ADAPTATION FUND

DATE OF RECEIPT:
ADAPTATION FUND PROJECT ID:
(For Adaptation Fund Board Secretariat Use Only)

PROJECT/PROGRAMME PROPOSAL

PART I: PROJECT/PROGRAMME INFORMATION

PROJECT/PROGRAMME CATEGORY:	REGULAR PROJECT (CONCEPT)
COUNTRY/IES:	CUBA
TITLE OF PROJECT/PROGRAMME:	Reduction of vulnerability to coastal flooding through ecosystem-based adaptation in the south of Artemisa and Mayabeque provinces
TYPE OF IMPLEMENTING ENTITY:	MIE
IMPLEMENTING ENTITY:	United Nations Development Programme
EXECUTING ENTITY/IES:	CITMA-MINAGRI
AMOUNT OF FINANCING REQUESTED:	US$6,067,320 (in U.S Dollars Equivalent)

PROJECT / PROGRAMME BACKGROUND AND CONTEXT:

Summary Overview

The proposed project seeks to reduce the vulnerability of communities in coastal areas of Artemisa and Mayabeque provinces in southern Cuba from climate change (CC) related phenomena including coastal erosion, flooding and saltwater intrusion. Under different IPCC scenarios and levels of climate sensitivity, sea levels in Cuba are expected to rise by between 0.22m and 0.85m by the year 2100, with an annual acceleration in SLR rates of 0.01mm. Cuba lies in one of the most active parts of the Atlantic/Caribbean hurricane region: hurricanes and cold fronts are among the principal causes of destructive flooding along the whole length of the Cuban coastline, giving rise to strong winds and high energy waves which can lead to significant levels of flooding. Given its long and narrow configuration, Cuba has a particularly high ratio of coastline to overall surface area and, as a consequence, a large proportion of the national population is vulnerable to such CC-related threats.

Mangroves cover a total area of 5647 km^2 nationwide, equivalent to 5.1% of the total area of the country. They have suffered high levels of degradation and elimination in many areas. Human impacts on mangroves include their direct elimination and the modification of the hydrological regimes on which they depend (elimination or reduction of water flows, and the reduction of freshwater and nutrient inputs and consequent increases in salinity which can prove lethal). They play a vital protective role against the effects of sea level rise and storm surges, by protecting coastal ecosystems, settlements and agricultural land further inland against wave impacts, and stabilizing coastlines which are otherwise receding at rates of up to several metres per year.

The project will focus specifically on an 84km long stretch of coastline, covering 27,500ha, in the western provinces of Artemisa and Mayabeque. This coastline is comprised of a large coastal wetland area based on clay and terrestrial deposits, dominated by mangroves (with a total area of 634km^2), into which numerous rivers, estuaries and coastal lagoons drain. This is one of the

most vulnerable in the country to tropical storms and hurricanes, and associated storm surges. It is particularly to subject to the problem of saline intrusion into its subterranean aquifers, which are vital for the irrigation of the coastal plains, which are some of the most productive agricultural in the country, and as a source of drinking water for the city of Havana. The narrowness of this area (which in places is little more than 30km in width) means that is susceptible in almost its entirety to CC-related impacts. Some of the highest levels of beach erosion in the country have occurred in this area, and the mangroves of the area also have some of the lowest health indices in the western region of the country.

Mangroves in this area have been heavily impacted in the past by the extraction of timber and poles, and by infrastructural works such as the construction of drainage channels, a 50km long retention wall and a coastal road. There is clear evidence that those parts of the coast with intact mangrove forests have been less affected by CC-related phenomena than those that have undergone significant anthropogenic modification, due largely to the role of mangroves in retaining sediment and buffering wave impact. Furthermore, benthic environments in coastal waters are generally less degraded in the areas where the seaward belt of red mangrove is intact. The project is designed to enhance the ability of ecosystems to supply this buffering function. The project will focus in particular on restoring and rehabilitating the areas, covering a total of 7,318ha, which have suffered severest degradation and which constitute flooding hotspots. This will serve to enhance the functionality of the landscape as a whole, stretching along 134km of coastline and covering a total of 27,500ha.

Cuba has a well-developed institutional framework, well-organized communities at local level, and excellent technical capacities for research into coastal ecology and the development of corresponding strategies for the management of coastal ecosystems. However the following barriers impede the effective implementation of EBA:

1. **EBA is not factored into adaptation measures:** responses to CC impacts have until now focused principally on structural and behavioural adaptation rather than EBA, due in large part to limited access, among institutions operating at field level to knowledge and to technical and logistical resources.

2. **CC is not factored into coastal zone development:** the planning and management of productive activities in the coastal zone has been governed by narrow and sector-specific visions which have failed to consider the longer term benefits and cost-effectiveness of avoiding damage to ecosystems which have potential to provide EBA services. This is compounded by the limited levels of awareness that exist in local communities regarding climate change and EBA.

3. **Cost benefit calculus for EBA:** there is limited appreciation by decision-makers at different levels of the precise nature and magnitude of the costs and benefits of EBA, compared to the alternatives, and of human activities that contribute to the degradation of these ecosystem services and reduce climate change resilience.

The project's objective will be achieved through investments in three complementary components. **Component 1** will focus on concrete investments in ecosystem recovery, leading to improved coastline resilience to the impacts of wave action, and improvements to coastal morphology which will reduce seawater incursion; this will be achieved by re-establishing the coastal belt of red mangrove between Surgidero de Batabanó and Punta Mora, restoring mangrove ecosystems between Majana and Surgidero de Batabanó, eliminating and/or controlling invasive alien species and restorating and enriching woodlands along the landward

limit of the coastal wetland belt. **Component 2** will focus on integrated and participatory management of coastal ecosystems, through mainstreaming EBA into integrated coastal zone planning and productive sector activities, promoting buy-in, participation and governance in local communities and developing knowledge management systems at community level. **Component 3** will focus on establishing a favourable enabling environment at regional level for the effectiveness and sustainability of adaptation investments, through the provision of consolidated information on costs and benefits of EBA to decision makers and planners and the strengthening of institutions supporting EBA actions, within the framework of updated and actively implemented action plans

Geographic & Environmental Context

The Republic of Cuba is located in the Caribbean Sea, at the entry of the Gulf of Mexico at a distance of 140km from the Bahamas, 180km from Florida, 210km from Cancún, 77km from Haití and 146km from Jamaica (Figure 1). Its total surface area is 109,886.19km², made up of the Island of Cuba (107,466.92km²), the Island of Youth (2,419.27km²) and almost 1,600 other islands, islets and cays totalling 3,126.43km².

Figure 1. Location of the Republic of Cuba

The country is divided into 15 provinces (Figure 2) and 168 municipalities (including the special municipality of the Island of Youth), of which 96 have coastline.

Figure 2. Political/administrative divisions (ONE, 2010)

The total population of the country is 11.2 million: these are distributed between 7075 settlements including the capital, Havana, which is home to 2 million people. 92% of the settlements are rural and 8% urban; there are 262 coastal settlements, without including the city of Havana. The country's Human Development Index score stands at 0.776 (High), ranking 51 worldwide out of 187 countries.

The coastal zone comprises virtually the whole of the archipelago: the total length of the coast is 5,746km (3,209km on the north coast and 2,357km on the south coast). The coastline is very irregular and diverse, including steep cliffs, sandy beaches, extensive low lying and swampy coastal plains, fringing coral reefs, marine terraces, inlets, deltas and bays.

Most coastal communities are characterized by a narrow economic base, dependent largely on artisan fishing, basic services and domestic tourism; in addition, many members of coastal communities are involved in agriculture and livestock raising in neighbouring areas due to limited employment opportunities in their own areas. Coastal communities have also been affected by decreasing employment opportunities due to the decline of the fisheries sector and the degradation of productive infrastructure by the weather and extreme climatic events.

Existing Climate & Climate Change Scenarios

Cuba is moving towards climatic conditions similar to those projected by the IPCC under a scenario of intensified greenhouse gas effect, particularly in relation to increases in surface level air temperatures, reductions in daily temperature ranges, increased frequency of long and severe droughts, especially in the dry season, and increases in the total amounts of rainfall associated with major precipitation events in the wet season.

Ample evidence has been generated by Cuban institutions and others regarding climate change and variability to date, and the corresponding vulnerability of human populations. Studies of circulation patterns in the Caribbean suggest that the structure and influence of the Azores/Bermuda High Pressure System on the region have undergone changes at a multi-decade scale (Naranjo y Centella, 1997). A significant warming of the lower troposphere of the region was detected in the 1970s, which is consistent with overall climate change and is in accordance with the significant patterns detected in circulation patterns in the Pacific/North American sector (Trenberth and Shea, 1997).

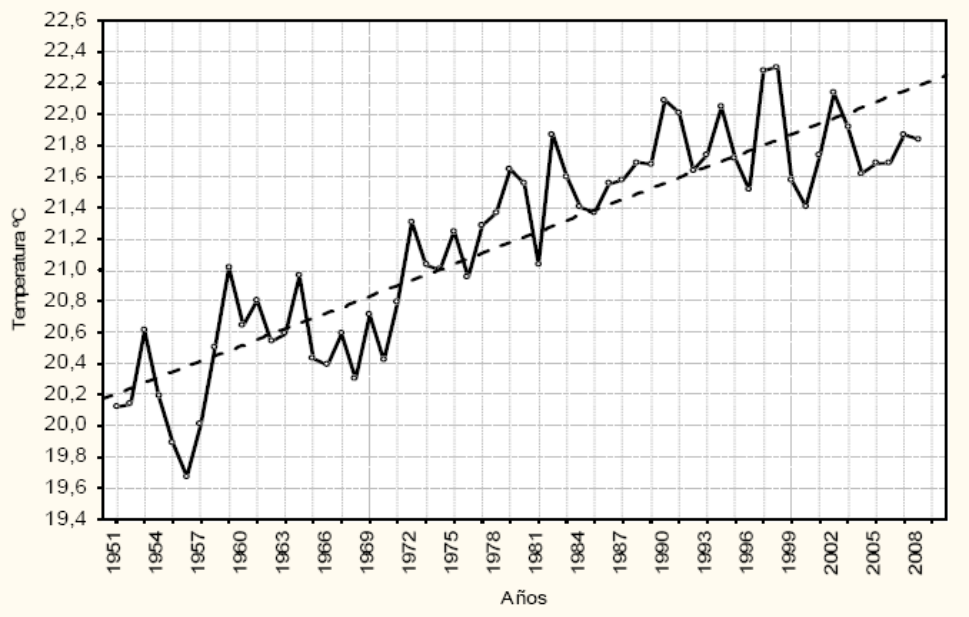
The El Niño-Southern Oscillation (ENSO) has a strong influence on climatic vulnerability in Cuba. This is reflected in increases in precipitation and the frequency of extreme weather events during the rainy season (Cárdenas y Naranjo 1996; Alfonso 1995). Although the influence of the ENSO has not been consistent over time, Naranjo and Centella (1997) suggest that its impact in the Caribbean has increased since the 1970s, and that this is related to underlying changes in climatic conditions since that time.

There has been an increase in anticyclonic influence in Cuba, which has resulted in a predominant effect of ocean currents from the east and descending vertical movements. This coincides with the tendency observed in the pattern of teleconnection of the Eastern Atlantic, one of the most important modes of variation of atmospheric circulation in the Atlantic Ocean. This pattern has maintained a statistically significant tendency of linear increase over the period 1951-2008. This tendency is a consequence of the marked multi-decade variation that has been shown, with a prevailing negative phase between 1951 and 1976 and a positive phase from 1977 to the present. During this latter phase, the 1996-2010 period stands out, in which the positive trend has been very strong and persistent, coinciding with a greater increase in sea surface temperature in the tropical Atlantic ocean,

It is probable that a close link exists between the patterns in anticylonic activity, observed variations in teleconnection patterns of the Pacific-North America región, North Atlantic Oscillation (NAO) and Eastern Atlantic (EA), with the observed fluctuations of temperature and precipitation. Increases in the frequency and intensity of droughts appear to be linked to these processes.

The most recent evaluation of climatic variation and change in Cuba, carried out by the Meteorological Institute of CITMA (R. Pérez et al. 2009), provides observation-based evidence which clearly indicates that the climate in Cuba has become warmer. Since the middle of the last century, the median annual temperature has increased by almost.9°C. The last two decades stand out as the hottest registered to date. Associated with this trend, there has been a very marked increase in mínimum temperatures, the monthly average values of which have increased by around 1.9°C. There have been no corresponding statistically significant trends in maximum temperatures, meaning that median daily temperature fluctuations have reduced by almost 2°C.

Figure 3. Trends in annual median values of minimum temperature in Cuba, 1951-2008 (Pérez et al, 2009[1])



The same evaluation found no statistically significant trends in rainfall totals in the country. The most important phenomenon has been the reduction in wet season (May-October) rainfall in the east of the country: in the 1990s, this region showed significant deficits in cumulative rainfall levels. Another interesting aspect with regard to precipitation levels is an increase in dry season (November-April) rainfall, related to a reduction in the magnitude of negative anomalies from the 1970s to the 2000s.

The significant increase in drought events that has been registered in the periods 1961-1990 and 1931-1960 continued into the 1990s, as shown by the persistent drought events that affected the east of the country since the beginning of that decade, culminating in the severe event that stretched from May 2003 to 2005, which progressively extended to affect the whole of the country. This behaviour is linked to the strengthening of anticylonic influences over Cuba at medium and high levels, which in turn is linked to a strong increase in descending vertical movements in the atmosphere.

Climatic trends related to coastal flooding

In recent decades, the increase in global temperatures has been reflected by increases in the temperature and salinity of both superficial and sub-superficial waters around Cuba (Mitrani y Díaz, 2008[2]), which corresponds to those observed by Curry et al. (2003). This situation results in increases in the thermic energy of the ocean which is available for the development of atmospheric systems. As argued by Anthes et al. (2006), increases in temperatura and salinity lead to changes in atmospheric and oceanic circulation, which favor the intensification of the transport of moisture from the sub-tropics to higher latitudes; this affectes the Multi-Decadal Oscillation of the Atlantic, which is one of the mechanisms with most influence on the frequency

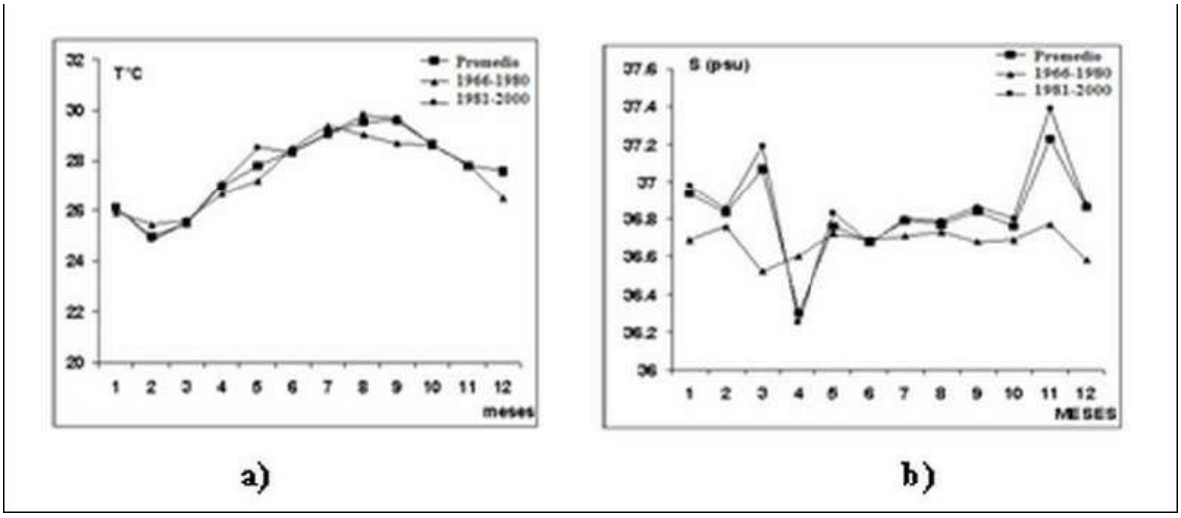
[1] Pérez Suárez, R., C. Fonseca, B. Lapinel, C. González, E. Planos, V. Cutié, M. Ballester, M. Limia and R. Vega (2009): "Segunda evaluación de las variaciones y tendencias del clima en Cuba". Informe científico. Instituto de Meteorología. La Habana, 75 pp."

[2] Mitrani and Díaz O. (2008): "Particularidades de la estructura termohalina y sus tendencias en aguas Cubanas" Revista Cubana de Meteorología, Vol. 14, No. 1 54:73

and intensity of tropical cyclones. The parameters which best reflect this situation are Ocean Surface Temperature and Maximum Salinity, in deep water (between 150 and 300m below the surface).

Figure 4 shows monthly variation patterns in these parameters over the 1966-2000 period, as well as averages for the two periods 1966-1980 and 1981-2000. Average values for the latter period are greater or equal than the median.

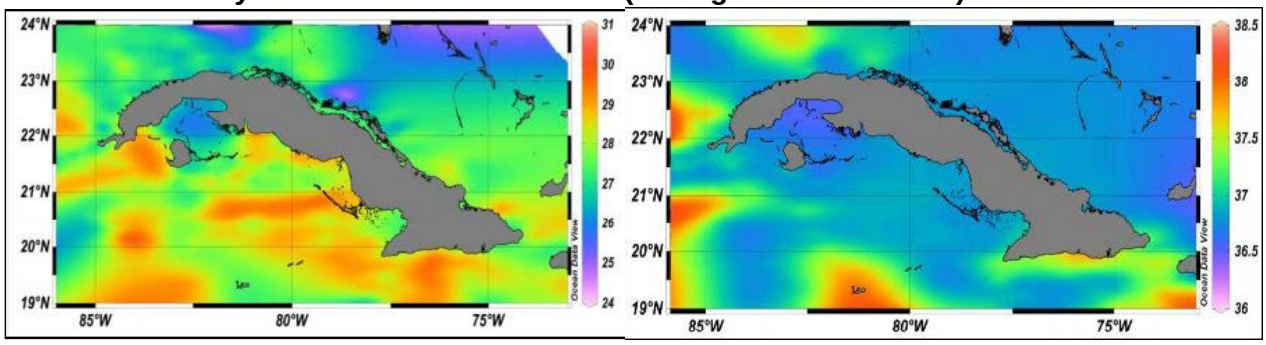
Figure 4. Monthly variations in Ocean Surface Temperature (a) and Maximum Salinity (b) in the 1966-1980 and 1981-2000 periods



As a consequence of these changes, the capacity of the sea to accumulate heat has increased, as has the depth of the homogenous layer with temperatures greater than 26°C (Mitrani et al. 2008[3]), leading to increases in the formation and destructive power of tropical cyclones.

Figure 5 shows that maximum values of Ocean Surface Temperature and Maximum Salinity are located close to both coasts of the western region of Cuba (Mitrani et al. 2008), which makes these areas the most vulnerable to increases in coastal flooding.

Figure 5. Spatial Distribution of (a) Ocean Surface Temperature and (b) Maximum Salinity values in relation to Cuba (averages for 1966-2000)



Sea Level Rise (SLR):

[3] Mitrani-Arenal et al. (2012): Tendencias climáticas de las inundaciones costeras severas en áreas de Cuba.

Under different IPCC scenarios and levels of climate sensitivity, sea levels in Cuba are expected to rise by between 0.22m and 0.85m by the year 2100 (Table 1). The linear annual trends of sea level rise that have been detected in the Cuban archipelago have varied between 0.214cm/year in Sibonet and 0.005cm/year in Casilda. These differences are a function of the oceanographic, hydrographic and topographic conditions in the areas adjacent to the measurement stations (Hernández et al. 2011[4]). There is predicted to be an annual acceleration in this SLR trend of around 0.01mm.

Table 1. Predictions of sea level rise in Cuba up to the year 2010, relative to the last decade of the 20th century (mm)

IPCC scenarios	Climate sensitivity	2020	2050	2070	2100
A1C	Low (1.5°C)	4	8	14	22
	Medium (2.6°C)	9	17	30	49
	High (4.2°C)	15	27	48	85
B2	Low (1.5°C)	4	7	10	15
	Medium (2.6°C)	10	16	23	35
	High (4.2°C)	15	26	40	62

Weather systems

The Atlantic Ocean is the source of approximately 11% of the tropical depressions, storms and hurricanes in the world. Figure 6 shows that Cuba lies in one of the most active parts of the Atlantic/Caribbean hurricane region. Hurricanes and cold fronts are among the principal causes of destructive flooding along the whole length of the Cuban coastline (Mitrani et al. 2001). These phenomena give rise to strong winds and high energy waves which result in accumulations of water which can lead to significant levels of flooding.

Over the last 8 years a total of 13 cyclones have affected the country, causing damage to 1,234,784 homes of which 12.4% collapsed completely. From 2001 to the present, the country has been affected by seven intense hurricanes, the highest rate in a single decade since 1791.

Historically, intense hurricanes have represented 26% of the total number of hurricanes affecting the country. During the first decade of the 21st century, however, this proportion rose to 78%. This corresponds to the increase observed across the Atlantic as a whole[5], including the Caribbean, and may be related to the high temperatures observed in the Caribbean since 1998.

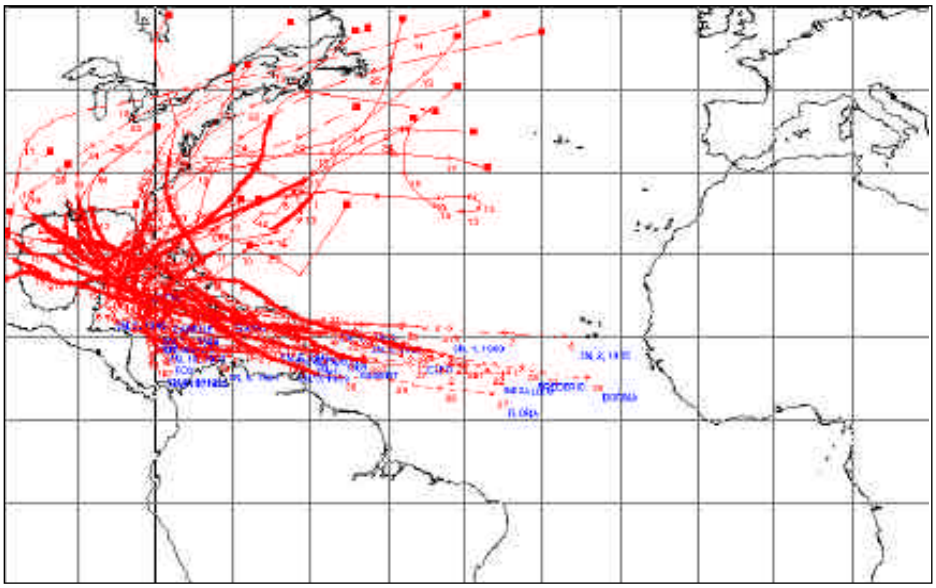
[4]Hernández, M et al (2011): Informe parcial correspondiente al 2010 del proyecto "Completar la determinación de la tendencia del ascenso del nivel medio del mar y los valores extremos, desde 1966 hasta la fecha a partir de mediciones directas"

Hernández, M., O. Marzo y A. Acanda (2010): Tendencia lineal del nivel medio del mar en algunas localidades del archipiélago cubano. Serie Oceanológica. No. 7, **p. 1 – 15.** ISSN: 2072-800X. http://oceanologia.redciencia.cu.

Hernández, M., O. Marzo, Y. Ríos, L. Martínez and A. Boffil (2009a): Completar la determinación de la tendencia del ascenso del nivel medio del mar y los valores extremos, desde 1966 hasta la fecha a partir de mediciones directas. Informe Científico Anual. Archivo Científico del Instituto de Oceanología.

[5] The trend over the past 200 years has not been statistically significant.

Figure 6. Category 4 and 5 Hurricanes affecting Cuba between 1890 and 1995



As a result of climate change, the storm surges arising from hurricanes and other storm events will build upon higher baseline sea levels, to produce a cumulative effect, as shown in Table 2.

Table 2. Estimated area that would be flooded if a Category 5 hurricane were added to climate-change related sea level rise (km^2)

	Year	
	2050	**2100**
Normal conditions (with climate change)	2,349.5	5,696.5
Climate change + Category 5 hurricane	19,935.3	20,614.2

Coastal ecosystems

Mangroves cover a total área of 5647 km^2 nationwide, equivalent to 5.1% of the total area of the country. They have suffered high levels of degradation and elimination in many areas. Human impacts on mangroves include their direct elimination and the modification of the hydrological regimes on which they depend (elimination or reduction of water flows, and the reduction of freshwater and nutrient inputs and consequent increases in salinity which can prove lethal). They play a vital protective role against the effects of sea level rise and storm surges, by protecting coastal ecosystems, settlements and agricultural land further inland against wave impacts, and stabilizing coastlines which are otherwise receding at rates of up to several metres per year. Beaches account for 16% of the coastline of Cuba, and studies carried out over the last 30 years have shown that 90% of beaches have been affected by erosion (Juanes et al, 1996), in large part due to the elimination of the protection offered by mangroves but also due to the impacts of coastal infrastructural works.

Coral reefs have been seriously affected by bleaching in recent years, which is directly attributable to CC-related increases in water temperature and is compounded by anthropogenic damage and the increased impacts of hurricanes. This decline has serious ecological and socioeconomic implications, given the importance of coral reefs as refuge and food source for fish and invertebrates, and in protecting coastline against wave impacts. Around 70% of reef crests in Cuba are highly deteriorated, due to a combination of factors including the excessive

growth of algae resulting from declines in the populations of aquatic herbivores, health problems including bleaching and, in certain sites, pollution. It is not however thought that SLR will have direct impacts on crest corals in the country (by increasing the depth of water above them and therefore reducing photosynthesis) as its rate is not expected to exceed the growth rate of the corals.

Current prediction models estimate a structural disappearance of coral crests around Cuba within around 40 years (Alcolado *et al*., 2009). This disappearance does not necessarily imply wholesale coral death, but rather a reduction of their physical profile: the reefs are composed of species such as *Millepora complanata, Siderastrea siderea* and *Porites astreoides*, which are generally resistent to a number of factors, but they will not have a sufficient height to be able to contribute effectively to the dissipation of wave energy and the protection of the coast.

An estimated 2.6 million ha of other ecosystems would be affected by the SLR that is expected by 2100, including 1.98 million ha of permanent wetlands, 507,500ha of forests, and 11,900ha of scrub.

Socioeconomic implications of climate change, SLR and storm surges

Given the insular nature of the country, a large proportion of Cuba is subject to the effects of SLR and storm surges. Of the total of 15 provinces (plus the special municipality of the Island of Youth), a total of 96 municipalities located near or close to the coast are subject to permanent effects from these phenomena. Of the country's 7075 human settlements, 262 are coastal and of these 122 (53 urban and 69 rural) will be affected and 21 are predicted to disappear by the year 2100. The damage to coastal settlements and agricultural land by these CC-related phenomena has particularly severe impacts on women, who typically are the first to be obliged to relocate in order to ensure adequate living conditions for their children.

By the year 2100, it is estimated that a total of 112,491ha of agricultural land will have been permanently or temporarily affected by sea level rise; if combined with a Category V hurricane, this total would rise to an estimated 1,658,665ha, or 25.5% of the agricultural land in the country. The crops most likely to be affected would be pasture, sugar cane and rice. The most extreme climate change/SLR scenario presented in Table 1 (0.85m) would result in the flooding of up to 5,696km², affecting more than 1 million people living in more than 220 settlements.

A sustained rate of SLR of 2.9mm/year would result in a total rise of around 0.3m over the next 100 years and a consequent retreat of the coastline of between 800 and 1,500km (without taking into account storm surges). This would have major impacts in terms of saline intrusion into subterranean aquifers, which in many areas are of fundamental importance for agricultural irrigation and domestic water supply.

The target area

The project will focus specifically on an 84 km long stretch of coastline between Punta Sucia and Punta Mora in the western provinces of Artemisa and Mayabeque[6], covering 6 municipalities[7], (see Figure 7). This coastline, which lies on the Gulf of Batabanó, is comprised of a large coastal wetland area based on clay and terrestrial deposits, dominated by mangroves

[6] These provinces were established in 2011 when the former province of Havana was divided into three parts: urban Havana, Artemisa and Mayabeque.

[7] Artemisa, Alquízar and Güira de Melena in Artemisa province and, Batabanó, Melena del Sur and Güines in Mayabeque Province

(with a total area of 634km^2), into which numerous rivers, estuaries and coastal lagoons drain (Figure 8).

Figure 7. Political divisions in the project area

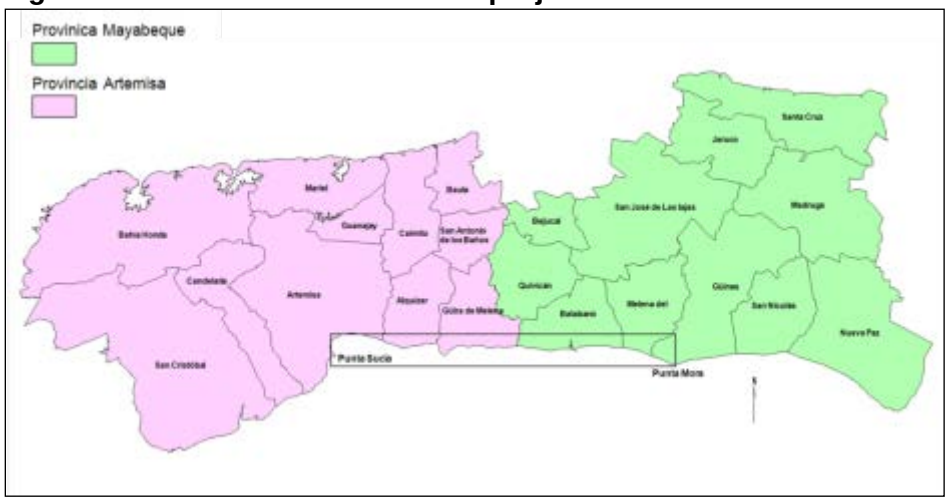
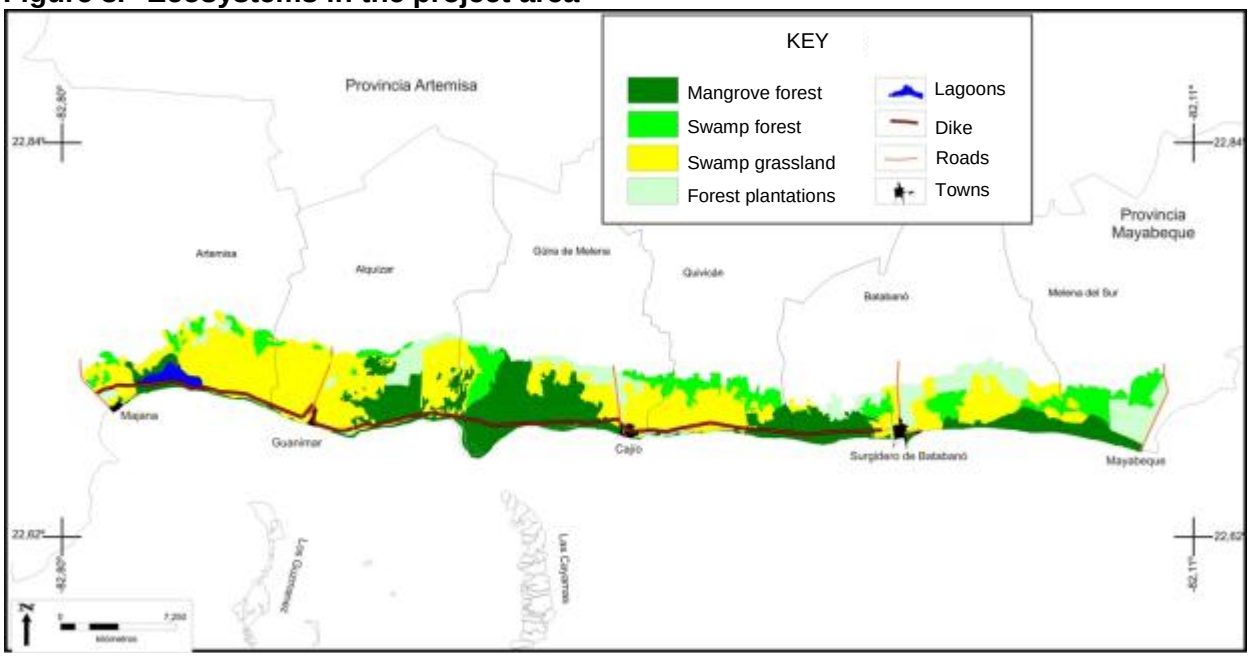


Figure 8. Ecosystems in the project area



This area is of crucial strategic importance: the plains that stretch from coast to coast include some of the most productive agricultural land in the country, and its underlying aquifers are the main source of water for the capital, Havana. The Southern Basin Aqueduct benefits a population of around 137,000 people. At the same time, it is one of the most vulnerable areas in the country to the diverse effects of climate change, due in part to its narrowness (in places less than 33km from coast to coast).

The six target municipalities produce an average of around 2,385 tons of vegetables per year (ONE, 2008). Batabanó municipality is home to the Pesca Habana Combined Fishery Enterprise, one of the most important in the country, which produces more than 900 tons of lobster, 300 tons of scale fish and 30 tons of sponges per year.

Climate change effects in the target area

In the target area, the coastline is retreating at around 1.2m/year. It is predicted that the storm surge associated with a a Category V hurricane would directly affect 49 settlements in this area, with a combined population of 24,509 people: when SLR (which is estimated at 2.14mm/year) is also taken into account, an estimated 36,253ha would be flooded by 2050 and 5 settlements would completely disappear.

Table 3. Storm events and their impacts in the target provinces between 2000 and 2008

Date	Event	Impacts
Sept. 2000	Gordon	Coastal flooding in the south of the former province of Havana, leading to evacuation of population from the south of Artemisa and Mayabeque provinces
Nov. 2001	Michelle	Sea incursion, population evacuation
Sept. 2002	Isidore	Coastal flooding, population evacuation
Oct. 2002	Lili	Coastal flooding
Aug. 2004	Charley	Strong sea incursion which destroyed settlements and beaches
Sept. 2004	Ivan	Coastal flooding, population evacuation
July 2005	Dennis	Coastal flooding, population evacuation
Aug. 2005	Katrina	Coastal flooding, population evacuation
Sept. 2005	Rita	Coastal flooding, population evacuation
Oct. 2005	Wilma	Strong sea incursion reaching more than 1km inland
Aug. 2008	Gustav	Dangerous coastal flooding reaching more than 1km inland, evacuation of population
Sept. 2008	Ike	Dangerous coastal flooding reaching more than 550m inland, evacuation of population

Table 4 and Figure 9 show that it is one of the most vulnerable in the country to tropical storms and hurricanes, and associated storm surges. A storm surge of up to 3.8m was recorded during Hurricane Charley in August 2004 (Figure 10). The areas in these provinces that are affected by flooding during hurricane events of different intensities are shown in Figure 11.

Table 4. Periods of return of hurricanes and tropical storms in different regions of Cuba

Region	Tropical storms	Hurricanes
West	2.4	2.6
Centre	5.6	6.3
East	4.5	4.8

Figure 9. Storm surge risk by sector

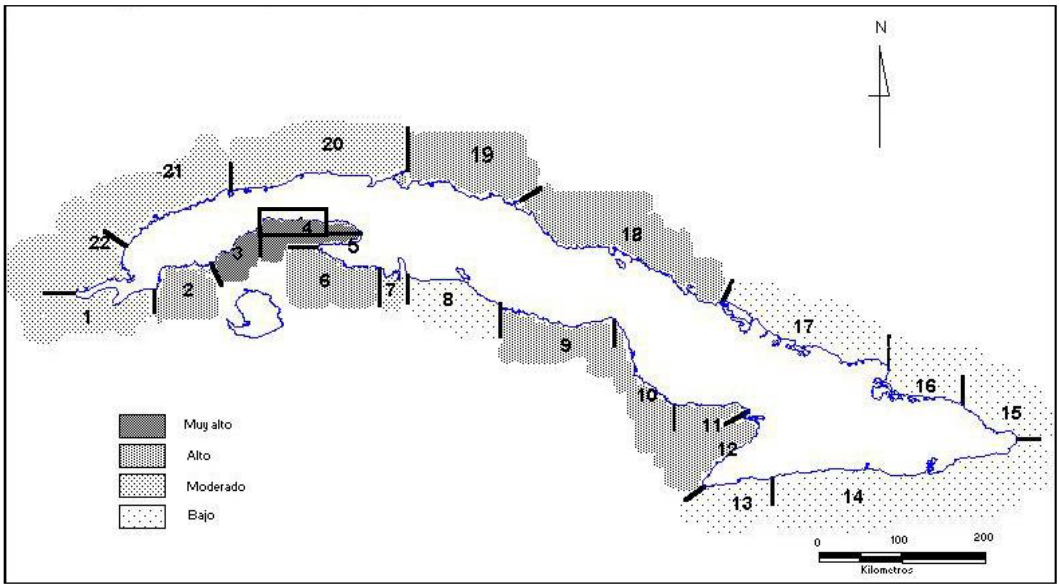


Figure 10. Storm surge caused by Hurricane Charley in August 2004

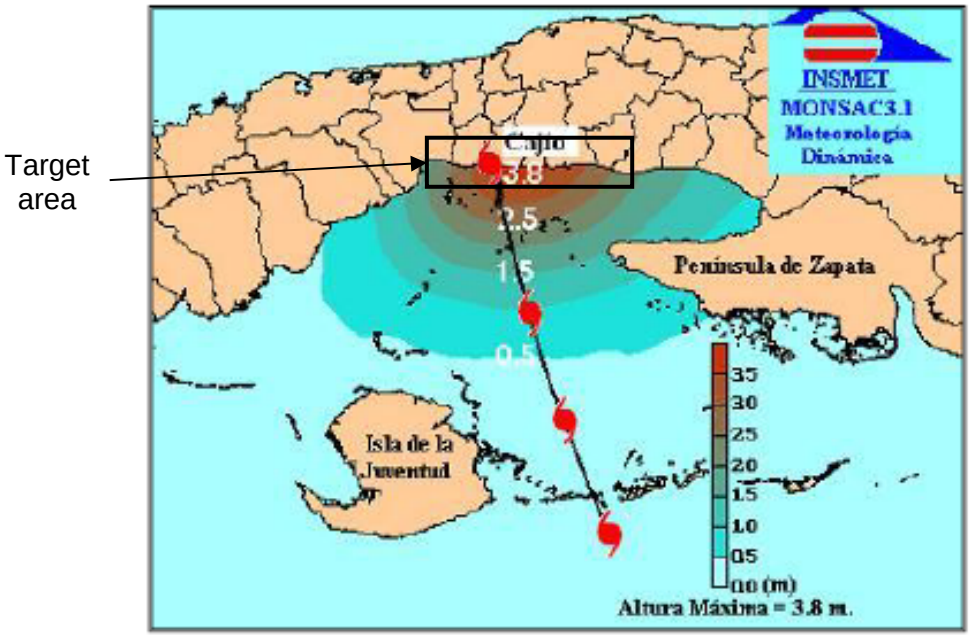


Figure 11. Areas of target provinces estimated to be affected by storm surge and waves during hurricanes

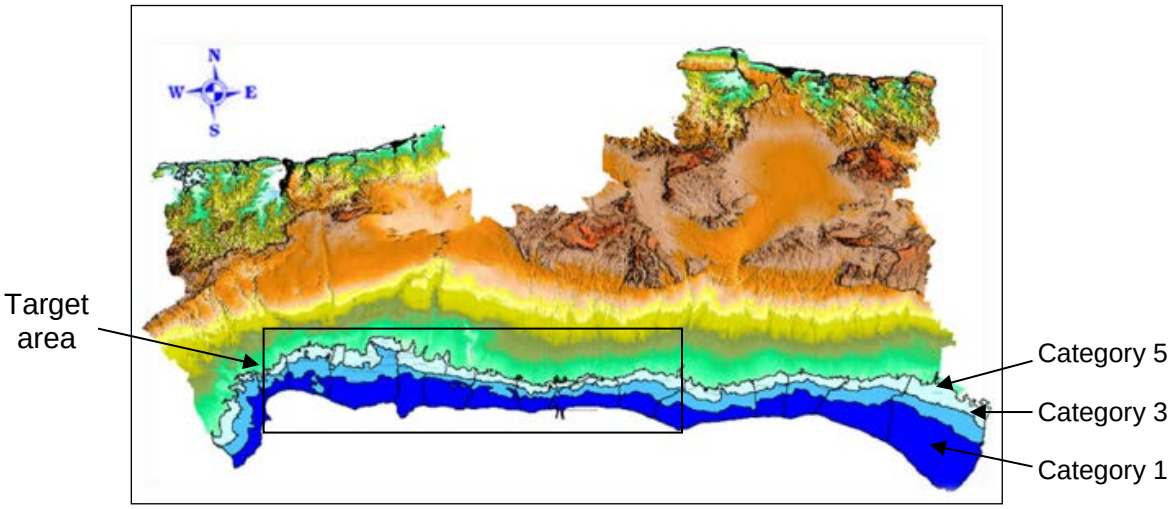
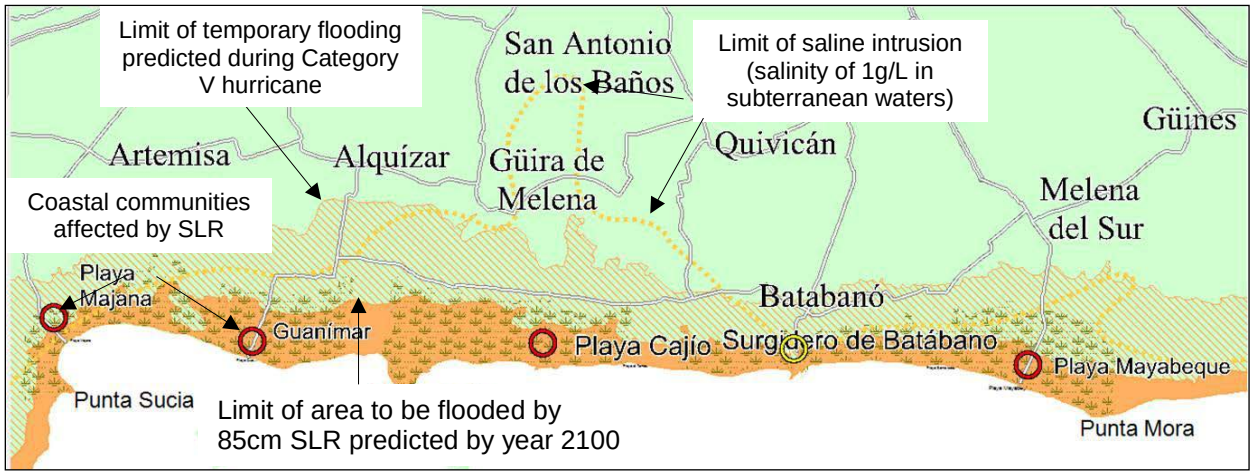


Figure 12. Areas to be affected by CC-related saline intrusion, temporary flooding during hurricanes and SLR



Furthermore, this area is particularly to subject to the problem of saline intrusion into its subterranean aquifers, which are typically located between 20 and 30m below sea level. The agriculture of this area (which is one of the most productive in the country) is heavily dependent on this aquifer for irrigation, as its highly permeable karstic geology means that there is little or no surface water available. The area is also one of the main sources of drinking water for the city of Havana. The narrowness of this area (which in places is little more than 30km in width) means that is susceptible in almost its entirety to this problem.

The inherent vulnerability of the target provinces to climate-related effects is reflected in, and exacerbated by, the high levels of degradation that have been suffered by their coastal ecosystems. Some of the highest levels of beach erosion in the country have occurred in this area: the beaches of Majana, Guanimar, Cajio, Mayabeque, Caimito, La Pepilla, Tasajera and Rosario were left completely without sand as a result of the erosive waves generated by Hurricanes Ike and Gustav in 2008. At La Pepilla beach, the coast is receding at a rate of up to

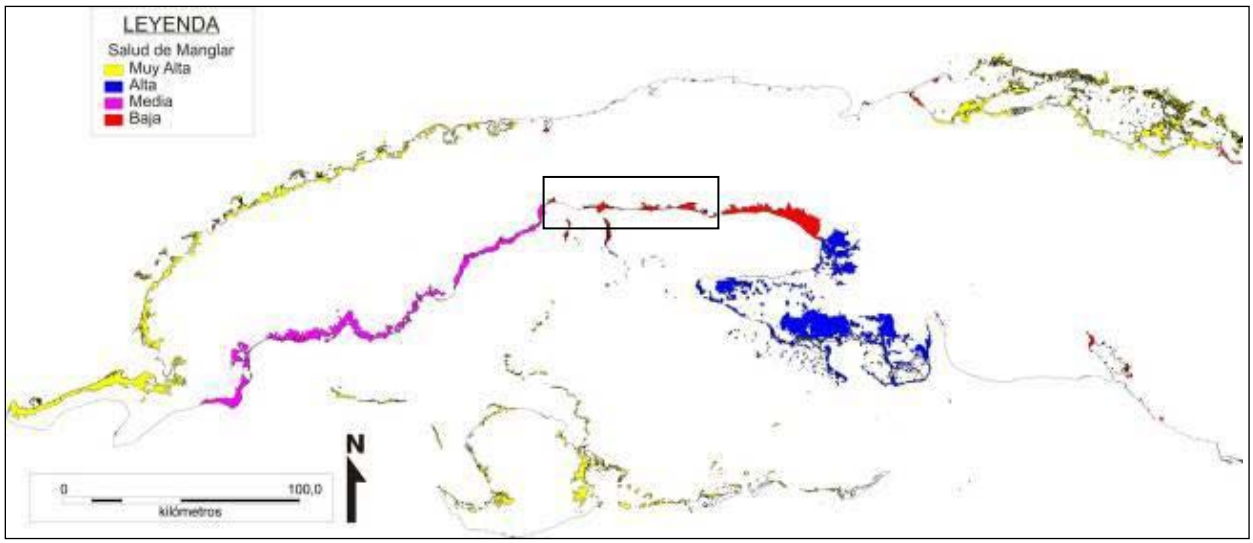
2m/year (Guerra et al 2000). The mangroves of the area also have some of the lowest health indices in the western region of the country (Figure 13).

Threats to coastal ecosystems in the project area

Historically, the mangroves of this area have been heavily impacted by the extraction of timber and poles for railway construction and for charcoal production. In the 1950s, a series of drainage channels were built which had the effect of drying out the mangroves and coastal swamps, and the forest on the landward margin of the swamps has suffered clearance by farmers, which has had negative effects on the underlying aquifer. In order to counteract these processes a 50km long retention wall (*Dique Sur* or Southern Dike) was built in the 1980s: this however resulted in mortality of mangroves (principally black mangrove *A. germinans*) due to flooding on its landward side, and increased wave impact and reduced freshwater inputs on its seaward side. These effects have been exacerbated by the culverts in the wall being clogged by vegetation, and compounded by increases in illegal harvesting of mangroves due to the access which the wall provides into the otherwise impenetrable swamps and forests.

Additional impacts which have affected the different coastal ecosystems of this area since colonial times include coastal development, construction of breakwaters, overfishing and sand extraction.

Figure 13. Health indices for mangroves in the western region of the country



There is clear evidence that those parts of the coast with intact mangrove forests have been less affected by CC-related phenomena than those that have gone significant anthropogenic modification, due largely to the role of mangroves in retaining sediment and buffering wave impact. Furthermore, benthic environments in coastal waters are generally less degraded in the areas where the seaward belt of red mangrove is intact.

The ecological integrity of coastal and marine ecosystems is particularly at risk from Invasive Alien Species (IAS), the spread of which is facilitated by the scarcity of competitors and predators due to the country's geographical isolation. IAS have the potential to generate drastic impacts for native ecosystems and to displace native species, directly or indirectly. Climate change will potentially exacerbate the risks posed by IAS, resulting in exotic species which are not currently invasive becoming so as climatic conditions favour their spread. Ecosystem

disturbance as a result of CC-related extreme weather events and fires also risks providing opportunities for exotic species with pioneer characteristics gaining a foothold in otherwise intact ecosystems and preventing them returning through natural regeneration to their original state.

Scientific studies carried out in Cuba have shown that *Casuarina equisetifolia*, *Dichrostachys cinerea* (Marabú), *Leucaena leucocephala* and *Eichhornia crassipes* (Water Hyacinth) have wide presence in the project area and have important impacts on the regenerative capacities and ecological balance of the target ecosystems. *Casuarina equisetifolia* in particular has well proven negative impacts on the ability of coastal ecosystems to buffer the effects of climate change. On sandy coasts, it has led to the significant modifications of coastline morphology, and the loss of sand and natural vegetation due to its rapid growth and allelopathic effects.

There are also strong indications that *Dichrostachys cinerea* (Marabú), *Leucaena leucocephala* and the Water Hyacinth have the potential to undermine EBA, although these remain to be conclusively demonstrated. The negative impacts of these species in this regard including the drying out of the wetlands due to high water demands relative to native vegetation; competition with native species with greater ability to stabilize coastlines; and/or interference with the ecology of the native wetland ecosystems, thereby reducing the ability of these to generate other ecosystem benefits (such as fish nurseries or honey production) which might otherwise provide additional incentives to the local population to participate in their conservation. *Dichrostachys cinerea* (Marabú) has spread rapidly in recent years, becoming the invasive of greatest concern in the country: it transforms natural ecosystems, converting them into spiny and impenetrable thickets of little use for human activity. *Leucaena leucocephala* also invades abandoned cropping areas and open areas of secondary vegetation, where it forms dense thickets which are of little value for local communities and where it is difficult to establish native vegetation.

Barriers to Addressing the Climate Change-Induced Problems

Cuba has a well-developed institutional framework, well-organized communities at local level, and excellent technical capacities for research into coastal ecology and the development of corresponding strategies for the management of coastal ecosystems. The principal deficiencies with regards to these aspects, which constitute obstacles to the effective implementation of EBA, are:

1. EBA is not factored into adaptation measures

To date, responses by the Government and local actors in Cuba to the current and potential implications of climate change in coastal areas have focused principally on structural and behavioural measures. Foremost among the structural investments has been the construction of the 50km long Southern Dike retention wall which, as explained in the previous section, has been counterproductive in the long term, as it has interrupted natural hydrological processes and thereby led to the mortality of mangroves, undermining the potential for EBA. Behavioural measures have largely focused on short-term emergency responses and on relocating further inland people living in communities which have suffered productive and infrastructural damage from CC-related flooding and storms.

The limited attention that has been paid to EBA in practice is due in part to the fact that technical knowledge and experiences of mangrove ecology and silviculture has been concentrated to date in national research institutions (such as universities, the IINAF and the IES): the State-owned forestry enterprises, which are responsible in practice for forest management in the area, have strong technical capacities in relation to terrestrial silviculture

(principally forest plantations) but have not to date worked to any extent in coastal ecosystems. . The principal obstacle to the effective application of EBA is limited access, among institutions operating at field level, to technical and logistical resources, especially the kinds of physical equipment that are required to gain access to and operate effectively in the marshy and inaccessible sites where reforestation, restoration and rehabilitation activities are to be carried out.

2. CC is not factored into coastal zone development

Some of the most significant negative impacts to which the coastal ecosystems of the project area have been subjected to date, such as the obstruction of hydrological flows by the Southern Dyke, the destruction of mangroves for the construction of the coastal road and the drying out of wetlands for agricultural drainage, can be explained by a failure to apply a fully integrated vision to the planning of productive activities in the coastal zone, or to develop adequate levels of awareness of the importance of coastal ecosystems among local stakeholders engaged in productive activities (members of local communities and productive sector entities). Each of these activities was planned and executed with a narrow and sector-specific vision which failed to consider the longer term benefits and cost-effectiveness of avoiding damage to ecosystems which have potential to provide EBA services. Despite the existence of strong policy commitment to EBA at various levels, this has not as yet been reflected in practice in the plans and investments of individual sector institutions.

This situation is compounded by the limited levels of awareness that exist in local communities regarding climate change and EBA. There is limited understanding among members of local communities of how individual short-term climatic phenomena fit into the long-term pattern of climate change, and the long-term cumulative implications of CC trends. Furthermore, local stakeholders tend to under appreciate the value of coastal ecosystems such as mangroves and wetlands for economic purposes and for climate change resilience: this undermines governance and means that the underlying drivers of coastal ecosystem degradation are ineffectively addressed.

3. Cost benefit calculus for EBA

Although there is solid policy commitment to addressing the implications of climate change (as shown for example in the National Environment Strategy 2011-2015, the Cuban Civil Society Progamme for Addressing Climate Change, and the First and Second National Communications to the UN Framework Convention on Climate Change – see Section D), there is limited appreciation by decision-makers at different levels of the precise nature and magnitude of the costs and benefits of EBA, compared to the alternatives, and of human activities that contribute to the degradation of these ecosystem services and reduce climate change resilience. This hinders them from taking adequate decisions on trade-offs between development initiatives and adaptation measures.

PROJECT / PROGRAMME OBJECTIVES:

The **objective** of the project is to increase the resilience of populations in the coastal regions of Artemisa and Mayabeque provinces to the effects of climate change. It will focus on delivering concrete and direct benefits along an 84km stretch of coastline in one of the areas of the country that is most vulnerable to CC-related SLR and storm impacts, and where such

phenomena have the greatest risk of generating negative socioeconomic and developmental impacts. This will be achieved through Ecosystem Based Adaptation (EBA), taking advantage of the proven potential of mangrove forests and associated coastal wetlands to limit the effects of wave erosion and coastal flooding, which are among the most damaging results of climate-change related SLR and storms[8]. An ideal approach would be also to protect and restore neighbouring marine ecosystems which also provide EBA benefits, namely coral reefs (which buffer wave impact) and seagrass beds (which trap sediments in shallow coastal waters); and to back up this restoration activities with limited physical infrastructure. Taking into account budgetary availability and complexity, however, this project will focus only on the mangrove and other wetland ecosystems where there is greatest potential to deliver EBA benefits in the short to medium term.

Although mangroves cannot halt SLR, they can absorb wave impact and modify coastal morphology in a way that buffers seawater intrusion, by anchoring their roots in the silt/sand substrate and trapping sediments. UNEP-WCMC (2000)[9] shows that 70 – 90% of the energy of wind-generated waves may be absorbed by mangroves and reefs, but that the buffering capacity depends on ecosystem integrity and physical characteristics. The project is designed to enhance the ability of ecosystems to supply this buffering function. The most effective species in this regard, especially at the exposed conditions of the seaward edge, is the red mangrove (*R. mangle*). The role of this species along the coastal fringe will be complemented by the protection and restoration of other species and ecosystems further back, including black mangroves (*A. germinans*), swamp forests and reed beds, and the belt of boundary forest that separates the wetlands from the agricultural areas further inland.

Mangrove ecology and silviculture has been extensively studied in Cuba, by national universities and Government departments such as CIGEA and IES. The project will also make use of lessons learned and best practices from other mangrove restoration projects in the region, such as a UNDP – Government of Panama project for "Protection of carbon pool and sinks within wetlands and protected areas of Panama", funded by the International Climate Initiative 2011.

Although the area has been subjected to heavy anthropogenic modification, extensive studies and practical experiences by Cuban institutions have shown that conditions still exist which would allow the reestablishment of mangroves and other coastal ecosystems that are capable of delivering effective EBA functions. The project will focus in particular on restoring and rehabilitating the areas, covering a total of 7,318ha, which have suffered severest degradation and which constitute flooding hotspots. This will serve to enhance the functionality of the landscape as a whole, stretching along 134km of coastline and covering a total of 27,500ha. The approach of restoring degraded areas with larger environments, thus enhancing overall ecosystem functioning, is well founded in the scientific literature. Devisscher (2010)[10] notes that restoration across a larger scale mosaic of ecosystems can further achieve enhancement of services. Restoring mosaics of inter-connected ecosystems can ensure that if some very degraded areas are only slowly recovering, other functioning ecosystems will provide

[8] Lewis III, R.R., Erftemeijer, P., Hodgson, A., 2006. A novel approach to growing mangroves on the coastal mud flats of Eritrea with the potential for relieving regional poverty and hunger: comment. Wetlands 26, 637–638. Lewis III, R.R., 2005. Ecological engineering for successful management and restoration of mangrove forests. Ecol. Eng. 24, 403–418.

[9] UNEP-WCMC (2006). *In the Front Line: Shoreline Protection and other Ecosystem Services from Mangroves and Coral Reefs*. UNEP-WCMC, Cambridge, UK, 33pp.

[10] Devisscher, T. 2010. *Ecosystem-based Adaptation in Africa. Rational, Pathways, and Cost Estimates*. Sectoral Report for the AdaptCost Study. Stockholm Environment Institute.

services and structure to build on. Therefore, restoration can be improved by harnessing positive interactions between ecosystems that stabilize community dynamics, ecosystem functions, and the structure of neighboring ecosystems. Halpern et. al. (2007)[11] argue that by broadening the scale of intervention through the spatial arrangement of ecosystems these positive interactions can be optimized.

Table 5. Target areas for restoration and rehabilitation work

Province	Plantation (ha)	Rehabilitation (ha)	Total (ha)
Artemisa	1,440.0	2,054.5	**3,494.5**
Mayabeque	1,562.5	2,261.0	**3,823.5**
Total	**3,002.5**	**4,315.5**	**7,318.0**

The project will rely on a combination of natural regeneration and artificial regeneration (planting) to achieve the recovery of structure, function and EBA services in mangroves and other associated coastal ecosystems. Natural regeneration will be the preferred option wherever possible, as it is significantly cheaper than planting (around $2,000-2,800/ha compared with $3,000-5,000/ha for direct sowing). Natural regeneration is most viable in clearings in the middle of mangrove areas, where there is an abundant natural supply of propagules ("seed rain") and favourable light, edaphic and hydrological conditions[12]. These conditions are less favourable, and natural regeneration therefore less feasible, in sites which have undergone major transformation from natural conditions. This is the case, for example, along the stretch of coastline between Surgidero de Batabanó and Punta Mora, where repeated human pressures have led to loss of the seaward belt of red mangroves (*Rhizophora mangle*) and consequent retreat of the coastline, scarcity of seed trees, absence of favourable substrate and exposure to damaging waves which do not allow natural regeneration to gain a foothold. There is an abundant supply of propagules along the entire length of the coast which can be collected (by boat) for use in the proposed planting programmes.

The technical proposals presented here for ecosystem restoration and rehabilitation are based on extensive studies of the ecology and hydrology of the targeted coastal wetlands, over the last four decades. These have analysed, for example, the impacts on coastal hydrology of major infrastructural works such as the Southern Dike, and the corresponding responses of mangrove and other coastal ecosystems. These studies have resulted in the generation of maps of mangrove coverage, and scientific publications on aspects such as phenology, litter production, ecosystem structure, natural regeneration, soil types etc.

There is also significant potential for the project to serve as a demonstration of the potential of EBA in other parts of the country similarly at risk from CC-related phenomena, as a more cost-effective and sustainable alternative to the construction of coastal protection infrastructure.

The main focus of project investments will be on carrying out ecosystem restoration works. This will however be complemented by limited levels of investment in ensuring the levels of awareness, technical capacity and commitment in local communities, capacities in local institutions, and mechanisms for knowledge management, necessary to ensure the effectiveness and sustainability of these works in the long term. This is in full accordance with the definition of EBA in the UNFCCC as "a range of local and landscape scale strategies for managing ecosystems to increase resilience and maintain essential ecosystem services and

[11] Halpern, B.S., Silliman, B.R., Olden, J.D., Bruno, J.P. & Bertness, M.D. 2007. *Incorporating Positive Interactions in Aquatic Restoration and Conservation.* Front. Ecol. Environ. 2007:5(3):153 – 160.
[12] Tomlinson, 1986; Capote *et al.*, 1988

reduce the vulnerability of people, their livelihoods and nature in the face of climate change. Ecosystem-based adaptation involves collective action among governments, communities, conservation and development organizations, and other stakeholders to plan and empower local action that will increase environmental and community resilience to the changing climate."

The EBA approach to be applied by the project will be of a "win-win". "no regrets" nature, simultaneously combatting the negative implications of climate change by increasing resilience to CC-related phenomena, and generating significant "collateral" benefits in terms ecosystem services; while incurring no negative impacts. The ecosystem benefits to be generated will include the maintenance of the role of coastal ecosystems as reproduction and grow-on sites for commercially important fisheries species and other coastal and marine fauna, and realization of the additional potential for the generation of income in local communities through the sustainable management of mangroves for honey production.

PROJECT / PROGRAMME COMPONENTS AND FINANCING:

The following table describes the project components, the main Outcomes, and the Outputs identified to achieve them. The proposed Outcomes reflect the project objective, while the Outputs are the deliverables of the project produced by its proposed activities. Details of the outputs and activities and their rationale are provided in the Strategic Results Framework in Part III, Section D).

PROJECT COMPONENTS	EXPECTED CONCRETE OUTPUTS	EXPECTED OUTCOMES	AMOUNT (US$)
1: Reduction of the impacts of coastal flooding through the recovery of coastal ecosystems	1.1 Re-establishment of coastal belt of red mangrove (*Rhizophora mangle*) between Surgidero de Batabanó and Punta Mora 1.2 Restoration of mangrove ecosystems between Majana and Surgidero de Batabanó 1.3 Elimination and/or control of invasive alien species in coastal wetlands between Majana and Punta Mora in order to improve ecosystem resilience 1.4 Restoration and enrichment of woodlands along the landward limit of the coastal wetland belt, between Majana and Punta Mora	Improvements in the conditions of coastal ecosystems, resulting in improvements in their contribution to CC resilience, as measured by: - 624.2 ha of red mangrove established along sea shore - 575.3 ha of mangrove ecosystem restored - Total 1,199.5 ha - 1 IAS management plans developed, covering 7,318.0 ha - 7,318.0 ha with IAS managed - 1,724.0 ha of landward edge woodlands restored and enriched	4,020,000
2: Integrated and participatory management of coastal ecosystems to increase resilience to	2.1 EBA mainstreamed into integrated coastal zone planning and productive sector activities 2.2 Buy-in, participation and governance in local communities	Coastal communities have the awareness and capacities required to participate in an active, effective and sustainable manner in EBA actions: - 4 voluntary groups addressing environmental and adaptation issues, with at least 15 members	700,000

climate change .	2.3 Knowledge management systems at community level	each (of which at least 45% are women) - 34 local schools with study programmes incorporating adaptation issues - 28 communities planning and realizing adaptation activities due to support received from local governments - 21,502 people from 6 popular councils (men and women) receiving economic benefits resulting from sustainable use and conservation of coastal ecosystems (e.g. mangrove honey) - Dissemination and awareness raising materials on adaptation issues, produced by local media Reviewed regulations and local and provincial levels regarding the protection and sustainable management of coastal ecosystems	
3: Establishment of a favourable enabling environment at regional level for the effectiveness and sustainability of adaptation investments	3.1 Consolidated information on costs and benefits of EBA available to decision makers and planners 3.2: Strengthened institutions (provincial and municipal Governments, Forest Guard Corps, Frontier Guards and Fisheries Department) supporting EBA actions, within the framework of updated and actively implemented action plans	- 2 provincial and 6 municipal development plans that make specific provision for EBA - 2 provincial and 6 municipal governments with EBA-related knowledge management systems in place - Provincial and municipal governments carrying out at least 3 training and technical support visits to each target coastal community/year - Provincial and municipal governments carrying out at least 3 supervision visits to each target coastal community/year	500,000
Project management costs			372,000
Total costs of project			5,592,000
Implementing agency fee			475,320
Total amount requested			6,067,320

PROJECTED CALENDAR:

MILESTONES	EXPECTED DATES
Submission to AF of a Full Project Proposal	January 2014
Approval of Full Project Proposal by the AFB (estimate)	February 2014
Start of Project/Programme Implementation	May 2014
Mid-term Review (if planned)	October 2016
Project Close	October 2019
Terminal Evaluation	March 2020

PART II: PROJECT / PROGRAMME JUSTIFICATION

A. Describe the project components, particularly focusing on the concrete adaptation activities of the project, and how these activities contribute to climate resilience.

Component 1: <u>Reduction of the impacts of coastal flooding through the recovery of coastal ecosystems</u>

The activities proposed under this component will consist of concrete investments in ecosystem recovery, leading to improved coastline resilience to the impacts of wave action, and improvements to coastal morphology which will reduce seawater incursion. The practices proposed have been fully studied and validated by Cuban institutions including the Institute for Ecology and Systematics (IES) and the National Institute for Forestry Research (IINAF), and take into account numerous detailed studies of the ecology and hydrology of the mangroves and other wetlands, carried out by these same institutions as well as national universities. The proposed actions, and the specific justifications of each in terms of EBA, are described under the different outputs listed below. The work will be carried out within a detailed framework of spatial and operational planning which has been developed by the IES and the forestry enterprises, which includes Geographical Information System (GIS) databases and maps based on detailed satellite imagery.

The work proposed under this component will be highly labour intensive, and will be carried out by the two forest enterprises that operate in the area, in collaboration with members of local communities. All labour costs will be co-financed by the Government of Cuba. Access to the areas where the work will be carried out is very difficult, due to the lack of roads and swampy nature of the area which makes walking virtually impossible: access can only be ensured by providing the forest enterprise, which will be responsible for the work, with boats (to enable access by sea) and tractors (for access by land).

There are no conflicts between the legal status of the target forests and the proposed implementation arrangements. The forests in the target area are State-owned, as are the Forest Enterprises which will be operating in them and which have tenure rights over them. The operations of the Forest Enterprises, as proposed in the project, will be fully in accordance with the zoning regulations applicable to these forests. These regulations (in accordance with the Forestry Law, No. 85) provide for two categories of forest: i) Production and Coastal Protection Forests[13], in which no form of productive management is permitted and ii) Productive Forests[14], into which category fall the forests in the transition zone between the wetlands and the agricultural areas. In reality, little productive activity is possible in the Productive Forests, due to the fact that they are in large part flooded. One of the adaptation strategies proposed under the Project is the permanent suspension of forest harvesting activities in areas within 15km of the coast and the reclassification of all forests in this area as conservation areas.

[13] Article 20 of the Forest Law defines the Coastal Protection Forests as “those which are situated along the length of the coasts of the Island of Cuba, the Isle of Youth and adjacent quays; their main function is protection against wind, coastal flooding caused by sea incursion, and saline intrusion, as well as national defence and the conservation of coastal ecosystems. They are also highly important as refuges and reserves of terrestrial and marine fauna”

[14] Article 17 of the Forestry Law

Output 1.1 Re-established coastal belt of red mangrove (*Rhizophora mangle*) between Surgidero de Batabanó and Punta Mora

Accelerated processes of coastal retreat have been observed along the stretch of coastline between Surgidero de Batabanó and Rosario Beach, due principally to the construction of a road close and parallel to the coast, aimed at linking Surgidero de Batabanó with Mayabeque Beach. This activity has resulted in the disappearance of the coastal belt of red mangrove (*R. mangle*) and the consequent erosion of the coast. The coast in this area is reported by Hernández-Zanuy et al., (2006) to have retreated by around 95m over a period of 40 years. The mangrove belt at present is composed of black mangrove (*A. germinans*), a species whose superficial root system does not equip it to withstand wave impacts, meaning that its roots become undermined and the trees eventually fall over.

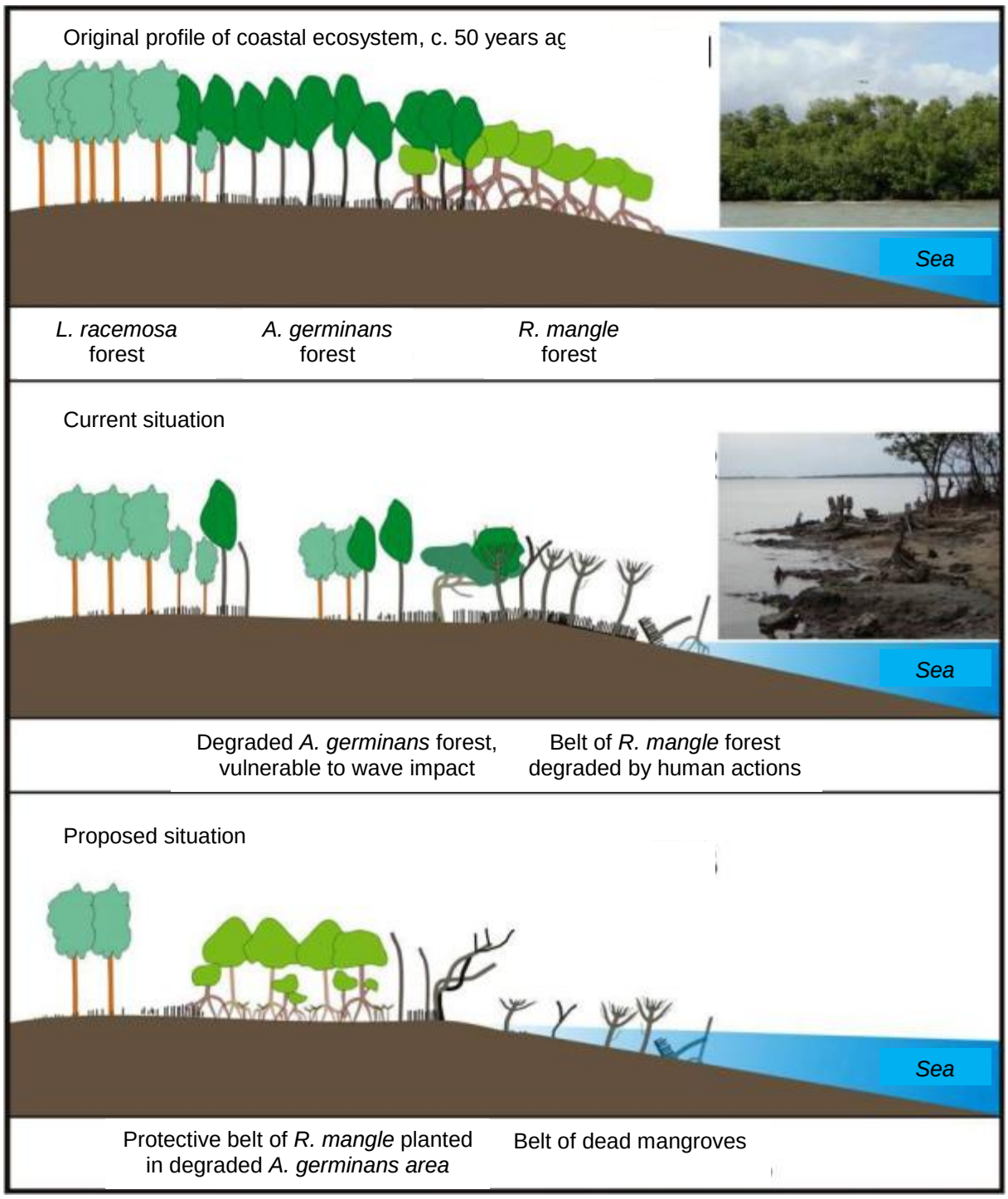
Although the seaward belt of mangroves along this stretch of the coastline has suffered severe anthropogenic degradation, studies that have been carried out of its hydrological conditions show that these have not been significantly modified (as occurred in the stretch of the coast where the Southern Dike was located) and are therefore favourable for mangrove establishment and development. The principal challenge in this area is, rather, wave impact which has resulted in increased water turbidity (affecting sea grass beds) and physical erosion of mangroves and the substrate on which they depend.

In order to detain the process of coastal retreat along this 25km long stretch, a belt of red mangroves, at least 25m wide, will be established behind the existing line of black mangrove which is currently being lost due to wave impact. This strategy will allow the young plants of red mangrove to be protected from wave impact by the existing black mangrove trees for long enough to become established. Once fully established and once the existing black mangroves have succumbed to wave impacts, the red mangroves, with their resistant and well anchored root systems, will constitute a robust first line of defence, dissipating wave impacts and accumulating sediments around their roots; these accumulated sediments will eventually also contribute to buffering wave impacts, as well as constituting a physical barrier to seawater incursion inland.

The establishment of the red mangrove belt will carried out in accordance with the technical norms of the State Forest Service. It will be planned on the basis of an initial inspection of hydrology, tide patterns, soils, salinity and microtopography in each target site. Planting material will be collected from local mangrove stands, and then planted directly without the need for nurseries; this will avoid seedling production costs and also significantly reduce the costs of plant transport. The precise locations for the establishment of each plant will take into account light conditions (the species is very light demanding) and competition with other species, principally black mangrove.

The planting will be carried out by members of the local forestry enterprises with the participation of other members of local communities: technical training will be provided to those involved as mangrove planting is not a normal activity of the forestry enterprises. Wherever possible, advantage will be taken of opportunities to use the planting activities for raising awareness of the importance of mangroves among local communities. Plant survival will be regularly monitored by the forestry enterprise, and restocking will take place as necessary, and at the age of three years the plantations will be inspected by the State Forest Service to determine whether the required standard of 85% survival has been reached.

Figure 1. Batabanó and Punta Mora



Output 1.2 Restored coastal ecosystems between Majana and Surgidero de Batabanó

Other existing coastal ecosystems, including mangroves and marshlands, will be restored through the planting of native tree species and the restoration of hydrological conditions. This ecosystem restoration work will be designed on the basis of detailed studies of to characterize the natural conditions of species composition and ecological functions, which the restoration work will aim to recreate as closely as possible in order to maximize ecological sustainability and permit the continued provision of diverse ecosystem goods and services.

The long term sustainability of this mangrove restoration work is dependent on the existence of favourable hydrological conditions. These will be ensured by clearing the accumulated vegetation which is currently blocking the drainage culverts in the Southern Dike dike which runs parallel to the coast for much of the area, thereby allowing fresh water to flow to the seaward side and reduce salinity to levels which can be tolerated by the mangroves, while at the same time reducing the excessive water levels on the landward side.

Output 1.3 Eliminated and/or controlled invasive alien species (IAS) in coastal wetlands between Majana and Punta Mora, resulting in improved ecosystem resilience

There are a number of invasive exotic species in the coastal wetlands of the target area (such as *Casuarina equisetifolia*, *Dichrostachys cinerea* and *Leucaena leucocephala*, the presence of which conflicts with EBA goals in a number of ways, including the drying out of the wetlands due to their high water demands; competition with native species with greater ability to stabilize coastlines; and/or interference with the ecology of the native wetland ecosystems, thereby reducing the ability of these to generate other ecosystem benefits (such as fish nurseries or honey production) which might otherwise provide additional incentives to the local population to participate in their conservation. A detailed plan for the management of each of these species will be developed at the start of the project.

In recognition of the difficulty that has been encountered worldwide with controlling and eliminating Water Hyacinth, and the fact that the implications of this species, as well as *Dichrostachys cinerea* (Marabú) and *Leucaena leucocephala*, for ecosystem resilience, have yet to be conclusively demonstrated in the project area, the resources dedicated to IAS under the project will be focused on *Casuarina equisetifolia*, which is the species which has been most conclusively demonstrated to undermine EBA.

Output 1.4 Restored and enriched woodlands along the landward limit of the coastal wetland belt, between Majana and Punta Mora

The swamp woodlands, which are generally found on the inner edge of the coastal belt, have been highly affected by a range of factors, including the advance of the agricultural frontier due to rice production, the pasturing of water buffaloes, the establishment of forest plantations (mostly with exotic species), and the use of agricultural chemicals and fire in the neighbouring farmlands. As a result, this forest is now highly degraded and fragmented. These forests provide important environmental services, including flood control, the reduction of the salinization of agricultural lands by salt spray, and the maintenance of the hydrological cycle. Gallery forests, located along the edges of rivers and other watercourses and water bodies, also play provide important environmental services including the control of erosion and flooding.

These woodlands will be restored through the planting of native species (the selection and location of which will be determined on the basis of the location and composition of existing fragments of these ecosystems): this will be complemented by the control of IAS (see above) and by reductions in the use of agricultural chemicals and fire in the neighbouring agricultural lands. This integrated approach will allow the restoration of both the physical structure and services of these ecosystems, and their biological composition, thereby maximizing their long term ecological resilience and their ability to generate other ecosystem-based benefits for local communities. The establishment of these native species will involve the planning of the areas and species to be restored; the collection of seed from trees in the locality; the establishment of nurseries managed by the forest enterprises in collaboration with local communities; and

planting, also carried out in collaboration between the forestry enterprises and local communities.

Component 2: <u>Integrated and participatory management of coastal ecosystems to increase resilience to climate change</u>

The effectiveness and sustainability of the concrete EBA works proposed under Component 1 will depend on them being integrated with other development and natural resource management activities in the area, and fully accepted by local communities. Despite the generally high levels of governance that are prevalent in Cuba, there ecosystems are subject to low levels of illegal extraction and clearance, principally in the form of the harvesting of mangrove trees for local construction and firewood, as well as to unintentional anthropogenic damage such as fires and runoff of agricultural chemicals. The project will help to address these threats through changes to the behaviour of the members of local communities, by increasing their awareness regarding the importance and values of mangroves, developing their capacities to participate actively in their conservation and sustainable management, and ensuring that adequate conditions of governance exist to address the drivers of degradation in coastal ecosystems.

Output 2.1 EBA mainstreamed into integrated coastal zone planning and productive sector activities

The plains inland from the coastal wetlands themselves constitute one of the most important agricultural areas of the country. In addition, a number of industrial installations are located in the area, and the communities located along the coast are bases for important fisheries activities in the Gulf of Batabanó. The success and sustainability of the EBA activities proposed under the project are dependent on these productive sector activities being carried out in ways that do not undermine ecosystem functioning. It is particularly important in this regard that roads, drainage works and other infrastructure connected with these sectors do not interfere with the hydrological processes on which mangrove ecosystems in order to maintain salinity within their tolerance levels, to permit the replenishment of sediment from terrestrial sources, and to transport propagules for natural regeneration. Particular attention will be given to the location of roads and other infrastructural works, in order that these do not obstruct water circulation routes; to the correct and adequate design of drainage works, particularly those related to the agricultural sector (in the past such drainage works have caused major negative impacts on wetland hydrology); and to the regulation of water extraction.

To this end, the project will establish mechanisms for communication and joint planning between the different sector ministries and productive sector entities functioning in the area, in order to ensure that their respective development plans are harmonized and are compatible with EBA; these considerations will also be incorporated into the spatial land use plans developed and applied by municipal and provincial governments. This joint planning will be oriented by technical guidance to be provided by the project on the location of vulnerable ecosystems and crucial routes for water movement within the project area, and on technical design options for avoiding negative impacts.

Output 2.2 Buy-in, participation and governance in local communities

The project will work in an integrated manner on developing awareness among community members regarding the importance of coastal wetlands from an EBA perspective, and on ensuring that the drivers of the degradation of coastal wetlands are addressed through effective governance.

At one level, the project will seek to influence and involve local people in relation to the protection and restoration of coastal ecosystems (and CC, EBA and integrated coastal management issues in general) by developing capacities among key members of their communities (including community leaders, teachers, leaders of productive enterprises and institutions, and journalists). This approach will be especially effective in Cuba given the well-developed organizational structures that exist in local communities and the high levels of influence of community leaders. Community leaders and motivators will be supported (through the provision of encouragement and technical advice) in the establishment and/or strengthening of local voluntary groups, dedicated to protecting coastal ecosystems and participating in reforestation and restoration initiatives, as well as the detection and reporting of threats, and the monitoring of ecosystem status. In addition, teachers in local schools will be advised on the incorporation of issues of EBA into their teaching programmes, as a means of reaching large numbers of young people who will be in a position to participate in wetland protection and other EBA activities for many decades into the future. Finally, the project will train representatives of the local and provincial media in EBA issues, so that they will be able to incorporate them into their content, especially through television and radio.

The activities involved will include:

- The design of training programmes and the production of training materials (e.g. pamphlets and videos) for key community figures.
- Conferences and workshops for local authorities, directors, specialists, technicians and workers in selected productive sectors
- Incorporation of CC and EBA issues in the political development programmes of local organizations.

The project will also carry out awareness raising directly with local community members, through the production of dissemination materials such as leaflets and posters, and the realization of public meetings, workshops and seminars. These will take advantage wherever possible of existing forums such as the Assemblies for Accountability of Delegates to their Constituents at community, municipal and provincial levels, and Neighbourhood Debates arranged by community organizations. These mechanisms will have two-way functions, serving both for raising community awareness and as channels for stakeholder consultation.

The messages delivered through these activities will vary in certain aspects from place to place. In Cajio and Guanimar, for example, they will focus on the need for resettlement of the population due to the environmental threats present there, as well as the definition of CC-resilient solutions to the challenges they will face in the areas in which they will be resettled. In Surgidero de Batabanó, by contrast, they will focus on addressing the CC-related threats in the locality where they currently live, including the rehabilitation of coastal ecosystems and infrastructure affected by CC-related impacts.

Other mechanisms to be used for promoting awareness of EBA at community level include the following:

- The creation of children's and youth groups
- Cultural activities, including festivals, plays, fairs etc.

The project will support the incorporation into local media of the results of studies carried out at local level, as well as information on the objectives of the project and issues of climate change in general. The audiovisual products to be developed to this end will include the following:

- A 3 chapter series on the ecological functioning of the Gulf of Batabanó and its fragility..
- Two documentaries on the current and potential impacts of climate change on the southern coast of Mayabeque and Artemisa provinces.
- A documentary on the recovery of mangrove areas.
- A documentary on the recovery of the Mayabeque and Surgidero de Batabanó beaches.
- A documentary of the formation, rehabilitation and restoration and protection of coral reefs.
- A documentary on the hydrological systems of these ecosystems and the actions to be carried out by the project.
- Short audiovisual presentations on local experiences of ecosystem restoration.
- Production of pamphlets, leaflets and stickers etc. for inforrmation, dissemination and awareness raising of the local population.
- Production of a manual on sucessful experiences and lessons learned.

Community members will be further involved in the project through their participation in demonstration activities, including the following:

- Reforestation of mangroves
- Rehabilitation of woodlands in the transition zones between cropping areas and swamps
- Elimination and management of invasive species in wetlands and cropping areas
- Maintenance and cleaning of drainage channels in Surgidero de Batabanó.

These increases in awareness will help to promote favourable governance conditions as they will increase peer pressure on those carrying out activities that damage coastal wetlands, and will motivate community members to monitor and report any such damaging activities. This will be backed up by reviews of existing regulations at local and provincial levels in order to ensure that they are fully appropriate, and strengthening of the capacities of the institutions at both of these levels which are responsible for the enforcement of legislation.

Output 2.3 Knowledge management systems at local level

The key objectives and principles of the project's KM strategy are described in Section G below.

The project will establish a long-term programme for monitoring of the activities carried out at the project field sites, and of key ecosystem functions and conditions, including: extent and functionality of mangroves and wetlands; hydrological and geomorphological conditions; coastal erosion rates; saltwater intrusion events; and coastal flooding events. Monitoring will involve on-the-ground activities as well as review of satellite imagery and the use of GIS and mapping software. The project will support training, equipment and infrastructure for enforcement and monitoring staff.

The long term contribution of KM to learning and to dissemination will further be promoted through the design and implementation of protocols and mechanisms for the systematization of experiences, and of the lessons learned from these. These systematization processes will be highly participatory in nature, involving members of local community members as well as forestry enterprises, local authorities and institutions of central Government. The systematization mechanisms will be tailored to the specific characteristics and needs of each of these groups of actors.

The project will furthermore develop and implement mechanisms for the active dissemination of the information generated and managed through these monitoring and systematization

processes to key decision makers at different levels (thereby contributing to Output 3.1 below); and for its continuous feedback into project decision-making to ensure that management is truly adaptive in nature, adjusting its strategies and emphases as necessary in order to maximize impact and cost-effectiveness.

Component 3: <u>Establishment of a favourable enabling environment at regional level for the effectiveness and sustainability of adaptation investments</u>

Output 3.1 Consolidated information on costs and benefits of EBA available to decision makers and planners

Economic valuations will be carried out to summarize landscape level costs and benefits of Ecosystem-Based Adaptation. The full economic value of ecosystem services provided by Cuba's coastal ecosystems are little understood and poorly quantified. This lack of understanding makes it difficult to accurately identify the true economic costs of potential climate change impacts, and of human activities that contribute to the degradation of these ecosystem services and reduce climate change resilience. In addition, local stakeholders tend to under appreciate the value of coastal ecosystems such as mangroves and wetlands for economic purposes and for climate change resilience. To further clarify these issues for local stakeholders, a study also will be carried out on the projected economic impacts of climate change on local communities, including analysis of impacts by gender, age, etc., and how those economic impacts may be mitigated by EBA approaches. Also, as a key element in selecting specific EBA approaches for the project, a report will be produced comparing the costs and benefits of various options for responding to climate change impacts, including: 1) EBA approaches proposed by the project; 2) construction of coastal protection structures (seawalls, dams); and 3) resettlement and relocation of persons and infrastructure from the coastal zone inland. Resource managers will thereby be capable of assessing the ecological, social, and economic costs/benefits of various management decisions so that EBA approaches are applied in view of short and long term ecological impacts and costs. The information presented in these studies, and the capacity to complete similar studies in the future, will equip decision-makers with the tools required to make fact-based economic arguments for EBA approaches to climate change. Activities and products generated by this output also will be used to increase local community support.

Output 3.2 Strengthened institutions (provincial and municipal Governments, Forest Guard Corps, Frontier Guards and Fisheries Department) supporting EBA actions, within the framework of updated and actively implemented action plans

Under instruction from central Government, provincial and municipal governments are currently in the process of developing Climate Change Action Plans. The project will assist these local governments in finalizing these plans (where appropriate) and ensuring that they make adequate provision for EBA in coastal ecosystems. It will also support their effective implementation through the development of knowledge management systems, including provision for the monitoring of advances and impacts, and the systematization of lessons learnt.

The two forestry enterprises in the project area have well developed technical capacities in relation to the establishment and management of 'conventional' forest plantations. They have little experience or technical knowledge, however, in relation to reforestation and restoration in mangroves and other coastal wetlands. The project will provide logistical support for the transfer of knowledge on these technical issues to the members of the enterprises, by staff of national academic institutions, the IES and the IINAF.

Discussions are currently in process regarding the legal protection status of mangroves at national level. The project will also support the local forest enterprises in defining those areas of mangroves under their responsibility to be designated for strict protection within their areas.

A. Describe how the project / programme provides economic, social and environmental benefits, with particular reference to the most vulnerable communities.

The proposed AF project will focus on the maintenance and restoration of essential ecosystem functions in the coastal zone, with the goal of reducing climate change induced flooding, erosion and saltwater intrusion through ecosystem based adaptation measures. By increasing the capacity of Cuba's coastal communities to adapt to climate change, the project will reduce the need for investment in immensely costly structural solutions (seawalls and dikes) and/or relocation away from the most vulnerable coastal areas. As a result, government funds can be directed towards social welfare and human development priorities, thereby generating significant national benefits. In addition, if projections for sea level rise and increased storm intensity become reality, more and more of the coastal zone of Cuba will require some combination of coastal protection structures and EBA approaches in the coming decades. Therefore, by providing models for the design and construction of future coastal protection infrastructure, the approaches developed in the project will provide benefits to the entire country.

The primary direct beneficiaries are the inhabitants of the most vulnerable coastal landscapes in the provinces targeted by the project. These districts have a combined population of approx. 292,207 persons. The farmers, fishermen and other inhabitants of these communities are particularly vulnerable to the loss of livelihoods from recurring flooding, saltwater intrusion on agricultural lands, destruction of mangroves (which are of vital importance as fisheries habitat) and other climate change impacts: the project will contribute to the reduction of all of these threats and consequently will significantly stabilize local livelihoods. This is likely to benefit women in particular, who tend to be the most subject to social upheaval as a result of climate change, typically being obliged to migrate first away from the affected areas in order to ensure safe conditions for their children. A gender-balanced approach will be taken and inclusion of female-headed households will be encouraged in all demonstration activities (a gender strategy for the project, with support from UNDP Cuba, will be developed at project inception).

The project will have a range of interlinked social, environmental and economic benefits, all of which will contribute to increasing community resilience and adaptive capacity to increasing climate variability and change.

Table 1. Summary of key benefits of the proposed project.

Benefits	Project – Adaptation Benefits
Social Benefits	• Around 21,502 people (men and women) in the targeted districts will benefit from protection from climate change impacts (flooding, erosion and saltwater intrusion), thereby protecting livelihoods, reducing property damage, ensuring water supplies, and reducing disease and other human health impacts • Around 270,705 local inhabitants (men and women) in specific areas where EBA approaches are implemented, in particular those persons

Benefits	Project – Adaptation Benefits
	whose livelihoods are based on agriculture, fisheries and tourism, will benefit from protected and/or enhanced ecosystem conditions and services necessary to sustain their livelihoods • Improved food security for local farmers and fishermen • Increased awareness and improved knowledge on climate change impacts enhances capabilities of communities to undertake autonomous adaptation actions
Economic Benefits	• Protection of land and crops from losses due to climate change impacts (reduced flooding, erosion and saltwater intrusion); increased security of water supply for agricultural production • Protection of critical habitat (mangroves) for commercial fishermen • Conservation of wetlands ecosystems (including prevention of overly saline conditions) allows for continued hunting, fishing and vegetation harvesting by local inhabitants • Important infrastructure (e.g. roads and settlements) protected from coastal erosion and flooding • Avoided cost of dike construction cost / maintenance (thus ensuring more funds available for other national priorities, such as health, education, etc.)
Environmental Benefits	• Increased resilience of ecosystems (mangroves and wetlands) to provide essential ecosystem provisioning and regulating services: flood control and prevention; erosion prevention; freshwater for human consumption and agricultural use; habitat for biodiversity. • Carbon sequestration increased through mangrove reforestation and wetlands conservation

B. Describe or provide an analysis of the cost-effectiveness of the proposed project / programme.

The primary focus of the project is the implementation of cost-effective, on-the-ground EBA approaches to ensure that vulnerable coastal areas can better resist potential future climate change impacts. During preparation of this concept, a number of different options to promote coastal protection were compared in terms of cost-effectiveness and sustainability. Table 7 shows the estimated costs of physical defence works in the Caribbean islands. Using the lowest of these estimates ($650/m for concrete and rock coating or rock breakwaters), the total cost for the 84km stretch between Punta Sucia and Punta Mora would be US$54,600,000.

Table 2. Cost estimates for physical coastal defence works in the Caribbean islands[15]

Type of structure	Cost (US$/m)	Total cost for 84km
Concrete and rock coating	650-975	54,600,000-81,900,000
Rock breakwaters	650-975	54,600,000-81,900,000
Concrete breakwaters	680-1,170	57,120,000-98,280,000
Offshore rock breakwaters	2,925-3,900	245,700,000-327,600,000
Offshore concrete breakwaters	3,250-4,225	273,000,000-354,900,000

The EBA approach to be applied by this project, which will result in the restoration and rehabilitation of 7,318ha of coastal ecosystems, is budgeted at US$5,245,211 for the same area, or 9.6% of the cost of physical works (a difference of $49,354,789) based on this assumption. Precise comparable data are not available for Cuban conditions; however additional detailed and current cost calculations have been developed during the project design process, for the structural rehabilitation of a 19.5km length of the Dike (which will in practice be carried out by the INRH under separate initiatives), which gives some indication of costs for comparable coastal infrastructure. The costs are as follows:

1. Reparation and leveling of 19km of Dike would cost $2,400,000
2. Draining and renewing the structures (including concrete cladding, sand and gravel filters, tarmac and sluices) would cost $50,000
3. Technical assistance and topographical work would cost $300,000.

The total for the 19.5km length would therefore be $2,750,000, equivalent to approximately $141/m. If this cost were used (which is 4.6 times lower than the minimum shown in Table 2), the EBA approach would still be only 44% of the cost of infrastructural work.

The relative cost-effectiveness of the EBA approach will be even greater when the ecosystem services of mangroves are taken into account: the conservative estimate of Constanza et al. shown in Table 8 is that these are worth around $9,900/ha/year: applying this estimate to the project area, this would equate to an additional sustained $74,228,200/year,

Table 3. Estimated mangrove ecosystem services worldwide[16]

Source	Region	Ecosystem services included	Value, US$/ha/yr
Constanza *et al.*	Worldwide	All services	9,900
Sathirathai and Barbier	Thailand	All services	27,264-35,921
Ronnback	Worldwide	All fisheries	750-11,280
Aburto-Oropeza *et al.*	Mexico	Fish and blue crab fisheries	37,500

With regard to the development of the enabling environment (policy and legal changes, capacity building, strategic planning, knowledge and information systems), there are no reasonable alternatives to the approaches proposed. The project is designed to address all national

[15] http://www.unesco.org/csi/pub/source/ero18.htm

[16] Aburto-Oropeza *et al.* PNAS . **July 29, 2008.** vol. 105. no. 30 _ **10457 ENVIRONMENTAL SCIENCES** information online at www.pnas.org/cgi/content/full/0804601105/DCSupplemental

policies, institutions and other resources that have some relationship to ecosystem based adaptation to climate change, and thereby ensure that all the necessary approaches and tools are in place to implement the EBA approaches, and to support their full replication over the long-term to all vulnerable areas in the country.

The project structure, with approximately 71% of funds allocated for technical solutions (Component 1) is believed to be the most effective and balanced way of implementing the coastal adaptation process in Cuba, with a priority given to actual interventions that reduce coastal vulnerability.

In terms of project execution, UNDP, national and local government and other stakeholders will each be dedicating large amounts of staff time to ensure that the project is properly executed. Technical assistance, both national and international, will be designed so that selected individuals can provide support for several project outputs, alleviating the need to recruit, transport, and otherwise support a large team of experts to support project implementation. Throughout the project, AF resources will be aligned with the financing and delivery of project Outputs that have competitive procurement components to ensure best value for money.

C. Describe how the project / programme is consistent with national or sub-national sustainable development strategies, including, where appropriate, national or sub-national development plans, poverty reduction strategies, national communications, or national adaptation programmes of action, or other relevant instruments, where they exist.

The principal legislative instrument of relevance to climate change adaptation is the **Environment Law (Law #81 of 11th July 1997)**.

Cuba has a well-developed legislative and institutional framework at national level in relation to CC adaption, as a result of its long experience and well-proven ability with disaster management. Provisions for civil defence in relation to natural disasters are established through **Decree #170 of May 1997, on the System for Civil Defence Measures**. This provides for a high level of participation of local institutions, in particular municipal governments. In reflection of the prioritization of this issue by the Government, studies have been produced at provincial and municipal levels, projecting threats, vulnerability and corresponding risks, especially in relation to hydrometeorological phenomena.

Project activities closely reflect the provisions of the following policy instruments:

- The **National Environment Strategy 2011-2015**, which stresses the strengthening of local environmental management, and recognizes climate change as the principal global challenge which requires the application of short, medium and long term measures in accordance with threats, vulnerability and risks.
- The **Cuban Civil Society Progamme for Addressing Climate Change**, which dates from 2007 and involves actors from ministerial level down to Local Organs of Popular Power, and is aimed at addressing the implications of CC for development plans, in terms of threats, vulnerability and risks, with particular reference to hydrological resources, agriculture, coastal zones, health, biodiversity and human settlements. This programme includes research and mapping for the whole country in relation to the threats, vulnerabilities and risks of strong winds, intense rainfall and seawater

incursions. The targets established under this Programme are incorporated into the National Environment Strategy.

- In the **First National Communication to the UN Framework Convention on Climate Change** in 2001, Cuba proposed a series of concrete measures in relation to CC adaptation, for the rational use of hydrological resources, the protection of beaches and mangroves, the improvement of agriculture, the conservation of forest resources, territorial land use planning, the protection of biodiversity and wildlife, and the preparation of the health system.
- The **Second National Communication** reflected the actions developed to date in relation to education and communication on climate change, mitigation and adaptation. As a final result of this process, a communication strategy was developed which constituted the basis for the "Cuban Programme on Education, Communication and Awareness Raising on Climate Change", which establishes the objectives and principal actions to be carried out in order to prepare the country for CC-related impacts, including sea level rise and saltwater intrusions.
- The **National Strategy for Environmental Education (2010-2015)** establishes as priority issues those related to climate change and to threats, vulnerability and risks, proposing in its action plan the incorporation of these issues into educational curricula at different levels, and also into the training programmes of decision-makers and workers, together with their dissemination through communications media and the incorporation of the population (especially the young) into community projects.

D. Describe how the project / programme meets relevant national technical standards, where applicable.

The actions undertaken under the project will be in full accordance with national legal and technical norms for environmental protection.

The principal legislative instrument in the Cuban environmental sector is the Environment Law #81 of 1997. Article 105 of that law refers specifically to mangroves, and stipulates that the Ministry of Agriculture, in coordination with the Ministry of Science, Technology and Environment (CITMA), will regulate the management of mangroves and other vegetation in cays, channels, bays, inlets and coastal areas, or on the coastline, in river mouths and other places that may serve as refuges for fisheries resources and for the protection of other natural resources.

The legal and technical standards for protection forests such as mangroves depend legally on the current norms related to coastal zones and the forest estate. The principal legal instruments that complement Law #81 in relation to coastal zones are as follows:

- Law #85 (Forestry Law) of 21st July 1998
- Decree/Law 212 on Coastal Zone Management, of 8th August 2000.
- Decree/Law 200 on Environmental Infractions, of 22nd December 1999.

Article 7e of the Forestry Law states that it is the responsibility of MINAGRI to "regulate, in coordination with CITMA, the protective management of mangroves and other coastal vegetation, in cays, in cays, channels, bays, inlets and coastal areas, or on the coastline, in river mouths and other places that may serve as refuges for fisheries resources and for the protection of other natural resources.

Article 15 of the Forestry Law defines three types of forests: production, protection and conservation. Protection forests are in turn classified as either “water and soil protection forests” or “coastal protection forests” (Article 18). Article 20 of the Law defines coastal protection forests as those situated along the length of the coastline. The main function of these forests is stated to be protection against saline intrusion, wind erosion and coastal flooding due to sea penetration. In these zones it is prohibited to carry out activities leading to the permanent elimination of the vegetation (Article 21). Article 27 adds that coastal forestry belts are subject to a special protection regime and the felling of trees for exploitation is prohibited.

Decree/Law 212 of 2000 on the Management of Coastal Zones defines the extent of the coastal zones on the basis of physiographic factors, and regulates actions which guarantee the protection and sustainable use of the coastal zone and its protection zone, on the basis of principles of integrated coastal zone management.

The approval and execution of plans for addressing disaster situations is established under Decree/Law #170 on the Systems of Civil Defense Measures and Directive #1 of the President of the Council for National Defense, of 2010.

The project includes no building or infrastructural works that would cause potential negative impacts on the environment, that would require an Environmental Impact Assessment.

The activities in the Project are in accordance with the following specific technical norms:

- **NC 93-05-202: 88**. This norm establishes measures for the prevention of fires that must be carried out prior to critical periods, in forests and neighbouring areas, in order to avoid fires.
- **NC 23: 1999**. This norm establishes the dimensions and characteristics of forestry belts in protection zones of reservoirs and watercourses, as well as the activities authorized there.
- **NC 31: 1999** on soil quality. This norm establishes requisites for the treatment to be applied to the fertile layers of the soil at the time of carrying out soil movements, which will also be used for the improvement of soils with low productivity and for the reestablishment of fertility in soils that are to be rehabilitated.
- **NC 53-126: 85** "Geometric design of forest roads". This norm specifies the fundamental parameters and typical cross sections of forest roads. They apply to all new road construction projects, and to the reconstruction of existing roads.
- **NC 71-03:** “Silviculture. Sampling of forestry seed”: This norm establishes methods for sampling to evaluate the quality of forestry sedes.
- **NRAG -508: 88** "Silviculture: site preparation and plantation maintenance”.
- **NRAG -1026: 2002** "Silviculture, Forestry Seeds". Quality specifications

E. Describe if there is duplication of project / programme with other funding sources, if any.

During the process of project formulation, all relevant actors were consulted and a review was carried out of current or planned projects. This review confirmed that the project will not duplicate any of these initiatives, but rather will generate synergies and complementarity.

There are several projects under implementation at present in Cuba in relation to the protection of marine and terrestrial biodiversity. Although some of these promote sustainable development initiatives and climate change adaptation practices in function of biodiversity conservation and the improvement of the quality of life of local communities, the objective of most of these is the reduction of threats to intact ecosystems, rather than the restoration or improvement of the functionality of degraded ecosystems, as is the case with this project. The other initiatives do not have a specific focus on the management of CC-related risks, though the application of EBA approaches.

The GEF/UNDP Project **"Application of a regional approach to the management of marine and coastal protected areas in the southern archipelagos of Cuba"** builds on the earlier project "Strengthening the National System of Protected Areas" (1998-2010) and covers more than 6 million hectares, including the marine and coastal area of the south of the Artemisa and Mayabeque provinces where this project will operate. The actions of the GEF/UNDP project will emphasize the conservation of marine and coastal ecosystems, and will complement the actions of the present project by helping to conserve marine ecosystems (coral reefs and seagrass beds) which constitute "first lines of defense" for the coast against the impacts of climate change, before the mangroves and wetlands which are the main focus of this project.
Invasive Alien Species (IAS) have the potential to modify the structure and/or species composition of coastal ecosystems, which potentially increases their susceptibility to the effects of climate change. The GEF/UNDP Project **"Improving the prevention, control and management of Invasive Alien Species in vulnerable ecosystems in Cuba"** includes in its target areas the Habana-Matanzas Plains, which adjoin the coast of Artemisa and Mayabeque provinces, where the present project will work. The IAS project will complement and support this project by contributing to the development of systemic capacities for the prevention, detection, control and management of IAS in Cuba.

There are other projects under way in the country aimed at supporting CC adaptation in the agricultural sector, but none have the specific objective of EBA. Project 2 of the GEF/UNDP Country Pilot Programme (CPP) on Sustainable Land Management **("Creation of capacities for the coordination of information and monitoring systems/sustainable land management in areas with water resource management problems"**) will also work on the Havana-Matanzas plains, but again does not have a direct EBA focus: the CPP aims to mitigate the causes and negative effects of land degradation on the structure and functional integrity of ecosystems, through sustainable land management practices.

The EU-financed project **"Environmental Bases for Local Food Security (BASAL)"** will work in three municipalities of agricultural importance (Los Palacios, Güira de Melena y Jimaguayú). Its actions will focus on support CC adaptation through strengthening capacities for monitoring environmental conditions and trends; training of local actors; and the incorporation of environmental issues in local socioeconomic development plans (with a focus on food security).

The detailed planning study for the "**Project for the Prevention of Saline Intrusion in Aquifers of the Southern Catchment Mayabeque and Artemisa provinces**", financed by JICA, aims to improve the management of subterranean aquifers, including measures for the prevention of saline intrusion, taking into account the influence of climate change. That project again complements, rather than duplicates this proposal, as it focuses on managing the aquifer itself rather than addressing the above-ground problem of seawater incursions.

The GEF-funded enabling activity project **"Activities in support of the preparation of the Second National Communication by the Republic of Cuba to the UNFCCC" strengthens** technical and institutional capacities in Cuba for the implementation of its commitments within the context of the UNFCCC, including the integration and systematization of knowledge and information related to CC, and linkages to priorities of sector and territorial development. The project uses the provinces of Artemisa and Mayabeque as a study area for evaluating the nature and trends of CC, with the aim of supporting efforts to establish policies and CC adaptation measures. It also includes evaluations of vulnerability and adaptation measures in selected sectors including energy, agriculture, water resources, biodiversity, forestry and industry, and involves actors from the education sector and communications media in the selected area. Its activities include scenario studies, the formulation of corresponding adaption measures and the evaluation of impacts. It therefore constitutes a valuable source of scientific information for the project proposed here, but does not involve the actual implementation of CC adaptation measures.

Summary of synergies and complementarity with other projects

CC impacts do not occur in an isolated manner. The activities of the EBA project proposed here, and the participation of local communities including the restoration of habitats such as mangroves constitutes a (cost-) effective means of reducing risks associated with disasters such as hurricanes, tropical storms and southerly winds, such as saline intrusion and coastal erosion. This complements and supports the adaption-related activities carried out by other projects in the agriculture and water management sectors further inland (especially on the Havana plains), through the control of flooding and of aquifer salinization, and the retention of saline spray. The recovery of the mangrove zone, meanwhile, complements the GEF-funded project on protected areas in the southern archipelagos due to the importance of this ecosystem as a breeding and grow-on zone for fisheries populations throughout the southern marine area.

Figure 2. Spatial relations between the present project and other CC-related initiatives

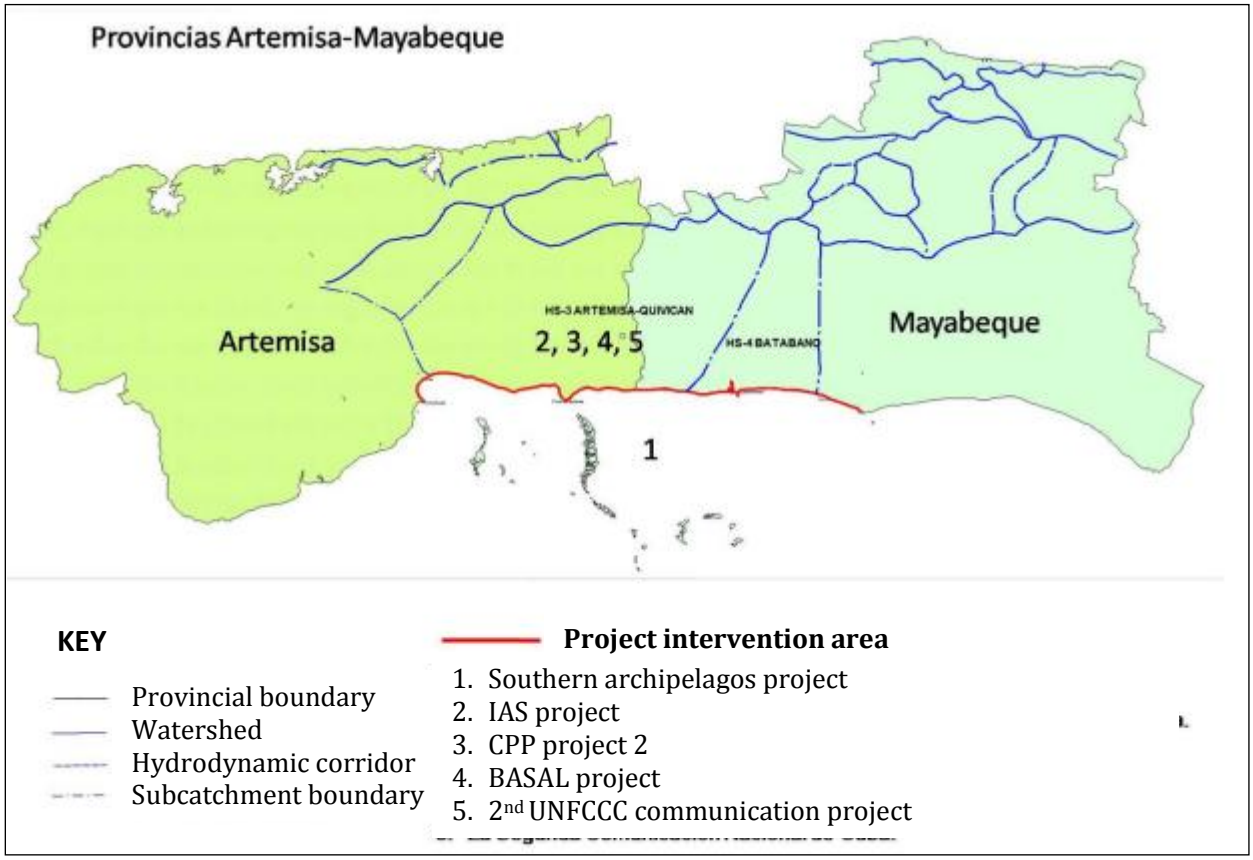
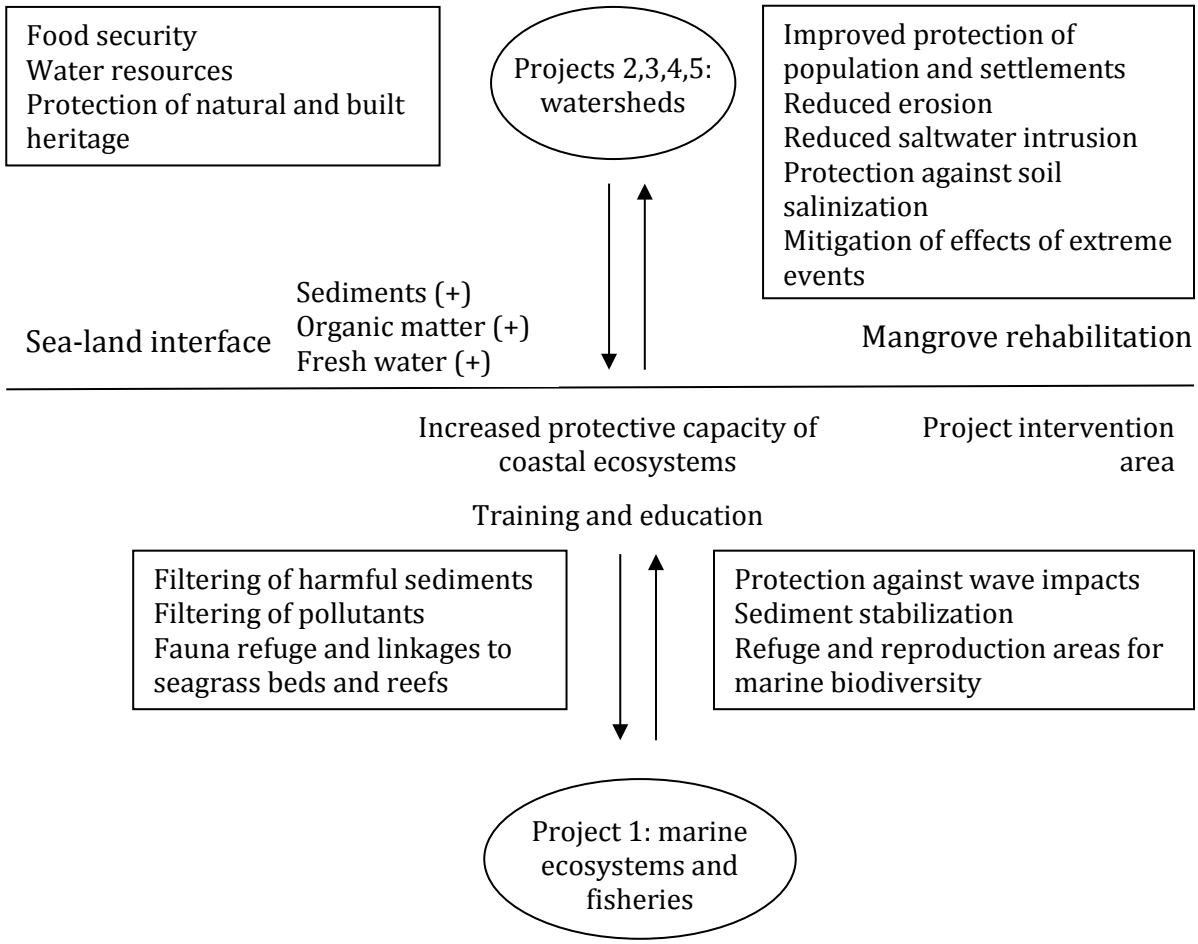


Figure 3. Schematic portrayal of the relations between the present project and other initiatives



Project 1. Management of marine and coastal protected areas in the southern archipelago.
Project 2. Improved prevention, control and management of IAS in vulnerable ecosystems.
Project 3. CPP Project 2: creation of capacities for information coordination and monitoring systems/SLMA in areas with water management problems
Project 4. Environmental bases for local food security (BASAL)
Project 5. Enabling Activity for Second National Communication to UNFCCC.

F. If applicable, describe the learning and knowledge management component to capture and disseminate lessons learned.

Learning and knowledge management is an important aspect of the project, reflecting one of the key themes of the Adaptation Fund. KM activities are provided for under Output 2.3. The implementation of adaptation activities on the ground will constitute the primary learning experience and the first country-specific knowledge on EBA approaches to climate change adaptation, and will feed into all awareness, training and knowledge management actions of the project. The project will share this information, along with best practices from international experiences, with key stakeholders and the general public. In accordance with AF guidance, the main objectives of the KM activities will be as follows:

1. To increase project impact increased through learning and access to information. The proposed KM activities will permit the application of an “adaptive management” approach to the project, whereby the management decisions of project managers at local, provincial and central levels will be guided on a continuous basis by regularly updated information on changes in the social and biophysical environment within which the project operates, and on the effectiveness of the strategies applied by the project itself, as measured by progress with key project indicators. This will be achieved through a combination of effective monitoring by the project team, and technical inputs from national research institutions.
2. To enhance synergies between local and global knowledge. Lessons learnt at local level (to date and in the process of project implementation), regarding EBA strategies such as mangrove reforestation and wetland restoration, will be systematized in accordance with predetermined protocols. At the same time, project managers and members of national research institutions will maintain themselves at the vanguard of global knowledge regarding EBA options and their effectiveness, on the basis of both academic literature and lessons generated, systematized and disseminated through other AF projects worldwide.
3. To capture effectively knowledge generated from the project to facilitate its dissemination at a local, regional, and global level. This will be achieved through the project’s monitoring and evaluation system and systematization procedures. Opportunities for replication at national level of the project’s experiences, as a result of the dissemination of knowledge generated and lessons learnt, as described below (Figure 17).

Specific aspects of the KM approach of the project will include:

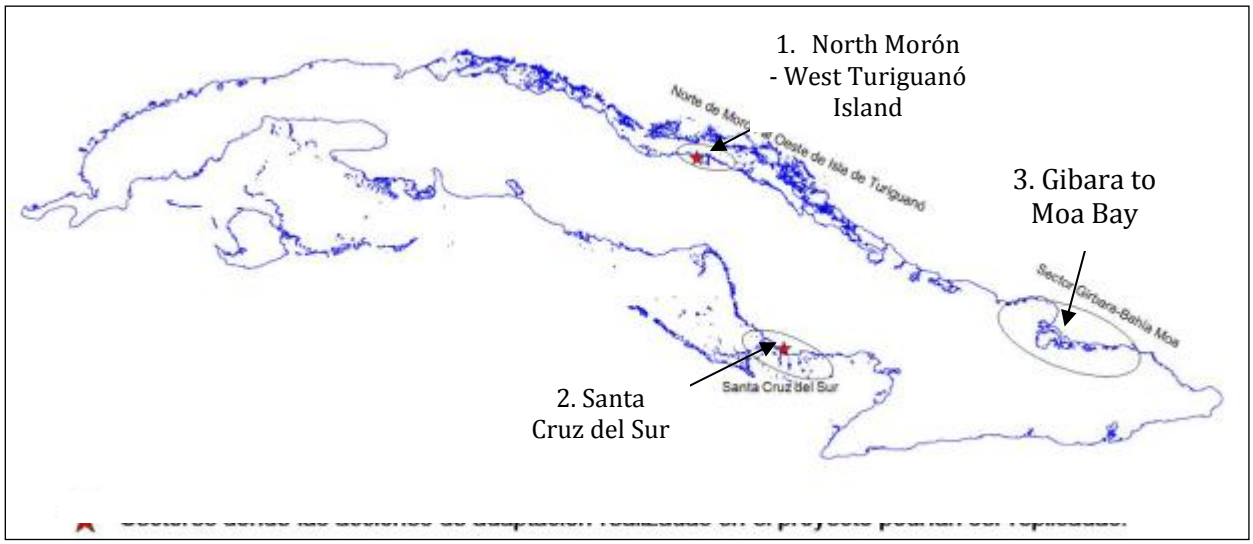
- A long-term programme for monitoring of the activities carried out at the project field sites, and of key ecosystem functions and conditions, including: extent and functionality of mangroves and wetlands; hydrological and geomorphological conditions; coastal erosion rates; saltwater intrusion events; and coastal flooding events. Monitoring will involve on-the-ground activities as well as review of satellite imagery and the use of GIS and mapping software. The project will support training, equipment and infrastructure for enforcement and monitoring staff.
- The design and implementation of protocols and mechanisms for the systematization of experiences, and of the lessons learned from these, in order to promote the long term contribution of KM to learning and to dissemination. These systematization processes will be highly participatory in nature, involving members of local community members as well as forestry enterprises, local authorities and institutions of central Government. The systematization mechanisms will be tailored to the specific characteristics and needs of each of these groups of actors.
- The development and implementation of mechanisms for the active dissemination of the information generated and managed through these monitoring and systematization processes to key decision makers at different levels (contributing also to Output 3.1); and for its continuous feedback into project decision-making to ensure that management is truly adaptive in nature, adjusting its strategies and emphases as necessary in order to maximize impact and cost-effectiveness.

The establishment of effective provisions for knowledge management by the project, under Component 2, will facilitate the replication of the lessons learnt in the course of its implementation. There is significant potential for the EBA approaches applied in this project to

be replicated elsewhere in the country, in other sites where mangroves have the potential to buffer and reduce the effects of CC-related phenomena, yet are in a degraded condition, including the following (see :

1. The sector from the North of Morón to the West of Turiguanó Island in Ciego de Ávila province (2 settlements)
2. Santa Cruz del Sur sector, in Camagüey province (2 settlements) – during Hurricane Ike in 2008, seawater penetrations reached at least 800m inland.
3. The sector from in Holguín province (9 settlements)

Figure 4. Potential replication areas



G. Describe the consultative process, including the list of stakeholders consulted, undertaken during project preparation.

The project design process commenced with a workshop to develop the initial project idea, based on national priorities in relation to climate change adaptation measures. This interchange involved experts from a range of different national institutions related to climate change issues, and took into account the analyses and recommendations of a series of different reports and directives, including “General Results of the Macroproject on coastal threats and vulnerability for the period 2050-2100” and “Directives and Action Plan of the Macroproject”, technical reports on threats, vulnerability and risks of coastal flooding due to marine penetration in all provinces in the country (up to 2011), activities in support of the preparation of the Second National Communication to the UNFCCC and the evaluation of possible implications of climate change for marine and coastal biodiversity in Cuba. In this event, a comparative analysis was carried out of a range of stretches of coastline in the country, taking into account the threats posed by SLR, and their physical, geographical, economic and social characteristics. On the basis of this the southern coast of Mayabeque and Artemisa provinces was selected.

Once the fundamental idea of the proposal had been defined, a number of working meetings were held with specialists from different institutions to define the objectives, principal components and areas of work of the project. In addition, the provincial and municipal governments of the two target provinces were involved, in order to discuss the project idea and

to visit the working areas. In the process of these field visits, exchanges were carried out with local authorities and community members, to discuss project activities.

A workshop was carried out to discuss the project with the different Organisms of the Central State Administration (OACES). From this moment on communications were undertaken with a number of these institutions to request information and advice, and to analyse more specific technical issues with a selection of them. Analyses were carried out with the institutions involved in each component of the project of their technical and human capacities for the proposed tasks, and of synergies with other projects in the area.

The development of the Project has been carried out in close consultation with the Designated National Authority for the Adaptation Fund, which is the Direction of International Relations of the Ministry of Science, Technology and Environment (DRI-CITMA), with functionaries of the Ministry of External Commerce (MINCEX) and UNDP as the multilateral implementing agency.

In order to ensure the participation of government, local communities, experienced non-governmental organizations and other sectors, well-established and tried participation mechanisms were used including consultations with local community delegates (who represent the lowest level of political/administrative division in the country. Consultations were also held with heads of Popular Councils, who are also representatives of the electors of other political/administrative divisions related to the economic, social and environmental management of the territory. The project preparation team met with representatives of local governments and obtained the opinions of grassroots organizations in the participating municipalities, with the Federation of Cuban Women and with the gender group of the Ministry of Agriculture to address gender issues, and with other NGOs with experience in the implementation of environmental and climate change projects, such as Pro-Naturaleza.

At the end of this process a launch workshop was held for the proposal, with the direct stakeholders of the project, to maximize their awareness and commitment.

Table 4. Consultations carried out during the project design process.

Type/objective of consultation	Date	Centre/Participants	Results/agreements
Expert workshop	16/06/2011	Location: Hotel Meliá Habana AMA, IES,IDO MINAG, ,MINCEX - DOEI,DMA,INSMET, PNUD, CITMA Matanzas	Identification of the initial idea of the project.
Working sessions	22/07/2011 2/08/2011	Location: AMA AMA,IDO,IES, dependencies of INRH and MINAG	Definition of objectives, área of work and components of the prject, technical discussion and proposals of solutions
Tour to the areas with specialists and	July 2011	Location: Coastal sector of Artemisa and Mayabeque	Evaluation of areas of work of the project

Type/objective of consultation	Date	Centre/Participants	Results/agreements
representatives of provincial governments		AMA,IDO,IES, dependencies of INRH, MINAG, provincial governments	
Visit to the Government of Surgidero of Batabano	July 2011	Location: Surgidero Government: AMA,IDO,IES, dependencies of INRH, MINAG and CGR	Exchanges with the government on the problems of this zone in relation to CC, and proposals of possible solutions
Consultation workshop to validate the project idea	31/8/2011	Location: INRH CIGEA, CNAP, *CIPS*-MINAL, IES, IDO, DCT-MINAG, DNF-MINAG, GEAM-MINAG, IPF MINFAR, EMDC, CGB-MININT**,** MINED, MINSAP, CH-INRH, GEARH, DPRH, EIP-INRH, PT Mundo Latino, CGRR- Batabanó, Municipal Government of Surgidero of Batabanó, CITMA-Artemisa and Mayabeque	Presentations and debates by different organisms to validate the proposal in relation to the situation of the coastal zone.
Working meetings with the different organisms involved in designing each component of the project	Sept –Nov. 2011	Location: AMA-PVR and EFI Mayabeque AMA-PVR, CIGEA, IES, IINAF,GEAM-MINAG,DCT-MINAG, DNF-MINAG**,**CITMA-Artemisa and Mayabeque, CAP Artemisa and Mayabeque	Elaboration of Project components and consultation with other organisms to request information needed for project design
Visit to Mayabeque and Artemisa provinces for meetings with communities	Sept –Nov. 2011	Location: Artemisa and Mayabeque Provinces AMA-PVR, CIGEA, IES, CITMA-Artemisa and Mayabeque, CAP Artemisa and Mayabeque	Meeting with provincial authorities in the government to define local level actions.
Meeting with DRI-MINCEX-PNUD	13/02/2012	Location: DRI DRI, AMA, PNUD	Support to the Project, taking into account national regulations on international cooperation projects

Type/objective of consultation	Date	Centre/Participants	Results/agreements
Launch of the proposal with direct Project stakeholders	25/05/2012	Location: DRI AMA-PVR, CIGEA, IES, IINAF,GEAM-MINAG,DCT-MINAG, DNF-MINAG**,**CITMA-Artemisa and Mayabeque, CAP Artemisa and Mayabeque, CGB-MININT, DRI- CITMA, DMA-CITMA, DCT-CITMA, DPI-CITMA, DOEI-MINCEX,PNUD	Approval of the project proposal in the DRI with direct Project stakeholders

The following institutions were consulted during project design:

- **Ministry of Science, Technology and Environment (CITMA)**
  - Directorate of Environment (DMA-CITMA)
  - Directorate of Science, Technology and Innovation (DCT-CITMA)
  - Directorate of Planning and Investment (DPI-CITMA)
  - Directorate of International Relations (DRI-CITMA)
  - Centre of Environmental Information, Management and Education (CIGEA)
  - National Centre of Protected Areas (CNAP)
  - *Centre* for *Psychological and Sociological Research* (*CIPS*)
- **Environment Agency (AMA-CITMA)**
  - Dpt. of International Collaboration (AMA-CITMA)
  - National Risk Evaluation Group (AMA-PVR-CITMA)
- **AMA-CITMA Research Centres**
  - Institute of Ecology and Systematics (IES)
  - Institute of Oceanology (IDO)
  - National Institute of Meteorology. Climate Centre (INSMET)
- **Ministry of Agriculture (MINAG)**
  - Directorate of Science and Technical Issues (DCT-MINAG)
  - National Forestry Directorate (DNF-MINAG)
  - Directorate of Mountain Empresarial Group (GEAM-MINAG)
  - Mayabeque Forestry Enterprise (EFI-MINAG)
  - Institute of Agroforestry Research (IINAF)
- **Ministry of Armed Forces (MINFAR)**
- **National Civil Defense Command (EMDC)**
- **Ministry of the Interior (MININT)**
  - Forest Guard Corps
- **Ministry of Education (MINED)**
- **Ministry of External Relations (MINREX)**
- **Ministry of Public Health (MINSAP)**
- **Ministry of the Food Industry (MINAL)**
  - Fisheries Research Centre (CIPS)
- **Ministry of External Commerce and Foreign Investment (MINCEX)**
  - Directorate of International Economic Organisms (DOEI) of MINCEX

- **National Institute of Hydraulic Resources (INRH)**
  - Directorate of Hydrological Basins (CH)
  - Hydraulic Management Enterprise Group (GEARH)
  - Provincial Delegation of Hydraulic Resources (DPRH)
  - Research and Hydraulic Projects Enterprise (EIP Habana-INRH)
- **Institute of Physical Planning (IPF)**
- **Provincial Governments**
  - Provincial Government of Artemisa
  - Provincial Governments of Mayabeque
  - Council of the Provincial Administration of Artemisa CAP-Artemisa
  - Council of the Provincial Administration of Mayabeque CAP-Mayabeque
- **Local Governments**
  - Municipal Government of Surgidero de Batabanó
  - Risk Management Centre of Batabanó, local Governments (CGRR- Batabanó)
- **Non-Governmental Organizations**
  - Federation of Cuban Women (FMC)
- **Mundo Latino Television Producer**
- **United Nations Development Programme**

In addition the project proponent included a consultation process with local communities during the project preparation phase. The following communities were consulted:

Municipalities	**Popular Councils (community-based organizations)**	**Communities**
Melena del Sur	Monte Zapote	Playa Mayabeque
		La Luisa
		Ojo de Agua
Batabanó	Surgidero	Surgidero de Batabanò
		Batabanó
		El Tomate
		Camacho
Güira de Melena	Cajío	Playa de Cajío
		El Junco
Alquìzar	Pulido-Guanimar	Guanimar
Artemisa	A. Lincoln	Playa Majana

Table 5. Role of Stakeholders in Project

Name/Abbreviation	Ministry	Functions and proposed roles in project
Ministry of Science, Technology and Environment (CITMA)	CITMA	CITMA is the principal executing entity of the Project, through its Environment Agency (AMA)
Environment Agency (AMA)	CITMA	AMA presides the Project Board. It will direct the Project in technical and administrative terms. AMA also participates through the National Risk Evaluation Group and through key research institutions such as the IES (see below).
Institute of Ecology and Systematics (IES)	CITMA	The IES will contribute its resource of knowledge regarding the impacts of climate change on local projects; territorial risk evaluations; processing of environmental information (gathered *in situ* and from remote sensing); models of municipal and community-based environmental land use planning; coordination and integration of the capacities of scientific entities to manage natural resources. The IES has a group of specialists which has decades of experience in studying Cuban mangrove systems. The IES will also contribute to the application of ecotechnology for the reforestation of mangroves, and the monitoring of the target areas. It will participate in components 1 and 2 of the project.
Centre for Environmental Research, Management and Education (CIGEA)	CITMA	CIGEA develops environmental education projects which involve different sectors of the population, and also produces teaching and dissemination materials and promotes environmental training activities. Its responsibility in the Project will be to direct and coordinate activities with communities for the strengthening of local capacities for adaptation and to ensure local participation in the measures proposed in the Project. It will participate in component 2.
Ministry of Agriculture (MINAG)	MINAG	Through the GEAM and DNAF, MINAG will be a member of the inter-institutional steering committee of the project. MINAG will participate through the two forest enterprises operating in the target area and the IINAF
National Institute for Agroforestry Research (IINAF)	MINAG	The principal role of the IINAF is to provide a scientific and technical base to guarantee the sustainable and competitive development of forestry production chains. It has carried out research into mangrove areas of the country and has developed a Technical Instructions

Name/Abbreviation	Ministry	Functions and proposed roles in project
		document for mangrove reforestation and the rehabilitation of mangrove areas affected by progressive salinization in Granma province, as well as works related to the rehabilitation of hydrological basins. It will participate in components 1 and 2.
Productive entities	MINAG	The Forestry Enterprises of Mayabeque and the South Coast are responsible for carrying out reforestation in the south of Artemisa and Mayabeque provinces, as the owners of the forest resource in the area. They will participate in component 1.
Forest Guard Corps (CGB)	MININT/ CGB	The mission of the CGB is to safeguard and protect forest resources, wildlife and other natural resources of the country, in association with other related organisms and state institutions. Its responsibility in the Project will be to strengthen compliance with environmental protection.
Agrarian University of Havana	MES	Higher education institution in the agriculture sector. Will participate in the development of a basic training programme and the elaboration of different educational products for communities and schools in relation to CC adaptation, as well as extension activities.
Provincial and municipal governments	DP CITMA SEF	These Governments are the key organisms for the execution of activities related to the coordination of the control, supervision and analysis of the results of components 2 and 3. The Provincial Directorates of CITMA (DPCITMA) and the State Forest Service (SSF) are responsible for protecting the areas and for supporting activities of inspection, oversight and environmental control, in conjunction with other organisms. The Government will be the principal actor in relation to knowledge management for CC adaptation.
Local communities		The project proposes to develop activities in local communities in support of education and participation in actions to protect ecosystems. These actions will include the following: - Community work on adaptation measures in Surgidero de Batabanó. - Demonstration activities to ensure sustainability of Project results - Training of families which have houses on Mayabeque Beach. - Training programme for key stakeholders and decisión-makers on measures to reduce climate-related risks.

Name/Abbreviation	Ministry	Functions and proposed roles in project
		- Training, information and dissemination programme for local communities.
Delegates of Popular Councils	N/a	They will be responsible for mobilizing other local organizations, namely the Union of Young Communists, Committees for the Defence of the Revolution and the Federation of Cuban Women, for the educational and awareness raising activities of the project. They will play a major role in coordinating community work in the constituencies, at grassroots level. This will include the establishment of control and feedback mechanisms regarding progress with project activities, through regular meetings. They will also play a vital role in facilitating communication between local communities and municipal governments in relation to the activities proposed under component 1 of the project.
Committees for the Defence of the Revolution	N/a	They will also play vital roles in awareness raising, and the planning, organization and execution of the activities proposed under component 2.
FMC (Federation of Cuban Women)	N/a	They will play a cross-cutting role across all of the project components, in promoting gender equity. In each popular council, the FMC will support workshops to analyse the respective roles of women, men, youths and children in relation to EBA
Schools	MES	The schools in the target areas, which are closely integrated with community plans and activities, will play a leading role in relation to the raising awareness of EBA issues

H. Provide justification for funding requested, focusing on the full cost of adaptation reasoning.

Relevance

The activities proposed by the project are highly relevant to the CC-related threats affecting livelihoods in the target area, inasmuch as they represent a three-pronged approach which combines i) direct field-level actions which will result in concrete increases in resilience in the short and medium terms, with ii) the strengthening of the capacities of local communities, in order to maximize the social sustainability of the adaptation measures and reduce the risks of their being undermined by productive and/or extractive activities, and iii) establishment of a favourable and supportive enabling environment at local level, in terms of commitment by decision-makers and capacities among local institutions.

An EBA approach is relevant in technical terms as it takes advantage of the natural potential of mangroves and wetlands, which constitute the natural vegetation of the project, to buffer CC impacts as long as adequate protection, silviculture and hydrological conditions are provided for.

Mangroves in particular are easy and cheap to establish and thereby constitute a highly cost-effective alternative to physical works (see Section C on cost-effectiveness).

The project will invest a limited amount of resources in activities other than physical works aimed at mangrove and wetland restoration. This balance, together with the local, rather than national, focus of the activities aimed at creating a favourable enabling environment, is justified by the high baseline levels of capacity and policy frameworks that exist in Cuba in relation to natural resource management and responses to extreme natural events.

Co-financing
As described in Section F, there are numerous opportunities for synergies between the present project and other initiatives already underway in the country. Those other initiatives will complement each other, for example in the following ways (more examples are provided in Annex VII):

- The coral reefs and seagrass beds on which the GEF/UNDP project on PAs in the southern archipelagos will focus, and the mangroves and other coastal wetlands on which the current project will focus, constitute respectively first, second and third lines of defence of the coast against CC impacts;
- The JICA-funded project focusing on aquifer management will generate further benefits in terms of the combat of groundwater salinization, in addition to those which the current project will generate by reducing seawater incursions.
- The GEF/UNDP project on IAS will help to generate IAS management recommendations which have the potential to increase the effectiveness of this project's actions aimed at reducing the detrimental effects of IAS on the adaptation role of coastal ecosystems.

In addition, the Government of Cuba will provide major direct co-financing to the project: most significantly, all labour and salary costs under all three components will be co-financed.

Stand-alone viability
In the absence of these complementary initiatives, cumulative improvements in ecosystem resilience and EBA would be reduced; however the present project and its EBA strategies would still be viable. For example, coastal erosion would still be reduced in comparison with the baseline level, but not by as much as they would be if adjacent coral reefs and seagrass beds were also effectively protected as first and second lines of defense; and aquifer salinization would be reduced, but not by as much as it would be if coastal protection through EBA were complemented by sound aquifer management. Conversely the stand-alone benefits of the project in terms of IAS control would be reduced in the absence of technical inputs generated by the GEF/UNDP IAS project, but would still represent a major improvement over the without-project scenario.

Component 1: <u>Reduction of the impacts of coastal flooding through the recovery of coastal ecosystems</u>

Baseline (without AF resources)
Coastal ecosystems in the project area (mangroves, coastal wetlands and woodlands separating the wetlands from neighbouring agricultural lands) have been subject to high levels of anthropogenic degradation over a number of decades, due to a combination of poorly-sited and designed infrastructural works (e.g. coastal roads), inappropriate water management initiatives (such as the drainage channels constructed in the 1950s and the subsequent

retention wall, which was intended to reverse their drying effect but in practice resulted in mangrove mortality due to localized flooding and disruption of freshwater flows on its landward and seaward sides, respectively), and incursion and degradation resulting from agricultural activities on the neighbouring plains.

Under natural conditions, the coastal ecosystems of the zone (particularly the red mangrove forests) are inherently resilient to wave impacts, and thereby constitute an effective buffer against coastal erosion as well as a morphological barrier to seawater incursion. The anthropogenic pressures described above have eroded their resilience and effectiveness in these regards, however, and their inherent ability to adapt to the changing conditions associated with global climate change. For example, much of the seaward edge of the mangrove belt is characterized by low-densities of black mangroves, which are suffering from progressive degradation and mortality due to wave impact and are failing to retain the sediment required to provide an effective morphological defence against seawater incursion; while the ecological intactness and resilience of other elements of the coastal wetlands are being degraded by the incursion of invasive alien species.

Under baseline conditions, these downward trends in the condition of coastal ecosystems would lead to their eventual disappearance, exposing settlements, agricultural land and infrastructure progressively further inland to climate impacts, as the coastline advances progressively inland; at the same time the other services provided by the coastal ecosystems would be lost, such as their contribution (as refuge and reproduction sites) to the viability of coastal and marine fisheries which are of vital importance to the national economy. The only option under such conditions would be the construction of major physical barriers, which would be much more costly than the proposed EBA approach

Additionality (with AF resources)
The opportunity to use AF resources for ecosystem restoration comes at a crucial juncture, when the coastal ecosystems are still sufficiently intact for their restoration to be feasible and cost-effective, with limited need for physical works to ensure the existence of the required hydrological conditions. This investment will circumvent the eventual need to establish costly physical defenses, with their associated ongoing maintenance costs. In addition to reducing CC-related impacts on local livelihoods, production systems and infrastructure, and their associated costs (for example the relocation of population, the remediation of degraded farmland and the reparation or substitution of infrastructure), the use of AF resources will generate additional benefits in terms of the maintenance or improvement of flows of ecosystem services from the coastal ecosystems (particularly for the fisheries sector), which would be lost under the without-project scenario.

Component 2: <u>Integrated and participatory management of coastal ecosystems to increase resilience to climate change</u>

Baseline (without AF resources)
Rural communities in Cuba generally have well-developed organizational structures, educational levels and technical capacities, compared to most countries in Latin America and the Caribbean, due to the high priority accorded to these aspects by the Government. In general, all community members are individually aware, from personal experience, of the nature and implications of CC-related phenomena including extreme climatic events. Without AF resources, however, most community members would fail to “join the dots” and appreciate how

these events form part of a long term trend, and the vital importance of taking opportune action now in relation to EBA. If the actions proposed under Component 1 were implemented on their own, without an associated programme of training and awareness raising, their long term sustainability would risk being undermined as a result of continued piecemeal degradation of the ecosystems, by extractive activities and agricultural activities in the neighbouring farmlands. Furthermore, without provisions for knowledge management, the lessons generated through the restoration activities would be lost: this again would limit sustainability, as well as the potential for the activities undertaken under the aegis of the project to be replicated elsewhere.

There is also a strong framework of institutions in the project area, including two State-owned Forestry Enterprises, provincial and municipal Governments, Forest Guard Corps, Frontier Guards and the Fisheries Department. In the absence of AF resources, these would concentrate on terrestrial and (in the case of the Fisheries Department) marine ecosystems and would lack the awareness and capacities required to undertake effective management and protection of the coastal ecosystems of most importance for EBA.

Additionality (with AF resources)

With AF resources, productive and infrastructural development in the project area will be planned and executed in an integrated manner that takes into account its full implications for the health, resilience and EBA potential of coastal ecosystems. Local communities that are currently affected most directly by CC-related phenomena will appreciate their nature, magnitude and implications and the importance of taking prompt and relevant action, and will have a technical understanding of the phenomena and of the options for addressing them through EBA. As a result, they will be fully committed to the adaptation measures that are proposed, participating in them actively (and thereby maximizing progress rates and cost-effectiveness) and taking measures to help counteract threats to their application and sustainability (such as illegal extraction of products from coastal ecosystems, or poor management of adjoining lands). They will in addition be equipped for adaptive management and innovation after the life of the project itself, being able to perceive the level of success of the EBA measures and, in the event of this being less than expected, to propose and apply appropriate solutions.

Component 3: <u>Establishment of a favourable enabling environment at regional level for the effectiveness and sustainability of adaptation investments</u>

Baseline (without AF resources)

The Government of Cuba is highly committed to strengthening the country's resilience to the effects of climate change, as evidenced by the planning and policy instruments referred to in Section D, and the high level of co-financing that the Government is providing to the current project to the other initiatives that complement it. Without AF resources, however, the full nature, magnitude and costs of CC-related phenomena would fail to be reflected adequately in plans, policies and budgetary allocations. There would consequently be a risk of Government-sponsored initiatives leading to "mal-adaptation", resulting for example in initiatives not compatible with CC-adaptation (such as coastal roads or other infrastructure that degrades coastal ecosystems) being preferred over the EBA alternative, due to an inadequate appreciation of the full costs of the former and the full benefits of the latter.

There is in addition a strong framework of institutions in the project area, including provincial and municipal governments, State-owned forestry enterprises and community-based organizations. The forestry enterprises have strong technical capacities in relation to conventional plantation silviculture in terrestrial areas: however, without AF resources, their technical capacities would be inadequate to implement and manage the major programme of

coastal ecosystem restoration and reforestation proposed under Component 1, which would have serious implications for its effectiveness. Furthermore, the actions of institutions in different sectors (e.g. forestry, agriculture and fisheries) would be carried out in an uncoordinated manner, which fails to recognise the shared implications of CC for them and which increases the risk of "mal-adaptation" and the undermining of CC adaptation measures.

Additionality (with AF resources)

As a result of AF support for the consolidation and dissemination of information on the costs and benefits of EBA, decision-makers in the Government at municipal, provincial and central levels will be capable of designing and prioritizing development and natural resource management initiatives on the basis of their net benefits, taking into account the implications of CC-related phenomena for them, and their implications for the resilience of coastal ecosystems and the vulnerability of local populations.

With AF resources, the forestry enterprises will have the full technical capacities required for the effective implement of the restoration and reforestation programme: this will allow the project's targets to be met in a timely manner and will also ensure sustainability in the longer term, as the enterprises will be capable of carrying out maintenance, restocking as necessary, and other silvicultural operations (all reforested areas will be formally assessed by the Forest Service at the age of three to determine whether an 85% survival rate has been achieved, and if not restocking will occur; with areas planted after year 2 of the project, this will take place after project end). Institutions in the forestry, fisheries and agriculture sectors will furthermore have increased logistical capacities for enforcing regulations and management prescriptions in the target ecosystems, and will in addition coordinate their respective actions more effectively, thereby enabling synergies to be delivered and reducing the risk of mal-adaptation.

J. Describe how the sustainability of the project/programme outcomes has been taken into account when designing the project / programme.

The project's activities will return the mangroves and other coastal wetlands of the project area to a condition where they are able to regenerate effectively through natural processes, and thereby sustain themselves and the adaptation benefits and other ecosystem services which they provide, in the long term. Currently, the vegetation along the seaward edge of the area is degraded and discontinuous, with a high proportion of black mangroves, whose root systems do not allow them to withstand wave impact: as a consequence, these mangrove trees are progressively being washed away, and the consequently unprotected coastline is subject to erosion, resulting in conditions which do not allow these losses to be replaced through natural regeneration. Under the with-project scenario, by contrast, the coastline will be stabilized by a seaward belt of resistant red mangroves: this will protect other vegetation from wave impact and at the same time trap sediment, which will in turn provide a favourable substrate into which seed from the trees in this restored belt can become established through natural and sustainable processes of regeneration.

Restocking and other silvicultural management operations, required in the medium term to ensure that the areas replanted and restored are placed on a fully sustainable footing, will be largely dependent on the availability of labour: this will be guaranteed by the Government of Cuba, which will entirely co-financed all labour costs.

Institutional sustainability will be ensured by the fact that the EBA activities will be carried out and supported by well-established permanent institutions, including the following:

- Two state-owned forestry enterprises, which will carry out the reforestation, restoration and maintenance activities themselves;
- Community-based organizations, which will constitute the main channels for the participation of local stakeholders, ensuring their support to sustaining the project's advances in the long term.
- Municipal and provincial governments: the social and institutional sustainability of the EBA actions supported by the project will further be promoted by ensuring that they are integrated into the CC adaptation plans for which the municipal and provincial governments are responsible.
- Entities of central Government (the lead institution will be the Institute for Ecology and Systematics) and national academic and research institutions which will provide ongoing technical and monitoring support.

PART III: IMPLEMENTATION ARRANGEMENTS

A. Describe the arrangements for project / programme implementation.

Upon the request of the Government of Cuba, UNDP will be the Multilateral Implementing Entity (MIE) for this project. The Project will therefore be implemented following UNDP's **National Implementation Modality (NIM)**. The designated Implementing Partner of the project will be the Ministry of Science, Technology and Environment (CITMA), through its Environmental Agency (AMA). AMA is ultimately responsible for the timely delivery of inputs and outputs and for coordination of all other responsible parties including other line ministries, relevant agencies, and local government Authorities. AMA will hold the responsibility of the Executive, and will appoint the **National Project Director**.

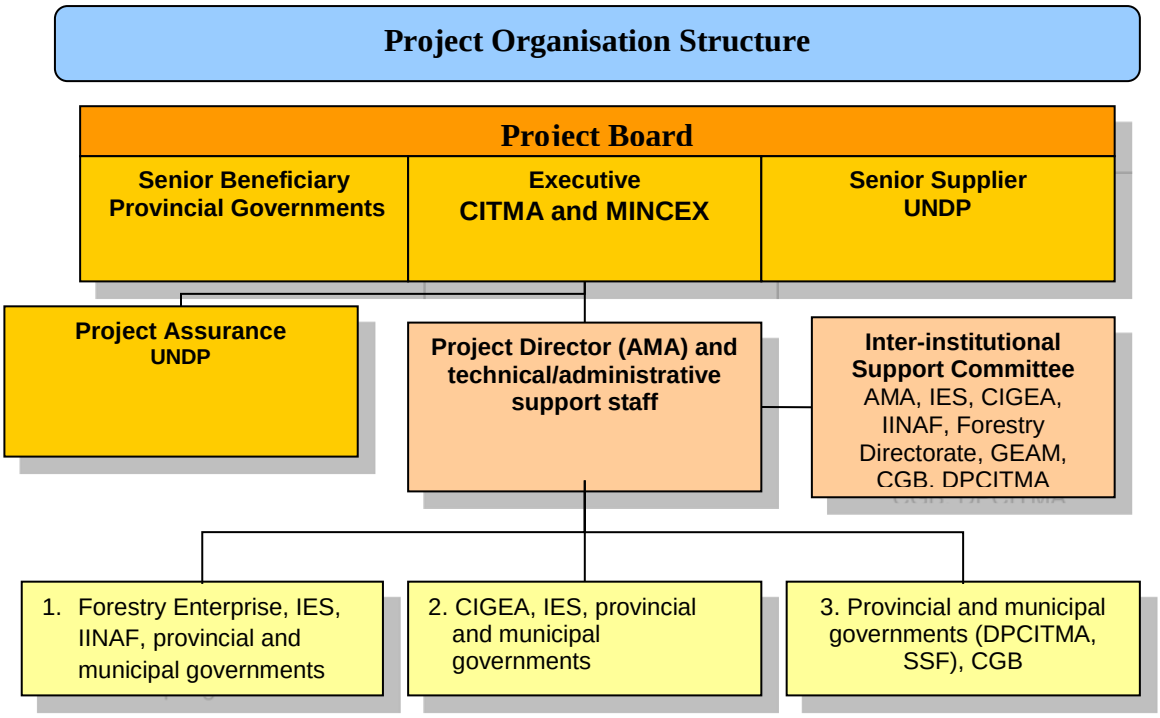
The Project Board (PB) is responsible for making management decisions for the project and plays a critical role in project monitoring and evaluations by quality-assuring these processes and products, and using evaluations for performance improvement, accountability and learning. The PB will be composed of designated senior-level representatives of CITMA, the Ministry of Foreign Trade and Investment (MINCEX), provincial governments (2), and UNDP.

Project Assurance: UNDP Cuba will support project implementation by assisting in monitoring project budgets and expenditures, recruiting and contracting project personnel and consultant services, subcontracting and procuring equipment. UNDP Cuba will also monitor the project implementation and achievement of the project outcomes/outputs and ensure the efficient use of donor funds through an assigned UNDP Programme Manager. UNDP will act as the Senior Supplier.

Project Director (PD): The PD will be a member of AMA, assigned to the project for its period of duration. The PD's prime responsibility is to ensure that the project produces the results specified in the project document to the required standard of quality and within the specified constraints of time and cost.

Project Support: The PD will be supported by a core technical and support staff located within AMA and other supporting organizations to execute the project activities, including day-to-day operations of the project, and the overall operational and financial management and reporting. In the target implementation provinces, local coordinators will be assigned by the offices of CITMA in the governments of each of the 2 provinces and the 6 coastal municipalities.

Mechanisms for local participation: the project will use existing well established mechanisms for local consultation and participation, principally the Assemblies for Accountability of Delegates to their Constituents that currently exist at community, municipal and provincial levels, and Neighbourhood Debates arranged by community organizations.



A. Describe the measures for financial and project / programme risk management.

#	Risk	Type	Impact / Probability 1: Low 5: High	Mitigation Measures
1	Extreme climatic events (storms, droughts) and fires, affecting plant survival rates	Environmental	I=3 P=3	Evaluation of survival rates followed by replanting to compensate for mortality. Effective fire detection and control by the Forest Guard Corps.
2	Variations in commitment to EBA among policy makers	Institutional	I=3 P=3	Promotion of awareness of EBA benefits among key institutions (including use of results of economic studies)
3	CC-related changes in tree phenology affecting seed collection and nursery activities	Environmental	I=1 P-3	Planning of seed collection activities based on previous experiences in order to maintain a reserve.
4	Slow equipment procurement processes in local Governments	Institutional	I=3 P=2	Early development, approval and execution of procurement plans
5	Limited availability of inputs and equipment on national market	Institutional	I=3 P=2	Early development, approval and execution of procurement plans
6	Short term economic and	Social	I=2	Promotion of local ownership of EBA initiatives

#	Risk	Type	Impact / Probability 1: Low 5: High	Mitigation Measures
	livelihood considerations outweigh medium term benefits of EBA actions in priorities of community members		P=1	through fostering active participation and awareness raising regarding EBA benefits (including use of results of economic studies)
7	Short term political considerations outweigh medium term benefits of EBA actions in priorities of members of local institutions	Institutional	I=1 P=1	Promotion of awareness of EBA benefits among key institutions (including use of results of economic studies)

B. Describe the monitoring and evaluation arrangements and provide a budgeted M&E plan.

The monitoring and evaluation (M&E) scheme will be applied in accordance with established UNDP procedures throughout the project lifetime. As the implementing partner, CITMA-MINAGRI, together with UNDP Cuba, will ensure the timeliness and quality of the project implementation. The M&E plan will be implemented as proposed in the table below. Technical guidance and oversight will be also provided by UNDP's Regional Bureau for Latin America and the Caribbean (RBLAC), as well as the Project Board (PB). Audits on the project will follow UNDP finance regulations and rules and applicable audit policies.

Project start: A Project **Inception Workshop** (IW) will be held within the first 3 months of project start with all persons and organizations that have assigned roles and responsibilities in the project organization structure. Representatives from the UNDP Country Office, as well as Regional Technical Advisors and other stakeholders will contribute to the inception workshop as necessary. The IW is crucial to building ownership for the project results and developing the first year annual work plan of the project. Following the IW, an **Inception Report** will be prepared as a key reference document. The Inception Report will serve as an Annex to the signed project document and shared with participants to formalize various agreements and plans decided during the meeting.

Annual Progress Report: An Annual Progress Report (APR) will be prepared by the Project Manager, shared with the Project Board and submitted to the Donor. The APR will be prepared with progresses against set goals, objectives and targets, lessons learned, risk management and detailed financial disbursements.

Mid-term of the project cycle: The project will undergo an independent Mid-Term Evaluation (MTE) at the mid-point of project implementation. The MTE will determine progress being made toward the achievement of outcomes and will identify course correction if needed. It will focus on the effectiveness, efficiency and timeliness of project implementation; will highlight issues requiring decisions and actions; and will present initial lessons learned about project design,

implementation and management. The findings of this review will be incorporated as recommendations for enhanced implementation during the final half of the project's term.

Periodic Monitoring through site visits: UNDP Cuba and the UNDP RBLAC will conduct visits to project sites based on the agreed schedule in the project's Inception Report / Annual Work Plan to assess at first hand project progress. Members of the Project Steering Committee and Technical Advisory Group will join these visits as required. A Field Visit Report will be prepared by UNDP for circulation no less than one month after the visit to the project team and

Project Closure: An independent Final Evaluation will be undertaken 3 months prior to the final PB meeting. The final evaluation will focus on the delivery of the project's results as initially planned and as corrected after the mid-term evaluation, if any such correction takes place. The final evaluation will look at impact and sustainability of results, including the contribution to capacity development and the achievement of global environmental benefits/goals.

Table: Monitoring and Evaluation Plan of the proposed project

Type of M&E activity	Responsible Parties	Budget US$	Time frame
Inception Workshop and Report	▪ Project Manager ▪ UNDP CO, RBLAC, AF	**$**4,000	Within three months of project start
Measurement of Means of Verification for Project Progress on *output and implementation*	▪ Oversight by Project Manager ▪ Project team	To be determined as part of Annual Workplan	Annually prior to ARR/PIR and to the definition of annual work plans
APR/PIR	▪ Project manager and team ▪ UNDP CO	**$**4,000	Annually
Periodic status/ progress reports, following meetings of Project Board	▪ Project manager and team	**$**8,500 (average of $2000/year)	After inception workshop and then at least twice per year
Mid-term Evaluation	▪ Project manager and team ▪ UNDP CO ▪ UNDP RBLAC ▪ External Evaluators	**$**25,000	At the mid-point of project implementation
Final Evaluation	▪ Project manager and team ▪ UNDP CO ▪ UNDP RBLAC ▪ External Consultants (i.e. evaluation team)	**$**25,000	At least three months before the end of project implementation
NEX Audit	▪ UNDP CO ▪ Project manager and team	**$**10,000 (average of **$**2500/year)	As per UNDP regulations
Visits to field sites	▪ UNDP CO ▪ Government representatives ▪ UNDP RBLAC	**$**10,000 (average of **$**2500/year)	Yearly
TOTAL indicative COST		**US$ 86,590**	

Note: The costs indicated here do not include the costs associated with UNDP staff; those UNDP related costs are covered by the MIE fee.

C. Include a results framework for the project proposal, including milestones, targets and indicators.

A detailed Results Framework, including project Outcomes, Outputs and measurable, verifiable Indicators, is provided in Annex II.

PART IV: ENDORSEMENT BY GOVERNMENT AND CERTIFICATION BY THE IMPLEMENTING ENTITY

A. RECORD OF ENDORSEMENT ON BEHALF OF THE GOVERNMENT[17]

RECORD OF ENDORSEMENT BY DESIGNATED GOVERNMENT AUTHORITY. *Provide the name, position, and government office of the designated government authority and indicate date of endorsement. If this is a regional project, list the designated government authorities of all participating countries endorsing the project. The endorsement letter(s) should be attached as an annex to the project proposal.*

(Enter Name, Position, Ministry) *Enrique Moret Hernandez,* *Director,* *AF Disignated Authority,* *Ministry of Science, Technology and Environment,* *Department of International Affairs*	Date*: (Month, day, year)* December 13, 2013

B. IMPLEMENTING ENTITY CERTIFICATION

Provide the name and signature of the Implementing Entity Coordinator and the date of signature. Provide also the project contact person's name, telephone number and email address.

I certify that this proposal has been prepared in accordance with guidelines provided by the Adaptation Fund Board, and prevailing National Development and Adaptation Plans (the National Environment Strategy 2011- 2015 and the Cuban Programme for Addressing Climate Change) and subject to the approval by the Adaptation Fund Board, understand that the Implementing Entity will be fully (legally and financially) responsible for the implementation of this project/programme.	
Adriana Dinu Executive Coordinator And Director a.i., UNDP/GEF	
Date: January 24, 2014	Tel. and email:+1212 906 5143
Project Contact Person: Lyès Ferroukhi	
Tel. And Email: +507 302-4576 / lyes.ferroukhi@undp.org	

[41] Each Party shall designate and communicate to the Secretariat the authority that will endorse on behalf of the national government the projects and programmes proposed by the implementing entities.

ANNEX I: Letter of Endorsement

ADAPTATION FUND

Letter of Endorsement by Government

MINISTRY OF SCIENCE, TECHNOLOGY AND ENVIRONMENT.
DEPARTMENT FOR INTERNATIONAL AFFAIRS.

DRI: 1122 /2013

Havana, December 13, 2013.

To: The Adaptation Fund Board
c/o Adaptation Fund Board Secretariat
Email: Secretariat@Adaptation-Fund.org
Fax: 202 522 3240/5

Subject: Endorsement for the Project: "Reduction of vulnerability to coastal flooding through ecosystem-based adaptation in the south of Artemisa and Mayabeque province".

In my capacity as designated authority for the Adaptation Fund in Cuba, I confirm that the above national project proposal is in accordance with the government's national priorities in implementing adaptation activities to reduce adverse impacts and risks, posed by climate change in Cuba.

Accordingly, I am pleased to endorse the above project proposal with support from the Adaptation Fund. The project will be implemented by UNDP-Havana and executed by the Environmental Agency (AMA) of the Ministry of Science, Technology and Environment with support from relevant partner institutions and organizations.

The financing requested for the project is detailed in the table below.

Source of Funds	Implementation Agency	Amount (in US$)			
		Project Preparation	Project	Fee	Total
AF	UNDP	-	5,592,000	475,320	6,067,320
Total AF Resources			**5,592,000**	**475,320**	**6,067,320**

Sincerely,

Enrique Moret Hernández. Director.
AF-Designed Authority

MINISTERIO DE CIENCIA, TECNOLOGÍA Y MEDIO AMBIENTE
DIRECCIÓN DE RELACIONES INTERNACIONALES

Calle 18 A # 4118 e/ 41 y 47, Playa, La Habana 11300, CUBA
Tel: (537) 2144256, FAX: (537) 2144257, E- mail: emoret@citma.cu

ANNEX II: Logical Framework Analysis

<table>
<tr><th>Objective & Components</th><th>Indicators</th><th>Baseline</th><th>Targets</th><th>Source of Verification</th><th>Risks and Assumptions</th></tr>
<tr><td rowspan="2">Objective: increase the resilience of populations in the coastal regions of Artemisa and Mayabeque provinces to the effects of climate change</td><td>Area with increases in indices of mangrove and wetland conditions (soil and water salinity, canopy density, existence of local protection regimes)</td><td>- Coastal ecosystems covering 7,318ha are degraded, have excessive salinity levels due to seawater incursion and impeded freshwater flows, and have little effective protection</td><td>- 7,318ha (the total area where mangrove reforestation, restoration of mangrove ecosystems and restoration and enrichment of landward edge woodlands will be carried out): indices to be proposed in methodological documents developed at project start.</td><td rowspan="2">Monitoring reports of IES and IINAF</td><td rowspan="2">Extreme climatic events
Variations in commitment of policy makers</td></tr>
<tr><td>Numbers of people (men and women) with reduced vulnerability due to proximity of functioning mangrove and wetland ecosystems</td><td>- 17,524 people in 47 communities are directly affected by coastal flooding
- 270,705 people are indirectly affected by impacts of CC-related phenomena on economic activities</td><td>- 21,502 people (of which at least 45% are women) directly benefit from reduction of coastal flooding
- 270,705 people (of which at least 45% are women) indirectly benefit from reduction of impacts of CC-related phenomena on economic activities</td></tr>
<tr><td rowspan="2">Component 1: Reduction of the impacts of coastal flooding through the recovery of coastal ecosystems</td><td>Area (ha) of red mangrove established along sea shore between Batabanó and Punta Mora</td><td>- 533ha of coastal belt is dominated by a degraded belt of black mangroves with limited resilience to wave impacts</td><td>
<table>
<tr><th>Project year</th><th>Area affected (ha)</th><th>With 85% survival at age 3</th></tr>
<tr><td>2013</td><td>78.1</td><td>66.4</td></tr>
<tr><td>2014</td><td>656.3</td><td>557.8</td></tr>
<tr><td>2015</td><td>546.9</td><td>464.8</td></tr>
<tr><td>2016</td><td>218.8</td><td>185.9</td></tr>
<tr><td>2017</td><td>62.5</td><td>53.1</td></tr>
<tr><td>Total</td><td>1,562.5</td><td>1,328.1</td></tr>
</table>
</td><td rowspan="2">Annual registers of Forestry Enterprises and Forest Service</td><td rowspan="2">Extreme climatic events (storms, droughts) and fires, affecting plant survival rates
CC-related changes in tree phenology affecting seed collection and nursery activities
Slow equipment procurement processes in local Governments
Limited availability of inputs and equipment on national market</td></tr>
<tr><td>Cumulative area of mangrove ecosystem restored between Majana and Surgidero de Batabanó</td><td>- 144ha of additional coastal mangroves and wetlands are in a degraded condition, with impeded freshwater flows</td><td>
<table>
<tr><th>Project year</th><th>Area affected (ha)</th><th>With 85% survival at age 3</th></tr>
<tr><td>2013</td><td>72.0</td><td>61.2</td></tr>
<tr><td>2014</td><td>604.8</td><td>514.1</td></tr>
<tr><td>2015</td><td>504.0</td><td>428.4</td></tr>
<tr><td>2016</td><td>201.6</td><td>171.4</td></tr>
</table>
</td></tr>
</table>

<table>
<tr><th>Objective & Components</th><th>Indicators</th><th>Baseline</th><th>Targets</th><th>Source of Verification</th><th>Risks and Assumptions</th></tr>
<tr><td></td><td></td><td></td><td><table><tr><td>2017</td><td>57.6</td><td>49.0</td></tr><tr><td></td><td>1,440.0</td><td>1,224.0</td></tr></table></td><td></td><td></td></tr>
<tr><td></td><td>Cumulative area of landward edge woodlands restored and enriched</td><td>- 939ha of landward edge woodlands are in a degraded condition</td><td><table><tr><th>Project year</th><th>Area affected (ha)</th><th>With 85% survival at age 3</th></tr><tr><td>2013</td><td>215.8</td><td>183.4</td></tr><tr><td>2014</td><td>1,812.5</td><td>1,540.6</td></tr><tr><td>2015</td><td>1,510.4</td><td>1,283.9</td></tr><tr><td>2016</td><td>604.2</td><td>513.5</td></tr><tr><td>2017</td><td>172.6</td><td>146.7</td></tr><tr><td></td><td>4,315.5</td><td>3,668.2</td></tr></table></td><td></td><td></td></tr>
<tr><td></td><td>Numbers of IAS management plans developed</td><td>0</td><td>1, covering 7,318ha</td><td></td><td></td></tr>
<tr><td></td><td>Cumulative area with IAS managed</td><td>0</td><td>- 7,318ha with effectively applied IAS management plans</td><td></td><td></td></tr>
<tr><td colspan="6">1.1 Re-establishment of coastal belt of red mangrove (Rhizophora mangle) between Surgidero de Batabanó and Punta Mora
1.2 Restoration of mangrove ecosystems between Majana and Surgidero de Batabanó
1.3 Elimination and/or control of invasive alien species in coastal wetlands between Majana and Punta Mora in order to improve ecosystem resilience
1.4 Restoration and enrichment of woodlands along the landward limit of the coastal wetland belt, between Majana and Punta Mora</td></tr>
<tr><td rowspan="3">Component 2: Integrated and participatory management of coastal ecosystems to increase resilience to climate change</td><td>Numbers of provincial and municipal development plans that make specific provision for EBA</td><td>- All provincial and municipal governments are developing plans for CC adaptation, but these do not provide for EBA</td><td>- 2 provincial plans and 6 municipal plans</td><td rowspan="2">Surveys and interviews in local provincial and municipal governments</td><td rowspan="3">Short term economic and livelihood considerations outweigh medium term benefits of EBA actions in priorities of community members</td></tr>
<tr><td>Numbers of provincial and municipal governments with EBA-related knowledge management systems in place</td><td>- 0</td><td>- 2 provincial governments and 6 municipal governments</td></tr>
<tr><td>Numbers of community members (men and women) belonging to local voluntary groups</td><td>0</td><td>1 group with at least 15 members (of which at least 45% are women) in each of four municipalities (Alquizar, Guira, Batabanó y Artemisa</td><td>Surveys and interviews in local communities</td></tr>
</table>

Objective & Components	Indicators	Baseline	Targets	Source of Verification	Risks and Assumptions
	addressing environmental and adaptation issues				
	Numbers of local schools with study programmes incorporating adaptation issues	0	- 16 primary schools - 15 secondary schools - 3 municipal universities - 1 teacher training institute	Surveys and interviews in local schools	
	Numbers of dissemination and awareness raising materials on adaptation issues, produced by local media	0	- 17 audiovisual presentations (TV series, documentaries, multimedia presentations) - 3 local television programmes. - 5 local radio programmes - 2 articles in local press on adaptation issues	Surveys and interviews in local media organisations	
2.1 Key community figures trained for promotion of adaptation activities and awareness among community members 2.2 Raised awareness of adaptation issues among community members in general 2.3 Knowledge management systems at community level					
Component 3: Ensure the effectiveness and sustainability of adaptation investments through the establishment of a favourable enabling environment at regional level	Frequency of training and technical support visits carried out by provincial and municipal governments to coastal communities in support of EBA	- 0	- 3 training and technical support visits per year to coastal areas by technical authorities	Surveys and interviews in local provincial and municipal governments	Short term political considerations outweigh medium term benefits of EBA actions in priorities of members of local institutions
	Frequency of inspection visits to coastal areas by provincial and municipal governments in support of EBA	- 0	- 3 inspection visits per year to coastal areas by provincial/municipal governments and/or other regulatory and enforcement authorities		
3.1 Consolidated information on costs and benefits of EBA available to decision makers and planners 3.2: Strengthened institutions (provincial and municipal Governments, Forest Guard Corps, Frontier Guards and Fisheries Department) supporting EBA actions, within the framework of updated and actively implemented action plans					

ANNEX III: Budgets

Total Budget and Workplan

Award ID:	00069416	**Project ID(s):**	00084007
Award Title:	AF-REDUCT. VULNERAB. TO COASTAL FLOODING		
Business Unit:	CUB10		
Project Title:	Reduction of vulnerability to coastal flooding through ecosystem-based adaptation in the south of Artemisa and Mayabeque provinces		
PIMS No.:	5090		
Implementing Partner (Executing Agency):	CITMA-MINAGRI		

Component	Resp. Party	SoF	UNDP B/L	UNDP B/L Description	Amount Year 1 USD	Amount Year 2 USD	Amount Year 3 USD	Amount Year 4 USD	Amount Year 5 USD	Total USD
1: Reduction of the impacts of coastal flooding through the recovery of coastal ecosystems	CITMA-MINAGRI	AF	71200	Intl. Consultants	-	15,000	10,000	15,000	10,000	**50,000**
			71600	Travel	10,000	10,000	10,000	10,000	10,000	**50,000**
			72100	Service Contracts	20,000	25,000	25,000	25,000	15,000	**110,000**
			72200	Equipment	50,000	439,000	1,367,030	250,000	112,970	**2,219,000**
			72300	Materials and Goods	71,300	114,000	114,000	282,760	147,940	**730,000**
			72500	Supplies	4,000	4,000	4,000	4,000	4,000	**20,000**
			72800	Info. and technology equipt.	51,000	7,800	19,600	7,800	7,800	**94,000**
			73400	Equipment maintenance	-	168,900	161,250	153,600	161,250	**645,000**
			74200	Audiovisual & Printing	22,000	20,000	20,000	20,000	20,000	**102,000**
				Sub-total component 1	**228,300**	**803,700**	**1,730,880**	**768,160**	**488,960**	**4,020,000**
2: Increase the adaptive capacity of coastal	CITMA-MINAGRI	AF	71600	Travel	10,000	10,000	10,000	10,000	10,000	**50,000**
			72100	Service Contracts	21,000	23,000	23,000	23,000	21,000	**111,000**
			72200	Equipment	45,000	45,000	-	-	-	**90,000**

Component	Resp. Party	SoF	UNDP B/L	UNDP B/L Description	Amount Year 1 USD	Amount Year 2 USD	Amount Year 3 USD	Amount Year 4 USD	Amount Year 5 USD	Total USD
communities to climate change			72300	Materials and goods	5,000	5,000	5,000	5,000	5,000	**25,000**
			72400	Comm. and audiovis. equipt.	35,000	35,000	-	-	-	**70,000**
			72500	Supplies	8,000	8,000	10,000	10,000	8,000	**44,000**
			72800	Info. and technology equipt.	40,000	5,000	-	-	-	**45,000**
			73400	Equipment maintenance	12,200	12,200	15,200	13,200	12,200	**65,000**
			74200	Audiovisual & Printing	35,000	40,000	40,000	45,000	40,000	**200,000**
				Sub-total component 2	**211,200**	**183,200**	**103,200**	**106,200**	**96,200**	**700,000**
3: Ensure the effectiveness and sustainability of adaptation investments through the establishment of a favourable enabling environment at regional level	CITMA-MINAGRI	AF	71600	Travel	10,000	10,000	10,000	10,000	10,000	**50,000**
			72100	Service Contracts	10,000	10,000	10,000	10,000	10,000	**50,000**
			72200	Equipment	50,000	130,000	-	41000	-	**221,000**
			72300	Materials and Goods	32,000	-	28,000	-	-	**60,000**
			72400	Comm. and audiovis. equipt.	2,000	-	-	-	-	**2,000**
			72500	Supplies	4,600	3,600	3,600	3,600	3,600	**19,000**
			72800	Info. and technology equipt.	38,000	-	-	-	-	**38,000**
			73400	Equipment maintenance	-	15,000	15,000	15,000	15,000	**60,000**
				Sub-total component 3	**146,600**	**168,600**	**66,600**	**79,600**	**38,600**	**500,000**
Project Management	CITMA-MINAGRI	AF	71200	Intl. Consultants	-	-	25,000	-	25,000	**50,000**
			71600	Travel	5,000	11,000	8,000	11,000	5,000	**40,000**
			72100	Service Contracts	6,000	2,000	2,000	2,000	2,000	**14,000**
			72200	Equipment	10,800	83,800	3,800	3,800	3,800	**106,000**
			72300	Materials and Goods	7,000	-	7,000	-	-	**14,000**
			72400	Comm. and audiovis. equipt.	11,000	-	-	-	-	**11,000**
			72500	Supplies	3,000	3,000	3,000	3,000	3,000	**15,000**
			72800	Info. and technology equipt.	25,200	1,700	1,700	1,700	1,700	**32,000**
			73200	Premises modification and upgrading	30,000	-	-	-	-	**30,000**
			73400	Equipment maintenance	-	15,000	10,000	10,000	10,000	**45,000**

Component	Resp. Party	SoF	UNDP B/L	UNDP B/L Description	Amount Year 1 USD	Amount Year 2 USD	Amount Year 3 USD	Amount Year 4 USD	Amount Year 5 USD	Total USD
			74100	Professional services	-	2,500	2,500	2,500	2,500	**10,000**
			74500	Miscellaneous	1,000	1,000	1,000	1,000	1,000	**5,000**
				Sub-total project management	**99,000**	**120,000**	**64,000**	**35,000**	**54,000**	**372,000**
				AF total	**685,100**	**1,275,500**	**1,964,680**	**988,960**	**677,760**	**5,592,000**
									UNDP Project Cycle Fee (8.5%)	**475,320**
									Total AF Request	**6,067,320**

Detailed budget breakdown by output and item

Output	Budget code		Amount	Description
1.1 Re-establishment of coastal belt of red mangrove (*Rhizophora mangle*) between Surgidero de Batabanó and Punta Mora	71200	Intl. Consultants	15,000	International experts on restoration and conservation of coastal ecosystems, advising on ecotechnologies and on the development of corresponding reports, procedures and manuals.
	71600	Travel	15,000	National and international travel for exchange of practical experiences on mangrove restoration and rehabilitation.
	72100	Service Contracts	30,000	Contracts with specialized institutions for supervision and oversight of the quality of mangrove re-establishment activities
	72200	Equipment	800,000	Purchase of heavy equipment and transport to enable access to and operation in the target sites
	72300	Materials and Goods	290,000	Purchase of materials and goods required for EBA activities in the difficult working conditions of the project site (working clothes, tools etc.).
	72500	Supplies	5,000	Materials for the production of information on results
	72800	Info. and technology equipt.	25,000	Equipment for information processing, spatial analyses and cartography to allow the evaluation and monitoring of ecosystem conditions in the target areas (digital cameras, GPS, batteries and chargers, laptops, projector, printer, plotter, toner).
	73400	Equipment maintenance	195,000	Costs of spare parts, fuel and lubricants needed for field activities in the target sites. The GoC will cofinance part of the fuel costs.
	74200	Audiovisual & Printing	18,500	Printing of technical and methodological materials (technical instructions, manuals and methodologies) in support of field work in the target areas and of the promotion and communication of results obtained, and for improvement of communication systems of Forest Enterprises in the target area, allowing constant communication to be maintained with work

				brigades.
		Total Output 1.1:	**1,393,500**	
1.2 Restoration of mangrove ecosystems between Majana and Surgidero de Batabanó	71200	Intl. Consultants	15,000	International experts on restoration and conservation of coastal ecosystems, advising on ecotechnologies and on the development of corresponding reports, procedures and manuals.
	71600	Travel	15,000	National and international travel for exchange of practical experiences on mangrove restoration and rehabilitation.
	72100	Service Contracts	30,000	Contracts with specialized institutions for supervision and oversight of the quality of restoration activities.
	72200	Equipment	700,000	Purchase of heavy equipment and transport to enable access to and operation in the target sites
	72300	Materials and Goods	202,000	Purchase of materials and goods required for EBA activities in the difficult working conditions of the project site (working clothes, tools etc.).
	72500	Supplies	5,000	Materials for the production of information on results
	72800	Info. and technology equipt.	23,000	Equipment for information processing, spatial analyses and cartography to allow the evaluation and monitoring of ecosystem conditions in the target areas (digital cameras, GPS, batteries and chargers, laptops, projector, printer, plotter, toner).
	73400	Equipment maintenance	150,000	Costs of spare parts, fuel and lubricants needed for field activities in the target sites. The GoC will cofinance part of the fuel costs.
	74200	Audiovisual & Printing	18,500	Printing of technical and methodological materials (technical instructions, manuals and methodologies) in support of field work in the target areas and of the promotion and communication of results obtained, and for improvement of communication systems of Forest Enterprises in the target area, allowing constant communication to be maintained with work brigades..
		Total Output 1.2:	**1,158,500**	
1.3 Elimination and/or control of invasive alien species in coastal wetlands between Majana and Punta Mora in order to improve ecosystem resilience	71200	Intl. Consultants	10,000	International experts on elimination and control of IAS.
	71600	Travel	10,000	National and international travel for exchange of practical experiences on elimination and control of IAS
	72100	Service Contracts	25,000	Contracts with specialized institutions for supervision and oversight of the quality of IAS control and elimination activities
	72200	Equipment	200,000	Purchase of heavy equipment and transport to enable access to and operation in the target sites
	72300	Materials and Goods	50,000	Purchase of materials and goods required for EBA activities in the difficult working conditions of the project site (working clothes, tools etc.).
	72500	Supplies	5,000	Materials for the production of information on results
	72800	Info. and technology equipt.	23,000	Equipment for information processing, spatial analyses and cartography to allow the evaluation and monitoring of ecosystem conditions in the

				target areas (digital cameras, GPS, batteries and chargers, laptops, projector, printer, plotter, toner).
	73400	Equipment maintenance	150,000	Costs of spare parts, fuel and lubricants needed for field activities in the target sites. The GoC will cofinance part of the fuel costs.
	74200	Audiovisual & Printing	40,500	Printing of technical and methodological materials (technical instructions, manuals and methodologies) in support of field work in the target areas and of the promotion and communication of results obtained, and for improvement of communication systems of Forest Enterprises in the target area, allowing constant communication to be maintained with work brigades..
	Total Output 1.3:		**513,500**	
1.4 Restoration and enrichment of woodlands along the landward limit of the coastal wetland belt, between Majana and Punta Mora	71200	Intl. Consultants	10,000	International experts on restoration and conservation of coastal ecosystems, advising on ecotechnologies and on the development of corresponding reports, procedures and manuals.
	71600	Travel	10,000	National and international travel for exchange of practical experiences on mangrove restoration and rehabilitation.
	72100	Service Contracts	25,000	Contracts with specialized institutions for supervision and oversight of the quality of restoration activities.
	72200	Equipment	519,000	Purchase of heavy equipment and transport to enable access to and operation in the target sites
	72300	Materials and Goods	188,000	Purchase of materials and goods required for EBA activities in the difficult working conditions of the project site (working clothes, tools etc.).
	72500	Supplies	5,000	Materials for the production of information on results
	72800	Info. and technology equipt.	23,000	Equipment for information processing, spatial analyses and cartography to allow the evaluation and monitoring of ecosystem conditions in the target areas (digital cameras, GPS, batteries and chargers, laptops, projector, printer, plotter, toner).
	73400	Equipment maintenance	150,000	Costs of spare parts, fuel and lubricants needed for field activities in the target sites. The GoC will cofinance part of the fuel costs.
	74200	Audiovisual & Printing	24,500	Printing of technical and methodological materials (technical instructions, manuals and methodologies) in support of field work in the target areas and of the promotion and communication of results obtained, and for improvement of communication systems of Forest Enterprises in the target area, allowing constant communication to be maintained with work brigades..
	Total Output 1.4:		**954,500**	
Total component 1:				**4,020,000**
2.1 EBA mainstreamed into integrated coastal	71600	Travel	20,000	Working travel to project areas and for interchanges of experiences
	72100	Service Contracts	40,000	Workshops and design of audiovisual media. Service contracts with

zone planning and productive sector activities				companies to develop educational and awareness raising materials.
	72300	Materials and Goods	5,000	Materials needed for dissemination and training workshops
	72500	Supplies	18,000	Office materials and other inputs to support work with local communities in the target areas
	72800	Info. and technology equipt.	10,000	Information equipment for training and information management (computers etc.)
	73400	Equipment maintenance	15,000	Spare parts, fuel and lubricants for training, education and awareness raising activities
	74200	Audiovisual & Printing	45,000	Printing of materials for EBA mainstreaming
		Total Output 2.1:	**153,000**	
2.2 Buy-in, participation and governance in local communities	71600	Travel	20,000	Working travel to project areas and for interchanges of experiences
	72100	Service Contracts	55,000	Workshops and design of audiovisual media. Service contracts with companies to develop educational and awareness raising materials.
	72200	Equipment	90,000	Furniture, equipment and materials for training, education and awareness raising in communities in the target areas. The GoC will provide the premises, and will cofinance electricity and other services.
	72300	Materials and Goods	10,000	Materials needed for dissemination and training workshops
	72400	Comm. and audiovis. equipt.	70,000	Equipment for producting and presenting audiovisual materials aimed at communities and key stakeholders in the target areas The GoC will make available existing audiovisual materials and will provide Access to national and local media.
	72500	Supplies	10,000	Office materials and other inputs to support work with local communities in the target areas
	72800	Info. and technology equipt.	25,000	Information equipment for training and information management (computers etc.)
	73400	Equipment maintenance	35,000	Spare parts, fuel and lubricants for training, education and awareness raising activities
	74200	Audiovisual & Printing	55,000	Printing of materials for education and awareness raising of population in the target areas, manuals and methodologies on working with communities and on EBA, and on the Adaptation Fund
		Total Output 2.2:	**370,000**	
2.3 Knowledge management systems at community level	71600	Travel	10,000	Working travel to project areas and for interchanges of experiences
	72100	Service Contracts	16,000	Workshops and design of audiovisual media. Service contracts with companies to develop educational and awareness raising materials.
	72300	Materials and Goods	10,000	Materials needed for monitoring and evaluation activities

	72500	Supplies	16,000	Office materials and other inputs to support work with local communities in the target areas
	72800	Info. and technology equipt.	10,000	Information equipment for training and information management (computers etc.)
	73400	Equipment maintenance	15,000	Spare parts, fuel and lubricants for monitoring activities
	74200	Audiovisual & Printing	100,000	Printing of materials for knowledge management
		Total Output 2.3:	**177,000**	
			Total component 2:	**700,000**
3.1 Consolidated information on costs and benefits of EBA available to decision makers and planners	72100	Service Contracts	15,000	Support services for workshops and meetings (technical evaluations, training for Government personnel and other key stakeholders, lessons learnt.
	72500	Supplies	,000	Materials required for the production, analysis and dissemination of reports of technical evaluations and economic valuation studies, as well as site-level action plans, maps and other materials.
	72800	Info. and technology equipt.	8,000	Equipment (computers etc.) required for the production of materials and reports on economic valuation
	73400	Equipment maintenance	10,000	Spare parts, fuel and lubricants.
		Total Output 3.1:	**39,000**	
3.2: Strengthened institutions (provincial and municipal Governments, Forest Guard Corps, Frontier Guards and Fisheries Department) supporting EBA actions, within the framework of updated and actively implemented action plans	71600	Travel	50,000	National travel costs of project personnel, for the diffusion and replication of experiencies with the creation of capacities for EBA.
	72100	Service Contracts	35,000	Support services for workshops and meetings (technical evaluations, training for Government personnel and other key stakeholders, lessons learnt.
	72200	Equipment	221,000	Furniture and equipment (3 vehicles and motorbikes) required by local Governments, Forest Guard Corps and State Forest Service to develop their capacities for management, inspection and control in the target areas. The GoC will provide cofinancing for other equipment as well as the salaries of specialists and technicians.
	72300	Materials and Goods	60,000	Materials and goods for management, monitoring and control activities by the Forest Guard Corps and the State Forest Service.
	72400	Comm. and audiovis. equipt.	2,000	Strengthening of the communications systems of the Forest Guard Corps.
	72500	Supplies	13,000	Materials required for the production, analysis and dissemination of reports of technical evaluations and economic valuation studies, as well as site-level action plans, maps and other materials.
	72800	Info. and technology	30,000	Equipment (computers etc.) required for the production of site specific

		equipt.		action plans, maps and other materials
	73400	Equipment maintenance	50,000	Spare parts, fuel and lubricants.
	Total Output 3.2:		**461,000**	
Total component 3:				**500,000**
Total components 1-3:				**5,220,000**

Budget Notes

Note	Atlas Code	Atlas Category	5 year total	Description of Expenditures (to be finalized at project inception phase)
Component 1: Reduction of the impacts of coastal flooding through the recovery of coastal ecosystems				
1	71200	Intl. Consultants	50,000	International experts on restoration and conservation of coastal ecosystems, advising on ecotechnologies and on the development of corresponding reports, procedures and manuals.
2	71600	Travel	50,000	National and international travel for exchange of practical experiences on mangrove restoration and rehabilitation.
3	72100	Service Contracts	110,000	Contracts with specialized institutions for supervision and oversight of the quality of restoration and rehabilitation activities and the application of ecotechnologies in the selected sites, and for execution of restoration and rehabilitation activities under component 1. The GoC will cofinance specialists' salaries.
4	72200	Equipment	2,219,000	Purchase of heavy equipment and transport (tractors, 4WD vehicles, trucks and 1 boat) to enable access to and operation in the target sites, the cleaning of drainage channels and culverts to reestablish water flows: - 4 4WD tractors - wide swamp tractors - front blade swamp tractors - 2 6WD trucks - 4WD vehicles - trailers - tipping trailers - 2 tractors

Note	Atlas Code	Atlas Category	5 year total	Description of Expenditures (to be finalized at project inception phase)
				- 2 back hoes - 1 18ft Sea Craft boat - 3 auxiliary boats - 2 portable generators - 5 quad bikes - 2 mobile workshops - 12 chainsaws The GoC will cofinance other equipment as well as the salaries of specialists, technicians and labourers.
5	72300	Materials and Goods	730,000	Purchase of materials and goods required for mangrove reforestation activities in the difficult working conditions of the project site (working clothes, tools etc.). The GoC will cofinance salaries, medical insurance and labour costs..
6	72500	Supplies	20,000	Materials for the production of information on results of outputs 1.1-1.4.
7	72800	Information and technology equipment	94,000	Equipment for information processing, spatial analyses and cartography to allow the evaluation and monitoring of ecosystem conditions in the target areas (digital cameras, GPS, batteries and chargers, laptops, projector, printer, plotter, toner). The GoC will provide cofinancing for electricity and furniture.
8	73400	Equipment maintenance	645,000	Costs of spare parts, fuel and lubricants needed for field activities in the target sites. The GoC will cofinance part of the fuel costs.
9	74200	Audiovisual & Printing	102,000	Printing of technical and methodological materials (technical instructions, manuals and methodologies) in support of field work in the target areas and of the promotion and communication of results obtained. The GoC will cofinance salaries of specialists and technicians. Improvement of communication systems of Forest Enterprises in the target área, allowing constant communication to be maintained with work brigades. The GoC will cofinance communication services.
Component 2: Increase the adaptive capacity of coastal communities to climate change				
10	71600	Travel	50,000	Working travel to project areas and for interchanges of experiences.
11	72100	Service Contracts	111,000	Workshops and design of audiovisual media. Service contracts with companies to develop educational and awareness raising materials.

Note	Atlas Code	Atlas Category	5 year total	Description of Expenditures (to be finalized at project inception phase)
12	72200	Equipment	90,000	Furniture, equipment and materials for training, education and awareness raising in communities in the target areas Equipment and materials for monitoring and evaluation (water analysis kits, salinometers, hypsometers, relascopes etc.). The GoC will provide the premises, and will cofinance electricity and other services.
13	72300	Materials and goods	25,000	Materials needed for dissemination and training workshops, and for monitoring and evaluation activities.
14	72400	Communications and audiovisual equipment	70,000	Equipment for producting and presenting audiovisual materials aimed at communities and key stakeholders in the target areas The GoC will make available existing audiovisual materials and will provide Access to national and local media.
15	72500	Supplies	44,000	Office materials and other inputs to support work with local communities in the target areas
16	72800	Information and technology equipment	45,000	Information equipment for training and information management (computers etc.)
17	73400	Equipment maintenance	65,000	Spare parts, fuel and lubricants for training, education and awareness raising activities
18	74200	Audiovisual & Printing	200,000	Printing of materials for education and awareness raising of population in the target areas, manuals and methodologies on working with communities and on EBA, and on the Adaptation Fund The GoC will cofinance the salaries of specialists and technicians.
Component 3: Ensure the effectiveness and sustainability of adaptation investments through the establishment of a favourable enabling environment at regional level				
19	71600	Travel	50,000	National travel costs of project personnel, for the diffusion and replication of experiencies with the creation of capacities for EBA.
20	72100	Service Contracts	50,000	Support services for workshops and meetings (technical evaluations, training for Government personnel and other key stakeholders, lessons learnt.
21	72200	Equipment	221,000	Furniture and equipment (3 vehicles and motorbikes) required by local Governments, Forest Guard Corps and State Forest Service to develop their capacities for management, inspection and control in the target areas The GoC will provide cofinancing for other equipment as well as the salaries of specialists and technicians.

Note	Atlas Code	Atlas Category	5 year total	Description of Expenditures (to be finalized at project inception phase)
22	72300	Materials and Goods	60,000	Materials and goods for management, monitoring and control activities by the Forest Guard Corps and the State Forest Service.
23	72400	Communications and audiovisual equipment	2,000	Strengthening of the communications systems of the Forest Guard Corps. The GoC will cofinance the costs of communication services.
24	72500	Supplies	19,000	Materials required for the production, analysis and dissemination of reports of technical evaluations and economic valuation studies, as well as site-level action plans, maps and other materials.
25	72800	Information and technology equipment	38,000	Equipment (computers etc.) required for the production of materials and reports on economic valuation, as well as site specific action plans, maps and other materials The GoC will cofinance costs of electricity and furniture.
26	73400	Equipment maintenance	60,000	Spare parts, fuel and lubricants. The GoC will cofinance part of the fuel costs.
Project Management				
27	71200	Intl. Consultants	50,000	International experts for the mid term and final reviews of the project.
28	71600	Travel	40,000	Travel for international experts for the mid-term and final reviews of the project, and field visits for monitoring and technical evaluations by the project management unit.
29	72100	Service Contracts	14,000	Support to inception, mid term and final review workshops and technical meetings.
30	72200	Equipment	106,000	Furniture and equipment for the project management office (1 minibus and a 2WD vehicle, office chairs, desks, photocopiers etc. The GoC will cofinance personnel salaries and utilities.
31	72300	Materials and Goods	14,000	Materials and goods for the control and evaluation of project sites. The GoC will cofinance salaries, medical insurance and labour costs.
32	72400	Communications and audiovisual equipment	11,000	Communications equipment for the Project office (fixed telephone), audiovisual equipment (televisión, projector etc.) The GoC will cofinance telephone bills and utilities.
33	72500	Supplies	15,000	Office materials and supplies.
34	72800	Information and technology equipment	32,000	Computers, printers, scanner, plotter etc. for the Project management office. The GoC will cofinance utilities and furniture.

Note	Atlas Code	Atlas Category	5 year total	Description of Expenditures (to be finalized at project inception phase)
35	73200	Modification and upgrading of premises	30,000	Maintenance of the Project office and local coordination offices. The GoC will cofinance electricity and furniture costs.
36	73400	Equipment maintenance	45,000	Maintenance costs of office equipment and transport (spare parts, fuel and lubricants). The GoC will cofinance part of the fuel costs.
37	74100	Professional services	10,000	Costs of financial audits.
38	74500	Miscellaneous	5,000	Unforeseen costs.

Details of budget for Materials and Goods (72300) under Component 1

Item	Quantity	Total (US$)
Forest nursery (180 and 290 cm^3 containers)	1	143,847
Asadas	220	7,912
Work trousers	1150	44,113
Work shirts	1150	35,290
Rubber boots	1070	28,731
Material boots	1070	49,253
Insect-proof clothing	200	44,113
10 gallon water containers	8	767
5 gallon wáter containers	11	527
Water bottles and covers	224	1,718
Textile forestry markers	450	3,021
Portable winch	9	9,753
Diameter tapes	17	1,027
5m metric tapes	17	424
50m metric tapes	21	1,249
Weatherproof notebooks	64	245
Forestry bags	20	249
Field backpacks	182	9,774
Clipboards	26	947
First-aid kits	34	1,630
Pick axes - Razor Back	220	4,494
Spades - Razor Back-M 45-107	60	604
Sets of hand tools for nurseries	16	1,534
Shovels	120	18,758
Belts	140	2,685
Safety helmets	160	2,516
Eye protection - ELVEX TRIX	370	1,419
Impermeable coats	200	1,726
Life vests	20	767
Pruning shears - FELCO M/2 and sheath	9	405
4 lb mallets	4	38
Multi-purpose pincers (Leatherman 300 Multi-Tool)+Forro.	6	489
Long handled shears (JAMESON)	10	2,397
Curved hand shears (Weaver)	10	599
Fire control sets	4	26,851
Wheelbarrows	10	240
Stem corer	2	384
Bark measurer	2	115

Item	Quantity	Total (US$)
10´´ Stem corers	2	384
Gloves	840	8,055
Machetes	1440	85,618
Flat files	720	8,631
Axes	40	6,214
Barbed wire	12	449
Smooth wire	30	978
Other materials and products		139,060

Details of budget for Equipment Maintenance (73400) under Component 1

Item	Quantity	Total (US$)
Tractor front tyres	40	20,000
Tractor rear tyres	40	47,706
Truck tyres	20	20,342
Tyres for mobile workshop	40	35,934
Quad bike front tyres	25	2,581
Quad bike rear tyres	25	2,581
Pickup tyres	60	9,293
Trailer tyres	240	61,956
Truck batteries	20	4,130
Swamp tractor batteries	20	4,130
Tractor batteries	40	8,261
Pickup batteries	15	1,549
Quad bike batteries	25	1,033
Chainsaw chains	12	1,797
Chainsaw blades	8	3,056
Chainsaw files	36	227
Transport maintenance		32,527
Diesel	200	278,800
Gasoline	51.5	61,155
7% engine oil	24.5	21,250
6% transmission oil	13	10,600
5% hydraulic oil	12.40	11,780
Chainsaw oil	3.36	2,949
3% automotive grease	1200	1,363

Details of Audiovisual and Printing Costs (74200) under Component 2

	Year 1	Year 2	Year 3	Year 4	Year 5	Totals
Programmes	1,000					**1,000**
Pamphlets (games)	40,000					**40,000**
Training materials	500	1,500	1,500	1,500	500	**5,500**
Educational kits		50,000				**50,000**
Dissemination materials	2,000	6,000	2,000	6,000	2,000	**18,000**
Sweatshirts, caps and backpacks for dissemination		2,000	1,500	2,000		**5,500**
Teaching materials	500	500	1,000	1,500	500	**4,000**
Posters etc. for dissemination	4,000	6,000	4,000	4,000		**18,000**
Signs			5,000			**5,000**
Manuals on lessons learnt					54,000	**54,000**
Totals	**48,000**	**65,000**	**15,000**	**15,000**	**57,000**	**200,000**

ANNEX IV: Project Implementation Schedule/GANTT Chart

Component	Outputs	Year 1				Year 2				Year 3				Year 4				Year 5			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
1: Reduction of the impacts of coastal flooding through the recovery of coastal ecosystems	1.1 Re-establishment of coastal belt of red mangrove (Rhizophora mangle) between Surgidero de Batabanó and Punta Mora			5%		40%				35%				15%				5%			
	1.2 Restoration of mangrove ecosystems between Majana and Surgidero de Batabanó			5%		40%				35%				15%				5%			
	1.3 Elimination and/or control of invasive alien species in coastal wetlands between Majana and Punta Mora in order to improve ecosystem resilience																				
	1.4 Restoration and enrichment of woodlands along the landward limit of the coastal wetland belt, between Majana and Punta Mora			5%		40%				35%				15%				5%			
2: Increase the adaptive capacity of coastal communities to climate change	2.1EBA mainstreamed into integrated coastal zone planning and productive sector activities																				
	2.2 Buy-in, participation and governance in local communities																				
	2.3 Knowledge management systems at local level																				
3: Ensure the effectiveness and sustainability of adaptation investments through the establishment of a favourable enabling environment at regional level	3.1 Consolidated information on costs and benefits of EBA available to decision makers and planners																				
	3.2: Strengthened institutions (provincial and municipal Governments, Forest Guard Corps, Frontier Guards and Fisheries Department) supporting EBA actions, within the framework of updated and actively implemented action plans																				
Project	Project personal contracted																				

Component	Outputs	Year 1				Year 2				Year 3				Year 4				Year 5			
		1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
management	Equipment purchased, office established																				
	PMU operational																				
	Inception report																				
	Quarterly reports																				
	Annual progress reports																				
	Project Board meetings																				
	Local Coordination Meetings																				
	Mid Term Review																				
	Final Review																				
	Final Report																				
	Audit																				

ANNEX V: UNDP Fees for Support to Adaptation Fund Project

"Reduction of vulnerability to coastal flooding through ecosystem-based adaptation in the south of Artemisa and Mayabeque provinces"

Category	Services Provided by UNDP	UNDP Fee (8.5%)
Identification, Sourcing and Screening of Ideas	Provide information on substantive issues in adaptation associated with the purpose of the Adaptation Fund (AF). Engage in upstream policy dialogue related to a potential application to the AF. Verify soundness & potential eligibility of identified idea for AF.	$23,766 (5%)
Feasibility Assessment / Due Diligence Review	Provide up-front guidance on converting general idea into a feasible project/programme. Source technical expertise in line with the scope of the project/programme. Verify technical reports and project conceptualization. Provide detailed screening against technical, financial, social and risk criteria and provide statement of likely eligibility against AF requirements. Determination of execution modality and local capacity assessment of the national executing entity. Assist in identifying technical partners. Validate partner technical abilities. Obtain clearances from AF.	$71,298 (15%)
Development & Preparation	Provide technical support, backstopping and troubleshooting to convert the idea into a technically feasible and operationally viable project/programme. Source technical expertise in line with the scope of the project/programme needs. Verify technical reports and project conceptualization. Verify technical soundness, quality of preparation, and match with AF expectations. Negotiate and obtain clearances by AF. Respond to information requests, arrange revisions etc.	$95,064 (20%)
Implementation	Technical support in preparing TORs and verifying expertise for technical positions. Provide technical and operational guidance project teams. Verification of technical validity / match with AF expectations of inception report. Provide technical information as needed to facilitate implementation of	$213,894 (45%)

Category	Services Provided by UNDP	UNDP Fee (8.5%)
	the project activities. Provide advisory services as required. Provide technical support, participation as necessary during project activities. Provide troubleshooting support if needed. Provide support and oversight missions as necessary. Provide technical monitoring, progress monitoring, validation and quality assurance throughout. Allocate and monitor Annual Spending Limits based on agreed work plans. Receipt, allocation and reporting to the AFB of financial resources. Oversight and monitoring of AF funds. Return unspent funds to AF.	
Evaluation and Reporting	Provide technical support in preparing TOR and verify expertise for technical positions involving evaluation and reporting. Participate in briefing / debriefing. Verify technical validity / match with AF expectations of all evaluation and other reports Undertake technical analysis, validate results, and compile lessons. Disseminate technical findings	$71,298 (15%)
Total		$475,320

Disbursement Schedule

The disbursement schedule to use for the AF funds is as follows: AF Trustee transfers the funds to UNDP in 6 tranches based on the following time-bound milestones. All figures in US Dollars

	Upon Agreement signature	One Year after Project Start[a/]	Year 2[b/]	Year 3	Year 4	Year 5[c/]	**Total**
Scheduled Date	February 2014	May 2015	May 2016	May 2017	May 2018	May 2019	
Project Funds		685,100	1,275,500	1,964,680	988,960	677,760	5,592,000
Implementing Entity Fee	190,128	34,940	65,050	100,199	50,437	34,566	475,320
Totals	190,128	720,040	1,340,550	2,064,879	1,039,397	712,326	6,067,320

[a/]Use projected start date to approximate first year disbursement
[b/]Subsequent dates will follow the year anniversary of project start
[c/]Add columns for years as needed

ANNEX VI: List of Abbreviations

Abbreviation	Meaning
AF	Adaptation Fund
AFB	Adaptation Fund Board
AMA	Environment Agency (Agencia de Medio Ambiente)
APR	Annual Progress Report
BASAL	Environmental Bases for Local Food Security
CC	Climate Change
CGB	Forest Guard Corps (Cuerpo de Guardabosques
CIGEA	Centre for Environmental Information, Management and Education (Centro de Información, Gestión y Educación Ambiental)
CITMA	Ministry of Science, Technology and Environment (Ministerio de Ciencia, Tecnología y Medio Ambiente)
CPP	Country Pilot Partnership
DPCITMA	Provincial Directorate of CITMA
EBA	Ecosystem-Based Adaptation
ENSO	El Niño Southern Oscillation
GDP	Gross Domestic Product
GEF	Global Environment Facility
GIS	Geographical Information System
IAS	Invasive Alien Species
IES	Institute of Ecology and Systematics
IINAF	National Agroforestry Research Institute
IW	Inceptio Workshop
KM	Knowledge Management
MINAGRI	Ministry of Agriculture
MINCEX	Ministry of External Cooperation
MTE	Mid Term Evaluation
NIM	National Implementation Modality
PD	Project Director
RBLAC	Regional Bureau for Latin America and the Caribbean
SLR	Sea Level Rise
TOR	Terms of Reference
UNFCCC	United Nations Framework Convention on Climate Change

ANNEX VII: SYNERGIES AND COMPLEMENTARITY WITH OTHER PROJECTS

PROJECT	FUNDING SOURCE	FOCUS	GEOGRAPHICAL RELEVANCE	OBJECTIVE	POTENTIAL SYNERGIES
Activities in support of the preparation of the Second National Communication to the UNFCCC.	GEF/UNDP	CC Adaptation	Includes Artemisa Province	Preparation and presentation of the Second National Communication .	Generation of updated information on CC conditions. Evaluation of the most vulnerable sectors to CC (agriculture, forestry, coastal zones, wáter resources, fisheries) Education, awareness raising and training
Enhancing the Prevention, Control and Management of Invasive Alien Species in Vulnerable Ecosystems	GEF/UNDP	Biodiversity and IAS	Includes Habana-Matanzas Plains	Development of system capacities for prevention, detection, control and management of the spread of IAS	Reduction of the risk of spread of IAS to the project area from adjoining areas on the Havana-Matanzas Plains Generation of IAS management protocols for application to the project area
Mainstreaming and Sustaining Biodiversity Conservation in Three Productive Sectors of the Sabana Camaguey Ecosystem	GEF/UNDP	Biodiversity	Archipelago on north coast	Promote operational changes in tourism, fisheries and agriculture sectors to ensure biodiversity conservation across seascape and landscape	Generation of experiences and lessons on coastal ecosystem management
Application of a Regional Approach to the Management of Marine and Coastal Protected Areas in Southern Archipelagos	GEF/UNDP	Biodiversity	Marine and coastal areas adjoining the project site	Conservation and sustainable use of biodiversity in coastal and marine PAs	Conservation of marine ecosystems (coral reefs and seagrass beds) which provide additional lines of defence against CC-related phenomena
CPP Project 2: Creation of capacities for information coordination	GEF/UNDP/ FAO/UNEP	Land degradation	Includes Havana-Matanzas plains	Improved management of land and water resources	Improved management of land and (ground)water resources threatened by the CC-related phenomena which the

PROJECT	FUNDING SOURCE	FOCUS	GEOGRAPHICAL RELEVANCE	OBJECTIVE	POTENTIAL SYNERGIES
and monitoring systems /SLM in areas with wáter management problems					project will address, inland from the project site
Environmental Bases for Local Food Security (BASAL)	EU	Agriculture and CC	Los Palacios, Güira de Melena and Jimaguayú municipalities	Strengthening of capacities for monitoring environmental conditions and trends in relation to CC	Strengthening of local capacities for adaptation
Prevention of saline intrusión in aquifers in the southern catchment of Mayabeque and Artemisa provinces	JICA	Water resource management and CC	Mayabeque and Artemisa provinces	Improvement of capacities for groundwater management, taking into account CC.	Improved management of the aquifers that are affected by seawater incursions which will be combatted by the EBA approach of the current project.

ANNEX VIII: Project/AF results framework alignment table

Project Objective(s)[18]	Project Objective Indicator(s)	Fund Outcome	Fund Outcome Indicator	Grant Amount (USD)
Increase the resilience of populations in the coastal regions of Artemisa and Mayabeque provinces to the effects of climate change	Area with increases in indices of mangrove and wetland conditions (soil and water salinity, canopy density, existence of local protection regimes)	**Outcome 5**: Increased ecosystem resilience in response to climate change and variability-induced stress	5.1. No. and type of natural resource assets created, maintained or improved to withstand conditions resulting from climate variability and change (by type of assets)	5,592.000
	Numbers of people (men and women) with reduced vulnerability due to proximity of functioning mangrove and wetland ecosystems	**Outcome 2:** Strengthened institutional capacity to reduce risks associated with climate-induced socioeconomic and environmental losses	2.2. Number of people with reduced risk to extreme weather events	
		Outcome 6: Diversified and strengthened livelihoods and sources of income for vulnerable people in targeted areas	6.1 Percentage of households and communities having more secure (increased) access to livelihood assets	
Project Outcome(s)	**Project Outcome Indicator(s)**	**Fund Output**	**Fund Output Indicator**	**Grant Amount (USD)***
1: Reduction of the	Area (ha) of red mangrove established along sea shore between Batabanó and	***Output 5:*** Vulnerable		**4,020,000**

[18] The AF utilized OECD/DAC terminology for its results framework. Project proponents may use different terminology but the overall principle should still apply

impacts of coastal flooding through the recovery of coastal ecosystems	Punta Mora	physical, natural, and social assets strengthened in response to climate change impacts, including variability	5.1. No. and type of natural resource assets created, maintained or improved to withstand conditions resulting from climate variability and change (by type of assets)	
	Cumulative area of mangrove ecosystem restored between Majana and Surgidero de Batabanó			
	Cumulative area of landward edge woodlands restored and enriched			
	Numbers of IAS management plans developed			
	Cumulative area with IAS managed			
2. Integrated and participatory management of coastal ecosystems to increase resilience to climate change	Numbers of provincial and municipal development plans that make specific provision for EBA	***Output 6:*** Targeted individual and community livelihood strategies strengthened in relation to climate change impacts, including variability	6.1.1.No. and type of adaptation assets (physical as well as knowledge) created in support of individual- or community-livelihood strategies	**700,000**
	Numbers of provincial and municipal governments with EBA-related knowledge management systems in place			
	Numbers of community members (men and women) belonging to local voluntary groups addressing environmental and adaptation issues			
	Numbers of local schools with study programmes incorporating adaptation issues			
	Numbers of dissemination and awareness raising materials on adaptation issues, produced by local media			
Component 3: Ensure the effectiveness and sustainability of adaptation investments through the establishment of a favourable enabling environment at regional level	Frequency of training and technical support visits carried out by provincial and municipal governments to coastal communities in support of EBA	***Output 2.1***: Strengthened capacity of national and regional centres and networks to respond rapidly to extreme weather events	2.1.1. No. of staff trained to respond to, and mitigate impacts of, climate-related events	500,000
	Frequency of inspection visits to coastal areas by provincial and municipal governments in support of EBA			

*Project Management cost is an additional $372,000

ANNEX IX: Economic Analysis of Mangrove Services

The Gross Benefits (GB) derived from the mangroves in the project area are calculated as follows[19]:

$$GB = \sum_{1}^{n}(BP * P) \quad (1)$$

$$GB = GB(e)+GB(p)+GB(ap)+GB(rc)+GB(pci)+GB(pcc) \quad (2)$$

Where:
BP = potential benefit
P = estimated price
N = total number of environmental services considered.
GB(e) = Gross Benefit from extraction
GB(p) = Gross Benefit from fishing
GB(ap) = Gross Benefit from apiculture
GB(rc) = Gross Benefit from carbon storage
GB(pci) = Gross Benefit from protection of coastal infrastructure
GB(pcc) = Gross Benefit from protection of coastal crops

In this case, the total area of restoration in the 84km of coastline between Punta Sucia and Punta Mora is 7,318ha, and the Gross Benefit is estimated to be US$99,570.90, based on the following:

Mangrove values	**Gross Benefits (US$)**
Extraction	5,188.46
Fishing	1,675.82
Apiculture	664.47
Carbon storage	567.15
Protection of coastal infrastructure	73,180.00
Protection of crops	18,295.00
Total benefits from restoration	**99,570.90**

The Net Present Value (NPV or VAN) is calculated as follows:

$$\boldsymbol{VAN = \sum_{t=0}^{Y}(B_t^M + B_t^{NM} + B_t^P - C_t)/(1+r)^t} \quad \textbf{(3)}$$

Where:
B_t^M = Gross benefit from timber production in year t.
B_t^{NM} = Gross benefit from non-timber production in year t.
B_t^P = Gross benefit from extraction, conservation and maintenance in year t
C_t = Cost of extraction, conservation and maintenance in year t
r = discount rate (12%)

[19] Methodology applied in the Sabana Camaguey project

In this case,

$$\boldsymbol{VAN} = \sum_{t=0}^{\gamma} \boldsymbol{B_t^{NM}} + \boldsymbol{B_t^{P}} - \boldsymbol{C_t}\ )/(\mathbf{1}+\boldsymbol{r})^{t} \quad \textbf{(4)}$$

$$\textbf{VAN} = (\textbf{GB}_{(ap)}+\textbf{GB}_{(rc)}+\textbf{GB}_{(pci)}+\textbf{GB}_{(pcc)})/(1+r)^{t} \quad \textbf{(5)}$$

VAN = 7.89 for the total area of restoration, 7,318.0 ha