPVEPA cooperative and storage area of 260 m², to shelter harvested vetiver roots and protect them from rain.

ESTABLISHING SUSTAINABLE VETIVER CULTIVATION PARCELS

The project supported and trained 25 landowners (50% of whom were women) to establish sustainable vetiver cultivation plots, covering an area of 6.5 hectares. Soil conservation and management techniques were applied to reduce soil erosion, which consequently will increase vetiver oil sustainability in the long run. The project also reached out to 129 people in consultations and awareness raising on sustainable vetiver farming.

Land preparation for sustainable vetiver cultivation involved six steps: calculating the slope, delineating contour lines (i.e. staking), creating digs (25 – 40 cm deep), establishing ramps with straw and sowing digs with vetiver and other soil stabilizing plants. Permanent hedges of vetiver or a mix of species were also established as an anti-erosion measure, allowing for better filtration of rainwater and reduced soil runoff. Farmers have agreed to avoid harvesting roots from the hedges - so the plots are not left bare - and to replant the hedges after four years. In addition to the cooperative farmers, more than 100 individuals from the community participated in the land preparation, which provided temporary employment to the community.

Creating digs as part of land preparation for soil management on sustainable vetiver farms

MAP 6. Map of land parcels participating in the sustainable vetiver cultivation. Neighbouring parcels were used to allow cultivation of staple crops and use for pasture in between parcels to adapt sustainable vetiver cultivation to local practices.

Prior to implementing interventions, meetings took place with members of the community to present the initiative, explain the general methodology and better adapt the methodology to local agricultural practices of producers. For instance, these meetings highlighted the importance of cultivating multiple crops on the same plot and undertaking crop rotation. Farmers mostly preferred to cultivate vetiver on one part of the parcel and staple crops and cereals (e.g. sorghum, corn, pigeon peas etc.) on other parts, or a combination of vetiver and other crops in neighbouring plots, while also leaving some room for pasture (**MAP 6**). In the first two years of project implementation, 55% of the plots were under full vetiver cultivation, while 26% have vetiver and sorghum, 10% pasture and 8% sorghum.

Cooperative members agreed to follow six sustainability criteria identified by NRSC as part of the certification system established for the vetiver cooperative. To sell roots with a certificate of traceability of sustainable production, farmers are required to respect the following criteria:

1. Harvest during the dry season to reduce soil erosion;
2. Harvest roots after a minimum of 12 months in the ground;
3. Thorough cleaning of roots to remove dirt before sale;
4. Stocking harvested roots in the stocking area to keep them dry;
5. Avoiding slash and burn agricultural methods;
6. Implementing anti-erosion measures and ensuring the preservation of soil fertility.

The cooperative administration is in charge of ensuring proper compliance by landowners with regards to soil management and vetiver cultivation.

Sustainable vetiver farms before (left) and after (right) terracing

Farmers harvesting vetiver roots

Vetiver roots are stored in the cooperative's root stocking area before sale

3.1.3. ESTABLISHING A NURSERY TO PRODUCE COASTAL, FOREST AND FRUIT TREES

A tree nursery was established to grow coastal, forest and fruit tree species and supply seedlings for re-vegetation activities. In partnership with the South Department Directorate of the Ministry of Environment (MDE) in Port Salut, the nursery was set up in Carpentier (northern section of Port Salut) with a surface area of 198 m^2 and the capacity to produce 137,000 seedlings. The MDE provided the land for the nursery. Twelve community members (5 women and 7 men) were involved in nursery development and maintenance. While the coastal species grown, such as mangroves, are salt tolerant, they can be grown in non-saline environments as long as the seedlings are also planted in fresh/brackish water environments with limited exchange of sea water, such as river mouths.

The nursery produced seedlings by June 2014. Three species of mangroves (*Avicennia germinans, Rhizophora mangle* and *Laguncularia racemoa*), and sea grape trees (*Cocoloba uvifera*) were produced for replanting on river mouths and some on the shoreline. Other species such as soursop (*Annona muricata*), avocado (*Persea americana*), Spanish/Cuban cedar (*Cedrela odorata*) and West Indies mahogany (*Swietenia mahogany*) were produced for river-bank re-enforcement to reduce erosion and sedimentation. In total 114,000 fruit and forestry trees and 23,000 mangrove and seagrape trees were produced.

In the first year, the survival rate of the nursery was 68.61% (**TABLE 1**). Due to delays in contract signature with the MDE, the establishment of the nurseries had been delayed. The trees therefore grew in the nurseries during part of the wet season, with some seedlings already over-grown by the time they were replanted.

Port Salut nursery, growing coastal, forest and fruit tree species

TABLE 1. Breakdown of seedlings produced in the Carpentier nursery and number of seedlings transplanted on community and private land for the period January 2014 - June 2015

English name	French name	Scientific name	Nursery		Transplanted seedlings	Location of transplantation	
			Number of seedlings planted	Number of seedlings that survived		Public land	Private property
West Indies Mahogany	Acajou Indigene	*Swietenia mahogani*	**46,000**	30,000	26,800	5,800	21,000
Spanish/ Cuban cedar	Cedre	*Cedrela odorata*	**28,000**	17,500	17,500	5,500	12,000
Bamboo	Bambou	*Bambusa sp.*	**2,300**	1,500	1,500	0	1,500
Cassia / Kassod	Cassia	*Cassia siamea*	**12,200**	11,350	11,350	2,150	9,200
Guacimo	Bois d'ormes	*Guazuma ulmifolia*	**3,000**	2,470	2,462	1,150	1,312
Custard apple	Cachiman	*Annona reticulata*	**16,500**	8,370	8,250	2,350	5,900
Avocado	Avocatier	*Persea americana*	**1000**	843	843	0	843
Sour sop	Corossolier	*Annona muricata*	**3,000**	2,850	2,550	2,100	450
Coconut	Cocotier	*Cocos nucifera*	**2000**	1,860	1,860	0	1,860
Sea grape	Raisin de mer	*Cocoloba uvifera*	**20,000**	15,000	15,000	15000	0
Red mangrove	Manglier rouge	*Rhizophora mangle*	**3,000**	2,250	2,250	2250	0
Total			**137,000**	**93,993**	**90,365**	**36,300**	**54,065**
Percentage				**68.61%**	**96.14%**	**40.17%**	**59.83%**

3.1.4. RESTORING NATURAL BUFFERS AROUND RIVER BANKS

Once the seedlings in the nursery had grown, the MDE started re-vegetation and reforestation following the guidelines of a re-vegetation plan produced by the Audubon Society of Haiti. The replantation area comprised of 54,065 fruit and forest trees planted on and around riverbanks to reduce soil and riverbank erosion. A total of 25,380 seedlings were provided to private landowners who owned land around the riverbanks of Carpentier river, while the rest were planted on public land.

Through numerous meetings, 150 private landowners who were interested in rehabilitating their land were identified as beneficiaries. Given the close proximity of many land parcels, neighbouring landowners grouped together. A total of 33 landowner groups were formed, which coordinated tree planting amongst themselves. Seedlings were distributed to landowners and planted, covering an area of 137 ha on and around riverbanks. In addition, landowners were trained in re-vegetation techniques.

The MDE signed an agreement with the landowners on the long-term management of seedlings. A monitoring process was developed to provide landowners with in-situ technical assistance and ensure that seedlings are transplanted using appropriate techniques. Selected land parcels were measured and geo-referenced to allow for systematic monitoring by the MDE of planted seedlings. Regular monitoring by MDE has confirmed a survival rate of 75% of fruit and forest trees planted on private land.

3.1.5. RESTORING NATURAL BUFFERS ON THE SHORELINE

Mangroves, seagrape seedlings as well as bamboo and other forest tree species produced in the nursery were planted on the shoreline and river mouths to reduce the impacts of storm surge and flood risk. A total of 36,300 seedlings were planted on 0.66 ha of river-mouths of Carpentier, Trouillac and Port Salut rivers (see example in **FIGURE 14**), and on 3.2 ha of the shoreline.

The Ministry of Environment contracted FODEP *(Fédération d'Organisations pour le Développement de Port Salut)*, which groups together community-based organizations around the three rivers of Carpentier, Trouillac and Port Salut to implement coastal revegetation activities. FODEP was in charge of transplanting seedlings from the nursery to different sites, as well as monitoring reforested sites. Fifty community members, including 35 women took part in activities, while 10 local elected officials also provided support and took part in planting activities and meetings.

FIGURE 14. Revegetation plan of the river-mouth of Trouillac River

Seagrape seedlings planted on the beach near Carpentier River

Before and after mangrove planting along the Trouillac River

In August 2014, monitoring of activities by technicians of the MDE revealed a low survival rate of planted seedlings on the shoreline and the river-mouths. Only 57% of coastal species had survived. Subsequently, a number of field visits took place to identify the reasons for low survival rate and necessary steps to establish adaptive management and improved practices in the future.

The main reasons for the low survival rate were identified as unfavourable planting season, inadequate planting skills, as well as human and animal disturbance. Planted areas were damaged by allowing free grazing of goats, burning of solid waste on the shore, as well as trampling by children in certain areas. In addition, the Eco-DRR project was the first experience of the MDE and the community in planting coastal tree species, which requires different techniques than ornamental trees, which they have usually planted.

It was therefore deemed vital to raise awareness in order to catalyse more protection by the community of the planted seedlings along the shoreline. A number of rectification actions were undertaken. UNEP partnered with the Botanical Gardens of Les Cayes to strengthen capacities for implementing coastal reforestation activities.[xviii] Training seminars and field visits were provided to over 150 individuals including staff of the MDE, the Ministry of Agriculture, nursery managers and NGOs. The training covered: **1)** the importance of native coastal species for disaster risk reduction and **2)** specific know-how for 5-7 native tree species, i.e. where/when to collect the seeds, how to manage the nursery and where/how/when to plant the seedlings.

The training catalysed additional efforts by the MDE to reinforce the re-vegetation activities on the coastal zone. The MDE independently carried out replanting of mangroves in areas where the survival rate was low, using seedlings from the nursery. In total, 2,500 seagrape and 900 red mangrove seedlings were planted along Carpentier and Touillac rivers and river mouths to replace dead seedlings. The result has been successful, and the new seedlings have been growing well.

The Botanical Gardens of Les Cayes ran an awareness-raising campaign in parallel, using brochures, posters, door-to-door visits to over 200 residents, restaurant owners and hotels, as well as the production and broadcasting of a television program on the topic.

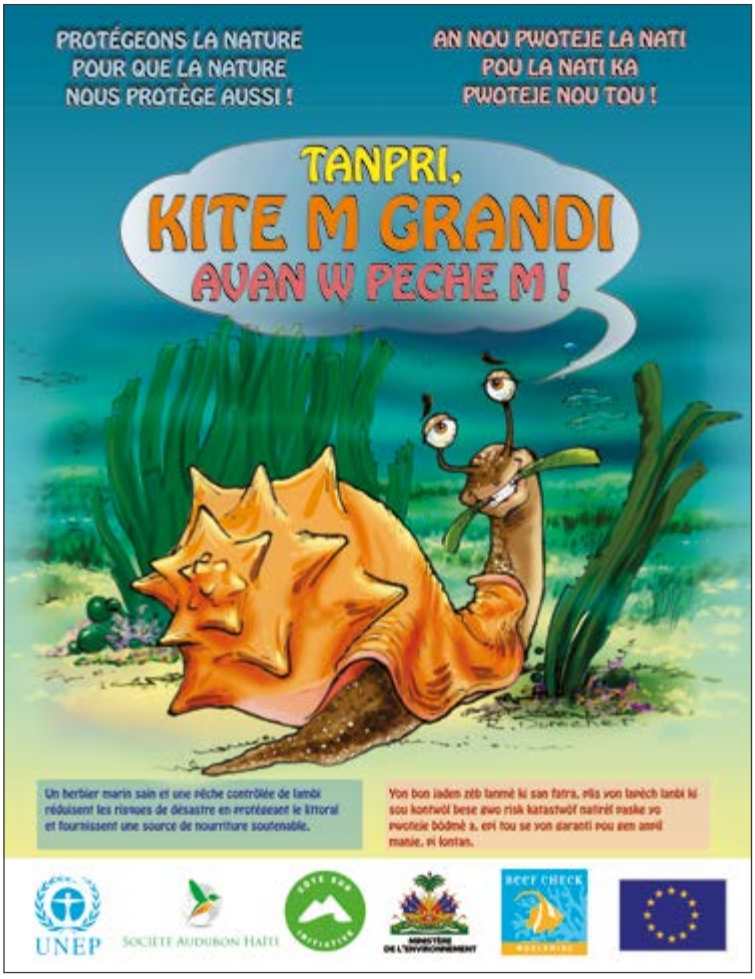
In addition, three environmental education events were held targeting school children, giving them practical experience of planting coastal tree species on the shoreline. A children's drawing competition was also organized. Winners were awarded during the World Environment Day in 2014, and their drawings were reproduced on t-shirts for wider distribution to other students. Environmental education events were also held targeting cattle owners around rivers, in order to reduce grazing in newly-planted areas close to the shore and raise their awareness of the importance of mangroves for coastal protection and fish habitat.

[xviii] The Botanical Garden of Les Cayes is a Haitian non-profit scientific organization that aims to promote plant conservation through its ecological gardens and conservatory of native and endemic plants, scientific research, and education.

Seminar on the role of native tree species in coastal protection against hazards

Training on coastal re-vegetation for resilience and disaster risk reduction included field visits

Children gain exposure to tree planting on the shoreline at an awareness-raising event on the importance of coastal vegetation



Posters with Eco-DRR messages in French and Créole were installed on the beach

3.1.6. SUSTAINABLE AND RESILIENT FISHERIES

To support sustainable coastal livelihoods and increase disaster resilience of the fisheries sector in Port Salut, UNEP partnered with PADI (La Plateforme pour l'Amélioration de la Pêche Artisanale et du Développement Intégré), a Haitian non-profit organization that aims to support associations of fishers and fish traders in the country. In addition, Government partners, in particular, the South Department Division of the Ministry of Agriculture, Natural Resources and Rural Development (MARNDR/DSS) and the South Department Committee for Risk and Disaster Management (CDS_GRD) were closely involved in the activities.

Through the Eco-DRR project, PADI and UNEP strengthened the capacity of the Fishers Association of Port Salut (AMPPOS) - the first and only fishers association in Port Salut with 50 members - as well as the fishermen's groups in Pointe Sable and Carpentier neighbourhoods. A number of focus group consultations were held with fishers to introduce the project, identify the main issues and select the most useful interventions.

A participatory action plan for the fishing community was developed involving 51 women and men from the fishing association, private sector, Ministry of Agriculture and Civil Protection Directorate (DPC), PADI and UNEP in the process. Consultations with the UN Food and Agriculture Organization (FAO) were also conducted. The action plan focused on the needs, priorities and solutions to develop sustainable and disaster resilient fisheries in Port Salut.

Fishermen identified the improvement of their fishing vessels as a key priority to increase fish catch and reduce fishing pressures in sensitive areas especially on the shore. The project provided trainings to fishermen on boat rehabilitation, to move away from using fragile boats made of one tree log and make larger, stronger boats available. Fishermen rehabilitated 10 sailboats, and another 15 boats were equipped with new sails. The fishers association was also equipped with two speedboat engines (Yamaha – 15 horsepower) to use for search and rescue (e.g. in the event of a hurricane). To ensure proper maintenance of the speedboat engines, training sessions were delivered to fishermen. During these sessions, five existing engines were also repaired and are now in use.

Sailboats and engines were repaired during training workshops, providing fishermen with sturdier boats and enabling them to fish further out to sea and reduce nearshore fishing

Click above (or visit http://bit.ly/2coBg3L) to view a video on the Eco-DRR project activities that supported sustainable and resilient fishing in Port Salut.

Repaired boats in use by the fishers association

Hands-on training on security at sea

An early warning system was developed in a participatory manner with the fishers' association and the DPC, including for instance, establishing a phone messaging system and identifying focal points within the community for communications and disaster response. AMPPOS has therefore been much more proactive in responding to early warnings of storms and undertaking preparations for potential disasters, compared with fishermen who are not formally organized. The tailor-made early warning system in Port Salut has also been connected to the regional early warning system of DPC in the South Department to improve information-sharing regarding potential disasters.

Safe shelters for fishing material were also identified within the community to reduce damage and loss of equipment during storms and hurricanes. Three shelters were designated, and collaboration protocols were signed between the fishers' association and the owners who volunteered to provide shelter. These shelters are strategically located to ensure easy access for fishing vessels.

Finally, with seed funding from UNEP equivalent to US$2,500 (100,000 Haitian gourds), a revolving fund for disaster insurance in case of loss or damage was established for its members and is managed by AMPPOS. This fund is distributed to fishers in case of a disaster and can be used for lost or damaged material, injuries or death or during periods of low fish catch, once a post-disaster assessment is undertaken by the Agricultural Department Directorate of South and AMPPOS. The association has agreed on a number of criteria for distributing the funds to affected fishermen, including damage to homes and loss of fishing gear.

In order to ensure a revolving fund, the association has set up a cash reimbursement system as part of its regulations. In order to repay use of the emergency fund, each crew of fishermen must give a fixed amount of 100 gourdes (US$2.5) shared among three to four fishermen for every exit to the sea, until the amount of money withdrawn from the emergency fund is replaced. The fund is functional and has already been accessed a number of times to replace lost gear during a storm, as well as to repair fishing gear and boat equipment.

PADI and AMPPOS members have also discussed sustainable fishing practices, reflecting on good and bad fishing practices. Association members also deliver key messages on sustainable fishing to other fishermen outside the fishing association.

Project activities to support sustainable and resilient fisheries will be continued through follow up projects of UNEP with FAO, which intend to bolster long-term investment in fisheries, increase incentives for joining fishers' associations, create alternative livelihoods for fishers and provide additional training in sustainable fisheries.

KONSÈY POU PWOTEKSYON PECHÈ

Nan sezon siklòn

Avan siklòn nan

* Rale tout materyèl nou genyen nan lanmè a tankou (kannòt, Nas, liy elatriye) mete yo sou tè yon kote lanmè a pa ka rive tankou:
  - Pou zòn Ranp, mete yo nan ansyen lokal MINUSTAH a;
  - Pou Kapantye, se nan lakou kay Denis Sinal la;
* Bay Komite Pwoteksyon Sivil Pòsali a bon jan enfòmasyon sou tout pechè ki ale nan fon lanmè ki poko retounen.
  - Kapantye se lakay Denis Sinal; Tel: 3613-8839
  - Pwent Sab se lakay Jean Mari Gauthier; Tel: 3721-4790
  - Nan Ranp se nan lokal AMPPOS la bò baz MINUSTAH a. Tel: 3613-5702
* Rete kè kal tande Radyo Fratènite ki nan Pòsali sou frekans 93.3 F.M epi enfòme lòt pechè yo sou ki jan tan ap ye.
* Chak pechè dwe gen nimewo lòt pou youn ka di lòt ki jan sa ye bò lakay yo.
* Lis non pechè yo nou kapab al pran yo nan lokal AMPPOS bò MINUSTAH oubyen rele nan nimewo sa pou yo kite lis la pou ou 3613-5702

Pandan siklòn nan

* Rete kè kal epi kontinye koute Radyo Fratènite ki nan Pòsali
* Si dlo sou wout pou anvayi nou pran fanmi nou epi ale:
  - Nan Sal Pawasyal ki anfas komisarya Pòsali a pou pechè ki rete nan Ranp la
  - Nan Lokal LEGLiZ DE DYE ki devan gran wout la pou pechè ki Kapantye yo
  - Nan LEKOL NASYONAL Pwent Sab la pou pechè ki Pwent Sab yo

Aprè siklòn nan

* Pa kouri al nan lanmè a
* Rete tann lanmèa fin kalme avan nou retounen al peche
* Tann Mo dòd AMPPOS kap pale ak Kominote Kominal Pwoteksyon Sivil Pòsali a avan nou pran lanmè
* Si gen pechè ki pèdi materyèl AMPPOS pral Mennen yon ankèt pou yo kapab evalye sa ki pèdi a
* Si gen nan pechè yo ki pèdi materiel AMPPOS ap gade sa ki plis viktim yo
* Sa ka pran youn ak 2 semen aprè siklòn nan fin pase avan pou pechè yo retounen al nan lanmè a

UNEP

A poster of activities to be undertaken by the fishers association before, during and after a cyclone

3.2. STRENGTHENING LOCAL AND NATIONAL CAPACITIES FOR ECO-DRR

The project invested significantly in strengthening local and national capacities for implementing Eco-DRR to achieve ridge-to-reef sustainable coastal zone management. As this was UNEP's first experience in applying the Eco-DRR approach in Haiti, it was critically important to progressively develop and strengthen capacities over time (**TABLE 2**). Also discussed in **SECTION 3.1**, capacity building activities included:

- **AWARENESS-RAISING;**
- **TRAININGS AND WORKSHOPS;**
- **HANDS-ON LEARNING ACTIVITIES IN THE FIELD DEMONSTRATION SITES;**
- **SUPPORTING IMPROVED MUNICIPAL COORDINATION;**
- **FIELD VISITS AND STUDY TOURS WITH GOVERNMENT AND OTHER PARTNERS.**

TABLE 2. Local and national level trainings and workshops delivered by the project

Types of trainings or workshops delivered	Implementing partner/s	Target audience	Number of trainings/ workshops and duration	Number of participants
Sustainable vetiver production	UNEP and Botanical Gardens of Les Cayes	Ministry of Environment, Ministry of Agriculture, community members involved in nursery management, local NGOs	4 (1 day each)	150
Coastal nursery development and management	MDE	Local residents, children	3 (1 day each)	250
Coastal revegetation	MDE	Cattle owners around rivers	3 (1 day each)	28
Awareness raising event on Eco-DRR and coastal revegetation	PADI	AMPPOS	3 (1 day each)	15
Awareness raising on mangroves for coastal protection and food security	PADI	AMPPOS	1 (four days)	30
Boat maintenance and repair	UNEP	Municipality of Port Salut, NGOs and other members of Municipal Coordination Roundtable	2 (1 day each)	33
Security at sea and rescue	Ministry of Environment, Ministry of Interior and Territorial Communities (Civil Protection Directorate), UNEP, PEDRR, UNU, IUCN CEM, Audubon Society of Haiti, UNDP	5 government institutions (Ministry of Environment, Ministry of Interior, Ministry of Planning and External Cooperation, Maritime and Navigation Service of Haiti, Inter-ministerial Committee for Land Use Planning), 2 national universities (Université de Quisqueya, State University of Haiti), civil society (PADI), and UN agencies (e.g. OCHA, FAO)	1 (two days)	39

3.2.1. DEVELOPING LOCAL CAPACITIES FOR ECO-DRR

The project focused on re-enforcing the capacities of local community-based organizations, such as the vetiver cooperative and the fishers association, as well as capacities of the Municipal Government, to implement Eco-DRR concepts into practice. It is important to note that the focus of capacity building was to improve practices of actors on the ground. As a result, capacity building mainly took place in the field, as part of "learning-by-doing" and implementation of the field interventions (discussed in **SECTION 3.1**).

The trainings provided tangible outputs, for instance strengthening of the vetiver cooperative and fishers' association, rehabilitation of boats, establishment of locally-managed early warning and preparedness systems, which could be sustained long after the project's lifespan. In particular, the capacity built within the MDE on coastal re-vegetation and nursery management will be instrumental for supporting reef-to-ridge ecosystem restoration in the future.

STRENGTHENING COASTAL GOVERNANCE AT THE MUNICIPAL LEVEL

The project aimed to increase understanding, participation and ownership of the Municipal Government of Eco-DRR interventions, and enhance capacities for sustainable coastal zone management. Through close engagement with the local authorities, a Municipal Coordination Roundtable (Table de Concertation Communale) was established under the leadership of the Mayor's office, to provide a platform for bringing together different development actors in the area and support integrated development planning.

UNEP delivered a training to Municipal Government staff and civil society organizations in Port Salut on participatory governance, with an emphasis on leadership and stakeholder conflict management. The training aimed to provide the management skills necessary for maintaining a coordination role under the Municipal Government. Thirty-three representatives from civil society and local government agencies participated in the training. The coordination roundtable has met several times and offers a valuable platform for civil society organizations to engage in local decision making.

In parallel, the project supported the Municipal Government of Port Salut to take on a more active role in the management of the coastal zone, and raise its profile as a visible development actor. Activities included community campaigns managed by the Municipal Government to remove solid waste from rivers, drainage canals, the shoreline and the beach, through cash-for-work schemes carried out in Port Salut beach, the fish market and the city centre in 2014 and 2015.

Meeting of the Municipal Coordination Roundtable

Support for municipal public works through community campaigns on waste removal along rivers (before and after)

3.2.2. DEVELOPING NATIONAL CAPACITIES FOR ECO-DRR

At the national level, capacity building efforts were directed at raising national awareness of the importance of the ridge-to-reef approach to disaster risk reduction and need for sustainable coastal zone management. The project organized Haiti's first national training on Eco-DRR, which promoted cross-sectoral integration and mainstreaming of Eco-DRR in coastal management planning processes and protected area management.

Organized in collaboration with the Ministry of Environment, and the Ministry of Interior and Territorial Communities/DPC, and the United Nations University (UNU) as a member of the Partnership for Environment and Disaster Risk Reduction (PEDRR), the two-day training workshop introduced Eco-DRR concepts within the framework of an integrated coastal zone management (ICZM). The training brought together 39 participants from five Government institutions (Ministry of Environment, Ministry of Interior, Ministry of Planning and External Cooperation, Maritime and Navigation Service of Haiti, Inter-ministerial Committee for Land Use Planning), two national universities (Université de Quisqueya, State University of Haiti), civil society (PADI), and UN agencies (e.g. Office for the Coordination of Humanitarian Affairs (OCHA), and FAO.

The project's success in raising national awareness on Eco-DRR was evidenced when the Government of Haiti took the initiative to promote Eco-DRR in various global fora. For instance, at the World Parks Congress held in Sydney, Australia, in November 2014, the national delegation from Haiti, represented by the Ministry of Environment, delivered two presentations on the country's recent marine protected area system and its linkages with increasing coastal resilience and disaster risk reduction. When delivering its formal statement, the Government of Haiti again emphasized the importance of marine protected areas in Haiti as important mechanisms for achieving disaster risk reduction, climate change adaptation and resilient livelihoods.[xix]

The Government of Haiti also promoted Eco-DRR at the Third World Conference on Disaster Risk Reduction, which was held in Sendai, Japan, in March 2015. The delegation was led by the Ministry of Interior and Territorial Communities, and supported by the Ministry of Environment. Through an official statement and at the high-level plenary session on Ecosystem Management and Resilience, the Haitian delegation promoted the integration of Eco-DRR in the post-2015 global framework on DRR, now the Sendai Framework for Disaster Risk Reduction (2015-203).[xx] These messages delivered by the Government of Haiti at both the World Park Congress and Sendai Conference reflect the increased national interest in implementing Eco-DRR measures through marine protected areas.

[xix] *Eco-DRR had the support from a number of countries, including Haiti, and was reflected in the "Promise of Sydney", the outcome document that emerged from the 2014 World Parks Congress.*

[xx] *The Haitian delegation at the Sendai Conference stated that:* ***"The driving force of this declaration is that Marine Protected Areas can be a new tool for disaster risk reduction in Haiti. This rationale flows from the increased recognition by Haiti that healthy marine and coastal ecosystems are key for disaster risk reduction, sustainable livelihoods promotion and diversification as well as climate change adaptation."***

National training on Integrated Coastal Zone Management and Eco-DRR

The Ministry of Environment presented on the role of marine protected areas for disaster risk reduction at the 2014 World Parks Congress

3.3. SUPPORTING NATIONAL ADVOCACY ON ECO-DRR THROUGH MARINE PROTECTED AREAS

Recognizing the importance of coastal zone management for long-term sustainable and resilient development in Haiti, the project promoted Eco-DRR as part of broader efforts to strengthen coastal governance in the country. Before 2013, despite being an island state, Haiti was the only Caribbean country without Marine Protected Areas (MPA). While the Eco-DRR project was being conceptualized, discussions had already started around the declaration of the first marine protected areas in Haiti.

UNEP both leveraged on the initial discussions and supported the Government of Haiti to finalize the designation of marine protected areas in Haiti, and provided technical assistance to the Government to draft the MPA declaration. The Eco-DRR project supported the case for the declaration of Port Salut as one of the MPAs, by making baseline data available on the diversity and status of coastal and marine ecosystems in the area and emphasizing the multiple benefits of protecting these ecosystems, in particular for disaster risk reduction.

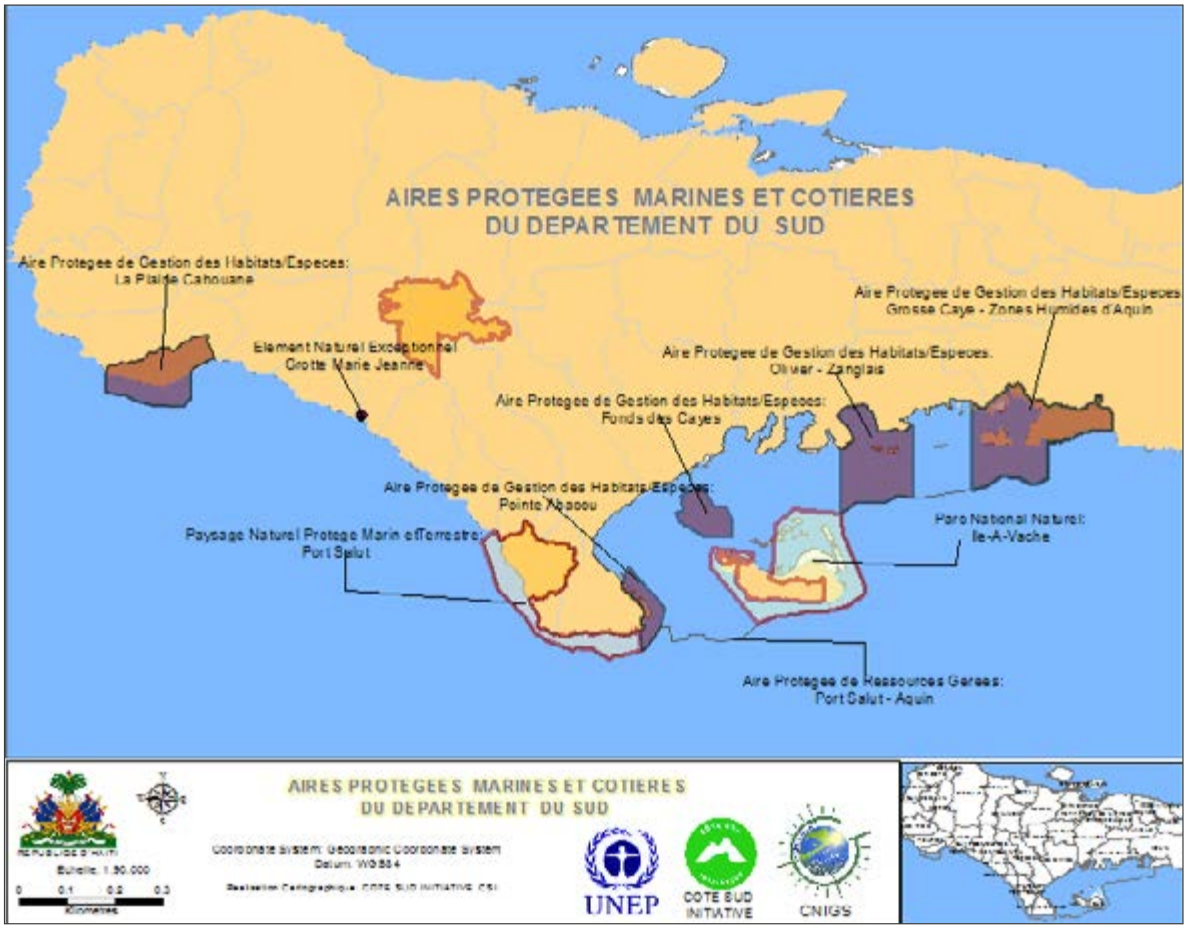
In 2013 the Government of Haiti declared the country's first nine marine protected areas (**MAP 7**) – including the coastal zone of Port Salut - with the objective to "maintain biodiversity, while responding to the needs of the communities that depend on these natural systems".[33] The protected area of managed resources of Port Salut/Aquin now covers 87,422 hectares of the coastal zone of Port Salut Municipality (**MAP 8**). At the local level, the declaration of Port Salut as a marine protected area presents an opportunity for protecting and restoring ecosystems for multiple benefits to the local community and for supporting the growing tourism industry. For the first time, the designation provides a legal framework within which a multi-objective coastal zoning process can be established to reduce coastal risks within the wider framework of integrated coastal zone management.

UNEP will continue to support the Government of Haiti in the establishment of the MPA and developing a management plan which integrates disaster risk considerations. The Eco-DRR experience will be integrated into the management of the Port Salut marine protected area, which could serve as a model for MPA planning and management in the country.

UNEP has also worked closely with the Inter-ministerial Committee for Land-use Planning (CIAT) on the declaration of MPAs, and the development of a regional sustainable development plan for the South Department. The Eco-DRR and other UNEP projects are feeding into this master plan and therefore supporting the scale-up of the Eco-DRR approach at the departmental level in Haiti.

UNEP also continues to support the Ministry of Environment in implementing the Territorial Planning Strategy (2012), which aims to ensure that multiple objectives by different interest groups (e.g. fishermen, tourism operators) are met and integrate environmental considerations. In addition, UNEP is supporting the Ministry of Tourism in better managing the Port Salut beach and promoting sustainable tourism, in collaboration with the Municipality, with the aim of projecting Port Salut as a model for other beaches of Haiti. A restoration plan for Pointe Sable beach, which was developed with the project's support, is now under Government consideration.

MAP 7. In 2013 the Government of Haiti declared the country's first marine protected areas



MAP 8. Port Salut/Aquin Marine Protected Area

4 HOW DID THE PROJECT CONTRIBUTE TO DISASTER RISK REDUCTION?

Planting mangrove seedlings in Port Salut

2014 © UNEP/Marc Lee Steed

As discussed in **SECTION 1**, disaster risk is understood as a composite of three main elements that must be present: hazard, exposure (i.e. people or assets located in hazardous locations), and vulnerability (i.e. the range of factors – social, physical, economic, environmental, cultural, political/ institutional, etc. – that shape how hazards affect or impact on people and communities) (see **BOX 1**). Through a ridge-to-reef approach, the Eco-DRR project aimed to influence all three components of the disaster risk equation in Port Salut: mitigating hazards and reducing exposure and vulnerability.

It is important to highlight that field demonstrations were undertaken at small scale, covering only a very limited geographic area. The intention was not to provide evidence of reducing the impacts of hazards (floods, storms/hurricanes), which would require field interventions at a much larger geographic scale and maintenance over a much longer time period that is beyond the scope and timeframe of this project. Rather, the project demonstrated how Eco-DRR measures could be implemented in practice and reduce disaster risk in a coastal area. It applied well-known Eco-DRR measures that have been proven effective in other field research and in the scientific literature to influence disaster risk. It showed "proof of concept" through field demonstrations, awareness-raising, capacity building and strengthening of national policy and planning processes.

4.1. MITIGATING HAZARDS

In order to mitigate hazards, in particular flooding linked to severe soil erosion and river sedimentation in Port Salut, the project promoted two key measures: sustainable vetiver cultivation and reforestation. Improved agricultural practices in vetiver cultivation, including soil conservation and management, were established through the vetiver farmers' cooperative. Reforestation was carried out around the banks of Carpentier River. These measures aimed to reduce soil erosion and river sedimentation originating from the uplands, which contributed to inland flooding downstream. These activities also helped to reduce sedimentation run-off on nearshore coastal and marine ecosystems (e.g. coral reefs and seagrass beds), thereby addressing an important source of their degradation.

4.2. REDUCING EXPOSURE

The project also reduced people's exposure to coastal hazards, in particular storm surges and coastal flooding, by undertaking several measures, namely:

- **Baseline assessments and modelling to inform coastal zone planning:**

The project carried out GIS modelling using InVEST to identify areas of the shoreline that are relatively more exposed to coastal hazards, and highlight those coastal and marine ecosystems that play a role in protecting the shoreline and people of Port Salut from coastal hazards. This information will feed into the development of the Port Salut/ Aquin MPA management plan which will inform future land-use planning.

- **Coastal re-vegetation to establish natural buffers against hazard impacts:**

The project planted native coastal vegetation that are adapted to shoreline conditions, such as mangroves and seagrape trees, along the beach and three river-mouths where coastal flooding is exacerbated by high river flows during storms. Coastal vegetation serve as natural barriers that can buffer against storm surges and strong winds, hence providing added protection to residences and public infrastructure including markets and merchandise of vendors. In addition, they provide stabilizing root structures that help mitigate beach erosion, which exacerbates the coastal impacts of storm surges, hurricanes and accelerated sea level rise.

- **Reduced nearshore fishing pressures to protect coastal and marine ecosystems as natural buffers:**

The project also promoted offshore fishing (e.g. through improved fishing vessels) in order to reduce nearshore fishing pressures and degradation of coastal and marine ecosystems (coral reefs, seagrass beds), in order to maintain natural protective buffers against coastal hazards.

- **Establishing a locally-managed early warning and disaster preparedness system:**

The project worked with fishermen and the fishers' cooperative to establish a locally-managed early warning system to prepare for storms and

hurricanes. The local early warning system is connected to the regional early warning system in the South Department, thus strengthening disaster communications and information sharing between the Department and Port Salut. Security training at sea was also carried out, including first aid, search and rescue. In addition, the project also helped fishermen identify safe shelters for their fishing gear and vessels, in order to reduce their exposure and the potential losses of vital, livelihood assets.

4.3. REDUCING LOCAL VULNERABILITIES

The project reduced local vulnerabilities to disasters and climate change impacts, by especially targeting highly vulnerable groups, namely fishermen, female fish vendors and vetiver farmers. Key measures included:

- **Strengthening the fishers' cooperative (AMPPOS) to promote sustainable and resilient fisheries:**

The project promoted sustainable fishing practices and enabled fishermen to catch larger fish by accessing offshore waters, and thus potentially earning higher incomes. Activities included awareness-raising of sustainable fishing techniques, skills training for boat construction and rehabilitation, and improved fishing vessels, thus also strengthening AMPPOS as a formal organization. The project established a revolving insurance fund managed by the fishers' association as an economic safety net against disasters. The fund is functional and has already been used multiple times by cooperative members. By supporting sustainable fisheries, the project also supported the livelihoods of female fish vendors who are highly dependent on the daily fish catch.

- **Strengthening the vetiver farmers' cooperative (COPVEPA) to promote sustainable vetiver cultivation:**

Given that vetiver production is an important source of income for farmers, the project supported cooperative farmers to practice more sustainable vetiver cultivation practices that are aimed to improve vetiver quality and yields, in addition to reducing soil erosion. It further addressed farm-to-market challenges, by establishing sustainability criteria within the cooperative that match the demands of vetiver oil distillers (buyers) looking for high quality, sustainably produced vetiver.

- **Strengthening municipal-level coastal zone planning**

The project facilitated the establishment of a municipal coordination roundtable, which for the first time provided a platform for bringing together local government officials as well as civil society to discuss issues related to coastal zone management and governance, for instance risk-informed land-use planning to reduce construction (e.g. homes, hotels, restaurants, public markets) in highly exposed areas on the shore and thus reduce potential losses of economic assets.

The roundtable helped raise local awareness about the importance of integrated planning for sustainable and disaster resilient coastal zone management. As a result, the Municipal Government was able to take a more active role in facilitating dialogue as well as conducting community awareness campaigns (e.g. removing solid waste from the beaches).

- **Raising national awareness and informing national policy and planning:**

The project supported the first national training on Eco-DRR with a focus on integrated coastal zone management and raised national awareness of strengthening disaster resilience in coastal areas. National dialogue on Eco-DRR has contributed towards the establishment of Haiti's first nine marine protected areas, including in Port Salut, which for the first time will provide a coastal and marine governance framework. Establishment of the MPAs is strongly premised on sustainable livelihoods promotion, disaster risk reduction and climate change adaptation.

UNEP in Haiti will continue to support the Government in developing the MPA management plan which integrates disaster and climate risk considerations. UNEP is also supporting the Government to promote the Eco-DRR approach in other planning processes, including the development of a regional sustainable development plan for the South Department and implementation of the National Territorial Planning Strategy (2012).

5 LESSONS LEARNED

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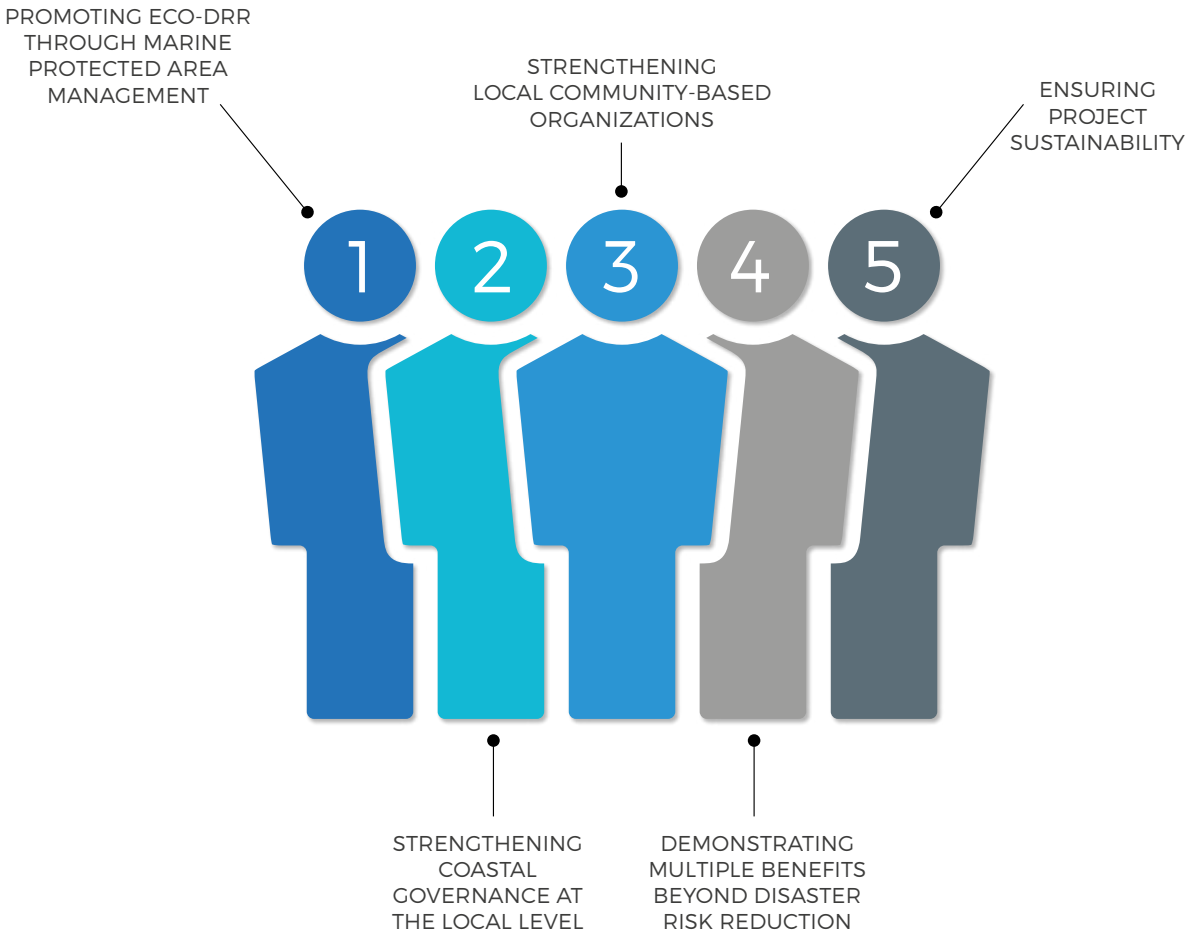
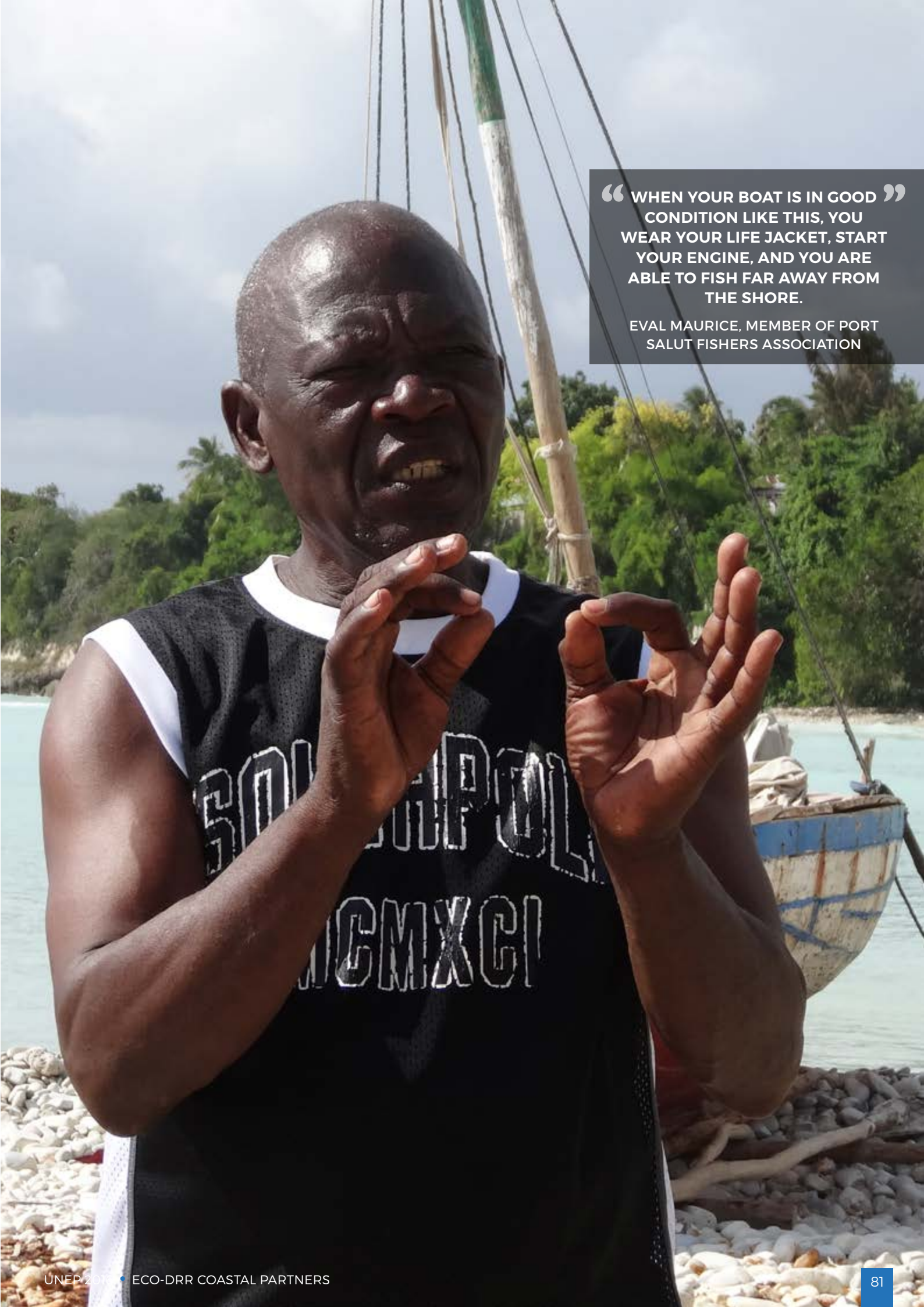
This final section reflects on the main lessons learned from our project, in order to inform design, implementation, replicability and sustainability of similar Eco-DRR approaches and initiatives in Haiti but also globally. The project clearly demonstrated that the Eco-DRR concept and approach can be applied through a ridge-to-reef approach in coastal areas of Haiti. Several factors, however, need to be considered to support project implementation, maximize results and outcomes and ensure sustainability.

LESSONS LEARNED





> **“WHEN YOUR BOAT IS IN GOOD CONDITION LIKE THIS, YOU WEAR YOUR LIFE JACKET, START YOUR ENGINE, AND YOU ARE ABLE TO FISH FAR AWAY FROM THE SHORE.”**
>
> EVAL MAURICE, MEMBER OF PORT SALUT FISHERS ASSOCIATION

PROMOTING ECO-DRR THROUGH MARINE PROTECTED AREA MANAGEMENT

The pilot project in Port Salut demonstrated how Eco-DRR could be implemented in practice in a coastal zone in Haiti. Project activities also served as an entry point to promote Eco-DRR within the framework of marine protected area management and coastal governance at the national level and raise national awareness of coastal and marine issues, including disaster and climate risks. The success of these efforts was evidenced when the Government of Haiti brought its key messages to various international fora, such as the World Parks Congress (2014) and the Sendai Conference (2015), with a clear priority on sustainable ecosystem management for building disaster resilience. Formal statements delivered by the Haitian delegation focused on establishing protected areas not only for protecting marine and coastal ecosystems, but also for reducing disaster risk (discussed in **SECTION 3.3)**.

UNEP will continue to assist the Government in the development of management plans of four MPAs through other projects supported by the Government of Norway, Global Environment Facility (GEF) and the Inter-American Development Bank (IDB) in 2016-2017. The coastal re-vegetation plan developed by SAH through the Eco-DRR project is currently feeding into the MPA management plan of Port Salut. UNEP will further promote the development of a network of MPAs in Haiti, which would also allow Eco-DRR approaches to be scaled up to a larger, ecologically significant scale.

STRENGTHENING COASTAL GOVERNANCE AT THE LOCAL LEVEL

The project aimed to strengthen local governance for integrated coastal zone management. However, early on, the project team recognized the challenges of doing so, given the very limited technical capacities and resources within Municipal Governments in Haiti in general. Hence, the project focused on introducing participatory dialogues between local government authorities and other stakeholders in Port Salut, through the establishment of the Municipal Coordination Roundtable. As discussed in **SECTION 3.2**, this process benefited especially civil society organizations which gained a more direct access and involvement in municipal planning and decision-making. It also enabled the Municipal Government to take on a more visible role in coastal zone management, for instance through community awareness-raising events (e.g. World Environment Day, cash-for-work schemes to remove solid waste from beaches).

However, more sustained capacity development support will be needed over the long-term to fully capacitate the Municipal Government. Local authorities have limited abilities to take decisions, or the capacity to deliver on their mandate, due to small budgets and lack of skilled staff. In addition, Government staff, including within the Municipal Government, are often absent and face high turnovers, making it difficult to anchor training efforts and build long-lasting capacity within local government institutions. Nonetheless, the initial efforts to strengthen the Municipal Government could be leveraged by future initiatives. For instance, the Ministry of Interior currently has plans to strengthen capacities in public relations/ communications and urban planning of eight Municipalities in the South Department, including Port Salut.

One lesson learned from the project was to work closely with the more permanent, technical Municipal Government staff and strengthen their capacities and ownership of the project. In addition, UNEP built partnerships and agreements with different Government entities, such as the Ministry of Environment, Ministry of Agriculture, the Inter-ministerial Committee for Land-use Planning (CIAT) and Ministry of Tourism, to manage local political instability and lack of continuity.

STRENGTHENING LOCAL COMMUNITY-BASED ORGANIZATIONS

The Eco-DRR project invested in strengthening community-based organizations of vetiver farmers and fishers as a key mechanism for delivering and implementing project activities. This approach is particularly effective in Haiti, given that it addresses a key vulnerability of vetiver farmers and fishers, who typically have limited incomes and meagre assets to increase their capital. By working through the COPVEPA and AMPPOS, the project enabled vetiver farmers and fishers to pool limited resources together, collectively enhance their production potential as well as manage shared risks. For instance, the project supported AMPPOS to improve fishing boats and to establish safety measures and a revolving insurance fund for fishers and their families. Through COPVEPA, the project is enabling vetiver farmers to improve their harvests through better farming practices and proper storage. Vetiver farmers have also become more formally organized, enabling them to gain higher market prices through collective bargaining and the certification/traceability of vetiver (discussed further in **SECTION 5.4**).

There is clear community demand for strengthened local cooperatives. For instance, COPVEPA currently has 40 members, with another 30 who are now in process of joining. Approximately half of the farmers' cooperative are women (55%), including the manager of the cooperative. Hence, it also provides an important vehicle for women to benefit from sustainable vetiver cultivation.

However, these community-based organizations still require sustained capacity development support. In the case of the COPVEPA, which still experiences challenges in leadership and effective decision-making, UNEP and the NRSC will continue to provide capacity support through other funded projects. For example, UNEP is implementing two projects financed by the Government of Norway and GEF, which will focus on expanding sustainable vetiver production, strengthening the cooperative and supporting alternative income sources to farmers (e.g. through agro-forestry).

DEMONSTRATING MULTIPLE BENEFITS BEYOND DISASTER RISK REDUCTION

The Eco-DRR interventions in Port Salut were designed to deliver multiple livelihood benefits in addition to disaster risk reduction.

For instance, investing in sustainable vetiver cultivation can provide higher incomes to vetiver farmers of COPVEPA. More sustainable farming practices that conserve the soil will help produce higher quality vetiver. Some vetiver oil distillers are willing to pay up to 15% higher premiums to cooperatives on purchased vetiver for a number of reasons: cooperatives ensure high quality vetiver roots, cleaner roots, and faster delivery to the distillery due to collective production.

However, given the short timeframe of the project, the clear economic benefits from the Eco-DRR measures are not yet fully demonstrable. For instance, impacts of sustainable vetiver cultivation such as restored soils and higher incomes will only be clearly visible after 4-5 years of continued activities. The design for measuring soil erosion reduction from managed and non-managed parcels is being developed by UNEP with the idea to put in place the soil monitoring devices and corresponding protocols through a next intervention phase.

Monitoring of vetiver sales and direct farmer incomes is also being established through COPVEPA, funded through other UNEP projects. The economic benefits of the cooperative will be monitored by comparing revenues of farmers before and after membership in the cooperative. The Eco-DRR project had earlier supported an economic baseline survey of vetiver farmers, which showed that the average annual revenue from each land parcel of vetiver is 5,134 gourdes (US$ 98 in 2015), and that mixed cultivations of vetiver and sorghum provide the highest revenue. This information will be used to compare the increase/decrease of farmer incomes from sustainable vetiver cultivation and sales. The economic survey is expected to be updated on a yearly basis and continued over the next 3-4 years. The manager of the cooperative is responsible for undertaking annual monitoring, under the supervision of Ayitika SA.

UNEP is also planning to measure the economic benefits of promoting sustainable fisheries to fishermen and female fish vendors. The Ministry of Agriculture together with the FAO will undertake a fishery survey in Port Salut to assess incomes of fishermen within the new protected area. Using this survey, UNEP's follow up projects will be able to compare catches between nearshore fishing methods and offshore fishing which was promoted by the Eco-DRR project.

ENSURING PROJECT SUSTAINABILITY

The project clearly demonstrated that Eco-DRR can be successfully applied in coastal areas to achieve inter-linked goals of ecosystem rehabilitation, sustainable livelihoods and disaster and climate risk reduction. As a result, the project received a high level ownership among local residents as well as local and national government authorities. Despite the various challenges of implementing project activities, there are reasons to be optimistic that the initial "seeds" planted by the project will continue to thrive and even expand.

Awareness-raising activities have stimulated national attention and investments in coastal zone management projects in the South Department. For instance, UNEP environmental advisory services are being requested to guide a US$ 15 million investment by the Ministry of Agriculture and Inter-American Development Bank (IDB) in the fisheries sector in Southern Haiti. The approach carried out through the Eco-DRR project for resilient fisheries will be integrated into this investment plan. In addition, the Ministry of Tourism has pledged that 50% of its US$ 36 million investment project for tourism infrastructure will be allocated to environmentally beneficial measures. In particular, funding will be allocated towards Port Salut's beach restoration, which is key for enhancing economic resilience and natural buffers against disasters.

The field interventions of the Eco-DRR project will be expanded by UNEP through secured funding from the Government of Norway and GEF, within the framework of MPA establishment. In this context, the project has successfully served as a stepping-stone for potentially larger-scale activities.

For instance, UNEP is establishing three other nurseries in the South Department, which are specialized for coastal and riverbank restoration. There is also interest from the IDB and other development actors to replicate and scale-up nursery establishment and coastal revegetation with native species.

Through the Eco-DRR project, the Government and local communities are now better equipped to undertake coastal re-vegetation and ecosystem rehabilitation activities. The nursery with native coastal tree species remains functional and under management of the MDE, and will be able to support future rehabilitation activities. MDE and local community residents have also gained valuable experience in best planting practices to ensure higher survival rates. The MDE on their own has already carried out additional mangrove planting along the coast.

UNEP will also continue efforts that strengthen local governance. In collaboration with FAO, UNEP will provide capacity building to the newly-established MPA Management Unit in the South Department, under the Ministry of Environment. In addition, both UN entities will promote an ecosystem-based approach to fisheries and strengthen fisheries management, targeting the Fisheries Management Unit of the Ministry of Agriculture.

MAXIMILIEN PARDO

UNEP COUNTRY
PROGRAMME COORDINATOR

"This Eco-DRR project was about "making connections": Connecting hills to reefs; connecting increased understanding to improved environmental practices; connecting protected area management to disaster risk reduction. In essence, the approach aimed to "plant Eco-DRR seeds" within local communities in Port Salut and seek cross-fertilization with other ongoing projects, programmes and policy frameworks at national and global levels."

6 ACRONYMS, ABBREVIATIONS AND REFERENCES

Follow-up work by UNEP and partners will expand sustainable fisheries management in Port Salut in order to reduce pressures on nearshore coastal ecosystems and support more resilient livelihoods.

ANNEX 1. ACRONYMS AND ABBREVIATIONS

AFD	French Development Agency *(Agence Française de Développement)*
AMPPOS	Marine Fishers Association of Port Salut *(Association des Marins Pêcheurs de Port Salut)*
CCA	Climate Change Adaptation
CDS_GRD	South Department Committee for Risk and Disaster Management *(Comité Départemental Sud pour la gestion des risques et Désastres)*
CIAT	Inter-ministerial Committee for Land-use Planning *(Comité Interministériel d'Aménagement du Territoire)*
cm	Centimetres
COPVEPA	Cooperative of Vetiver Producers of Port Salut and Arniquet *(Coopérative des producteurs de vétiver de Port Salut et d'Arniquet)*
CRED	Centre for Research on the Epidemiology of Disasters
CSI	Côte Sud Initiative
CV	Coastal Vulnerability
DPC	Civil Protection Directorate *(Direction de la protection civile)*
DRC	Democratic Republic of the Congo
DRR	Disaster Risk Reduction
EbA	Ecosystem-based Adaptation
EC	The European Commission
Eco-DRR	Ecosystem-based Disaster Risk Reduction
FAO	Food and Agriculture Organisation of the United Nations
FFEM	French Fund for the Global Environment *(Fonds Français pour l'Environnement Mondial)*
FODEP	Fédération d'Organisations pour le Développement de Port Salut
GEF	Global Environment Facility
GIS	Geographical Information Systems
GPS	Global Positioning System
ha	Hectares
IDB	Inter-American Development Bank
ICZM	Integrated Coastal Zone Management
IPCC	Intergovernmental Panel on Climate Change
IUCN/CEM	International Union for Conservation of Nature/Commission on Ecosystem Management
InVEST	Integrated Valuation of Ecosystem Services and Tradeoffs
JBC	Botanical Garden of Les Cayes *(Jardin Botanique des Cayes)*
km/h	Kilometres per hour
m	Metre
MARNDR /DSS	South Department Division of the Ministry of Agriculture, Natural Resources and Rural Development *(Ministère de l'Agriculture des Ressources Naturelles et du Développement Rural)*
MDE	Ministry of Environment of Haiti *(Ministère de l'environnement)*
MICT	Ministry of Interior and Territorial Communities *(Ministère de l'Intérieur et des Collectivités Territoriales)*
mm	Millimetre
MPA	Marine Protected Areas
MPC	Ministry of Planning and External Cooperation *(Le Ministère de la Planification et de la Coopération Externe)*
NGO	Non-Governmental Organisation
NRSC	Natural Resources Stewardship Circle
OCHA	United Nations Office for the Coordination of Humanitarian Affairs
OFDA	Office of U.S. Foreign Disaster Assistance
PADI	Platform for Improving Artisanal Fisheries and Integrated Development *(La Plate-forme pour l'amélioration de la pêche artisanale et du développement intégré)*
PEDRR	Partnership for Environment and Disaster Risk Reduction
SAH	Audubon Society of Haiti
SPGRD	Permanent Secretariat of Risk and Disaster Management
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNISDR	United Nations Office for Disaster Risk Reduction
UNU	United Nations University
USD	United States Dollar

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