Empowered lives.
Resilient nations.

United Nations Development Programme
Country: Timor-Leste
Project Document[1]

Project Title:

Building shoreline resilience of Timor-Leste to protect local communities and their livelihoods

UNDAF Outcome(s):

- Outcome 1: People of Timor-Leste, especially the most disadvantaged groups, benefit from inclusive and responsive quality health, education and other social services, and are more resilient to disasters and the impacts of climate change.
- Outcome 3: Economic policies and programmes geared towards inclusive, sustainable and equitable growth and decent jobs

UNDP Strategic Plan Primary Outcome:

- Outcome 1: Growth and development are inclusive and sustainable, incorporating productive capacities that create employment and livelihoods for the poor and excluded

Expected CP Outcome(s):

- **Outcome 2: Sustainable Development**
  Output 2.2. Solutions developed at national and subnational level for sustainable management of natural resources, ecosystem services and waste
  Output 2.3. Scaled up action on climate change adaptation and mitigation across sectors which is funded and implemented

Expected CPAP/UNDAF Output (s):

- Sub-Outcome 1.4. People of Timor-Leste, particularly those living in rural areas vulnerable to disasters and the impacts of climate change, are more resilient and benefit from improved risk and sustainable environment management
- Sub-Outcome 3.2. Technical capacity enhanced to develop viable and sustainable agribusiness sub-sectors and value chains promoting local bio-diversity

Executing Entity/Implementing Partner: UNDP
Implementing Entity/Responsible Partners: Ministry of Agriculture and Fisheries (MAF)

Programme Period:	2016-2019
Atlas Award ID:	00092621
Project ID:	00097253
PIMS #	5330
Start date:	Jan 2016
End Date	Dec 2019
Management Arrangements:	DIM
PAC Meeting Date :	Jan 2016

Total resources required	38,644,402
Total allocated resources:	38,644,402
• Regular	
• Other:	
○ GEF	7,000,000
○ Government	18,000,000
○ In-kind	
○ Other	13,644,402
In-kind contributions	

[1] For UNDP supported GEF funded projects as this includes GEF-specific requirements

Brief Description

Climate change is causing Timor-Leste to become hotter and drier, with increasingly variable rainfall –water, soils, and coastal areas are all sensitive to these changes. Riverine and catchment runoff from the country's mostly steep terrain, with increasing deforestation and poor agricultural and catchment practices, causes significant soil erosion, increased incidence of landslides and flash flooding. This results in sedimentation of rivers and streams, and major impacts on riverine and coastal water quality, as well as the compromised health of coastal ecosystems (such as mangroves, coral reefs and seagrasses).

These pressures from upland areas, coupled with the rapidly rising sea level, are putting coastal communities (and the ecosystems and resources upon which they depend), particularly at risk. Over the past 2 decades, mangroves, which serve as a natural defense to the sea, have been severely degraded – leaving the country's shoreline and coastal communities vulnerable to coastal inundation, erosion, salt water intrusion, and impacts of sea-borne natural hazards (e.g. waves, storm surges, and in extreme cases, small scale tsunamis).

The Government of Timor-Leste (GoTL) faces the unique challenge of responding to these climate change impacts, while addressing the needs of a least developed country (LDC) with one of the most rapidly growing populations in the world. Conservative growth rate projections estimate that the population will more than double to 2.5million over the next 30 years. With approximately 40% of the population living in coastal areas, the GoTL is seeking to minimize adverse impacts of both, climate change and rapid population growth, on shoreline resilience and the achievement of its development goals.

The Timor-Leste Strategic Development Plan (SDP) 2011-2030 clearly articulates the long-term preferred situation of preserving an ecological balance to safeguard the sustainable development of the economy. The SDP stresses, in particular, the challenges of increased risk of flooding to low-lying coastal villages, as well as food shortages in the country in general, which climate change presents. The Timor-Leste National Adaptation Programme of Action (NAPA) further emphasizes the need to specifically tailor adaptation support to those most vulnerable, particularly children and youth, and stresses the importance of reflecting those needs in the development goals and aspirations of the country.

The objective of the LDCF project is **to strengthen resilience of coastal communities by the introduction of nature-based approaches to coastal protection**. Issues of coastal areas are complex and cross-sectoral. The project therefore employs an integrated approach, while tailoring activities to address the specific needs, challenges and priorities of the GoTL.

LDCF funds will support inter-ministerial and intra-ministerial coordination for collaborative development planning ensuring protection of coastal areas, as well as identify and research potential revenue streams for long term sustainability. As mangroves are a vital natural defense to impacts of climate change, extensive mangrove protection and re-afforestation will be supported by the project while also addressing community pressures (i.e. felling for fuelwood) by introducing alternative mangrove-supportive livelihoods and improving public awareness about the important role of mangroves in coastal protection. Degraded coastal watersheds, particularly upland areas exert pressures on the coastline through excess sedimentation, increased runoff and flash flood causing more erosion and prolonged inundations. Such broader landscape processes for greater coastal protection will also be addressed. The project is thus structured into 3 complementary outcomes:

Outcome 1: Policy framework and institutional capacity for climate resilient coastal management established
Outcome 2: Mangrove-supportive livelihoods established to incentivize mangrove rehabilitation and protection
Outcome 3: Integrated approaches to coastal adaptation adopted to contribute to protection of coastal populations and productive lands

The lead partner in the project is the Ministry of Agriculture and Fisheries (MAF). As coastal management is cross-sectoral, various ministries will be engaged in implementation, as well as development partners, international and local non-governmental organizations (NGOs), civil society organizations (CSOs), academia and the private sector.

Agreed by (Government):

Date/Month/Year

Agreed by (Executing Entity/Implementing Partner):

Date/Month/Year

Agreed by (UNDP): Date/Month/Year

Date/Month/Year

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List of Acronyms

ACDI/VOCA	Agricultural Cooperative Development International/Volunteers in Overseas Cooperative Assistance
ACIAR	Australian Centre for International Agricultural Research
AIMS	Australian Institute of Marine Science
ALGIS	Agro-meteorology, Land Use and Geographic Information Systems
AMAT	Adaptation Monitoring and Assessment Tool
AR5	Fifth Assessment Report
ASEAN	Association of Southeast Asian Nations
BESIK	Bee, Saneamentu no Ijiene iha Komunidade
CBA	cost-benefit analysis
CBEMR	community-based ecological mangrove restoration
CBNRM	community-based natural resources management
CI	Conservation International
CO	Country Office
CPAP	Country Programme Action Plan
CSO	civil society organization
CVA	coastal vulnerability assessment
DFAT	Department of Foreign Affairs and Trade
DIM	Direct Implementation Modality
DRM	disaster risk management
ECCA	Capacity Building Programme on the Economics of Climate Change Adaptation
EIA	environmental impact assessment
ENSO	El Niño Southern Oscillation
ESI	Estimated Sustainable Income
FAO	Food and Agriculture Organization
FFDTL	Falintil-Forcas Defensa Timor Lorosa´e ka
FGD	focus group discussion
GCCA	Global Climate Change Alliance
GEF	Global Environment Facility
GHG	greenhouse gas
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GNI	Gross National Income
GoTL	Government of Timor-Leste
HDR	Human Development Report
HDI	Human Development Index
ICM	integrated coastal lmanagement
IBA	important bird and biodiversity area
IDP	internally-displaced person/people
IFC	International Finance Corporation
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
JICA	Japan International Cooperation Agency
KOICA	Korea International Cooperation Agency
LDC	Least Developed Country
LDCF	Least Developed Countries Fund
LiDAR	light detection and ranging
LNG	liquefied natural gas
MAF	Ministry of Agriculture and Fisheries
MCIE	Ministry for Commerce, Industry and the Environment
MPI	multi-dimensional poverty index
MPSI	Ministry of Planning and Strategic Investments
MSME	micro, small and medium-sized enterprises
MSS	Ministry of Social Solidarity
MTAC	Ministry of Tourism, Arts and Culture
MTOP	Midterm Operational Plan
Mtpa	metric tons per annum
NADS	National Aquaculture Development Strategy
NAP	National Adaptation Plan

NAP-GSP	National Adaptation Plan – Global Support Programme
NAPA	National Adaptation Programme of Action
NBSAP	National Biodiversity Strategy and Action Plan
NDAH	National Directorate of Agriculture and Horticulture
NDF	National Directorate of Forests
NDFA	National Directorate of Fisheries and Aquaculture
NDPA	National Directorate of Protected Areas
NEGA	National Ecological Gap Assessment
NGO	non-governmental organizations
PIF	Project Identification Form
PPP	public-private partnership
PPP	purchasing power parity
RDTL	República Democrática de Timor-Leste
SDG	Sustainable Development Goal
SDP	Strategic Development Plan
SEPASEM	Secretariat of State for Support and Social-Economic Advancement of Women
SIDS	Small Island Developing State
SLR	sea level rise
SNC	Second National Communication
SoL	Seeds of Life
TWG	technical working group
UNTL	National University of Timor-Leste/Universidade Nacional Timor Loroa'se
UNTAET	United Nations Transitional Administration in East Timor
USDA	United States Department of Agriculture
UNDP	United Nations Development Programme
USP	University of the South Pacific
WHO	World Health Organization
WTA	willingness to accept
WTP	willingness to pay

1. SITUATION ANALYSIS

1.1. Climate Change-Induced Problem

1. Climate change is causing Timor-Leste to become hotter and drier, with increasingly variable rainfall –water, soils, and coastal areas are all sensitive to these changes[2]. Riverine and catchment runoff from the country's mostly steep terrain, with increasing deforestation and poor agricultural and catchment practices, causes significant soil erosion, increased incidence of landslides and flash flooding. This results in sedimentation of rivers and streams, and major impacts on riverine and coastal water quality, as well as compromises the health and stability of coastal ecosystems, such as mangroves, coral reefs and seagrasses that have significant protective functions for the coastal lands.

2. These pressures from upland areas, coupled with the rapidly rising sea level, are putting coastal communities and resources upon which they depend, particularly at risk. Over the past 2 decades, mangroves, which serve as a natural defense to the sea, have been severely degraded – leaving the country's shoreline and coastal communities vulnerable to coastal inundation, erosion, salt water intrusion, and impacts of sea-borne natural hazards (e.g. waves, storm surges, and in extreme cases, small scale tsunamis).

3. The Government of Timor-Leste (GoTL) faces the unique challenge of responding to these climate change impacts, while addressing the needs of a least developed country (LDC) with one of the most rapidly growing populations in the world. Conservative growth rate projections estimate that the population will double to 2.5million over the next 30 years[3]. With approximately 40% of the population living in coastal areas, the GoTL is seeking to minimize adverse impacts of both, climate change and rapid population growth, on shoreline resilience and the achievement of its development goals.

1.1.1. Impact of Climate Change on the Shoreline and Coastal Communities

4. Sea level rise projections indicate a rise of 3.2-10cm by 2020, 8.9-27.8cm by 2050, and 18-79cm by 2095[4]. Recent studies by the Pacific Climate Change Science Programme (PCCSP) indicated that sea level rise near Timor-Leste, measured by satellite altimeters since 1993 and tidal gauges closest to Timor-Leste, is about 9mm per year on average, larger that the global average of 3.2 ± 0.4 mm per year[5].

5. Due to a) tectonic activity, which results in an average annual uplift of 1cm, and b) inadequate data given the lack of tidal gauges, it is difficult to project sea level rise around Timor-Leste with certainty. Nearly all of the uncertainties however indicate that corrections could be for higher rather than lower estimates[6].

6. Mangrove forests would offer a natural barrier between the sea and coastal communities. The total mangrove area of Timor-Leste has reduced significantly (~80%) from 9,000 to ~1,300ha[7,8,9], since 1940, due to both climate and non-climate factors, including sea level rise, increased storm frequency/severity, salt water intrusion, upstream sediment impacts, cutting and felling (for fuel wood and building materials),

[2] Vulnerability to Climate Variability and Change in East Timor, Royal Swedish Academy of Sciences, Ambio, vol. 36, no. 5, (J. Barrett, S. Dessai, RN Jones, 2005)
[3] 2010 Timor-Leste Population and Housing Census http://www.statistics.gov.tl/
[4] National Adaptation Programme of Action (NAPA) on Climate Change (RDTL, 2010)
[5] Climate Change in the Pacific: Scientific Assessment and New Research Vol 2. Country Reports (PCCSP, 201?)
[6] National Adaptation Programme of Action (NAPA) on Climate Change (RDTL, 2010)
[7] Global Forest Resources Assessment 2005 Thematic Study on Mangroves – Timor-Leste Country Profile (FAO, 2005)
[8] Marine and Coastal Habitat Mapping in Timor-Leste (North Coast) – Final Report for Tourism & Fisheries Development Project (Boggs, et. al., 2009)
[9] Mangrove Forests of Timor-Leste: Ecology, Degradation and Vulnerability to Climate Change (Alongi, 2014)

coastal development[10] and animal grazing – leaving the shoreline and coastal communities exposed to coastal risks of climate change.

7. Timor-Leste has approximately 747km of coastline and an estimated two-thirds of the population live in coastal areas – this comprises of over 600,000 people residing in coastal and lowland areas with an elevation up to 500m[11]. The topography of Timor-Leste exacerbates its vulnerability to climate risks, as over 40% of the country has extremely steep slopes of 40% grade[12], with fragile soils, which are vulnerable to erosion by monsoonal rains – accumulating sedimentation to water catchment areas, and the numerous, short rivers draining to the sea. Increased extreme rainfall events are resulting in increases in natural hazards, such as landslides and flash floods, not only putting pressure on mangroves, but also putting coastal communities at risk.

8. Coastal communities are therefore especially vulnerable to climate change due to both, sea level rise and natural hazards originating from upland areas in broader coastal watersheds.

1.1.2. Impact of Climate Change on Food Security

9. As many as 60-70% of households in Timor-Leste are already moderately-to-severely food insecure, particularly between December and February – often termed the 'hungry season', when most farmers have exhausted their stock of cereals and are awaiting their next harvest[13]. Children are particularly vulnerable, as 47% under the age of five suffer from chronic malnutrition[14]. Malnutrition weakens the immune system and can lead to a heightened risk of illness and disease. Chronic undernutrition in early childhood also results in diminished cognitive and physical development, which can put children at a disadvantage for the rest of their lives[15]. Research has shown that the effects of chronic malnutrition are irreversible if left untreated by the time a child reaches two or three years of age[16].

10. Agriculture production has not yielded enough, to meet what is required by the growing population[17]. While there has been an overall increase in total food production since 2002, imports are still needed to supplement the shortfall[18]. 80% of the country's poor and 90% of the rural poor depend on subsistence rain-fed agriculture for their livelihood. Unusual or extreme weather has been cited as the cause for low crop yields (i.e. 25% decrease in rice in 2009 and 20% decrease in maize in 2010)[19]. Climate change will continue to challenge food security with increasing temperatures and variability in rainfall. The impacts are likely to be particularly acute in the coastal regions where the sea surges, coastal inundation, prolonged submersions, erosion, and long term sea level rise undermine land productivity.

11. The fifth assessment report (AR5) from the Intergovernmental Panel on Climate Change (IPCC) indicates that temperature in the Southeast Asia sub-region has been increasing at a rate of 0.14°C to 0.20°C per decade since the 1960s, and predicts increases from 0.8°C to 3.2°C by the end of this century. The report further highlights the positive trend in the occurrence of heavy (top 10% by rain amount) and light (bottom 5%) rain events, and the influence of climate change on several large-scale phenomena affecting the region[20]. Temperature observations in Timor-Leste are consistent with the high end of the range of the IPCC AR5 temperature trend. Rainfall observations are also consistent with the report; heavy rain events are more common, while the overall average annual rainfall has decreased.

[10] Mangrove Ecosystems Strategy, Design and Recommendations for Building shoreline resilience of Timor-Leste to protect local communities and their livelihoods (K. Edyvane, 2015)
[11] National Statistics Directorate 2006: 16
[12] Assessing Environmental Needs and Priorities in East Timor: Final Report. UNDP and Norwegian Institute for Nature Research NIN˜ A, Trondheim, Norway (Sandlund, O., Bryceson, I., Carvalho, D., Rio, N., Silva, J. and Silva, M. 2001)
[13] Timor-Leste and FAO Achievements and success stories (FAO, 2011)
[14] https://www.oxfam.org.au/what-we-do/health/food-and-nutrition/childhood-malnutrition-in-timor-leste/
[15] Tracking Progress on Child and Maternal Nutrition: A survival and development priority (UNICEF, 2009)
[16] https://www.oxfam.org.au/what-we-do/health/food-and-nutrition/childhood-malnutrition-in-timor-leste/
[17] Climate Change and Population Growth in Timor Leste: Implications for Food Security (N. Molyneux, et. al, 2011)
[18] Timor-Leste and FAO Achievements and success stories (FAO, 2011)
[19] Timor-Leste and FAO Achievements and success stories (FAO, 2011)
[20] Climate Change 2013: The Physical Science Basis (IPCC, 2013)

The below table compares 1954-1974 data collected during the Portuguese colonial period, to 2004 - 2012 data collected by Agro-meteorology, Land Use and Geographic Information Systems (ALGIS) department in the Ministry of Agriculture and Fisheries (MAF).

Table 1: Observed Changes in Temperature and Rainfall[21]

Location	Alt.	1954-1974			2004-2012			Change in Climate			
		Tmax (°C)	Tmin (°C)	Annual Rain (mm)	Tmax (°C)	Tmin (°C)	Annual Rain (mm)	Δ Tmax (°C)	Δ Tmin (°C)	Δ Ann. Rain (mm)	Δ Rain (%)
Aileu	990	26.0	18.4	1726	28.3	15.0	1383	2.3	-3.3	-343	-20%
Ainaro	809	25.8	16.2	2604	27.8	17.5	2212	2.0	1.3	-392	-15%
Betano	3	-	-	1329	31.7	22.0	1128	-	-	-201	-15%
Dare	492	27.0	21.3	1572	30.1	21.8	1073	3.1	0.6	-499	-32%
Lospalos	394	27.8	19.1	1905	28.9	20.2	1213	1.1	1.0	-693	-36%
Maliana	298	30.9	20.7	2053	33.0	20.9	1315	2.1	0.2	-738	-36%
Manatuto	4	30.1	22.5	570	32.7	22.6	698	2.6	0.2	128	23%
Maubisse	1406	22.3	14.7	1500	22.8	14.3	1031	0.5	-0.4	-469	-31%
Viqueque	108	30.9	21.2	1617	31.3	21.9	1506	0.4	0.7	-111	-7%
Average		27.6	19.2	1653	29.6	19.5	1284	1.7	0.0	-369	-19%

12. While the degree of change varies by location, the trends of increasing maximum temperatures and decreasing rainfall are present in 8 of the 9 locations. On average there has been an increase in maximum temperature of 1.7°C and a decrease of 19% in average rainfall.

13. Timor-Leste is also affected by the El Niño Southern Oscillation (ENSO), which brings increased rainfall variability. Historical rainfall data from the Portuguese colonial period of Timor-Leste was analyzed together with historical data on the Southern Oscillation Index. For the 13 district centers analyzed, the annual total rainfall during a La Niña event was 1885 mm compared to the average 1583mm - a 19.1% increase. During an El Niño event, rainfall fell to 1313mm – a 17.0% decrease[22]. ENSO had a greater impact on rainfall during the transition periods between the wet season and dry season. During La Niña, the wet season starts 22 days earlier on average. During El Niño, the wet season starts 15 days later on average[23].

14. Ongoing ENSO monitoring indicates that the current event could be worse than 1997, which had devastating effects. Southeast Asian countries have been advised to take measures to mitigate its impact – especially for the poor[24]. Due to the late onset of the rainy season and the decreased rainfall, as historically measured during previous El Niño events, Timor-Leste can expect drier conditions, with impacts on food production and water availability in 2015-2016.

15. Changes in rainfall and sea level rise, and related salt water intrusion, also impact groundwater quality and recharge rates, as does excessive runoff during the wet season due to deforestation. Groundwater is recharged by rainfall during the wet season, ideally in sufficient amounts for reliable use

[21] Climate Change Research in Timor-Leste, Summary Release, (RDTL, MAF, Seeds of Life, 2013)
[22] The Impact of the El Niño Southern Oscillation on Rainfall Variability in Timor-Leste, (MAF, Seeds of Life, 2013)
[23] The Impact of the El Niño Southern Oscillation on Rainfall Variability in Timor-Leste, (MAF, Seeds of Life, 2013)
[24] http://edition.cnn.com/2015/08/16/opinions/el-nino-asia-impact/

during the dry season. Without regular recharge, the stored groundwater decreases in volume. Groundwater is a critical resource in Timor-Leste, as a main source of drinking water for rural communities and for agricultural activities. Rural villages may have one or two groundwater wells which service the entire community, while many others get their water solely from natural groundwater springs.

16. Most areas of Timor-Leste oscillate between having surplus water to being water-stressed. During the wet season and in wetter years there are often floods and excess water whereas in the dry season and drier years, there can be areas of water stress, drought and water shortages for consumptive and agricultural use. In these drier times, and to some extent during the wetter periods, surface waters are largely unavailable for use and groundwater is heavily relied on.

17. Further, as water extraction drops the levels of fresh groundwater, reducing its water pressure and allowing to saltwater to infiltrate and flow further inland. The groundwater in addition to being a critical freshwater reserve for coastal communities, is a natural asset that buffers away saltwater intrusion, provided that extraction is controlled and the reserves kept recharged.

18. In addition to these stresses, past and continued forest clearing for agriculture, timber and firewood harvesting has led to exposed soils throughout the country. In turn, these exposed soils have eroded quickly causing soil loss, high water turbidity, increased water runoff and increased flash flooding. There is also concern that the high sediment loads could damage estuaries, offshore reefs and wetlands. In many areas high sediment loads can and have made water unfit for human consumption.

19. Sea level rise, high sedimentation and felling for fuelwood, have all contributed to the large scale mangrove loss in Timor-Leste. This loss not only exposes coastal communities and their assets to climate change induced coastal threats, but also has direct implications on food security. When mangrove forests are destroyed, declines in local fish catch often result. Mangroves maintain fisheries by providing nursing and breeding habitat for fish.

20. Essential fats from fish are critical for brain development and cognition, particularly in the first 1,000 days of a child's life[25]. Fish also provide animal protein and micronutrients like vitamin A, iron, zinc and calcium[26]. As a means to address food security and malnutrition, the GoTL seeks to raise the consumption of fish to 15kg per capita by 2020, from the currently low 6.1kg per capita (less than half the global average). To achieve this goal, rapid development of the aquaculture sector has commenced. If not well planned, however, aquaculture can further accelerate mangrove loss through the clearing of land for coastal ponds, and thus inadvertently reduce the number of fish in coastal areas. Assessments of the links between mangrove forests and the fishery sector suggest that, for every hectare of forest cleared, nearby coastal fisheries lose up to 480kg of fish per year[27].

1.2. Long Term Solution

1.2.1. Long Term Solution

21. To address flooding in coastal areas from sea level rise, the government has built sea walls as a means to protect valuable infrastructure and people. One sea wall has already been established to protect the airport and another to protect the centre of Dili. The trend has therefore favored hard engineering solutions – man-made barriers to prevent or slow the movements of the sea. However, with expansion of coastal urbanization and rise in asset value of a fast developing coastal infrastructure, the government has realized that such approaches are costly, and many are of limited longevity. At the same time, there is a growing realization globally, including in Timor-Leste, that natural ecosystems may be

[25] https://www.devex.com/news/funding-needed-for-fish-farming-in-east-timor-80806
[26] https://www.devex.com/news/funding-needed-for-fish-farming-in-east-timor-80806
[27] The World's Mangroves 1980 – 2005, A thematic study prepared in the framework of the Global Forest Resources Assessment (FAO, 2005)

able to perform coastal protection functions more effectively, while at the same time continuing to provide other critical benefits to people – such as food, timber and recreation.

22. The Timor-Leste Strategic Development Plan (SDP) 2011-2030 also reflects this desired shift, clearly articulating the approach going forward, of preserving an ecological balance to safeguard the sustainable development of the economy. Specifically, the SDP highlights the need to strengthen institutions, policies and action for improved management of coastal zones and related watersheds, including protection of mangrove areas.

23. Mangroves and other coastal wetlands (i.e. seagrasses and coral reefs) provide physical protection to the shoreline by creating a buffer – protecting coastal communities from sea level rise, and absorbing the impact of waves, storm surges, and in extreme cases, small scale tsunamis. In addition to coastal protection, mangroves and coastal wetlands provide multiple ecosystem services and benefits for coastal communities, such as provisioning services (e.g. timber, fuel wood, and charcoal), regulating services (e.g. protection against floods, storms and erosion control, prevention of saltwater intrusion), habitat (e.g. breeding, spawning and nursery habitat for fish species, biodiversity), and cultural services (e.g. recreation, aesthetic, non-use). Mangroves are also among the most carbon-rich forests in the tropics, storing an immense amount of carbon from the steady accumulation of organic matter over several millennia.

24. Poor catchment management, deforestation, conversion to agricultural land, and existing inappropriate agriculture practices (e.g. slash and burn and free livestock grazing), have led to a rapid degradation of catchments and watersheds in Timor-Leste and increases in flash-floods, which have downstream impacts on rivers, estuaries and coastal ecosystems, causing more erosion and prolonged coastal inundations. A viable solution to coastal protection must therefore also exhibit the strong connectivity of catchments and coastal ecosystems, by including effective soil conservation and effective watershed management in protecting mangroves and coastal areas. This is especially relevant in Timor-Leste, given the country's steep terrain and extensive deforestation.

25. Importantly, as all adaptation support in Timor-Leste must be tailored to those most vulnerable[28], a long term solution is one which also takes into account the country's food security and poverty challenges. The long term solution can thus be summarized by three complementary outcomes:

- Policy framework and institutional capacity for climate resilient coastal management established
- Mangrove-supportive livelihoods established to incentivize mangrove rehabilitation and protection
- Integrated approaches to coastal adaptation adopted to contribute to protection of coastal populations and productive lands

26. There are number of barriers however, which can inhibit progress towards this long term solution.

1.3. Barriers to Achieving the Long Term Solution

1.3.1 Insufficient Policy Framework and Institutional Capacity for Climate-Resilient Coastal Management

27. Timor-Leste is a young country, having restored independence in 2002 after 450 years as a colony of Portugal, 24 years of occupation by Indonesia and two years of UN transitional administration[29]. Though Timor-Leste has a largely oral tradition, the GoTL is moving swiftly to establish the necessary frameworks and polices which foster development while protecting its natural resources.

[28] National Adaptation Programme of Action (NAPA) on Climate Change (RDTL, 2010)
[29] National Adaptation Programme of Action (NAPA) on Climate Change (RDTL, 2010)

28. In the context of coastal areas management, which are cross-sectoral, there is no obvious lead ministry and a mechanism to facilitate inter-ministerial dialogue is not defined. Decree-Law no. 6/2015 of 11 March 2015 - Organic Law of the VI Constitutional Government, details a revised institutional composition, hierarchy and structure. Responsibilities as they relate to potential impacts on coastal areas are listed below:

- the **Ministry of Agriculture and Fisheries (MAF)** is responsible for promoting agribusiness and fisheries, managing forest resources and water basins; monitoring and supervising fisheries and aquaculture; managing national parks and protected areas; ensuring the protection and conservation of nature and biodiversity; and monitoring the implementation of policies and of activities that are harmful to national fauna and flora
- the **Ministry of Commerce, Industry and the Environment (MCIE)** is responsible for designing, implementing and evaluating the policies for trade, industry and the environment; evaluating and licensing projects for facilities, and the operation of commercial and industrial ventures; promoting, supporting and following-up the strategies to mainstream environmental issues into sectoral policies; undertaking strategic environmental assessments of policies, plans, programmes and legislation and coordinating the environmental impact assessment of project at the national level; and ensuring the adoption and monitoring of measures for the integrated control and prevention of pollution in facilities in general and during the environmental licensing procedures.
- the **Ministry of Planning and Strategic Investments (MPSI)** is responsible for the design, coordination and evaluation of the policies, defined and adopted by the Council of Ministers for the promotion of the country's economic and social development, through strategic and integrated planning and the rationalization of available financial resources. Specifically, the ministry is responsible for the implementation of the Strategic Development Plan, as it pertains to:
  - Infrastructure and urban planning
  - Oil and mineral resources
  - Territorial planning and management
- the **Ministry of Public Works, Transport and Communications (MPW)** is responsible planning and carrying out works aimed at protecting, preserving and repairing bridges, roads, river banks and coastal areas, namely with a view to controlling flooding.
- the **Ministry of Social Solidarity (MSS)** is responsible for proposing and developing policies and strategies to manage the risk of natural disasters; and designing and implementing programmes for managing the risk of natural disasters
- the **Ministry of Tourism, Arts and Culture (MTAC)** is responsible for designing, implementing and evaluating the policy for tourism; contributing to the development of the tourism sector and proposing relevant measures and public policies to that effect; providing opinions on information requests regarding the establishment of tourism ventures; qualifying and classifying tourism-related activities in the tourism sector; qualifying and classifying tourism-related activities in accordance with the law; and implementing and enforcing the legislation regarding the establishment, licensing and supervision of the operating conditions of tourism facilities
- the **Ministry of Justice** is responsible for the design, implementation, coordination, and evaluation of the policies defined and adopted by the Council of Ministers for justice, land and property, law and human rights. This includes organizing the cartography and land register of immovable property.

29. The pace of development and the ambitious targets of the SDP require effective coordination between ministries to ensure that development planning is conducive to the long term sustainability, including the protection and the continued benefits of Timor-Leste's coastal ecosystems. A national coastal management and adaptation plan could help define this, but there is currently no plan in place.

30. Within MAF, various directorates are engaged in activities which directly contribute to effective coastal management and to building shoreline resilience. Coordination across directorates with MAF is therefore also important to ensure that the activities of one do not inadvertently affect the goals and targets of another. For instance, the goal of the 2012-2030 National Aquaculture Development Strategy

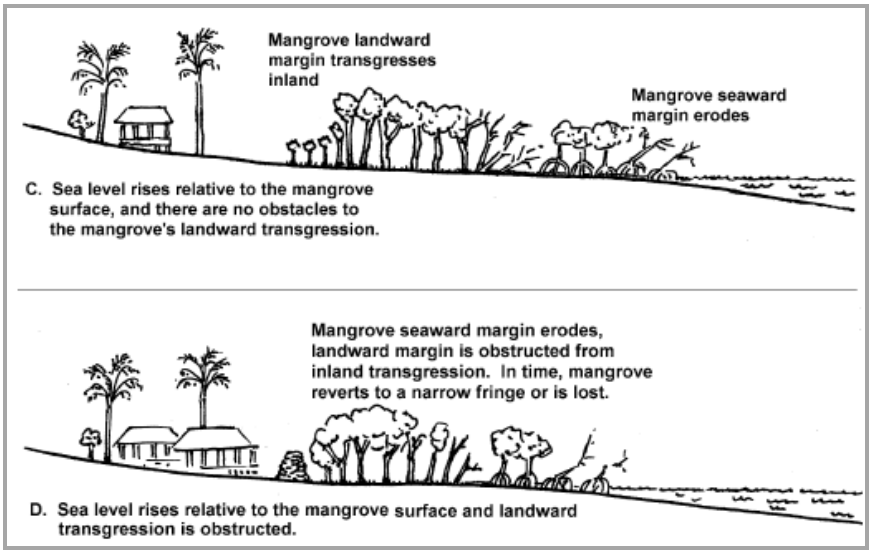
(NADS) is that by 2030, aquaculture will contribute up to 40% of domestic fish supplies. The strategy seeks to ensure 'coordination with other line ministries/departments with regard to the use of land and water resources for aquaculture purposes and develop synergistic relationships between aquaculture and other water, land and natural resource management and conservation policies,' yet NADS does not specifically state minimizing the impact on mangroves. Further, the National Biodiversity Strategy and Action plan (NBSAP) highlights that mangroves have been removed for the establishment of brackish water shrimp and/or fish ponds. There are a significant number of INGOs, NGOs and faith-based organizations engaged in aquaculture development in Timor-Leste: WorldFish, Caritas Australia, CARE International, Catholic Relief Services (CRS), ChildFund, Hivos and MercyCorps, with financial support from various partners, including AusAID, Australian Department of Foreign Affairs and Trade (DFAT) the European Union (EU), FAO, JICA, NZAid, and USAID. There is not however a cohesive approach across ongoing activities informed by national guidelines, which adequately takes into account the vulnerable shoreline and the need to preserve of mangrove areas.

31. Maintenance of mangroves areas has been a challenge for MAF, with related public resource allocations remaining too low to undertake enforcement at the national to municipal level. Mangrove rehabilitation efforts have been largely projectized and fragmented – lacking in scale and short-term in nature. There are at least seven identified mangrove species in Timor-Leste, and habitat requirements are specific for each. Effective rehabilitation is complex as it requires an approach tailored to the location, both from a technical and social perspective. Previous rehabilitation efforts have largely failed due to a) lack of financial and human resources to maintain the sites after completion of the project, b) incorrect rehabilitation techniques respective to the site (e.g. species selection, poor understanding of the hydro-ecological requirements of mangroves), c) failure to adequately engage communities in rehabilitation efforts and long term maintenance and/or address community pressures on mangroves and d) ineffective or inadequate education/sensitization for communities on the benefits of mangroves.

1.3.2. Pressure from Rapid Population Growth and Economic Development on Mangroves

32. Mangroves naturally respond to sea level rise by moving landward, provided there is space and conditions suitable, to thrive. If the mangroves do not have space to move landward, due to development, or are not able to thrive due to human factors (e.g. cutting, felling, etc.), mangrove coverage will diminish and narrow, and will eventually be lost – exposing coastal areas to the sea (see Figure 1).

Figure 1: Mangrove Response to Sea Level Rise[30]



[30] Adapted from Figure 1 of Assessment of mangrove response to projected relative sea-level rise and recent historical reconstruction of shoreline position (E. Gilman, J. Ellison, R. Coleman, 2005)

33. Mangroves are legally protected under the Biodiversity Decree Law (currently under Parliament review) and UNTAET Regulation No 2000/19 Section 5 – stating that wetlands and mangrove areas shall be protected in Timor-Leste. However, infrastructure development, human settlements, and land use are all contributing to the diminishing or narrowing effect on mangroves in Timor-Leste.

34. Rapid infrastructure development (including roads, ports and electricity plants), clear forest land and disturb and/or encroach on coastal habitats. Having only recently emerged from conflict, public spending is focused largely on reconstruction and development of critical infrastructure to support economic growth. Per the SDP, the GoTL plans to upgrade about 3,000km of roads and build/upgrade eight ports. Without proper assessments and consideration for coastal vulnerabilities, such large scale construction and expansion of infrastructure networks will inevitably result in the clearing of vegetation, likely contributing to erosion and making the coastal area more exposed and vulnerable.

35. Rapid population growth and migration towards the coasts in search of livelihood opportunities, as well as a history of conflict and internally displaced people (IDP), have resulted in informal settlements – putting pressure on mangrove areas. While mangroves are protected by regulations, and some sites by protected area status, enforcement is difficult as MAF does not have sufficient financial/human resources to cover the entire country, nor are they able to prevent settlement of communities in protected areas. Spatial planning laws and plans are lacking (though documents are currently in draft form) to prevent settlement in areas vulnerable to coastal flooding, or in areas which need protection to bolster the country's natural defenses. The lack of land tenure and property rights hinders community ownership near mangrove areas or any vested interest in maintaining this common good. Further, employment and income generation potential, associated with mangrove rehabilitation, protection and sustainable management, has not been explored as part of the government programmes, suco development plans, investments or public-private partnership initiatives.

36. Consultations with coastal communities indicate knowledge of the importance of preserving mangroves to a) protect the coastline from storms and wave surges, b) prevent coastal erosion, and c) reduce saltwater intrusion. Fishing communities especially valued mangroves as breeding areas for reef fish. This was based on their own observations over time, but also indicative of successful efforts by government and development partners to raise awareness. However, mangrove coverage, even in areas where rehabilitation efforts were previously implemented, continues to face pressure from communities.

37. In addition to being cleared for settlement, communities also use mangroves for fuel wood and boat/home construction. In some cases, it is communities from upland which come to the coast for the wood. As the coastal community is often on public land (i.e. does not own the land), it is in a difficult position to prevent this from happening, even if they acknowledge the importance of mangroves to the coastal ecosystem. Relatively simple approaches to mangrove rehabilitation efforts, such as fencing to keep grazing animals away from mangrove seedlings, has also been difficult to maintain, due to the lack of successful exit strategies of mangrove rehabilitation projects.

38. Changing land use practices (particularly coastal salt production, coastal aquaculture, coastal rice production and intensification of agriculture,) have also led to a rapid degradation of natural, coastal protective (and shoreline defense) features such as mangrove forests, particularly along the north coast, but also along the southern coast of the country, exposing vulnerable, coastal communities to the risks of slow onset sea-level rise and sudden/extreme storm surges.

39. While Timor-Leste is an island, the potential for artisanal fishing to supplement the food supply is limited. The types of boats generally owned by communities are unsuitable and unsafe for fishing, due to the steep drop off (upto 3km) beyond the reef. With the very low current levels of fish consumption and fisheries production, aquaculture has been identified as a major national development priority to address food security and malnutrition. To this end, the NADS envisions a strong role for aquaculture, through increasing domestic fish supply and consumption, and sets ambitious national targets for aquaculture development. Under this development strategy, a total area of 2,515ha has already been identified for

aquaculture development, with Metinaro, Manatuto, Same, Suai, Bobonaro and Viqueque, being identified as major districts suitable for aquaculture. Several of these sites, particularly Metinaro and Manatuto and Suai, contain some of the largest, mangrove stands in Timor-Leste.

1.3.3. Adaptive Capacity to Respond to Climate Change

40. The 2014 Human Development Index (HDI) value for Timor-Leste was 0.620, ranking the country at 128 (of 187) on the global list. Peace has provided the needed space for development and growth, resulting in a significant HDI value increase, from 0.465 in 2000. However, 49.9% of the population is still below the poverty line, with women especially affected due to limited opportunities for decision-making and less access to economic opportunities. This is reflected in the stark difference in the purchasing power parity (PPP) between men and women. Per the 2014 HDR, the 2011 estimate gross national income per capita PPP for men was US$13,582 and only US$5,634 for women.

41. As part of PPG activities, a desk review of available research and stakeholder consultations were conducted to identify main areas of concern for women in Timor-Leste (see Annex G.2.). These include[31]:

- Low levels of education and literacy – 37% of women have never been to school, 30% have some primary education, 26% have some secondary education, and 2% have more than secondary education
- Dual workload burden – women are responsible for reproductive work and household duties, but equally responsible for productive work and sale of produce (e.g. from farming)
- High fertility rates and high number of dependent children – 5.7 births per woman
- High maternal and child mortality, and malnutrition particularly of children
- Lack of inheritance and land ownership rights; resulting in
  - Financial dependence on husbands
  - Inability to accumulate financial resources and proceed with potential business ideas
  - Inability to escape domestic abuse and violence[32]
- Low decision making rights in relation to major decisions and assets, within households and within the community;
- Little-to-no acknowledgment of women as drivers of transformational change in the community and in society
- Cultural practices – e.g. *Barlake*, a negotiated contractual agreement between families (monetary or otherwise) for wives, which ultimately determines broader family relationship patterns – including property rights, children's obligations to the family, and the role of women in the household

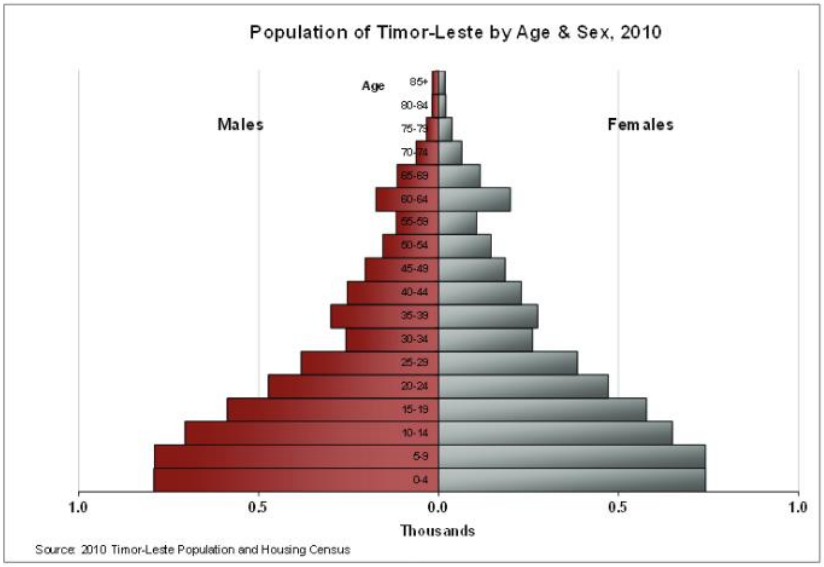
42. Approximately 63% of households are engaged in crop production, and 40% live in coastal areas. As climate change continues to impact agricultural production and sea level rise, women will be especially affected due to their weaker economic and social position. These above findings indicate the need for tailored support which responds to the particular needs of women, in order to strengthen overall capacity to respond to climate change.

43. The country's high birth rate highlights the need to also tailor support to youth and young adults. Figure 2 shows the distribution of the population by both, age and gender. Timor-Leste has one of the youngest populations in the world; 2/3 of the total population is under 30, 1/2 under 20, and 40% under 15.

[31] Gender Report for Building Shoreline Resilience of Timor-Leste to Protect Local Communities and Their Livelihoods (S. Larson, 2015)

[32] Nationally, more than 38% of women have experienced physical violence, with 28% having experienced violence in the past 12 months. Of women having experienced violence, the husband was the person responsible for 74% of cases. Justification of wife beating is captured in the HDR, and Timor-Leste is among the highest in the world in terms of acceptance, with 86.2% of women and 80.7% of men believing that wife beating is justified in certain circumstances.

Figure 2: Age Distribution in Timor-Leste per 2010 Census[33]



44. This presents an incredible challenge for the GoTL to ensure that for youth and young adults a) public awareness on climate change and critical ecosystems is raised b) related education/training is accessible and c) economic/livelihood opportunities exist. By contrast, a lack of public awareness, access to education, and livelihood alternatives could result in the continuation of unsustainable practices by future generations, leading to further degradation of already fragile ecosystems.

45. Groups with limited access to economic opportunities, such as women and youth, depend disproportionately on natural resources for their livelihoods, and are the most affected when these resources become degraded[34].

[33] Timor-Leste Population and Housing Census 2010, Analytical Report on Youth Vol. 16 (NSD, UNFPA, UNICEF, 2012)
[34] Regional programme document for Asia and the Pacific 2014-2017 (UNDP, 2014)

2. STRATEGY

The project design was guided by the GoTL, is consistent with national strategy and policy documents, and was informed by consultations with various stakeholders and likely beneficiaries.

2.1. Country Ownership: Country Eligibility and Country Drivenness

46. The **Timor-Leste Strategic Development Plan (SDP) 2011-2030** was a guiding document in the design of the project. The SDP lays out a 20 year plan aimed to transition Timor-Leste from an LDC to an upper middle income country. As challenges to meet that goal, the plan details the GoTL's concerns regarding the impacts of climate change on agricultural production, food security and its promising tourism industry, as well as the increased risk of flooding, drought and landslides. The plan acknowledges 3 critical areas as being especially susceptible to changes in climate and sea level rise, which need protection: water resources, soil and the coastal zone. The resulting **VI Constitutional Government Plan 2015-2017** commits to continuing to develop policies for river basin management and coastal zones, including strategies to rehabilitate and protect mangroves. The plan also seeks to improve land management and strengthen conservation efforts, towards more sustainable economic development for Timor-Leste, through the introduction of appropriate legislation, rehabilitation efforts, and programmes designed to reduce deforestation (e.g. identifying alternative energy sources to reduce deforestation for fuelwood).

47. Priority Strategy 2 of the **National Biodiversity Strategy and Action Plan of Timor-Leste (NBSAP) 2011-2020** seeks to protect biodiversity and promote sustainable use, which focuses on a) rehabilitation activities in critical watersheds and degraded lands, and b) sustainable livelihoods to local communities through ecosystem restoration activities. Listed activities include:

- Enhance and develop national biodiversity laws and relevant environmental policies on nature conservation, pollution and other related concerns, including traditional laws
- Intensively rehabilitate critical and damaged habitats and ecosystems and degraded watersheds through massive tree planting, including mangroves reforestation
- Implement sustainable livelihood activities for local communities and promote sustainable use of natural resources, including promoting traditional conservation knowledge and practices, and enhancing the role of women and youth

48. Section 5 of **Regulation No. 2000/19 on Protected Areas** specifies the protection of wetlands and mangroves. Articles 22 and 23 of the **Biodiversity Decree Law** protect natural existing wetlands and mangrove areas from pollution, draining, or destruction.

49. Action Programme 6 of the **National Action Plan to Combat Land Degradation** focuses on the rehabilitation of degraded lands and protection of water resources. The plan states that the achievement of the national development goal of eradicating poverty is directly related to resolution of the land degradation problem, specifically because degraded lands will be not able to perform their productive function to maintain the provision of the resources in order to support basic human needs. The plan states that immediate action is required for the rehabilitation of degraded lands and protection of water resources.

50. Priority Adaptation 5 of the **National Adaptation Programme of Action (NAPA)**, to which this LDCF project directly responds, seeks to restore and conserve Timor-Leste's mangrove ecosystems and raise awareness of the need to protect coastal ecosystems exposed to sea level rise, through the following 2 activities:

- Maintain mangrove plantations and promote awareness raising to protect coastal ecosystems from impacts of sea level rise.

- Include ecosystem management in national planning to develop sustainable, ongoing programmes, nurseries and community awareness development

2.1.2. Stakeholder Baseline Analysis

51. Input was sought from stakeholders and potential beneficiaries during the project preparation phase at the Inception Workshop held on 12 February 2015 as well as through individual consultations and fieldwork surveys in the months that followed. Consultations captured views from government ministries, suco heads, community members, district departments and municipalities, development partners, NGOs, and INGOs.

52. Field visits and community consultations were undertaken on the North coast: Tibar Bay, Liquica, Biqueli, Atuaro, Dili, Hera, Metinaro, and Vermasse; and on South coast: Irabin leteria, Irebere, Ilomar, Vessuro, Beaço, Uaitame, Natarbora, Clacuc, Kicras, Welaluhu, Fatucahi, Betano, Beço, Suai, Rib Tafera and Cova Lima. Community members were asked about perceived climate change and climate change impacts and how it's affected livelihoods. Communities were also asked about pressure from livelihoods on mangroves, and interest was gauged about alternative livelihood options.

53. While PPG activities resulted in input from a various stakeholder groups, there were several key messages which were consistent:

- the project must reach the communities in a meaningful way – ultimately, the project must contribute to reducing their vulnerability
- investments by the project must be based on robust analysis - science/technical approach to mangrove rehabilitation, and economic analysis for the livelihoods activities
- the project must include a sustainable maintenance plan if mangrove rehabilitation efforts are to be successful

54. Development of the project document, from the original Project Identification Form (PIF), is the result of integrating this feedback. Stakeholders consulted in this process include:

Table 2: Stakeholder Consultations

Stakeholder	Role[35]
Ministry of Agriculture and Fisheries (MAF) National Directorates of • Forestry (NDF) • Protected Areas (NDPA) • Agriculture and Horticulture (NDAH) • Fisheries and Aquaculture (NDFA)	MAF, through its directorates, is responsible for the design, implementation, coordination and evaluation of agriculture, forestry, fisheries and livestock programmes in Timor-Leste. MAF is the main stakeholder in the project and will drive implementation, facilitate collaboration with relevant ministries, oversee the accomplishment of project objectives and tasks, champion efforts towards innovative financing/revenue streams for maintaining mangroves areas, and will ultimately be responsible for the long term sustainability of project's investments. MAF will serve as the Executive on the Project Board.
Seeds of Life (SoL)	SoL is a programme within MAF focused on increasing crop yields in Timor-Leste by selecting and distributing improved seed varieties of superior genetic quality. To inform this work, SoL has conducted exhaustive research on climate change in Timor-Leste. This was done through collaboration with the climate change science community in Timor-Leste and overseas as well as through accessing public domain data/information published by leading international institutions for climatic research. With the data gathered, SoL has been able to augment the

[35] This column describes the information from stakeholder in the design of the LDCF project, and/or the role of the stakeholder in the implementation of the LDCF project

Stakeholder	Role[35]
	scant observed data available for Timor-Leste with a multitude of calculated baseline data and predictions to 2080[36]. This valuable analysis has been referenced in this project document. The project team will work closely with SoL to ensure that LDCF activities are informed by the latest climate research, and that activities are complementary. This is especially relevant for SoL activities related to data collection, institutional capacity building, and support to MAF in analyzing and developing strategies to overcome climate variability and change.
Ministry of Public Works, Transport and Communications (MPW)	MPW proposes and implements policy guidelines and enforces legal frameworks in the areas of public works, housing, water supply, management of water resources, sanitation, as well as power, transport, and communications. MPW is leading the National Spatial Planning, urban master planning, as well as Housing and Accommodation, laws and plans. The zoning decisions, and enforcement of the laws and plans, will be important to inform project implementation, especially site selection for mangrove rehabilitation.
International Finance Corporation (IFC) • Tibar Bay PPP	IFC has provided support to the GoTL to structure and implement a Public Private Partnership (PPP) project for the proposed Tibar Bay port. IFC assistance will cover all project pre-investment activities including due diligence review, transaction structuring, marketing and promotion, contract preparation and development of bid/tender documents, as well as supporting the client during the bidding process up to the award of the concession contract. As an offset will be part of the Tibar Bay port development contract, collaboration is needed to ensure that the contract to the concessioner details the guidelines for mangrove rehabilitation efforts (to be developed as part of this project). This includes integrating the results of environmental impact assessment (EIA) and ensuring implementation of the environmental management plan (EMP). This offset will be an important means of gauging inter-ministerial collaboration, as well as effectiveness of enforcement efforts related to mangrove preservation.
Ministry of Planning and Strategic Investment (MPSI)	The Ministry is specifically responsible for the implementation of the Timor-Leste Strategic Development Plan 2011-2030, namely as it applies to a) infrastructure and urban planning, b) oil and mineral resources, and c) territorial planning and management. The Strategic Development Plan was a guiding document is the design of this project; close engagement is therefore critical to ensure that the project stays in line with the plan's objectives and that project implementation is informed by the plan's activities and progress. Established in 2015 under the restructured government, MPSI is headed by the former Prime Minister. This ministry is new and not yet fully operational. Consultations will be organized during project implementation.
Ministry of Social Solidarity (MSS) National Directorate for Disaster Risk Reduction	MSS is responsible for designing, implementing, coordinating and evaluating programmes for managing the risk of natural disasters, namely in the fields of civic education, prevention, mitigation, emergency response and recovery after a disaster. The LDCF project will assess issues such as erosion and landslides from the upland areas which affect coastal communities and mangroves. Expertise and data is available from MSS to inform related activities. MSS is also the key government counterpart for the UNDP/LDCF *Strengthening*

[36] http://seedsoflifetimor.org/about-us/activities/

Stakeholder	Role[35]
	Community Resilience to Climate-induced Disasters in the Dili-to-Ainaro Road Development Corridor project. Collaboration is critical to ensure that these 2 LDCF projects are not only complementary, but also responsive to country priorities highlighted in the NAPA.
Ministry of Commerce, Industry and the Environment (MCIE)	MCIE is responsible for the promotion of economic activities, including national and international competitiveness, promoting the development of the cooperative sector particularly in rural areas and in the agriculture sector, in coordination with MAF. MCIE is responsible for industry and economic development, as well as the environment. MCIE is therefore also responsible for imposing and enforcing environmental standards, regulations and legal requirements, and oversees Timor-Leste's ratification of Rio Conventions (UNFCCC, UNCCD, and UNCBD) and international obligations. The Ministry maintains the role of GEF operational focal point for Timor-Leste; collaboration will help ensure complementarity with other ongoing projects/programmes. MCIE will represent the beneficiaries on the Project Board.
Ministry of Tourism, Arts and Culture (MTAC)	MTAC is working with communities to build capacity to support growing ecotourism sector and awareness raising about tourism demand, thus improving access by communities to the market. There is potential to build on these efforts in areas with tourism potential receiving support from the project.
Ministry of Education	Given the country's demographics, it will be important to work with the Ministry of Education for a) integrating key lessons related to coastal ecosystems into curricula b) developing educational products such as children's books, and c) developing an effective public awareness campaign. The Ministry of Education is responsible for designing the national curriculum for the various levels of schooling and the corresponding assessment schemes and approving the school programmes, as well as the guidelines for their implementation. In addition to the Ministry of Education, the project will engage national and district focal points to ensure the related sensitization and education needs of youth and women are captured in LDCF project workplanning, implementation, monitoring and evaluation. Focal points include those tasked with: • Socio-economic advancement of women • Youth and Sports
National University of Timor-Leste/ Universidade Nacional Timor Loroa'se (UNTL)	The Centre for Climate Change and Biodiversity was established in 2014, at UNTL. The Centre conducts and houses related research. The training under Outcome 1 will be developed into course material to be made available at the Centre. This will not only allow knowledge access to a wider group, but also contribute to sustainability, as training will not be a one-time activity. The project will also actively engage university students to support specific aspects of the project, especially related to data collection, monitoring activities and consultations with the communities – to stimulate and nurture interest in relevant areas of socio-economic development (e.g. climate-resilient planning, climate change projections, vulnerability assessments, rural development, coastal management, natural resources management, ecosystems services, environmental economics, etc.).
European Union (EU) – Global Climate Change Alliance	The EU's Global Climate Change Alliance (GCCA) support programmes to Timor-Leste through the University of the South Pacific (USP), GIZ and Instituto

Stakeholder	Role[35]
(GCCA) • University of the South Pacific (USP) • GIZ • Instituto Camões	Camões. The USP EU-GCCA project is a community project that is being implemented in 15 Small Island Developing States (SIDS) of the Pacific, including Timor-Leste. The USP programming in Timor-Leste involves climate change vulnerability and adaptation rapid assessments across, and implementation of adaptation activities identified (mainly addressing water resources). The EU – GCCA for Timor-Leste project is undertaken by two organisations; GIZ and Instituto Camões. The programme is to improve capacity of vulnerable populations living in selected subdistricts (municipalities) to cope more effectively with climate change impacts, through reliable weather monitoring, adaptation to climate change challenges by rural communities, and rural resilience to climate change impacts improvements. This includes providing training to ALGIS in mapping, data interpretation from an agro-ecological perspective and land use management through adapted courses in regional universities. The project will also enable 19 existing weather stations to be fully functional and improve national capacity to monitor and map climate events. Findings and results of data interpretation will be provided to policy makers to support decision-making and the integration of climate change data and related impacts into policies and plans. GIZ and Instituto Camões are also providing support for water and soil conservation activities, and for forest protection and reforestation measures, particularly in the upland areas. A watershed management policy is expected to be developed and implemented in the selected target areas. The LDCF project will coordinate activities closely with the partners of the EU GCCA programme to ensure complementarity with ongoing efforts.
Japanese International Cooperation Agency (JICA)	JICA is providing critical support to GoTL in several areas of relevance to this project, namely forest management, catchment and watershed management and spatial planning. JICA is providing training to MAF-National Directorate of Forestry and ALGIS, particularly in the area of forest management and reforestation, catchment and watershed planning and management (soil conservation, water resources, biodiversity), community-based forestry and livelihood development, This includes the identification of priority watersheds (and actions) for reforestation and management - as detailed in the draft National Forest Conservation Plan (2013). JICA is a key partner in the project. The LDCF project will coordinate activities closely with JICA to ensure mangrove conservation, reforestation and livelihood activities align with broader community-based forestry, reforestation, watershed and catchment management activities.
Korea International Cooperation Agency (KOICA)	KOICA is supporting MAF-NDFA in the aquaculture sector. Activities include the establishment of a training facility in Liquiça. The curriculum is targeted at both government staff and communities, with support expected to continue for the next 4 years. As aquaculture is a priority for the GoTL and a livelihood to be explored as part of the LDCF project, activities will be closely collaborated with KOICA to ensure complementarity.
WorldFish	WorldFish is an INGO whose mission is to reduce poverty and hunger by improving fisheries and aquaculture. WorldFish's ecosystem approach to aquaculture is consistent with the approach of the LDCF project related to livelihoods. Through close collaboration, the LDCF project will benefit from the WorldFish's expertise and best practices working in aquaculture in Timor-Leste.

2.2. Project Rationale and Policy Conformity

55. The project supports national development priorities, its design is therefore aligned with national policies, strategies and planning documents. Further, the project is eligible for LDCF funding as it responds to the priorities highlighted in Timor-Leste's National Adaptation Progamme of Action (NAPA).

2.2.1. National Adaptation Progamme of Action (NAPA)

56. The GoTL outlined its key adaptation priorities in its NAPA, finalized in 2010. The country has already benefited from the LDCF funding to address climate resilience of the rural infrastructure and improve its climate related disaster risk management. This LDCF project will further contribute directly and indirectly to several priorities of the NAPA, specifically 1, 2, 4, 5 and National Institutional Capacity for Climate Change (see Table 3: NAPA Adaptation Priorities).

57. Outcome 2 focuses on mangrove regeneration to protect the shoreline from sea level rise, storm surges and coastal erosion. Outcome 2 also supports alternative livelihoods to relieve community pressures on mangroves areas (e.g. to prevent felling for firewood to cook salt). Given the food security challenges of Timor-Leste, particular focus will be on livelihoods that contribute to food production (e.g. mangrove-friendly aquaculture). Outcome 3 looks at the broader landscape to protect coastal areas and coastal communities from upland pressures; this includes targeted, small scale reforestation, land stabilization and groundwater monitoring and management. Outcome 1 focuses on the institutional capacity and policy frameworks to support coastal adaptation, as well as disaster risk reduction in the context of the coastal setting. The project is described in greater detail in section 2.4. Project Objective, Outcomes and Outputs/Activities.

Table 3: NAPA Priorities

Rank	NAPA Priorities
1	**Food Security**: Reduce vulnerability of farmers and pastoralists to increased drought and flood events by improving their capacity to plan for and respond to future climatic conditions and improve national food production.
2	**Water Resources**: Promote integrated water resource management (IWRM) to guarantee water access for food production, sanitary uses, ecosystems and industry development.
3	**Human Health**: Enhance capacity of the health sector to anticipate and respond to changes in distribution of endemic and epidemic climate-sensitive diseases, and reduce vulnerability of the population to infection in areas at risk from expansion of climate-related diseases.
4	**Natural Disasters**: Improve institutional and staff capacity in the disaster sector in relation to climate change induced disasters.
5	**Forests, Biodiversity and Coastal Ecosystems Resilience** • Maintain mangrove plantations and promote awareness-raising to protect coastal ecosystems from impacts of sea level rise. • Include ecosystem management in national planning to develop sustainable, ongoing programme, nurseries and community awareness development.
6	**Livestock Production**: Improve planning and legal framework for promoting sustainable and balanced food for livestock production under increased climate variability and climate change conditions.
7	**Physical Infrastructure**: Improve regulations and standards for climate-resilient infrastructure.
8	**Oil and Gas Production**: Strengthen and protect valuable offshore oil and gas infrastructure against climate change impacts.
Not ranked, integrated into all of the above	**National Institutional Capacity for Climate Change**: Strengthen capacity and improve coordination, through which overarching programme level coherence will be ensured.

2.2.2. Least Developed Countries Fund

58. The project contributes to two objectives of the LDCF. Progress against outcomes will be measure by the corresponding indicators detailed below.

- LDCF Objective 1: *Reduce the vulnerability of people, livelihoods, physical assets and natural systems to the adverse effect of climate change.*
  Outcome 1.1: Vulnerability of physical assets and natural systems reduced
    - Indicator 2: Type and extent of assets strengthened and/or better managed to withstand the effects of climate change

  Outcome 1.2: Livelihoods and sources of income of vulnerable populations diversified and strengthened
    - Indicator 3: Population benefiting from the adoption of diversified, climate-resilient livelihood options
- LDCF Objective 2: *Strengthen institutional and technical capacities for effective climate change adaptation*
  Outcome 2.2: Access to improved climate information and early-warning systems enhanced at regional, national and local level
    - Indicator 7: Number of people/geographic area with access to improved climate information services
- LDCF Objective 3: *Integrate climate change adaptation into relevant policies, plan and associated process*
  Outcome 3.2: Policies, plans and associated processes developed and strengthened to identify, prioritize and integrate adaptation strategies and measures
    - Indicator 12: Regional, national and sector-wide policies, plans and processes developed and strengthened to identify, prioritize and integrate adaptation strategies and measures.

2.3. Design principles and strategic considerations

59. The objective of the LDCF project is **to strengthen resilience of coastal communities by the introduction of nature-based approaches to coastal protection**. Issues of coastal areas are complex and cross-sectoral. The project therefore employs an integrated approach across sectors, while tailoring activities to address the specific needs, challenges and priorities of the GoTL.

60. LDCF funds will support inter- and intra-ministerial coordination for collaborative development planning ensuring protection of coastal areas, as well as identify and research potential revenue streams for long term sustainability. As mangroves are a vital natural defense to impacts of climate change, extensive mangrove protection and re-afforestation will be supported by the project while also addressing community pressures (i.e. felling for fuelwood) and introduce alternative mangrove-supportive livelihoods, as well as improve public awareness about the important role of mangroves in coastal ecosystems. Timor-Leste's landscape is generally quite steep, therefore, where relevant, the project looks at upland deforestation and its impacts on coastal areas (i.e. sedimentation, increased runoff and flash floods, and availability of groundwater).

Through this integrated approach, the project will contribute to numerous development goals.

2.3.1. National and Local Benefits

61. The LDCF project is expected to deliver both national and local benefits. The project design responds to the adaptation priorities identified in the NAPA, all of which are relevant for supporting national development priorities and contributes to several of the Sustainable Development Goals (SDGs) adopted in September 2015, specifically:

- SDG 1 – No Poverty – by introducing livelihood alternative which contribute to household income
- SDG 2 – Zero Hunger - by introducing livelihoods alternatives which promote food production
- SDG 5 – Gender Equality - through specific gender inclusion methodologies for livelihood support and training opportunities
- SDG 6 – Clean Water and Sanitation - through restoration of waterway systems and recharge to aquifers and groundwater supplies
- SDG 12 – Responsible Consumption and Production – through training on value of mangroves in coastal ecosystems, to prevent felling for fuelwood
- SDG 14 – Life Below Water – by providing nurturing habitat for fish, through the rehabilitation/protection of mangrove forests
- SDG 15 – Life on Land – by providing nurturing environment for birds and other species, through the rehabilitation/protection of mangrove forests
- SDG 17 – Partnerships for the Goals – through close collaboration with development partners and the private sector to support Timor-Leste in achieving its goals

62. As an activity of the NAPA programme for Timor-Leste, the project also aligns and contributes to the country's articulation through the UNFCCC program for LDCs.

2.3.2. Links to Baseline Initiatives

63. The project builds on a range of on-going baseline initiatives and leverages 4 times the grant contribution of $7,000,000 in the form of co-financing totalling US$31,644,402.

64. The plan for the GoTL's rehabilitation and reforestation goals is detailed in MAF's Midterm Operation Plan (MTOP). With a budget of US$18,000,000 until 2018, the MTOP seeks to establish management regimes and strategies for degraded coastal areas, and protection and conservation of biodiversity in forest and coastal areas. The plan also promotes local communities as stewards of their natural environment.

65. In addition, there are several partners contributing to both, the above baseline, as well as the food security and sustainable livelihoods goals of the country – goals which are also reflected in the design of the LDCF project.

66. Development of the aquaculture sector is a priority for the GoTL to address food security. The LDCF project will therefore consider livelihood support of mangrove-friendly aquaculture for communities, where appropriate, in close collaboration with established partners. The Korea International Cooperation Agency (KOICA) will provide vocational training on aquaculture, including a training-of-trainers programme for communities, in Timor-Leste over the next 4 years. Assessment of sites for an aquaculture training facility is currently underway. KOICA's budget for aquaculture support in Timor-Leste is US$6,000,000. WorldFish, an IGO, has worked with the government on the national aquaculture strategy and local coastal mapping. In addition to supporting aquaculture activities (e.g. pond input systems), WorldFish is also working with communities on identifying local ingredients for the production of fish food. The recipe is expected to be completed by end-2015, and will provide an additional, and related, livelihood option to communities – production of fish food is also a livelihood considered by the LDCF project. The ongoing budget for WorldFish in Timor-Leste is approximately US$5,304,402 (i.e. NZD 5.1M, US$1.5M, and AUD 600,000) over the next 4 years.

67. The European Union's (EU) *Global Climate Change Alliance (GCCA)* programme to Timor-Leste, through GIZ and Instituto Camões, seeks to strengthen the capacity of populations vulnerable to climate change risks to cope with climate change effects through the sustainable management of natural resources and the improvement of livelihood options. Activities include improving weather monitoring and analysis to inform planning, support to communities in assessing the best climate-adapted options at the local level and integrating solutions into existing planning processes. The programme will support communities in drafting local soil and water conservation plans. For this purpose, environmental profiles

of the five major watersheds will be prepared, using participatory processes for assessing climate change effects on communities. The programme will also invest in awareness raising activities on climate change and its impacts, and promoting/providing training on forestry production (e.g. for enhancing the production capacity of national and community nurseries, improving planting success rates) and agroforestry (e.g. intercropping, forest gardening for non-timber forest products) as a response to land degradation. The programme is planned until 2018; the largest allocation related to the GIZ implemented portion has a total budget of approximately US$2,340,000 (i.e. €2.2million).

Below is a financial summary of co-financing for the LDCF project.

Table 4: Financial Summary of Co-financing

Sources of Co-financing	Name of Co-financier	Type of Co-financing	Co-financing Amount (US$)
Government	MAF	Grant/In Kind	18,000,000
Bilateral	KOICA	Grant	6,000,000
IGO	WorldFish	Grant	5,304,402
Bilateral	GIZ - EU GCCA	Grant	2,340,000
Total Co-financing			**31,644,402**

In addition, this LDCF project will be complemented by the efforts of other UNDP and LDCF projects.

68. The GEF-funded *Promoting Sustainable Bio-energy Production from Biomass (SBEPB)* project is a four-year project contributing to the reduction of greenhouse gas (GHG) emissions through removal of barriers to sustainable production and utilization of biomass resources in Timor-Leste, and application of biomass energy technologies to support local economic, environmental and social development. The objective of the project is to promote investment in renewable energy technologies by a) enhancing the capacity of all relevant public and private stakeholders, b) developing policy and legal bioenergy frameworks for the promotion of energy efficient and low carbon end-use appliances and c) scaling up of 20,000 improved cook stoves in the country. The project will assist the GoTL in mainstreaming sustainable biomass energy in policy formulation and consequently help in mitigating the national emission of greenhouse gases resulting from deforestation and the use of non-renewable biomass. The project will help to increase Timor-Leste's access to clean bioenergy, as well as create employment through inclusive businesses and support community-managed forestry. Opportunities for complementarity exist with this project, which will reduce community pressures on mangroves for fuel wood. Site selection for mangrove rehabilitation under LDCF project will consider intervention sites for the SBEPB project to maximize the impact of combined resources.

69. The LDCF-funded *Strengthening Community Resilience to Climate-induced disasters in the Dili-to-Ainaro Road Development Corridor, Timor-Leste* project seeks to strengthen critical economic infrastructure for sustained human development protected from climate-induced natural hazards (flooding, landslides, wind damage) through better policies, strengthened local disaster risk management (DRM) institutions and investments in risk reduction measures. Vulnerability assessments will be conducted and watershed management plans developed, which may include elements for implementation such as a) ecosystem farming that is diverse, multi-storey and mid-successional to promote climate resilience and productivity; b) permaculture/conservation farming/agro-forestry methods applicable to local conditions that increase resilience to climate impacts such as water scarcity; c) planting trees that will reduce the risk of erosion while also providing shade for coffee plantations; and d) home garden and hillside farming techniques. Given the relevance to Outcome 3 of this project, there are opportunities for complementarity, sharing of lessons learned and best practices, as well as joint activities on public awareness with communities on integrated ecosystems.

70. The UNDP *Mobilizing Social Business to Accelerate MDGs Achievement in Timor-Leste* project explores innovative ways to engage the private sector and facilitates social business partnerships and networks that contribute to generating rural employment and income. Rural communities in Timor-Leste

remain dominated by farm-based livelihoods and the UNDP project is helping to broaden the income and livelihood base. The project aims to a) improve the coordination and networking of investors, service providers, regulatory bodies, and social businesses, b) create a rich environment to foster the growth of social business investments, c) establish a Social Business Fund to finance viable business solutions and d) conduct capacity building of service providers to better serve the technical needs of the Social Businesses. It also aims to employ 300 women and youth through social business and 200 women/men/youth members of rural cooperatives and MSMEs to benefit from service provision: joint marketing, value chain management, business skills development, and building standards of product quality. The LDCF project will benefit from the lessons learned and best practices from the social business model approach implemented through the UNDP project.

71. And a PIF, for LDCF funding consideration, has been developed and submitted for donor approval. The proposed *Developing capacities for iterative National Adaptation Planning (NAP) process for climate resilient development* project will build capacity in adaptation planning, budgeting, implementation and monitoring, and improve individual and institutional capacities to deliver climate services for adaptation planning across priority sectors. Importantly, the project will support the development of a NAP to establish the institutional, policy and fiscal framework for climate change adaptation planning.

2.3.3. Comparative Advantage of UNDP

72. The LDCF project is closely aligned with UNDP's comparative advantage, as articulated in the GEF Council Paper C.31.5. UNDP was selected as the preferred GEF Implementing Agency by the GoTL based on its recognized added-value in most strategic elements of the project, including integrated policy development, capacity building and institutional strengthening, community mobilization, environmental finance, and decentralized governance of natural resources. The project is supported by UNDP's policy framework and technical expertise, at three levels: global, regional and national.

Global

73. The project's overall focus is on strengthening climate resilience, and as such contributes to Outcome 1 of the **UNDP Strategic Plan 2014-2017**:

- Outcome 1: Growth and development are inclusive and sustainable, incorporating productive capacities that create employment and livelihoods for the poor and excluded
  Output 1.4: Scaled up action on climate change adaptation and mitigation across sectors which is funded and implemented

74. The project is part of UNDP's well-established programme of work on supporting nature-based approaches to building resilience to climate change, through projects funded by LDCF, SCCF, the Adaptation Fund as well as bilateral donors. The project will therefore benefit from UNDP's extensive experience, as well as the best practices and lessons learned from similar efforts in other countries, especially LDCs.

75. Technical backstopping will be provided to the project by the UNDP-GEF Technical Adviser based at the Bangkok Regional Hub, and as needed by UNDP's global network of expertise.

Regional

76. The LDCF project complements Outcomes 1 and 3 of the **UNDP Regional Programme Document for Asia and the Pacific 2014-2017**:

- Outcome 1 - Growth and development are inclusive and sustainable, incorporating productive capacities that create employment and livelihoods for the poor and excluded

77. UNDP works with local, national and regional institutions to improve the legal, policy and institutional frameworks for natural resource management, especially to ensure that these frameworks are inclusive, pro-poor, gender-sensitive and conflict-resilient. UNDP also promotes the adoption and scaling up of innovative approaches to natural resource management by countries in the region, and strengthens

regional and trans-boundary management of shared resources such as river and marine systems, migratory species and coastal zones.

- Outcome 3 - Countries are able to reduce the likelihood of conflict, and lower the risks of natural disasters, including from climate change

78. UNDP promotes resilience to shocks resulting from natural hazards and social conflict, and links humanitarian, peace-building and longer-term development efforts. The overall intent of which is to reduce risks, prevent crises (whether from human-made or natural causes) and avert major development setbacks. By enhancing regional harmonization of standards, and providing policy advice at the national level, UNDP seeks to strengthen the capacity of communities to better manage current climate risks and support initiatives that enhance coordination and alignment of climate change adaptation and disaster risk reduction policies.

79. The design of the project is in line with UNDP's ongoing assistance in the region towards creating employment and livelihood opportunities, while strengthening sustainable management of ecosystems and natural resources. The project will therefore benefit from the best practices and lessons learned from similar projects in the region, facing similar climate scenarios and/or with similar development challenges.

National

80. The project is aligned to **Country Programme Document for Timor-Leste 2015-2019**, The project seeks to both protect natural resources and bolster ecosystem services, while supporting communities to identify alternative sustainable livelihoods, and thus contributes to Outcome 2, Sustainable Development, specifically:

Output 2.2. Solutions developed at national and subnational level for sustainable management of natural resources, ecosystem services and waste
Output 2.3. Scaled up action on climate change adaptation and mitigation across sectors which is funded and implemented

81. UNDP is well-positioned to support strengthening land management and ecosystem integrity. UNDP was the main counterpart to the government, helping to develop the country's first national biodiversity policy process and document – the NBSAP that was approved by the Council of Ministers in February 2012 as well as the NAPA approved in August 2011. UNDP has also implemented, together with the Ministry of Agriculture and Fisheries (National Directorate for Forestry) a sustainable land management project from 2008-2010. The goal of the project was to ensure that the agricultural, forest and other terrestrial land uses of Timor-Leste are sustainable to support productive systems that maintain ecosystem productivity and ecological functions while contributing directly to the environmental, economic and social well-being of the country. One of the outputs was the National Action Plan to Combat Land Degradation in Timor-Leste.

82. The UNDP Country Office (CO) in Timor-Leste is resourced to provide the necessary support to both implement and oversee the project. The CO has extensive experience in direct implementation, and is ready to execute the procurement elements of the project. Professional staff from the country office will be responsible for oversight and project assurance, under the guidance of CO senior management. Specifically, the following staff will be dedicated to the LDCF project a) Environment Programme Officer, tasked with continuous oversight of project implementation, including technical support, quality assurance and monitoring & evaluation; b) Programme Associate, in charge of project management backstopping, e.g. budget planning and revisions, periodic reporting, audits, technical and financial troubleshooting c) Finance and Procurement Associates, who support financial management tasks, such as budget reviews, delivery reporting, billing, bidding and contracting of service providers; and d) Country Director, responsible for providing strategic leadership and support to the policy reforms advocated by the project.

83. CO Programme Officers from different practice areas have been engaged during the design of the project and will continue to be consulted during implementation to ensure the highest level of cross-practice collaboration.

2.4. Project Objective, Outcomes and Outputs/Activities

84. The objective of the project is **to strengthen resilience of coastal communities by the introduction of nature-based approaches to coastal protection**. The objective is achieved through three complementary outcomes. Outcome 1 focuses on the policy framework and institutional capacity necessary for effective coastal management in the face of climate change. Outcome 2 focuses on rehabilitating mangrove areas to restore Timor-Leste's natural defenses to sea level rise and coastal erosion. Importantly, Outcome 2 also addresses the community pressures on mangrove areas by supporting livelihood alternatives, with particular focus on mangrove-supportive livelihoods, thereby incentivizing coastal communities to protect the essential mangrove stands and become the stewards of these natural defense systems. As pressures on mangroves are not limited to activity in coastal areas, Outcome 3 focuses on the broader landscape to address erosion and excessive runoff from upland areas. Outcome 3 also explores innovative financial mechanisms to ensure long term sustainability of efforts. MAF is the main partner of the project and will therefore guide each of the outcomes.

Table 5: LDCF Project Complementary Outcomes and Outputs

LDCF Project Objective To strengthen resilience of coastal communities by the introduction of nature-based approaches to coastal protection		
Outcome 1: Policy framework and institutional capacity for climate resilient coastal management established	Outcome 2: Mangrove-supportive livelihoods established to incentivize mangrove rehabilitation and protection	Outcome 3: Integrated approaches to coastal adaptation adopted to contribute to protection of coastal populations and productive lands
Outputs 1.1. A comprehensive coastal management and adaptation plan developed and budgeted for the entire coast of Timor-Leste (as part and a direct contribution to NAP) 1.2. Coastal protection and resilience strategy for infrastructure planning, adopted and budgeted 1.3. Technical skills (through specialized trainings), hardware (at least two sets of hydro-meteorological stations and wave gauges), methods (economic valuation and cost-benefit analysis), solid value-chain analysis of livelihood options, and software introduced to monitor climate change induced coastal change and to plan management responses at policy levels. 1.4. Forestry, Protected Areas, Aquaculture and Fisheries Directorates under the Ministry of Agriculture and Fisheries have their roles, coordination, and planning mechanisms clarified and enforced for improved management of mangrove and other critical coastal habitats (as emerges from NAP consultation process	Outputs 2.1. At least 1000 ha of coastal mangroves and wetlands conserved or degraded mangrove areas rehabilitated through natural recruitment and restoration of hydrological regimes both in the northern and southern coasts with a direct employment of local coastal communities • Restore and monitor mangroves, using natural, ecological approaches, including restoration of hydrological regimes, enhanced propagule dispersal and livestock control • Establish maintenance protocols under MAF, with direct participation/employment of coastal communities, particularly women 2.2. Mangrove-supportive, diversified livelihoods/social businesses established in mangrove rehabilitation project sites, benefiting at least 1,000 households and empowering women 2.3. In project site sucos, development plans include mangrove-supportive livelihood support measures benefiting at least 26,000 people	Outputs 3.1. Upstream watershed replantation demonstrate risk reduction, (including reduction of excessive sediment loads) to downstream coastal waterways and areas 3.2. Coastal wetland restoration and groundwater recharge plans developed and initiated to increase storm water absorption capacity and buffer seawater intrusion 3.3. Based on economic valuation study of ecosystem services, infrastructure offset for coastal protection scheme (and other financial mechanisms, such as payment for ecosystem services - PES) devised to secure financial resources for coastal resilience

Outcome 1: Policy framework and institutional capacity for climate resilient coastal management established

Co-financing amounts for Outcome 1: $2,500,000
LDCF project grant requested: $700,000

Without LDCF Intervention (baseline)

85. Though Timor-Leste is a young country, the GoTL is moving swiftly to establish the institutional structure and policy frameworks necessary to ensure that development planning is both economically and environmentally sustainable. A lack of institutional leadership, coordinated land use decision-making and finance, however, are currently challenges towards effective coastal management.

86. Decree-Law no. 6/2015 of 11 March 2015 - Organic Law of the VI Constitutional Government, details a revised composition, hierarchy and structure, to create a more agile State machinery emphasizing efficiency, effectiveness and accountability. The new structure however does not indicate a clear lead ministry for overall shoreline protection or coastal management. MPW is responsible for planning and carrying out works aimed at protecting, preserving and repairing bridges, roads, river banks and coastal areas, namely with a view to controlling flooding'. Issues related to coasts, such as fisheries, protected areas, tourism, environment, and natural disasters, appear in the mandated responsibilities of MAF, MCIE, MTAC, and MSS. The National Adaptation Plan (NAP) process is expected to promote coordination across the ministries related to all adaptation planning and including coastal resilience within established inter-ministerial working groups.

87. The ambitious targets detailed in the SDP highlight the urgency of inter-ministerial coordination to ensure the conservation and protection of the coast's natural defenses. Consultations during the project preparation stage indicated already increasing pressure on natural shoreline mangroves, from rapid infrastructure development and informal housing settlements. Ad-hoc land allocation decisions in fragile coastal areas, increase pressures and create greater vulnerabilities. Though several mangrove areas already have protected area status, enforcement is difficult due to the lack of zoning regulations in surrounding areas and adequate resources for active monitoring. The Spatial Planning Law will partially remedy this. Article 14, Land Use Plan, seeks to develop and implement the terms of occupancy of any area of the district territory, establishing, inter alia, rules on the deployment of infrastructure and the design, location and integration of urban spaces for collective use, as well as how edification and the discipline of its integration into the landscape. The law further states as one of its guiding principles "the protection and safeguard of natural, cultural and landscape heritage, and namely the coastal areas, the shores of lagoons and rivers and forest lands." Guiding the development of the law and the eventual National Spatial Plan, is a steering committee comprised of senior and technical government officials representing state administration, environment, forests and nature conservation services, housing, public works, transport and communications, tourism, finance, oil and mineral resources, agriculture and fisheries, education, health, security, culture and sports. This inter-ministerial steering committee will likely be maintained to monitor the Spatial Planning Law and the National Spatial Plan, consultation with the committee would benefit any cross-sectoral planning initiatives, such as shoreline protection the development of coastal development guidelines. JICA is providing support to MPW on developing national land use zoning and urban master planning.

88. Rapid infrastructure development, especially, is putting incredible pressure on Timor-Leste's coastal areas and remaining mangroves. Decree-Law No. 5/2011 of 9 February 2011 on Environmental Licensing creates a system of environmental licensing for public and private projects likely to produce environmental and social impacts on the environment. The law stipulates the need for environmental impact assessments, based on technical studies and consultations with public participation, including identification and assessment of likely impacts, positive and negative, that the project may have on the environment, as well as the environmental management measures designed to avoid, minimize or compensate for adverse impacts expected. The law further stipulates the need for an environmental management plan (EMP) to address the findings of the assessment. Mangroves, specifically, are legally protected under the Biodiversity Decree Law (currently under Parliament review) and UNTAET Regulation No.2000/19 Section 5 – stating that wetlands and mangrove areas shall be protected in East Timor – 5.1)

a) the pollution, b) the draining, or c) the destruction, of a naturally existing wetlands and mangrove areas shall be prohibited; and at 5.2) a) the cutting, b) the damaging, or c) the removing of a mangroves shall be prohibited.

89. There are currently a number of large scale projects which must be well-planned in order to avoid destabilization of foreshores and damage to coastal ecosystems:

- The construction of the **Tibar Bay Port**, which can accommodate international container shipping, was highlighted as a priority in the SDP. This port will eventually replace the port in Dili which is more suited for general cargo. After assessment of potential locations for the port, as well as the option of expanding the existing Dili port, Tibar Bay was selected as the preferred location given the depth/capacity of the bay, proximity to Dili and relative cost. The Scoping Study for the Tibar Bay Port commission by the IFC, acknowledges the impact the port will have on the country's mangroves. Tibar Bay represents approximately 2% of the quickly diminishing mangrove coverage in Timor-Leste[37] - a significant amount given the large scale loss of mangroves observed in Timor-Leste over time. The bidding process for the Tibar Bay port construction is expected to be completed in 2015, with a thorough environmental impact assessment (EIA) to immediately follow. The EIA will further define the government-required offset, to be executed by the concessioner (i.e. the winner of the bid for construction of the port). While IFC has been engaged in the preparation process, it is not expected to support the GoTL on oversight or technical assistance once the contract to the concessioner is issued.
- Similarly, the **Tasi Mane Project**, for supporting growth of the petroleum industry, will also put pressure on fragile coastal and wetland ecosystems. In the Tasi Mane Project's three South coast sites, a number of adjacent mangrove stands are potentially threatened. An extensive EIA was undertaken for the project, however, the recommendations for the EIA have not yet been implemented. This includes further studies on the 'crocodile conservation area and mangrove protected area'. The Tasi Mane Project is comprised the Betano Petroleum Refinery, the Beaço LNG Plant and the Suai Supply Base[38]. Collectively, the development will result in the construction of a sea port (breakwaters and jetties), at least 150km of new highways, upgraded airstrips, and four new towns to accommodate over 22,800 residents.

90. The expected increase in population surrounding the Tibar Bay Port and the Tasi Mane Project will result in significant changes to existing land uses and will increase the rate of land degradation (i.e. forest/mangrove clearance, erosion, water harvesting). Further, the SDP has planned for extensive road development to accommodate the increased and heavier traffic expected to, and for, these sites. Inter-ministerial coordination is needed to both plan for findings of the EIAs, as well as to identify and implement mitigation measures.

91. Within MAF, various directorates are engaged in activities which directly contribute to effective coastal management and to building shoreline resilience. To this end, MAF is well-positioned to implement mangrove conservation and integrated coastal management, with its jurisdictional responsibilities for mangroves, fisheries, aquaculture, forestry, agriculture, watersheds and protected areas. Intra-ministerial coordination mechanisms, however, which would ensure that activities of department do not inadvertently affect the goals and targets of another, are lacking. Further, there is not a comprehensive approach across MAF, informed by national guidelines, which adequately takes into account the vulnerable shoreline and the need to preserve of mangrove areas. For instance, the goal of the NADS is that by 2030, aquaculture will contribute up to 40% of domestic fish supplies. The strategy seeks to ensure 'coordination with other line ministries/departments with regard to the use of land and water resources for aquaculture purposes and develop synergistic relationships between aquaculture and other water, land and natural resource management and conservation policies'. The NBSAP highlights that mangroves have been removed for the establishment of brackish water shrimp and/or fish ponds, yet NADS does not specifically mention minimizing the impact on mangroves. Guidelines would not only inform government programmes, but also non-government programmes, to ensure coordination of

[37] Tibar Bay Port - Summary of Environment and Social Scoping Study (IFC, 2013)
[38] This contract has recently been awarded to the South Korean Group, Hyundai.

multiple actors towards common goals. There are a significant number of INGOs, NGOs and faith-based organizations engaged in aquaculture development in Timor-Leste: WorldFish, Caritas Australia, CARE International, Catholic Relief Services (CRS), ChildFund, Hivos and MercyCorps, with financial support various partners, including AusAID, EU, FAO, JICA, NZAid, and USAID.

92. MAF's Midterm Operation Plan (MTOP) details its five priority programmes: a) sustainable increase in production and productivity b) improved market access and value addition c) improved enabling environment d) organizational development of MAF and e) natural resource conservation and management. Although, the LDCF project responds to most of the above government priorities, the latter constitutes the main programme baseline that the proposed initiative will build upon. This programme fully recognizes that managing the connections between agriculture and natural resources is an integral part of agriculture sector development. The specific investment of US$18million includes a) integrated crop-livestock-fisheries management practices b) conservation and sustainable management of aquatic and marine resources and c) conservation of biodiversity in forest and coastal areas. The programme will seek the ways to promoting local communities as stewards of their natural environment. This approach may require compensation programmes that are at a nascent stage of consideration, especially related to the establishment of management regimes and strategies for degraded coastal areas, and the protection and conservation of biodiversity in forest and coastal areas. The MTOP falls short of a coherent climate resilience strategy for coastal protection and lacks necessary technical inputs for determining a range of cost-effective adaptation options.

93. Support for skills development in areas such as economic analysis, which would enable MAF to present stronger proposals based on robust analysis, is currently lacking. This is in part reflected in the limited budget allocated to MAF. While the scope of MAF's work is significant, it only receives 2% of the State budget. Per the Timor-Leste Transparency Portal, the total 2015 budget was US$1.5trillion, with the allocation to MAF being approximately US$26million for all of its programme activities and administrative costs (for details, please see Table 6). Stronger funding proposals would improve MAF's ability to secure the necessary resources, both to fulfil its mandate as well as improve long term maintenance/sustainability of interventions.

Table 6: MAF 2012-2014 Expenditure & 2015-2018 Budget Figures[39]

Description	Expenditure ($000s)			Preliminary Budget ($000s)			
	2012	2013	2014	2015	2016	2017	2018
Ministry of Agriculture and Fisheries (MAF)	**15,425**	**24,176**	**25,247**	**26,257**	**27,307**	**28,399**	**29,535**
Office of the Minister of Agriculture and Fisheries	*96*	*136*	*154*	*160*	*167*	*173*	*180*
Office of the Deputy Minister of Agriculture and Fisheries	*82*	*180*	*131*	*136*	*142*	*147*	*153*
Office of Forest and Nature Conservation	*85*	*101*	*106*	*110*	*115*	*119*	*124*
Office of Fisheries	*82*	*101*	*110*	*114*	*119*	*124*	*129*
Office of Animal Husbandry	*85*	*100*	*123*	*128*	*133*	*138*	*144*
Office of the Director General	*39*	*48*	*51*	*53*	*55*	*57*	*60*
National Directorate of Administration	*3,485*	*1,475*	*4,510*	*4,690*	*4,878*	*5,073*	*5,276*
Inspection and Auditing	*33*	*40*	*38*	*40*	*41*	*43*	*44*
Legal Advisory Unit	*23*	*32*	*27*	*28*	*29*	*30*	*32*
Office Community Protocol Unit	*24*	*24*	*24*	*25*	*26*	*27*	*28*
National Directorate for Research and Special Services	*290*	*306*	*559*	*581*	*605*	*629*	*654*
National Directorate of Quarantine and Biosecurity	*403*	*327*	*207*	*215*	*224*	*233*	*242*

[39] The table compiled from the Orçamento Geral do Estado (RDTL, 2014), and does not yet reflect budget adjustments following the 2015 government restructuring/streamlining exercise.

Description	Expenditure ($000s)			Preliminary Budget ($000s)			
	2012	2013	2014	2015	2016	2017	2018
National Directorate of Technical Agriculture Training	*527*	*864*	*1,082*	*1,125*	*1,170*	*1,217*	*1,266*
National Directorate of Policy and Planning	*171*	*200*	*2,644*	*2,750*	*2,860*	*2,974*	*3,093*
National Directorate of Agriculture and Horticulture	*2,594*	*6,216*	*6,114*	*6,359*	*6,613*	*6,877*	*7,153*
National Directorate of Plants Industry for Agro-Come	*281*	*449*	*550*	*572*	*595*	*619*	*643*
National Directorate of Forests	*533*	*718*	*1,467*	*1,526*	*1,587*	*1,650*	*1,716*
National Directorate of Irrigation and Water Utilization	*423*	*1,025*	*1,053*	*1,095*	*1,139*	*1,184*	*1,232*
National Directorate of Fisheries and Aquaculture	*637*	*712*	*801*	*833*	*866*	*901*	*937*
National Directorate for Animal Husbandry	*867*	*1,512*	*1,462*	*1,520*	*1,581*	*1,645*	*1,710*
National Directorate for the Support of Agriculture Community Development	*806*	*1,162*	*294*	*306*	*318*	*331*	*344*
Directorates of Agriculture Services in the Districts	*3,859*	*8,448*	*3,740*	*3,891*	*4,044*	*4,208*	*4,375*

94. To support the research and data needs of Timor-Leste, the Centre for Climate Change and Biodiversity was established in 2014, at the National University of Timor-Leste (UNTL). The Centre conducts and houses research on climate related issues and biodiversity conservation. The Centre's mission is to provide policy makers, natural resource managers, and development practitioners with the tools and information needed to develop and implement management strategies that address the impact of climate variability and change on all aspects of socio-economic development and to contain rising greenhouse gases (GHG).

95. Some data and related monitoring equipment for comprehensive climate risk analysis, however, is lacking in Timor-Leste. The country incurred significant losses to the hydro-meteorological network during its conflict period. There are currently five operational stations in the national meteorological network; this is currently being updated to 19 stations across the country supported by the EU-GCCA programme. The primary climate station is located at Dili Airport, near the nation's capital. Rainfall and air temperature data are available for Dili Airport from 1954-1974 and 2004 to present. This record is 90% complete and homogeneous[40]. Neither systematic tidal measurements nor sea-level rise monitoring are carried out for Timor-Leste in any port of the Pacific or Indian Ocean. This monitoring is necessary to gather knowledge of the long-term implications of sea-level rise on the coastal systems of the country.

96. Historically, the existing hydro-meteorological observation network had been managed by number of ministries in Timor-Leste. With the recent restructuring, hydro-meteorological monitoring has now been consolidated under MPW. MAF has its own network of 22 weather stations across the country, mostly automated. The data had been kept manually in journals, but has recently been digitized by SoL. The fragmented management of the hydro-meteorological network makes it difficult to have data readily available, especially in digital form to input into the scenario generation or modelling. The limited professional capacity is illustrated by the fact that there are not yet any trained meteorologists in the emerging Bureau of Meteorology; four meteorological observers work at the airport and four geophysical staff in the Bureau with support of six administrative staff.

97. The EU-GCCA programme to Timor-Leste is providing training to ALGIS in mapping, data interpretation from an agro-ecological perspective and land use management through adapted courses in regional universities. The project will also enable 19 existing weather stations to be fully functional and improve national capacity to monitor and map climate events. Findings and results of data interpretation

[40] Climate Change in the Pacific: Scientific Assessment and New Research Vol 2. Country Reports (PCCSP, 201?)

will be provided to policy makers to support decision-making and the integration of climate change data and related impacts into policies and plans.

98. There are opportunities to link this important data and relevant analysis to coastal management and adaptation planning. Enhancing this further with economic analysis would also enable the GoTL to make the most cost-effective decisions, after assessing the economic value of natural assets, projected climate change impacts, and national development priorities. For instance, understanding the economic value of mangroves, coastal ecosystems and their coastal protection functions, and the potential impact of climate change on these assets, could result in more risk-informed, climate-resilient and cost-effective development planning.

With LDCF Intervention (adaptation alternative)

99. LDCF funds will address identified gaps in institutional frameworks, policy guidance, and related data and technical capacity.

100. Consistent with the targets of the SDP and the NAPA, a comprehensive coastal management and adaptation plan will be developed, which will include strategies to protect mangroves and coastal watersheds. This will include engagement of MAF, MPW, MSS, MCIE, MPSI, their respective directorates, academia and other stakeholders as necessary. To facilitate this coordination, the inter-ministerial steering committee for the National Spatial Law and Plan, and other relevant technical working groups (e.g. the technical working groups for the National Adaptation Plan (NAP) and Second National Communication (SNC)) will be engaged to ensure discussion and endorsement by the various ministries, which plan and implement activities impacting coastal zones.

101. The comprehensive coastal management and adaptation plan will clarify and reconcile current gaps, overlaps and inconsistencies in functions and mandates across main institutions. There are some nascent steps taken in this regard that offer the opportunity for the LDCF funding to support and scale up. For example, National Directorate of Fisheries and Aquaculture (NDFA) under MAF plans to introduce integrated coastal resources management and ecosystem-based coastal fisheries management around the islands of Atauro Island and Batugade. This can serve as a starting point for a broader shoreline management plan for the Timorese coastline that will introduce a range of cost-effective adaptation strategies across short, medium and long term timescales. This also offers an opportunity to promote greater coherence through forthcoming actions taken for advancing a NAP process to commence in 2015. The UNFCCC focal point in Timor-Leste has requested for such support under the LDCF-funded National Adaptation Plan - Global Support Programme (NAP-GSP). While such actions will be national in nature, coastal management frameworks would be an important component in such national and possibly sub-national planning frameworks.

102. Significantly, the coastal management and adaptation plan will incorporate various considerations, such as climate change, particularly sea-level rise, and coastal change from climate and non-climate threats and impacts. A national coastal vulnerability assessment will therefore precede development of the plan to identify vulnerable areas and threats.

103. Given the importance of infrastructure development to support economic growth in Timor-Leste, and the potential impact on coastal areas, LDCF funds will also support development of a coastal protection and resilience strategy for infrastructure planning going forward. This will include support on translating the recommendations of the Tibar Bay Port and Tasi Mane EIAs into activities with costs and responsibilities defined and embedding into the projects' operational plans and environmental and social management plans, in particular related to mangrove and related ecosystem protection/offsets. While infrastructure development is progressing at a rapid pace, it is still in its early stages. To the extent possible, the coastal resilience strategy will be outlined in detail and embedded into the Tibar Bay port construction and operation plan and the Tasi Mane environmental and social management plan. There is therefore, both, an urgent need and a timely opportunity to put in place a framework which will protect coastal areas from infrastructure development for years to come.

104. With protection measures identified, LDCF will support data collection and technical training to implement solutions, as well as secure related finance. LDCF funds will address data gaps by providing monitoring equipment and training. There are relevant ongoing programmes which can be replicated in Timor-Leste to support policy makers with the skills needed towards efficient and effective coastal planning in light of climate change. The Capacity Building Programme on the Economics of Climate Change Adaptation (ECCA) responds to the consensus reached by participating countries that skills development in economic appraisal methods for climate change impacts on key sectors, including cost-benefit analysis of investment options is required to facilitate a more comprehensive approach to mainstreaming climate change risks into planning processes. The programme is comprised of a series of trainings, interspersed with in-country data collection and economic analysis. The programme is currently near completion and is in the process of packaging its training material, including case studies from countries with similar challenges (i.e. Southeast Asian countries and SIDS from the Asia and Pacific region), into university courses designed for government staff. Similarly IUCN's Mangroves for the Future project is developing course material on the technical issues of coastal management. The LDCF project will link to and build on these efforts, and develop a tailored course(s) for government staff in Timor-Leste. The course(s) will expound on the role of coastal ecosystems to provide critical protection services (i.e. natural barrier between sea and communities, prevention of coastal erosion, buffering saltwater intrusion into the groundwater and inland, habitat for fish, etc.). To ensure that climate risk informed planning is able to identify climate resilient choices of coastal management and development, skills training will include cost benefit analysis, taking into account the economic value of ecosystem services and their adaptation benefits. Establishing links to the broader regional programmes will ensure course material reflects international standards, while promoting South-South knowledge sharing. The course will be housed at a local learning institution, such as the UNTL Centre for Climate Change and Biodiversity.

105. Intra-ministerial coordination is also important to ensure effective coastal management. As aquaculture development is a priority to address food security in Timor-Leste, LDCF funds will support the development of intra-ministerial Standard Operating Procedures (SOPs) for MAF, to ensure that aquaculture development under the NDFA does not interfere with the mangrove protection/rehabilitation targets of National Directorate of Forestry (NDF) and the National Directorate of Protected Areas (NDPA).

The below description of outputs and indicative activities provides further detail.

Outputs and Indicative Activities

Output 1.1. A comprehensive coastal management and adaptation plan developed and budgeted for the entire coast of Timor-Leste (as part and a direct contribution to the NAP)

Output 1.1. Supports the inter-ministerial data and coordination needs for effective coastal management and adaptation planning in Timor-Leste. Indicative activities include:

1.1.1. Undertake extensive coastal vulnerability assessment (incl. community pressures such as salt production and aquaculture) for Timor-Leste to inform development of integrated coastal management and adaptation plan for building shoreline resilience.
1.1.2. Comprehensive review of existing laws, regulations, standards, and sectoral plans; identifying gaps and opportunities for enhancing collaboration towards effective coastal management.
1.1.3. Facilitate inter-ministerial dialogue, engaging Technical Working Groups (TWGs) such as the TWG for the NAP, SNC, National Spatial Planning Law and Planning and others; discuss and agree on coastal management and adaptation planning objectives for Timor-Leste, including mangrove and coastal wetland protection and restoration management strategy, action plan, budget and monitoring framework, and coastal development guidelines with recommended coastal considerations to sectoral plans detailed and related ministry, directorate and municipality roles defined.
1.1.4. Prepare draft integrated coastal management and adaptation plan document informed by the above
1.1.5. Inter-ministerial endorsement/agreement of comprehensive integrated coastal management and adaptation plan

Output 1.2. Coastal protection and resilience strategy for infrastructure planning, adopted and budgeted

1.2.1. Technical support to Tibar Bay Port PPP, Suai, Betano and Beaço sites under the Tasi Mane Project, and concessioner in reviewing EIA and translating the EIA recommendations into actionable plan.
1.2.2. Based on above, support in design of environmental and social management plan for Tibar Bay Port project and Tasi Mane Project sites, including activities, costs, responsibilities, and monitoring framework.
1.2.3. Support to ensure that national infrastructure development activities and costs are captured in relevant construction project legal documents, e.g. concessioner's contract, sub-contracts, bill of quantities, etc.
1.2.4. Enhance environmental and social safeguards procedures for infrastructure planning affecting coastal areas, informed by support to Tibar Bay Port PPP and the Tasi Mane Project
1.2.5. Inter-ministerial endorsement/approval of environment and social safeguards procedures, to ensure integration into infrastructure development planning

Output 1.3. Technical skills (through specialized trainings), hardware (at least two sets of hydro-meteorological stations and wave gauges), methods (economic valuation and cost-benefit analysis) and solid value-chain analysis of livelihood options, and software introduced to monitor climate change induced coastal change and to plan management responses at policy levels.

1.3.1. Installation of hydro-meteorological stations (1 wave/tidal gauges/site) in relevant locations and trainings for operations and maintenance, in consultation with National Directorate for Disaster Risk Reduction and ALGIS.
1.3.2. Training programme with multiple sessions on cost-benefit analysis (CBA) and coastal management for government staff to inform adaptation planning, in partnership with UNTL's Centre for Climate Change & Biodiversity
1.3.3. Sensitizing policy makers on the importance of mangroves and coastal wetlands (an ecosystem-based approach) in climate change adaptation.
1.3.4. Guidelines on mangroves for coastal defense, for coastal managers and policy makers, and for local communities.

Output 1.4. Forestry, Protected Areas, Aquaculture and Fisheries Directorates under the Ministry of Agriculture and Fisheries have their roles, coordination, and planning mechanisms clarified and enforced for improved management of mangrove and other critical coastal habitats (as emerges from National Adaptation Plan consultation process)

1.4.1. Establish a technical working group within MAF for formulation of the SOP, strategy and action plan for mangrove rehabilitation (this will also be a critical element of the integrated coastal management plan, Output 1.1) linking to the NAP, SNC, land use and/or other relevant technical working groups
1.4.2. Draft SOP, led by technical working group and supported by expertise in mangroves protection and rehabilitation with a) criteria defined for appropriate sites for implementation of directorate plans in a manner that preserves protected mangrove areas and overall mangrove rehabilitation efforts, and b) with roles defined for monitoring and reporting of mangrove areas and rehabilitation, as well as enforcement of SOP across directorates.
1.4.3. Approval of SOP by MAF Minister.
1.4.4. Monitor and evaluate the SOP mechanism periodically, and improve based on lessons learned as necessary.

Outcome 2: Mangrove-supportive livelihoods established to incentivize mangrove rehabilitation and protection

Co-financing amounts for Outcome 2: $17,604,402
LDCF project grant requested: $4,000,000

106. Outcome 2 provides an integrated approach to coastal adaptation, encompassing a) mapping and vulnerability assessments (shoreline vulnerability, coastal change assessment, mangrove assessment and vulnerability mapping,); b) policy and institutional capacity for coastal adaptation, monitoring and management; and c) coastal adaptation planning and mangrove re-afforestation and conservation, through integrated local land-use planning and coastal livelihood development.

Without LDCF Intervention (baseline)

Mangrove Preservation and Rehabilitation
107. Timor-Leste has lost an estimated 80% of mangrove area since 1940, leaving approximately ~1,300ha[41,42,43], as at 2005. Aerial photos taken in 2014, for ongoing national spatial planning, can be analyzed and compared to historical records to update these figures.

108. MAF holds site-specific information (e.g. species listings) and regular updates from local enforcement staff, however, a comprehensive baseline is missing. Sites have been identified by district MAF forestry enforcement staff, however, size mapping, quality and biodiversity information is limited. Based on initial surveys undertaken by the PPG team, a number of mangrove stand sites remain undocumented or unaccounted for.

109. There is currently no system in place that regularly monitors mangrove coverage and related coastal inundation and coastal erosion, nor assesses sediment transport or conducts sediment budget analysis. Several agencies have been involved in local mangrove and coastal habitat mapping and faunal surveys (i.e. Charles Darwin University, Northern Territory Government), and human impacts on mangroves (i.e. Australian Institute of Marine Science (AIMS)), though data on mangrove areas, condition, as well as changes in adjacent community settlements is lacking, particular on the South coast. Critically, field surveys and assessments are required to 'ground truth' satellite imagery and enable mapping of mangrove change and vulnerability. AIMS and Charles Darwin University have undertaken several studies on catchment impacts on coastal mangroves. At the local-scale, surface elevation monitoring is necessary for predicting the survival of mangrove areas and long-term viability of restoration efforts. Knowing this would allow for evidence-based restoration action, by prioritizing management efforts at mangrove sites that offer the best conditions for sustained rehabilitation through natural recruitment process.

110. There are existing laws protecting mangroves, but enforcement is lacking. Protected areas are a vital component of an integrated coastal adaptation strategy and to building shoreline resilience to climate change. In recognition of the current low representation of mangroves in the national protected areas network, the National Ecological Gap Assessment (NEGA), recommends that 80% of the current distribution of mangroves be protected within protected areas. With the current proposed network of 30 protected areas, nearly 50% of mangroves fall within the proposed network. These proposed areas, include some of the largest stands of mangroves in Timor-Leste, (i.e. Behau (Hera-Metinaro), Lamansak (Manatuto), and Ribeira de Clere/Lake Modo Mahut (Manufahi), Lake Naan Kuro (Natabora)). There is an opportunity for LDCF funding to assist MAF to link and integrate protected area planning initiatives with mangrove conservation and re-afforestation and coastal livelihood development.

[41] Global Forest Resources Assessment 2005 Thematic Study on Mangroves – Timor-Leste Country Profile (FAO, 2005)
[42] Marine and Coastal Habitat Mapping in Timor-Leste (North Coast) – Final Report for Tourism & Fisheries Development Project (Boggs, et. al., 2009)
[43] Mangrove Forests of Timor-Leste: Ecology, Degradation and Vulnerability to Climate Change (Alongi, 2014)

111. Rapid ongoing infrastructure development is a concern for planning and long term sustainability of mangrove rehabilitation efforts. For instance, the selected location for the Tibar Bay Port represents approximately 2% of the quickly diminishing mangrove coverage in Timor-Leste[44] – a significant amount given the large scale loss of mangroves observed in Timor-Leste over time. The offset will be further defined over the next year (with support under Outcome 1), and will include mangrove rehabilitation along the South-eastern shoreline of the bay. Currently, potential offset activities, per the scoping study, include:

- Avicinea marina mangrove rehabilitation along the south-eastern shoreline of the bay
- Supporting the protection and management of un-impacted mangrove, sea grass and/or coral reef communities, in areas east of Dili
- Establishment of community-based marine protected areas in the bay, on the coast immediately west of the bay, and at other coastal sites (potentially Hera, Metinaro and Manatuto)

112. Monoculture regeneration, as detailed above is not considered international best practices to ensure high survival rates. At the moment, however, there are no technical guidelines for mangrove rehabilitation in Timor-Leste, to effectively inform species selection, planting techniques and approaches to long term preservation. Previous efforts of mangrove rehabilitation have therefore been largely unsuccessful. The Haburas Foundation, a local NGO, implemented a 2-year project which included planting 2000 mangroves, of which very few survived. The Haburas Foundation shared its lessons learned with the LDCF project design team, these include:

- Community awareness – more time should have been devoted to social preparation before the plantation of mangroves, stressing the importance of the preservation of mangroves, their coastal protection and livelihood benefits;
- Community ownership – community did not feel a sense of ownership, this might be remedied through direct access to finance by the community for regular maintenance of related infrastructure (e.g. for small repairs to fencing to prevent animal grazing)
- Regular engagement by strong project team – engagement with the community by the project was too sporadic, should be more intensive, while taking into account the community dynamic
- Species selection – must ensure that the mangrove species selected is appropriate for the site, and planting method and placement is conducive to its growth.
- Project duration – the project was too short, active and regular maintenance of the replantation area is needed for at least the first 2 years, to ensure seedlings reach maturity
- Effective materials for protection of seedlings – must ensure that fencing materials are resilient to tides and where appropriate, strong enough to deter grazing livestock

113. Consultations with communities at previous project sites provided further input. Communities expressed concerns over long delays in receiving necessary inputs (e.g. materials to repair fencing which would have deterred grazing animals). Sustainability of payment mechanisms to maintain mangrove areas was also a concern. As funding ended with the project, there was no incentive to continue to protect the project sites. Community-based finance mechanisms may be more successful going forward.

114. While MAF is responsible for conservation and maintenance of mangrove areas, the geographic scope of this responsibility against the limited number of personnel, make this a daunting task. Further, given community pressures on mangroves areas (e.g. felling for fuel wood), community awareness, cooperation and engagement are necessary to ensure the long term sustainability of mangrove conservation and rehabilitation efforts. MAF resourcing solely, however, is not adequate to implement these practices. While a number of NGOs, local and international exist to assist in the implementation, much of the work needs to be undertaken by the communities themselves, and will require long-term behavior change mechanisms to ensure they are effective.

[44] Tibar Bay Port - Summary of Environment and Social Scoping Study (IFC, 2013)

Mangrove-Based Livelihoods

115. Pressure from communities is a key driver for mangrove loss in Timor-Leste. Traditional coastal livelihoods, such as salt production, entail cutting mangroves for fuel. There are ongoing efforts to reduce this demand for wood by communities. The GEF-funded *Promoting Sustainable Bio-energy Production from Biomass (SBEPB)*, which began implementation in 2015, promotes sustainable production and utilization of biomass resources to support local economic, environmental and social development. As the project will work in part also in mangrove areas, its activities will relieve the pressure from communities on mangroves for fuel wood. There is opportunity to work collaboratively with this project on relevant sites to maximize the impact of combined resources. UNDP's *Mobilizing Social Business to Accelerate MDGs Achievement in Timor-Leste* is developing a viable social business model for the salt producers of Liquiça – an important mangrove area in the country. Economic analysis conducted as part of project indicated that farmers were able to generate more salt with the introduction of the salt evaporation ponds with reduced physical effort. An observation however to note, from implementation of this project is that during the rainy season, farmers did revert to using mangrove wood to cook the salt to prevent disruptions to household incomes. Further, when additional funds were needed for other reasons, reasons (e.g. *adat* - family and customary ceremonies, food or schooling fees), communities reverted to cooking salt. Given that in practice, many salt-farming communities do not have access to financial management or earn too little to be able to have forward-looking practices, the need for making immediate earnings means that salt-farming by cooking is widespread, despite efforts to shift to evaporation methods, communities in many cases reverted to cooking salt. While salt production is not a livelihood that will be supported by the LDCF project, the social business model of the project has been successful and will be explored for application in the LDCF project. Under Outcome 1, LDCF support will ensure that siting for future investments in salt production consider the need to maintain mangrove areas for coastal protection and maintenance of coastal ecosystem functions.

116. Timor-Leste's rapidly expanding population is bringing with it development challenges related to both job creation and food security. The NADS envisions a strong role for aquaculture in diversifying and improving livelihoods, and building resilience among rural households and agro-ecological systems. Aquaculture is intended to contribute to increasing fish supply and consumption, with the objective of raising per capita fish consumption in Timor-Leste from 6.1kg to 15.0kg by 2020 (closer to the global average annual per capita consumption of 17.8kg). The expectation is that aquaculture will by 2030 contribute up to 40% of domestic fish supplies, with the remainder coming from wild capture fisheries.

117. There are a number of organizations which have contributed, or are contributing, to the development of the aquaculture sector in Timor-Leste.

- WorldFish supported the government in the development of its NADS and is currently working in the provinces of Atauro, Beaço, Vemasse and Baucau. WorldFish adopts an ecosystems approach to aquaculture and includes fish stock and reef damage assessments, market research, small capacity building programme and development of a fish strategy for Timor-Leste. Future activities, with funding from New Zealand Aid, include aquaculture development (i.e. milkfish and tilapia). WorldFish is also researching options for locally-sourced, plant-based fish feed ingredients to support local production of aquaculture inputs.
- Towards the goals detailed in NADS to develop skills in the aquaculture sector, a memorandum of understanding (MoU) has been signed between KOICA and the NDFA to start an aquaculture training center in Liquiça, where 40 people will to be trained per every 9-month cycle. The programme also includes a training-of-trainers programme for communities. The programme is expected to run until 2017-8.
- The Agricultural Cooperative Development International and Volunteers in Overseas Cooperative Assistance (ACDI/VOCA) was awarded a grant from the United States Department of Agriculture (USDA) for a three-year project, to cultivate mud crabs and fish in the coastal villages of Timor-Leste. Until its completion in January 2015, the project operated in five districts and was implemented in collaboration with NDFA and with local and international stakeholders. The Mud Crab and Fish project worked with coastal communities to raise mud crabs in cages partially submerged in coastal mangrove forests. The program also explored sustainable cultivation of other aquaculture products including various fish species. Emphasizing sustainable mangrove

use, the Mud Crab and Fish Cultivation project helped establish 85 producer groups in coastal areas to develop and manage crab and fish nurseries. Producers were trained in crab and fish cultivation as well as business and group enterprise skills. Cages, pens, and ponds were built using local materials such as bamboo and palm stalk.

- Several NGOs, IGOs and faith-based organizations are supporting communities on related livelihood activities. MercyCorps is providing training on aquaculture, and seeks to extend its program to 1500 farmers. Caritas Australia's work covers a wide range of issues including climate change adaptation, food and water security, sustainable agriculture, and institutional strengthening of community-based organizations. Activities include training in food processing and the introduction of aquaculture practices in coastal communities, as well as establishing sustainable gardens and tree nurseries using alternative sloping land gardening methods to increase soil fertility, reduce erosion, and increase production.

118. While previous aquaculture support has had some success, the fragmented nature of interventions and the lack of strong links to markets, have resulted in challenges with sustainability after project closure. For instance, after ACDI/VOCA's initial establishment, growers have struggled to obtain feed and maintain the necessary pH levels for healthy fish, due to costs. Some growers also indicated having to sell fish before they reached maturity, because of financial constraints in the household. There is opportunity to strengthen the aquaculture in Timor-Leste through cost and market analysis, to ensure that growers are able to maintain the ponds, as well as sell their product, after the project close.

119. Critically, there is a need for salt production and aquaculture site selection to be informed by the products of Outcome 1, to ensure that development does not inadvertently interfere with the goals of mangrove protection and rehabilitation in Timor-Leste.

With LDCF Intervention (adaptation alternative)

120. With LDCF intervention, mangrove coverage of Timor-Leste will increase through conservation and re-afforestation efforts, protecting the shoreline from sea level rise; pressure from communities on mangroves will be reduced through the introduction of alternative livelihood support.

121. The aerial photos taken in 2014, for ongoing national spatial planning, will be analyzed and compared to historical records to update these figures. ALGIS and MAF will receive training in mangrove mapping/inventory, field surveys and coastal change analysis, to identify key areas of mangrove loss and vulnerability, and importantly, identify potential areas for mangrove restoration. A training-of-trainers programme will also be implemented for communities to contribute to ground truthing in selected project sites will verify this information. As light detection and ranging (LiDAR) data for the country becomes available, the project will assist in using this data to identify further areas of loss through coastal erosion and inundation.

122. LDCF funds will systematically strengthen the synergistic relationship between coastal communities and mangroves ecosystems and ensure that coastal communities in Timor-Leste have economic incentives to maintain and safeguard these protective natural systems, without compromising their livelihood options. This will be achieved through community-led adaptation interventions, which include mangrove re-afforestation, conservation and livelihood diversification options (such as agroforestry, fish ponds, sustainable diversified localized agriculture) developed through integrated community-based, land use models, localized water security and harvesting, and adaptation plans.

123. Community plans will be strengthened through local, customary management tools, such as *tara bandu*[45] methods, linked to complementary, protected areas planning (where appropriate) and incorporated into suco (village) development plans. Given past failures with mangrove restoration via plantings and seedling nurseries, restoration efforts will adopt the ecological mangrove restoration (EMR)

[45] *Tara bandu* is traditional law or a social contract decided by local traditional knowledge and rules passed on orally within a region to regulate relations between people and the environment, and between people and groups. As it relates to mangroves, *tara bandu* can be a means of protecting mangrove sites from community pressures.

approach, which prioritizes natural regeneration and community governance informed by a detailed biophysical, socio-economic-political assessment.

Mangrove Protection and Afforestation

124. Many mangrove restoration attempts have failed worldwide due to a) poor understanding of the ecological and hydrological requirements of mangroves, particularly in establishment and early growth, and b) complex social-cultural, land tenure and ownership issues (Lewis, 2005, 2009). Direct seedling planting is also characterized by often, high mortalities (due to inappropriate siting and handling) and when successful, the establishment of unnatural, low diversity, mangrove systems or plantations.

125. The project will support community-based ecological mangrove restoration (CBEMR) – a local-scale, community-based approach to mangrove restoration that prioritizes natural regeneration and socio-cultural-political understanding, using participatory methods (Brown et al. 2014). Because of its emphasis on natural regeneration, EMR activities typically result in high diversity, near-natural ecosystems. A rapid assessment uncovers the ecological, social and economic viability of mangrove generation at a proposed site. Principally, the rapid assessments help develop an understanding of the state of the mangrove system from an ecological and social perspective. In Indonesia, CBEMR has been particularly successful in re-afforesting, disused shrimp ponds (or tambaks). Biophysically, this involved hand-digging of tidal creeks to encourage proper drainage of the site, and periodic propagule dispersal to encourage natural re-vegetation. In Timor-Leste, rice paddies have been established on the margins of many mangrove forests (particularly on the South coast) – and like shrimp ponds, are directly amenable to restoration of hydrological regimes. Where appropriate, natural fencing will be installed to deter grazing animals. Materials used will be strong enough to withstand tides and immersion in salt water.

126. An important message repeated during consultations, was the need to improve resilience of communities – the project must reach people. The project will employ community-based approaches to the extent possible. This includes mechanisms to provide funding directly to communities for CBEMR activities; this would not only empower communities but also prevent implementation delays related to administration. A number of mechanisms were explored during the PPG phase to deliver cash directly to communities. GIZ has, in the past, used a 'cash box'. The box has 4 keys and a log to ensure agreement by various members of the communities on appropriate uses of the funds. Communities even established a lending system when surplus funds due to timing of activities, which generated interest and therefore extra funds for the project's community-based activities. The GIZ project has recently concluded, use of this approach will informed by the results of the final evaluation, once available. Another option that will be explored is the use of credit unions, with accounts held at the community-wide level for rapid disbursement of funds for activities.

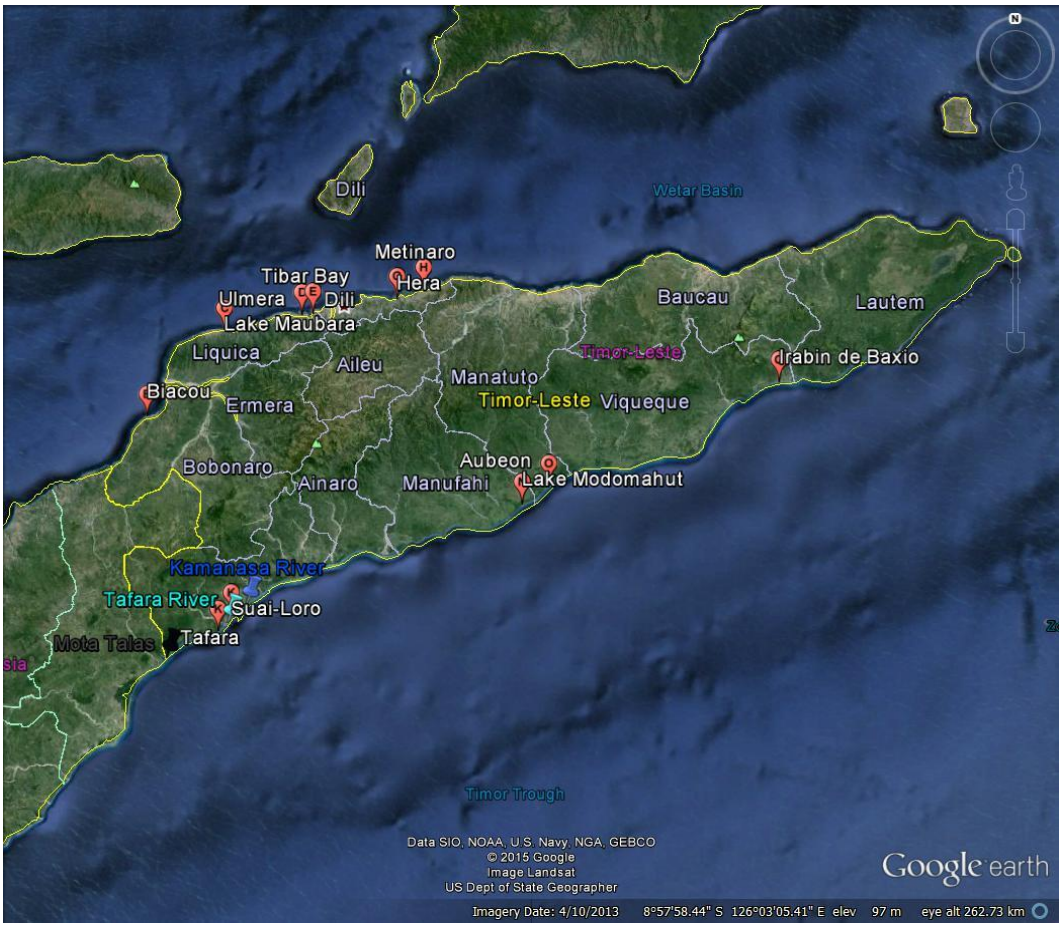
127. To inform mangrove rehabilitation efforts, guidelines will be developed both for government technical officers as well as communities, detailing results of the rapid assessment from the specific site and the appropriate approach to ensure successful rehabilitation efforts. Guidelines will also ensure a consistent approach for mangrove rehabilitation going forward. Given the various parties engaged in supporting Timor-Leste, it is critical that efforts are consistent, in the sense that a national standard of excellence is maintained. Site selection for mangrove area rehabilitation will be informed by:

- Climate change risks and vulnerability
- Community-based, participatory, adaptive management approach
- Biophysical and socio-cultural site assessments - CBEMR provides a framework for both, biophysical and socio-cultural, assessment of potential restoration sites, to assess their suitability for EMR activities.
- Complementarity with offsets for the Tibar Bay Port and Tasi Mane construction projects, related to mangrove and wetland preservation
- Ramsar prioritization – wetlands of international importance under the Ramsar Convention
- Approval of MAF technical working group

128. A preliminary assessment of potential sites for mangrove rehabilitation was conducted during the PPG phase. The following sucos were identified based on national priority and vulnerability, as well as

potential for community engagement: **Biacou** - Bobonaro district, **Lake Maubara, Ulmera** and **Tibar** - Liquiça district, **Hera** and **Metinaro** - Dili district, **Suai-Loro** and **Tafara** - Covalima district, **Lake Modo Mahut** - Manuhafi district, **Aubeon** - Manatuto district, **Irabin de Baixo** - Viqueque district, Further assessment of sites against the established criteria will be conducted during the project inception phase, for approval by the MAF technical working group.

Image 1: Map of Potential Project Sites



129. These sites represent approximately 5,300 households and a population of 26,000. Livelihoods support under the LDCF project will directly target 1000 households or 5,000 people. Through mangrove rehabilitation, and by incorporating mangrove maintenance and mangrove-supportive livelihoods into suco development plans, the LDCF project will reach all 26,000 coastal residents. (Mangrove-supportive livelihoods and suco development plans are further described in the next section.) In project sites on the South coast, public awareness and monitoring by communities might be sufficient to ensure that mangroves areas are able to regenerate/thrive.

130. It is important to note that mangroves are an ideal habitat for crocodiles. By increasing mangrove coverage, there is also the likelihood of increasing the crocodile population. Crocodile attacks are a concern in Timor-Leste. Since 2007, Timor-Leste has had 53 reported attacks, 72% fatal[4647]. The Crocodile Task Force was established in 2012, and includes representatives from the Office of the

[46] http://theconversation.com/croc-attacks-a-new-website-with-bite-20671

[47] These numbers are likely lower than the actual figures, as crocodile incidents in Timor-Leste go mostly unreported. This is due in part to the important cultural significance of crocodiles. Consultations on the South coast during the PPG phase found that communities had many stories of deaths resulting from encounters with crocodiles. The PPG team also noted a large visual presence of crocodiles during fieldwork consultations.

President, MAF, MCIE, the Maritime Police of Timor-Leste and the Naval Force of the FFDTL. The LDCF project will consult with the task force to ensure that measures are taken to protect coastal communities (e.g. diamond mesh fencing to section off safe areas for swimming).

Introduction of Mangrove-Supportive Livelihoods

131. As a means of relieving community pressure on mangroves, the LDCF project will introduce alterative livelihood options which are in line with the vision and economic restructuring detailed in the SDP, particularly favoring women-lead social businesses. Specifically the plan seeks to move the economic base away from subsistence farming, and towards a more efficient agriculture sector, a growing private sector, and an expanding services sector. By modernizing and expanding the agriculture sector, and supporting rural economic development, the GoTL seeks to eradicate extreme poverty by 2030. The plan's related outcomes, which will inform project interventions include:

- Self-sufficiency in food with flourishing export trade in a range of agricultural products, including staples, livestock, fruit and vegetables and other cash crops, forestry products and fisheries products
- A growing number of light industries such as food processing, apparel manufacturing, handicrafts and cultural items, and furniture making
- A high number of sustainable small and micro businesses in growing industry sectors such as tourism, small scale manufacturing and high value cash crops

132. There are two critical elements to the mangrove-supportive livelihood strategy of the project a) addressing current malpractice (e.g. salt production, aquaculture) that is destructive to the mangroves and b) diversification by introducing other mangrove-friendly production practices (e.g. agroforestry, fuel wood production, fruit and vegetable gardens). A number of potential livelihood options were explored during the project design phase with a particular focus on a role for women, such as mangrove nurseries, mangrove-friendly aquaculture, food/fish processing, closed-loop sustainable agriculture, agroforestry, high value cash crops, and handicrafts (i.e. made from mangrove debris) with links to community-based ecotourism. Further information is available in Annex G.2. on initial feedback from communities.

133. Given the challenge of food security in Timor-Leste, the project will look primarily to support livelihoods which contribute to food production. Aquaculture development is a priority for the GoTL, however it can put pressure on the country's remaining mangrove areas. The SOPs and guidelines developed under Outcome 1 will help to ensure that site selection for aquaculture does not interfere with the NDF's and NDPA's mangrove protection efforts. Similarly, in project sites where aquaculture is a priority, LDCF support will ensure training to communities and collaboration with partners to ensure aquaculture is as mangrove-friendly as possible.

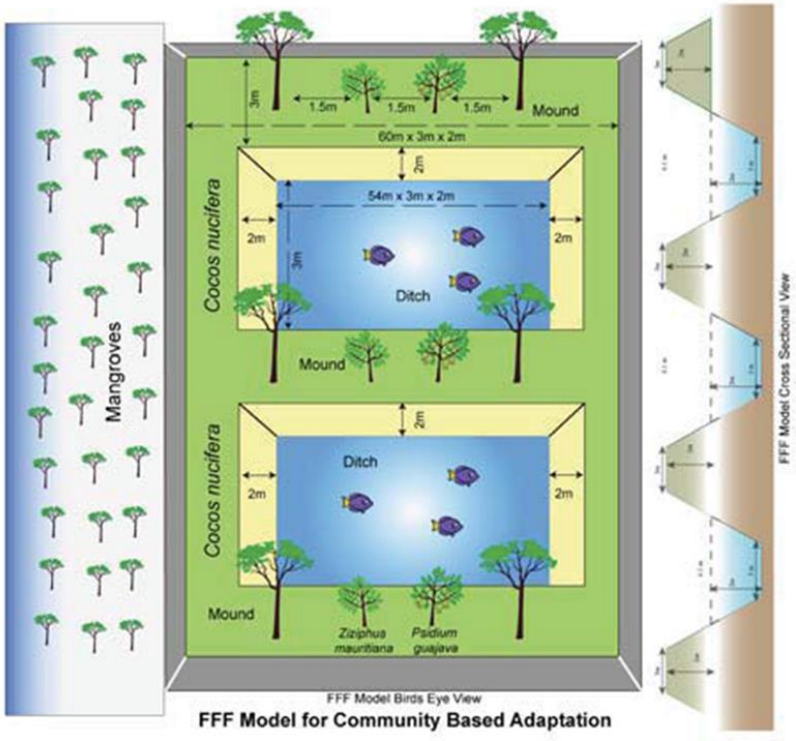
134. The Forest-Fish-Fruit model[48], for instance, has seen success in Bangladesh, and will be assessed for replication in Timor-Leste under the LDCF project. With support from the LDCF-funded *Community-based Adaptation to Climate Change through Coastal Afforestation in Bangladesh* project, communities plant protective, productive vegetation interspersed with fish nursery ponds. The project provides additional income and establishes a natural barrier of protection around some of Bangladesh's most vulnerable communities. An estimated 20,000 households have benefited from this model on more than 6,000 hectares of vulnerable coastal zones to manage and protect these resources that they rely on for their livelihoods in a changing climate[49]. The model provides an innovative way to make barren coastal land productive again. By building mounds and ditches, fruit and timber trees can be grown, and fish can be cultivated. Interspersed with the fruit and timber trees are high yielding vegetables, which can also be grown on top of the mounds and along the banks of the ditches. The model can be created in areas that are protected by coastal mangrove forests, but that are outside of embankments. Because the entire

[48] http://www.bd.undp.org/content/dam/bangladesh/docs/Publications/A%20New%20Land%20Use%20Model_Forest%20Fruit%20Fish.pdf

[49] Case Study 7: Community-Based Adaptation to Climate Change through Coastal Afforestation in Bangladesh (J. Gordon, UNDP and F. Iqbal, GEF, 2015)

model is raised, it is protected from tidal surges and storms. The below figure provides a visual representation of the model.

Figure 3: Forest-Fish-Fruit Model[50]



135. While successful, it should be noted that one of the challenges faced in Bangladesh in implementing the Forest-Fish-Fruit model was related to land use and community understanding of land rights. In Timor-Leste, the Constitution states fundamental rights to private property (Article 54), the right to housing (Article 58) and the right to the environment (Article 61). The National Spatial Planning and Law and Plan will further define land use in Timor-Leste. The proposed CBEMR approach to mangrove re-afforestation specifically undertakes pre-EMR socio-cultural assessments for target sites, to understand and address complex land tenure issues.

136. WorldFish also employs an ecosystems-based approach to aquaculture, specifically to address food insecurity. WorldFish's mission is to reduce poverty and hunger by improving fisheries and aquaculture, and it strives to achieve large scale, environmentally sustainable, increases in supply and access to fish at affordable prices for poor consumers in developing countries[51]. A concern raised by WorldFish was the trend in Timor-Leste towards production of aquaculture for high value fish, such as grouper. Grouper have a market price of $20-$40/kg. While this may seem economically appealing, there are two challenges with this approach a) grouper feed on other fish (i.e. fish which could instead be consumed by communities) and b) such costs put grouper beyond the ability of the communities themselves to purchase. WorldFish instead focuses on fish such as milkfish and tilapia, which have a lower market value and does not require feed with fish meal. WorldFish is currently developing a recipe for plant-based, locally-sourced fish feed, expected be completed in 2015. The LDCF project will collaborate closely with WorldFish, benefiting from their expertise and experience, to ensure quality support to livelihoods related to aquaculture and production of fish feed. The coastal vulnerability assessment data of Outcome 1 will help to inform WorldFish on siting for aquaculture – ensuring that

[50] More detailed information can be found at: http://www.bd.undp.org/content/dam/bangladesh/docs/Publications/A%20New%20Land%20Use%20Model_Forest%20Fruit%20Fish.pdf.

[51] http://www.worldfishcenter.org/who-we-are/mission

further aquaculture development in Timor-Leste is mangrove-friendly and conducive to the goals coastal protection.

137. The ACDI/VOCA infrastructure (hatchery) was established to support mudcrab farming, with the intention to develop a mudcrab industry for export to Singapore, as well as a parallel stream for local markets. Currently the hatchery lab is operational, but requires engagement of communities to raise these hatchlings locally, if it is to grow to potential scale. The LDCF project can foster these links with the communities at the selected sites to promote further mangrove supported livelihood development. Fieldwork consultations found that mudcrab projects established under the ACDI/VOCA project were working effectively in those locations where access to market links had been put in place (e.g. Kamanek – a Dili based supermarket providing a regular delivery truck from local harvesting communities on the South coast – to be sold in the Dili market).

138. In addition to mangrove-friendly aquaculture, the LDCF project will support activities related to the mangroves themselves as livelihood alternatives. The CBEMR approach detailed above, for instance, provides various entry points for community engagement, such as coastal mapping, planting, and monitoring. Also, to support mangrove rehabilitation targets of the project, mangrove nurseries will need to be established. Guidance will be provided to communities on appropriate species selection and maturity of seedlings to ensure a good survival rate. The EU-GCCA programme has experience in nurseries as a viable livelihood, related to reforestation and sustainable land management (SLM) efforts. The EU-GCCA has applied an entrepreneurial approach, which will be considered for the LDCF project. The EU-GCCA programme works on reforestation, which includes livelihoods support to nurseries for this effort. The programme provides the technical expertise, and promises to purchase as many viable seedlings as produced. For instance, if the programme needed 50 trees, but 55 were produced which met quality standards, 55 would be purchased from the farmer. This incentive not only ensures a quality supply for reforestation efforts, but also creates opportunities for the farmer to ultimately sell quality outputs beyond the scope of the EU-GCCA programme. This entrepreneurial approach will be considered to mangrove nurseries supported by the LDCF project.

139. Given the promise of the tourism sector in Timor-Leste and the high priority given to ecotourism in the SDP, community-based ecotourism will also be explored as a complementary livelihood alternative in relevant project sites, where MTAC is already engaged. MTAC and the Tourism Association are supporting communities that have little access to market, through sensitization programmes on the demands of a growing tourism sector, and providing seed funding (i.e. for local investment and cooperative items such as boats). Similarly, the Marine Development Group has documented successes in engaging communities to support ecotourism in Atauro. The potential for ecotourism is very site specific, and due to risk, support would be provided at a small-scale in cooperation with MTAC or other partners. Another complementary livelihood which will be explored is the locally-sprung craft of collecting driftwood surface roots from mangrove trees for decorative painting. There is great potential to link these unique crafts to the tourism market, including for instance, messaging about the important role of mangroves in coastal ecosystems.

140. Livelihood support will be appropriate to the site, and be selected following extensive consultations with communities and MAF, and following robust economic analysis. Sucos selected for livelihoods support will correspond to priority areas for mangrove rehabilitation.

The below description of outputs and indicative activities provides further detail.

Outputs and Indicative Activities

Output 2.1. *At least 1000 ha of coastal mangroves and wetlands conserved or degraded mangrove areas rehabilitated through natural recruitment and restoration of hydrological regimes both in the northern and southern coasts with a direct employment of local coastal communities*

- *Restore and monitor mangroves, using natural, ecological approaches, including restoration of hydrological regimes, enhanced propagule dispersal and livestock control*
- *Establish maintenance protocols under MAF, with direct participation/employment of coastal communities, particularly women*

141. LDCF funds will be used to preserve and rehabilitate at least 1000 ha of degraded mangrove area. Site selection, and the scope/scale of intervention needed, will be informed by national priorities, technical review and cost assessments. A maintenance plan for the sites will be developed in consultation with coastal communities.

142. Regular monitoring of the rehabilitated sites will help identify best practices and lessons learned to enhance, if necessary the guidelines developed under Outcome 1. Indicative activities include:

2.1.1. In consultation with MPW, use the 2014 high resolution aerial photographs for land use planning as well as LiDAR data (expected to be available in 2015), to take inventory of coastal wetlands and calculate actual mangrove coverage with follow up ground surveying - identify areas most affected by sea level rise and mangrove loss; with data to be maintained at the UNTL Climate Change and Biodiversity Centre.
2.1.2. Training-of-trainers programme to government staff on mangrove and wetland mapping, monitoring and coastal change assessment, ultimately for mapping to be done by extension officers and communities to identify suitable areas for mangrove re-afforestation and inform development of shoreline management
2.1.3. Analysis of existing mangroves that can be protected through measures such as fencing and upper watershed rehabilitation; and determining severely degraded mangrove areas to be rehabilitated/re-established where appropriate
2.1.4. Applying the selection criteria identify sites for project intervention (for approval by the Project Board), informed by activities 2.1.1-3
2.1.5. Analysis of existing mangroves that can be protected through measures such as fencing and upper watershed rehabilitation; and determining severely degraded mangrove areas to be rehabilitated/re-established where appropriate
2.1.6. Develop guidelines for mangrove rehabilitation, in consultation with academia and partners specializing in this field, to ensure species selection and replantation techniques are appropriate and specific for each site. This will include monitoring and maintenance requirements and protocols;
2.1.7. Consultations and pre-EMR site assessment (biophysical, socio-cultural) with communities, ensuring engagement of women, to define roles in preservation, as well as maintenance and monitoring in rehabilitation sites, of mangrove areas; develop CBEMR guidelines for selected coastal communities for mangrove rehabilitation
2.1.8. Starting with 4-5 sites, protect or rehabilitate mangrove areas, and, where necessary, install necessary infrastructure for protection of seedlings (e.g. establishing community monitoring system and installing fencing to prevent animal grazing, where appropriate).
2.1.9. Document best practices and lessons learned to inform subsequent phase of project implementation, as well as suco development plans of Output 2.3

Output 2.2. Mangrove-supportive, diversified livelihoods/social businesses established in mangrove rehabilitation project sites, benefiting at least 1,000 households and empowering women

143. To alleviate the pressure by communities on mangrove forests, alternative livelihood programmes will be designed and implemented. Reasons for mangrove loss vary from site to site, therefore identifying the key pressure and designing an appropriate approach is necessary to improve the success of preservation and rehabilitation efforts. For instance, community consultations conducted during the PPG phase indicate that in some sites, it is the upland communities which are cutting the mangroves for sale and/or for fuel, and soil erosion which were the biggest pressures on mangroves. This was especially relevant in coastal fishing communities, where households understand the link between healthy mangroves and fishing, and therefore do not cut down the mangroves. In such cases, the livelihood

options could include investment in agroforestry for upland communities, which would not only provide a livelihood alternative for those communities, but also help prevent soil erosion, allowing coastal mangrove areas to regenerate and create an environment conducive for the return of fish to the coastal area. Aquasilviculture that integrates aquaculture with mangroves offers a viable solution for mangrove-supportive livelihoods. In other areas, particularly on the South coast, mangroves are being cleared to drain land area for livestock or misguidedly for agriculture – many of these efforts have failed as the sites were too saline to support agriculture. Guidance is needed for farmers to make appropriate agriculture choices given soil conditions and the need to preserve mangroves for ecosystem services.

144. Community consultations and thorough economic analyses will be conducted to select an alternative livelihood (or combination of livelihoods) which is most appropriate to the site and sustainable as a means of income generation. This would begin by measuring the willingness to accept (WTA) of the households in the community to help preserve the mangroves by accepting the investment by the project. WTA values would inform the design of a livelihoods programme which would seek to at least match that value. Value chain analysis and market development research would be conducted to project the realistic revenue generation potential of the livelihood, as well as a value chain analysis to identify gaps which would require investment. These values would be input to the cost-benefit analysis (CBA), which compares ongoing practices in the context of projected climate change, to the alternative livelihoods acceptable to the community, in order to make the best choice.

145. This Output seeks in particular to support livelihoods which empower women. Ensuring thorough consultations with communities, and effective livelihoods support will require sensitivity to the particular challenges faced by women. For instance, a 2009 baseline study found that domestic violence was a 'normal' occurrence for many women. A gender specialist will be recruited by the project to ensure that consultations a) capture the views of women b) are gathered from women in a manner that does not put them at risk, and c) that selected livelihood interventions are implemented in a gender-sensitive manner and prioritize benefit to, and empowerment of, women.

Indicative activities for Output 2.3 include:

2.2.1. In sites selected for project intervention, analyze key drivers of mangrove loss (e.g. animal grazing, cutting of mangroves for fuel wood).
2.2.2. In consultation with MAF, identify combination of CBEMR and potential livelihood options appropriate for selected site to present to communities for further consideration. These options will take into account the key pressures on mangroves in the site, and existing investments by MAF or development partners, and UNDP programmes, to ensure complementarity.
2.2.3. Conduct robust economic analyses to identify most viable mangrove-supportive livelihood option
2.2.4. Design and implement training programmes for communities on the technical skills related to the selected livelihood investment(s), as well as basic business skills
2.2.5. Document best practices and lessons learned to inform subsequent phases of project implementation, as well as suco development plans of Output 2.3

Output 2.3. In project site sucos, development plans include mangrove-supportive livelihood support measures benefiting at least 26,000 people

146. A major challenge in evaluating any intervention is establishing its real impact (i.e. attribution). The LDCF project will use an experimental design approach to assess the success of livelihoods support – providing evidence to inform further decision making both in the roll out of project implementation and for consideration in inclusion in suco development plans. Output 2.3 thus focuses on analysis of livelihood support results for further upscaling/replication. Indicative activities include:

2.3.1. Based on evidence (generated from randomized control trials (RCT), see Annex E), highlight successes of livelihood interventions for replication/upscaling
2.3.2. Assess potential for replication/upscaling and costing exercise to detail level of support needed from State budget, including costs of knowledge sharing and continued public awareness

2.3.3. Public awareness raising activities to highlight the economic potential of mangrove-supportive livelihoods and environmental benefits of protecting mangroves, and to highlight the livelihood and coastal environmental protection elements of restoring mangroves and wetland functions.
2.3.4. Support proposal development of livelihood support measures for inclusion in suco development plans

Outcome 3: Integrated approaches to coastal adaptation adopted to contribute to protection of coastal populations and productive lands

Co-financing amounts for Outcome 3: $9,790,000
LDCF project grant requested: $1,969,000

Without LDCF Intervention (baseline)

147. Pressure on coastal areas is not limited to immediately surrounding areas. Past and continued forest clearing for agriculture, timber and firewood harvesting has led to exposed soils in upland areas. These exposed soils have eroded quickly causing soil loss, high water turbidity, increased water runoff and increased flash flooding. The high sediment loads are damaging estuaries, offshore reefs and wetlands, including mangrove areas. Loss of coastal wetlands disrupts the hydrology that supports mangrove systems, which protect coastal areas from water inundation by slowing and filtrating flows. Moreover, coastal natural ponds, wetlands and marshes act as important storm and flood water storage facilities, as well as provide protection from erosion, flood and storms and capturing sediment loads – maintaining and purifying water quality.

148. High sediment loads also make water unfit for human consumption. Associated urban water shortages after heavy rainfall events are regular in some areas[52]. In these situations, when surface water becomes unusable, groundwater is relied on as a primary source of water. At the shoreline, mangroves would buffer seawater intrusion into the aquifers. Aquifers themselves protect against saltwater intrusion provided that water tables are kept at appropriate levels.

149. Most areas of Timor-Leste oscillate between having short periods of surplus water resources to being water-stressed. During the wet season and in wetter years there are often floods and excess water whereas in the dry season and drier years, there can be areas of water stress, drought and water shortages for consumptive and agricultural use and the natural environment[53]. In these drier times, and to some extent during the wetter periods, surface waters are largely unavailable for use and groundwater is heavily relied on. Rainfall variability due to climate change, as well as the growing population and related increasing demand for water, will further exacerbate this.

150. Current predictions for the end of 2015, indicate that Timor-Leste is entering into ENSO affected period that will likely result in severe water-shortages. Protection of water resources is of major importance for the GoTL – with the MSS, MAF and MCIE currently trying to coordinate efforts to respond to El Niño and protect water resources.

151. Water supply and water management policies are currently under review with the Council of Ministers. Water use, however, is not widely monitored, and only large commercial users are charged for the supply. There are no licensing arrangements with agricultural users nor is there currently regulation of, or fees imposed on, those who release wastewater into the river systems. Improved understanding and management of both the surface-water and groundwater resources of Timor-Leste is required to ensure there are not water shortages in any sector, including environmental water uses, into the future.

[52] Mangrove Ecosystems Strategy, Design and Recommendations for Building shoreline resilience of Timor-Leste to protect local communities and their livelihoods (K. Edyvane, 2015)
[53] Mangrove Ecosystems Strategy, Design and Recommendations for Building shoreline resilience of Timor-Leste to protect local communities and their livelihoods (K. Edyvane, 2015)

152. The EU-GCCA programme is providing support to communities in assessing the best climate-adapted options at local level and integrating them into existing planning processes. The programme will support communities in drafting local soil and water conservation plans. For this purpose, environmental profiles of the five major watersheds will first be prepared, using participatory processes for assessing climate change effects on communities. Specific attention will be paid to degraded areas, the protection of water catchment areas and the potential for soil and water conservation techniques. The identification of conflict mitigating measures will be an integral part of the process. The resulting soil and water conservation plans will be integrated into suco and district development plans.

153. Data is available for geological layers for Timor-Leste, but not the water table. BESIK (Bee, Saneamentu no Ijiene iha Komunidade), with funding from Australian Aid/DFAT, has conducted analysis in Liquiça to regularly measure depth and salinity of groundwater. This has included training of extension officers to monitor water levels using accessible technologies (i.e. electric tape tools) and regularly report findings. The results of the project will be a database and map of water quality.

154. Long-term resilience of coastal areas demands comprehensive approaches that examine and address risk acceleration factors at a broader coastal landscape and catchment area. Sustainable finance is needed to plan and implement these comprehensive approaches; however, public revenue streams in Timor-Leste are currently not reliable in the long term.

155. The majority of the State Budget is financed by the Petroleum Fund. The Petroleum Fund is held in the Central Bank of Timor-Leste, administered by Ministry of Finance. All petroleum income initially enters the Fund before any transfers are made to the State Budget. The amount of the transfer to the State Budget is guided by Estimated Sustainable Income (ESI), set at 3% of total petroleum wealth. The rationale behind using the ESI is to regulate spending of temporarily high petroleum income, shield against the volatility of petroleum inflows, and safeguard a sustainable use of public finances. The Petroleum Fund has increased considerably since it was established in 2005. During 2013, petroleum revenues and net investment return added $3,042million and $865million to the Fund, respectively, while withdrawals subtracted $730million. These, however, are believed to be peak figures. Analysis factoring in falling oil production, and changes in the global oil market prices, indicate that the Petroleum Fund may be exhausted by as early as 2024[54]. The current means of financing the State Budget is therefore not sustainable; Ministries must identify additional revenue streams to support planned activities.

156. The tourism sector in Timor-Leste is one with great economic promise. By 2030, the GoTL seeks to have a well-developed tourism industry attracting a large number of international visitors – contributing substantially to national and local community income, creating jobs throughout the country[55]. The tourism industry is currently in its early stage of development. As part of the Coral Triangle, however, Timor-Leste has potential to develop a niche market in the area of eco- and marine tourism. The Coral Triangle is a global center of marine biodiversity. It is home to 75% of all known coral species, more than 3,000 species of reef fish, six of the seven turtle species, whale sharks, manta rays and a diversity of marine mammals such as 22 species of dolphin, and a variety of whale species[56].

157. Rehabilitation of mangrove areas directly benefits coral reefs, and thus this nascent tourism sector. Coastal wetlands, especially mangroves, supply energy and nutrients to coral reefs and maintain fisheries by providing nursing and breeding habitat. Further, mangroves buffer marine ecosystems from terrestrial sedimentation and pollutants[57]. There are unexplored opportunities to link tourism revenue to mangrove rehabilitation and preservation efforts for long term sustainability.

[54] http://www.laohamutuk.org/Oil/PetFund/05PFIndex.htm (Accessed 8 June 2015)
[55] Timor-Leste Strategic Development Plan 2011-2030 (RDTL, 2010)
[56] Mangrove Ecosystems Strategy, Design and Recommendations for Building shoreline resilience of Timor-Leste to protect local communities and their livelihoods (K. Edyvane, 2015)
[57] Mangrove Ecosystems Strategy, Design and Recommendations for Building shoreline resilience of Timor-Leste to protect local communities and their livelihoods (K. Edyvane, 2015)

158. Given the wide array of benefits provided by mangroves, there is great potential to identify revenue streams based on economic valuation, to support the long term sustainability of protection and re-afforestation efforts.

With LDCF Intervention (adaptation alternative)

159. Improved watershed management upstream, reforestation and restoration of degraded lands, is needed to reduce excessive sediment loads to downstream coastal waterways, and areas that cause siltation of natural pond, mud-marsh and wetland systems, as well as in some places contributing to coastal accretion. Therefore, comprehensive plans for the restoration and protection of such natural systems within a broader landscape are essential for coastal resilience. Mangrove and wetland protection and restoration needs to be addressed from the national level through to community level and livelihood practices. Improved watershed management upstream, reforestation and restoration of degraded lands will reduce excessive sediment loads to downstream coastal waterways and areas that cause siltation of natural pond, mud marsh and wetland systems and in some places contribute to coastal accretion. Moreover, coastal natural ponds, wetlands and marches act as important storm and flood water storage facilities. They also buffer seawater intrusion into the aquifers.

160. Aquifers themselves protect against salt water intrusion provided that water tables are kept at appropriate levels. Therefore, plans for the restoration and protection of such natural systems within a broader landscape are essential for coastal resilience. LDCF resources will be used by MAF, MPW and MCIE to work together to outline coastal land use strategies and plans that are consistent with the restoration and protection of these natural systems that provide unique coastal protection services to the economic assets and coastal communities. In addition to groundwater salinity monitoring, LDCF resources will be used to design management and recharge scheme with accompanying monitoring procedures. Small scale micro-watershed and natural pond/wetland restoration measures with the engagement of local district / sub-district authorities and residing communities will be implemented. Liquiça and Metinaro provide a unique combination of mangrove and wetland systems that the project may focus for the on-the-ground actions under this outcome.

161. Through inclusion of project interventions into suco development plans (Outcome 2), LDCF resources will be used to ensure that public resources are secured for restoration and protection of coastal habitats that deliver essential services. The project will go further to identify other financial mechanisms will follow the principles of payment for ecosystem services (PES) and will be devised based on a thorough review of existing good practices worldwide that can be effectively customized to the country-specific context as well as contextual information from target areas in Timor-Leste.

162. An economic valuation conducted as part of PPG activities, estimated the total economic value of mangrove in Timor-Leste to be approximately US$55.1million[58]. Mangroves are used directly and indirectly by economic agents and the benefits are realized in various spatial contexts. The estimated value excludes other uses such as protective functions, regulation of sedimentation loads, breaking down and absorbing harmful materials and the non-use values. The direct and indirect use value constitutes an equal proportion to the economic value of the mangroves. The valuation is meant to provide an indication upon which to begin work related to PES.

163. The NBSAP sets a 2020 target to mobilize of financial resources for effectively implementing the SDP. Potential avenues identified include:

- Encourage and engage the major sources of fund support such as the government (oil and gas fund sources) and the private sector to invest in infrastructure services such as transportation and ecotourism activities
- Eco-tourism development/gate revenue
- Nature conservation tax
- Ecological service provider (water user tax)
- Catalyzing financing from private enterprise, developers and international donors

[58] Mangrove Economic Valuation and Payment for Economic Services Report (S. Masike, 2015)

164. Project activities will build on the above, while also exploring other innovative financial mechanisms, especially with links to infrastructure development and the private sector. A PES rapid assessment conducted during the PPG phase of the project further indicated several areas which should be explored as potential revenue streams, specifically carbon credit markets[59], tourism level and fishery levy (please see Annex G.3).
The below description of outputs and indicative activities provides further detail.

Outputs and Indicative Activities

Output 3.1. Upstream watershed replantation demonstrate risk reduction, (including reduction of excessive sediment loads) to downstream coastal waterways and areas

3.1.1. Upscaling of successful reforestation efforts with diversity of tree species, promoting agroforestry
3.1.2. Rehabilitation and protective measures of wetland and estuary areas;
3.1.3. Land works such as contour/swale building and small scale bio-engineering for reducing runoff and soil loss and providing enhanced water-access for agricultural and agro-forestry use, as well as for infiltration to restore springs and aquifers.
3.1.4. Securing steep slopes with 'pioneer' deep root vegetation (e.g. grasses such as vetiver), to support the establishment of slower-growing agro-forestry species, using integrated land management-approaches.
3.1.5. Knowledge sharing/awareness raising activities targeted at various age groups, these will include:
- promotion of nature-based risk reduction practices in communities
- support in integrating ecosystem services and adaptation into school/university curriculum
- events for children and youth linked to legislated adaptation practice-learning (e.g. involvement in coastal mapping exercises of Outcome 2)
- children's book and video in Tetum, Portuguese and English on interconnectedness of watershed ecosystems and coastal processes

Output 3.2. Coastal wetland restoration and groundwater recharge plans developed and initiated to increase storm water absorption capacity and buffer seawater intrusion

3.2.1. Train-the-trainers programme on use of water level meters (e.g. electric tape method, as the technology is available in Timor-Leste)
3.2.2. Monitor groundwater levels 3-4 times over span of a year to assess groundwater quantity and quality across seasons
3.2.3. Identify challenges prohibiting effective recharge
3.2.4. Draft plan with proposed interventions and costs
3.2.5. Restoration of water soil filtration to replenish aquifers and springs
3.2.6. Promotion of rainwater harvesting measures to relieve water table pressures through reduced reliance of increasing groundwater infrastructure (e.g. groundwater wells)
3.2.7. Introduction of ecological and water-health monitoring activities to school curricula (to promote and engage youth in watershed and shoreline processes; and as a tool for engaging the broader community – e.g. children bringing home the messaging to their families)
3.2.8. A number of behaviour change and educational activities on mangrove and wetland restoration targeted to school children as a means of also engaging the broader community in restoration and monitoring activities, and home-water collection (rainwater harvesting techniques)

Output 3.3. Based on economic valuation study of ecosystem services, infrastructure offset for coastal protection scheme (and other financial mechanisms, such as payment for ecosystem services - PES) devised to secure financial resources for coastal resilience

[59] It is estimated that the --average annual carbon sequestration rate for mangroves averages between 6 to 8 Mg CO_2e/ha (tons of CO_2 equivalent per hectare). These rates are about two to four times greater than global rates observed in mature tropical forests. http://thebluecarboninitiative.org/category/about/blue-carbon/

3.3.1 Identify budgetary needs for coastal ecosystems monitoring and protection

3.3.2 Conduct market research to gauge willingness-to-pay (WTP) for building on the potential revenue sources identified in the NBSAP and PPG PES assessment. Additional indicative activities based on selected revenue streams, particularly for carbon credit markets, tourism levy and fish levy, can be found in Annex G.3.

3.3.3 Develop a financing plan, based on budgetary needs, results of the above market research and a review of best practices and lessons learned from similar efforts in other countries and regions

3.3.4 Support MAF in formalizing public-private partnerships with identified partners to improve the financial sustainability of conservation and protection efforts

2.5. Key indicators, Risks and Assumptions

2.5.1. Key Indicators

165. The outcome indicators (Table 7) are designed to measure changes in the coverage, impact, sustainability and replicability of the project outcomes. Please see Section 3. Project Results Framework, for additional details.

Table 7: **Objective and Outcome Indicators, Time Scale and Measurement**

Key Indicators	End of Project Targets
Project Objective To strengthen resilience of coastal communities by the introduction of nature-based approaches to coastal protection	
Regional, national and sector-wide policies, plans and processes developed and strengthened to identify, prioritize and integrate adaptation strategies and measures. (LDCF Indicator 12)	Coastal protection and resilience strategy for infrastructure planning endorsed benefitting coastal communities (40% of the total population or 400,000 people)
Outcome 1 Policy framework and institutional capacity for climate resilient coastal management established	
SOP for directorates under MAF, developed and approved	SOP for coordinated approach to protect mangrove areas designed and successfully tested
Number of people/ geographical area with access to improved climate information services (LDCF Indicator 7)	26,000 people, total population at indicative project sites (per 2010 Census)
Outcome 2 Mangrove-supportive livelihoods established to incentivize mangrove rehabilitation and protection	
Type and extent of assets strengthened and/or better managed to withstand the effects of climate change (UNDAF Indicator 3.2.3, LDCF Indicator 2) Population benefiting from the adoption of diversified, climate-resilient livelihood options (LDCF Indicator 3) % change in household income in select communities (data disaggregated by gender)	2,300ha (23 sq km) protected or re-afforested using CBEMR 1,000 households benefiting from mangrove-supportive livelihoods (30% of support will target women specifically) Positive % change in household income, specifically in households where women are engaged in mangrove-supportive livelihoods supported by the project
Outcome 3 Integrated approaches to coastal adaptation adopted to contribute to protection of coastal populations and productive lands	
Number of funding mechanisms in support of improved coastal watershed management	At least one financing mechanism or plan with committed resources extending at least 2 years after the project end date

Key Indicators	End of Project Targets
% target population aware of role of mangroves in coastal protection and coastal watershed protection	Print material, videos (TV), community events to raise public awareness about the role of mangroves in coastal ecosystems, reaching especially youth and school-aged population in coastal areas, approximately 250,000 people

2.5.2. Risks

166. Risks and mitigation measures were identified during the inception workshop, as well as through consultations with government, development partners and communities, during the project development phase. Key risks and planned mitigation measures for project implementation include the following:

Table 8: Risks and Mitigation Measures

Risks	Probability and Impact[60]	Mitigation Measures
Coordination among the various directorates at the concerned ministries will remain limited and preclude an agreement over a consensus-based, multi-sectoral and integrated coastal management and adaptation plan.	P:3 I:4	The stakeholder involvement plan will ensure consultations with the inter-ministerial steering committee for Land Use Planning, as well as other relevant technical working groups. This will not only ensure the input and consensus is sought from various sectors, but also, will give the project and its objective a high level of visibility in planning processes.
Ineffective coordination among the various MAF directorates, result in policies and plans which inadvertently impact the mangrove rehabilitation targets.	P:2 I:4	A technical working group will be established and an SOP developed for directorates under MAF, detailing roles, responsibilities and a monitoring framework.
Coastal flood risk not adequately considered in coastal adaptation plan because tidal gauge information not captured and applied. Mangrove protection and re-afforestation efforts result in low survival rates because tidal data is not appropriately considered.	P:1 I:4	Tidal gauges will be installed, monitored and maintained with project resources during the project duration. Information collected during this time will inform all LDCF project activities. Training will be provided to government staff and to communities to monitor, record and report data.
Mangrove protection and re-afforestation efforts result in low survival rates.	P:2 I:4	The LDCF project will employ international best EMR best practices, with community engagement to reduce related pressures on mangrove forests.
Communities are reluctant to adopt new land use practices and mangrove-supportive livelihood options due to, perceived risks to their income stability, and uncertainties over the market demand, and continue with activities which degrade mangrove areas.	P:3 I:4	Community consultations, robust economic analysis will precede introduction of alternative livelihood options. Training will be provided to communities to making the link between protection of ecosystems and economic/social value.
Rehabilitated mangrove areas are eventually degraded after the project close.	P:3 I:4	Guidelines on mangrove rehabilitation will be developed to inform appropriate species selection and technique. Innovative financial mechanism for long term maintenance of mangrove forests. This will be accompanied by financial analysis skill for

[60] Impact and Probability Scale, 1-5 (from very low to very high)

Risks	Probability and Impact[60]	Mitigation Measures
		government staff for cost efficient planning and securing of financial resources.
Protection and re-afforestation efforts result in increases in the crocodile population.	P:2 I:2	The project will seek advice and guidance from the Crocodile Task Force to ensure measures are taken to protect coastal communities.
Failure to identify viable revenue streams or secure financing for long term maintenance or mangrove areas	P:3 I:2	The project will build on the work already conducted for the NBSAP, as well as the LDCF PPG stage, to identify potential revenue streams. An expert will be hired to further explore these options. Training on economic analysis will ensure that MAF is able to present the needs and proposed measures for mangrove activities, for public or other sources of funds, in a manner that proves economic value and cost-effectiveness.
Communication materials are not tailored to audiences or delivered in a manner which ensures broad outreach.	P:2 I:3	Communications will target groups with potential for greatest impact, especially coastal communities and youth, with specific consideration for the distribution possibilities which will maximize absorption and reach (i.e. books, events, print material, radio, TV in a language appropriate for the target audience, etc.)

2.5.3. Assumptions

167. The project design is based on the assumptions that the SDP remains in place, as do the relevant laws pertaining to the protection of mangroves. The project also assumes that Tibar Bay Port and Tasi Mane construction projects continue to move forward.

2.6. Cost-effectiveness

168. The greatest cost consideration of the project is the rehabilitation of mangrove areas. The costs to successfully restore both the vegetative cover and ecological functions of a mangrove forest have been reported to range from $225/ha to $216,000/ha. Unpublished data would indicate that the even higher costs, as much as $500,000/ha, has been spent on individual projects[61]. This is due to the extent of degradation to the site and the level of effort needed to rehabilitate the area, as well as repeated interventions resulting from low survival rates.

169. Mangrove rehabilitation in general has a high rate of failure in many countries, citing the same lessons learned from the pilot projects in Timor-Leste (i.e. Haburas). The LDCF project design has been informed by these lessons learned, as well as by international best practices (i.e. CBEMR). In Indonesia, the proven effectiveness of the CBEMR process at small and medium scales has been its ability to resolve both, biophysical and socio-political issues underscoring mangrove forest degradation[62]. Because of its emphasis on natural regeneration, CBEMR activities typically result in high diversity, near-natural ecosystems, with high survival rates. In Viet Nam, EMR techniques improved survival rates from 50% to 80% under government mangrove rehabilitation programmes[63].

[61] Mangrove Restoration - Costs and Benefits of Successful Ecological Restoration (RR Lewis III, 2001)
[62] Mangrove Ecosystems Strategy, Design and Recommendations for Building shoreline resilience of Timor-Leste to protect local communities and their livelihoods (K. Edyvane, 2015)
[63] Conservation and Development of the Kien Giang Biosphere Reserve Project - Restoration of Coastal Mangrove Forest in Viet Nam Study Report, (WT, 2012)

170. Based on initial visits to potential project sites during the PPG stage, mangrove interventions are expected to be of low difficulty, especially on South coast sites where mangrove forests are more robust given the remote location. An average cost of $1,500/ha has been applied for budgeting purposes, which is consistent with cost norms for low difficulty sites.

171. Without lifting the pressures of mangrove loss and degradation, project interventions may be ineffective and short-term. Mangrove-supportive livelihood alternatives will be introduced, to relieve community pressure on mangrove areas. Livelihoods support will be preceded by economic analysis so that only financially sound alternatives are pursued, ensuring both cost-effectiveness, as well as sustainability of mangrove rehabilitation efforts. Furthermore, upland land degradation in broader coastal watersheds causes excess sedimentation, flash floods, prolonged coastal inundation and accretion. These are damaging for mangroves and supporting systems, such as wetlands and marshes. Although the cost of adaptation increases with such integrated approach, a long-term adaptive capacity of the coastal systems will otherwise be undermined.

2.7. Sustainability

172. The LDCF project is aligned with national policies and priorities and considers the ambitions economic development goals of the country. During the PPG phase, an assessment of barriers was conducted and the project designed to specifically address those barriers – to ensure successful achievement of the project objective, as well as sustainability of project interventions.

173. Outcome 1 focuses on enabling policy for coastal adaptation, institutional capacity support, including coordination mechanisms, hardware for data collection, and training for informed and cohesive decision-making related to coastal zones. The coastal management and adaptation plan, the coastal protection and resilient strategy for infrastructure planning, and the MAF SOP, will put in place the necessary frameworks for inter-ministerial and intra-ministerial coordination going forward on planning decisions affecting coastal zones. Improved observation systems and economic analysis training will ensure that decision-making going forward is informed by the climate change risks and vulnerabilities, as well as the economic value of protective services the coastal ecosystems, such as mangrove stands, provide. To ensure that the training material is available beyond the duration of the project, it will be developed into a course for government staff/interested practitioners, to be housed at the UNTL Climate Change and Biodiversity Centre. The LDCF project will also design a course targeted at younger university students (at the bachelor and/or master level) – stimulating interest on the topic for future policy makers.

174. Under Outcome 2, best practices will be applied to mangrove rehabilitation, coupled with SLM interventions to address erosion into coastal areas (Outcome 3), to ensure a high survival rate. By applying the CBEMR approach, communities will be engaged in planting, maintenance and monitoring of rehabilitation sites. This will include training on specific tasks, as well as sensitization regarding the important role of mangroves in coastal protection. Where community livelihood activities are putting pressure on mangrove areas, mangrove-supportive livelihood alternatives will be introduced. By sensitizing communities to these values and introducing livelihood alternatives, the risk of communities returning to practices which degrade mangrove forests will be mitigated to a considerable extent. Integration of mangrove forest maintenance costs into suco development plans will be a means of securing financing from the State budget, for continued maintenance.

175. Outcome 3 land-stabilization efforts through afforestation, agroforestry and bio-engineering methods will greatly contribute to integrity of coastal watersheds and improve a long term adaptive capacity of the natural systems and the population. This Outcome will also identify viable and sustainable funding options and mechanisms for landscape/watershed rehabilitation as to increase functional integrity of the broader coastal watersheds that include headwaters, waterways and all natural systems down towards the coastline. Further, this Outcome includes knowledge sharing/awareness raising activities

targeted at various age groups, including promotion of best practices, integrating ecosystem services into school/university curriculum, and children's books/videos in Tetum, Portuguese and English on the nature-based approaches to climate change risk reduction. By raising public awareness, greater value can be placed on mangroves and destructive activities reduced.

2.8. Replicability

176. Replicability was a key factor in the design of the project. While the groundworks will only be implemented in the priority coastal areas, the monitoring framework is designed to produce evidence of best practices, which can be considered for replication elsewhere. Given the high rate of failure of mangrove rehabilitation efforts, aerial photographs and ground truthing will be undertaken to ensure that mangrove areas are flourishing and that the used rehabilitation techniques are working. Similarly, an experimental design approach is being employed to produce evidence of increases in income as a result of the livelihoods interventions of the project. By comparing income at the start of the project, with income after the introduction of alternative livelihoods, the project can not only assess the success of livelihoods support but also provide assurance to communities based on evidence for further continuity, upscaling and replication, through inclusion in suco development plans.

177. Through the sharing of experiences, the project can also be replicated in other countries and regions, especially LDCs that face similar challenges as Timor-Leste with shoreline resilience. Lessons learned and best practices will be periodically documented through the regular monitoring, evaluation and reporting requirements of project implementation (further detailed in the Monitoring Framework and Evaluation section of this document). These will be disseminated according to UNDP policies, including publicly accessible online tools such as the UNDP Evaluation Resource Centre (http://erc.undp.org) and the UNDP Office of Audit & Investigation website (http://www.undp.org/content/undp/en/home/operations/accountability/audit.html). More frequent updates and communications materials will be shared via UNDP communication channels with national, regional, and global reach; these include UNDP websites, newsletters and press releases, the UNDP Adaptation Learning Mechanism.

2.9. Stakeholder Involvement Plan

178. As the key partner in the project, MAF is involved in every aspect of the project. The below details additional stakeholders, inclusion of MAF is implied throughout.

179. Successful delivery of the products of Outcome 1 will entail extensive consultations and collaboration with various ministries. The coastal management and adaptation plan, each ministry engaged in activities affecting coastal zones will be consulted, namely: MCIE, MPSI, MPW, MSS, MTAC and MoJ. Similarly for the coastal protection and resilience strategy for infrastructure planning, MCIE, MPSI, and MPW will be engaged, as will the steering committee/technical working groups for the Tibar Bay Port and Tasi Mane projects. JICA has been providing support to MPW on land use and will also be consulted. To develop and deliver training, input will be sought from IUCN, UNDP (ECCA), and UNTL. The MAF SOP will require engagement with various directorates under MAF, including NDF, NDPA and NDFA.

180. The steering committees/technical working groups for the Tibar Bay Port and Tasi Mane projects are also stakeholders for Outcome 2 due to the related offsets, as is MPW. For the livelihoods support under Outcome 2, organizations, such as WorldFish and KOICA, are important stakeholders given their ongoing work to support aquaculture in Timor-Leste. In addition, various NGOs are engaged in small-scale livelihoods support in communities. The communities themselves are integral to the success of the project; communities are also direct beneficiaries. Communities of course will be engaged extensively throughout the project.

181. GIZ, Instituto Camões and JICA are supporting SLM and watershed management activities in Timor-Leste, and will be consulted regarding related interventions of Outcome 3. As the project seeks to identify potential revenue streams, MTAC and the tourism sector are critical stakeholders given the potential for tourism in the country.

182. The engagement of communities has been woven throughout the project design, particularly through the CBEMR approach to mangrove rehabilitation, as well as livelihoods support (Outcome 2).

2.10. Compliance with UNDP Safeguards Policies

183. This project has completed the UNDP social and environmental screening procedure (see SESP attached as Annex E). This screening was undertaken to ensure this project complies with UNDP's Social and Environmental Standards.

184. The project will have a number of environmental impacts, which will be managed and impacts limited. During mangrove planting (Outcome 2) and SLM activities (Outcome 3), it may be necessary to undertake earthworks. The earthworks will move sediment that, if not properly contained, may enter the marine environment or waterways. To ensure that the sediment is not mobilized through either wind, or more specifically, through water movement, an erosion control sediment plan will be prepared. The plan will contain aspects including but not limited to the installation of sediment curtains to reduce sediment movement and the covering of sediment where practicable.

185. Sediment movement may also expose acid sulfate soils, specifically within the mangrove areas. Acid sulphate soils and/or potential acid sulphate soils occur in areas of mangrove and are known to occur in large areas of the coastal delta. Deposits of acid sulphate soils are commonly found less than five meters above sea level, particularly in low-lying coastal areas which is where the interventions will occur. Mangroves, salt marshes, floodplains, swamps, wetlands, estuaries and brackish or tidal lakes are ideal areas for acidic sulphate soils formation and therefore there is the potential for it to observe in the project's location. Controls would potentially be required for the management of acid sulphate soils and/or potential acid sulphate soils due to their locations of the projects within mangrove areas. The presence of acid sulphate soils may not be obvious on the soil surface as they are often buried beneath layers of more recently deposited soils and sediments of alluvial or Aeolian origin. These soils contain iron sulphide minerals (predominantly as the mineral pyrite) or their oxidation products. In an undisturbed state below the water table, acid sulphate soils are benign. However if the soils are drained, excavated or exposed to air by a lowering of the water table, the sulphides react with oxygen to form sulphuric acid. The release of this sulphuric acid from the soil can in turn release iron, aluminium and other heavy metals (particularly arsenic) within the soil. Once mobilized, the acid and metals can create a variety of adverse impacts including killing vegetation, seeping into and acidifying groundwater and water bodies, killing fish and other aquatic organisms and degrading concrete and steel structures to the point of failure. Prior to any excavation, sediments will be tested for their presence of acid sulphate soils and/or potential acid sulphate soils. If the analysis proves positive, the sediment can be treated by a range of techniques including but not limited to liming the sediment. Reference will be made to appropriate standards and guidelines. Every effort will be made to ensure there is no direct or residual impact following treatment.

186. Overall, it is expected that the project may have some environmental impacts although these can be mitigated effectively through appropriate management measures. The project will have significant environmental benefits in the short to long term through the improvement of water quality, coastal protection, the absorption of greenhouse gas emissions.

187. To relieve pressure from communities on mangrove areas, Outcome 2 includes the introduction of mangrove-supportive livelihoods. Extensive consultations with communities, including sensitization on the role and economic value of mangroves in coastal ecosystems, as well as economic analysis will precede introduction of any livelihood alternative. In this way, communities will have a say in the most suitable intervention. Economic analysis and financial modelling will both, ensure the livelihood support is viable as a means forward, as well as provide assurance to communities that changing will still enable them to

meet their needs. Through RCTs, the livelihoods support will be assessed periodically to measure the extent to which households are positively benefiting.

3. PROJECT RESULTS FRAMEWORK

This project will contribute to achieving the following Country Programme Outcome as defined in CPAP/CPD or UNDAF:

UNDAF Outcome 1: People of Timor-Leste, especially the most disadvantaged groups, benefit from inclusive and responsive quality health, education and other social services, and are more resilient to disasters and the impacts of climate change.
Sub-Outcome1.4. People of Timor-Leste, particularly those living in rural areas vulnerable to disasters and the impacts of climate change, are more resilient and benefit from improved risk and sustainable environment management

UNDAF Outcome 3: Economic policies and programmes geared towards inclusive, sustainable and equitable growth and decent jobs
Sub-Outcome 3.2. Technical capacity enhanced to develop viable and sustainable agribusiness sub-sectors and value chains promoting local bio-diversity

Country Programme and/or UNDAF Outcome Indicators:
UNDAF 1.4.1. Number of evidence-based climate change risk/vulnerability assessment reports and policy recommendation documents, timely disseminated
UNDAF 3.2.3. Ha of degraded mangrove areas habilitated

Primary applicable UNDP Strategic Plan Outcomes:
Outcome 1: Growth and development are inclusive and sustainable, incorporating productive capacities that create employment and livelihoods for the poor and excluded

Applicable SOF (LDCF) Strategic Objective and Program:
Objective 1: Reduce the vulnerability of people, livelihoods, physical assets and natural systems to the adverse effects of climate change
Objective 2: Strengthen institutional and technical capacities for effective climate change adaptation
Objective 3: Integrate climate change adaptation into relevant policies, plans and associated processes

Applicable LDCF Expected Outcomes:
Outcome 1.1: Vulnerability of physical assets and natural systems reduced
Outcome 1.2: Livelihood and sources of income of vulnerable populations diversified and strengthened
Outcome 2.2: Access to improved climate information and early-warning systems enhanced at regional, national, sub-national and local levels
Outcome 3.2: Policies, plans and associated processes developed and strengthened to identify, prioritize and integrate adaptation strategies and measures

Applicable LDCF Outcome Indicators:
Indicator 2: Type and extent of assets strengthened and/or better managed to withstand the effects of climate change
Indicator 3: Population benefiting from the adoption of diversified, climate-resilient livelihood options
Indicator 7: Number of people/ geographical area with access to improved climate information services
Indicator 12: Regional, national and sector-wide policies, plans and processes developed and strengthened to identify, prioritize and integrate adaptation strategies and measures

	Indicator	Baseline	Targets End of Project	Source of Verification	Risks
Project Objective[64] To strengthen resilience of coastal communities by the introduction of nature-based approaches	Regional, national and sector-wide policies, plans and processes developed and strengthened to identify, prioritize and	This is currently no coastal protection and resilience strategy for infrastructure planning in place.	Coastal protection and resilience strategy for infrastructure planning endorsed benefitting coastal communities (40% of the total	Inter-ministerial meeting minutes	Coordination among the various directorates at the concerned ministries will remain limited and preclude an agreement over a consensus-based, multi-sectoral and integrated coastal management and

[64] Objective (Atlas output) monitored quarterly ERBM and annually in APR/PIR

to coastal protection	integrate adaptation strategies and measures. (LDCF Indicator 12)		population or 400,000 people)		adaptation plan.
Outcome 1[65] Policy framework and institutional capacity for climate resilient coastal management established	SOP for directorates under MAF, developed and approved	Efforts across MAF directorates are not effectively coordinated to ensure the protection and rehabilitation of mangrove areas.	SOP for coordinated approach to protect mangrove areas designed and successfully tested	MAF TWG established MAF TWG meeting minutes Project Reports Independent Evaluations	Ineffective coordination among the various MAF directorates, result in policies and plans which inadvertently impact the mangrove rehabilitation targets.
	Number of people/ geographical area with access to improved climate information services (LDCF Indicator 7)	0 – tidal information not regularly collected to inform coastal planning, including mangrove re-afforestaion efforts	26,000 people, total population at indicative project sites (per 2010 Census)	Regular collection and recording of data Maintenance of equipment Application of data in risk maps for planning purposes	Coastal flood risk not adequately considered in coastal adaptation plan because tidal gauge information not adequately captured and applied. Mangrove protection and re-afforestation efforts result in low survival rates because tidal data is not appropriately considered.
Outcome 2 Mangrove-supportive livelihoods established to incentivize mangrove rehabilitation and protection	Type and extent of assets strengthened and/or better managed to withstand the effects of climate change (UNDAF Indicator 3.2.3, LDCF Indicator 2)	~1,300ha or 13km^2 in Timor-Leste (2005) - these figures will be updated once the 2014 high resolution aerial photographs are analyzed, followed by ground truthing, to calculate more current mangrove coverage, especially in sites selected for project intervention	2,300ha or 23km^2 protected or re-afforested using CBEMR	Ground truthing at the midterm and end of the project to assess actual mangrove coverage. Regular project site visits by project manager and experts.	Mangrove protection and re-afforestation efforts result in low survival rates. Rehabilitated mangrove areas are eventually degraded after the project close. Protection and re-afforestation efforts result in increases in the crocodile population.
	Number of population / households benefiting from the adoption of diversified, climate-resilient livelihood options (LDCF Indicator 3)	0 – project will introduce livelihood options, which contribute to protection and re-afforestation efforts and/or relieve community pressure on mangroves	1,000 households benefiting from mangrove-supportive livelihoods (estimated at 5000 people, 5/household) (30% of support will target women specifically)	Community training, investment in livelihood inputs Surveys Annual Reports. Independent Evaluations	Communities are reluctant to adopt new land use practices and mangrove-supportive livelihood options due to, perceived risks to their income stability, and uncertainties over the market demand, and continue with activities which degrade mangrove areas.

[65] All outcomes monitored annually in the APR/PIR.

	% change in household income, as a result of mangrove-supportive livelihoods activities implemented by the project	Baseline study to be conducted at start of project to assess current household income levels (see Annex H – Randomized Control Trials)	Positive % change in household income, specifically in households where women are engaged in mangrove-supportive livelihoods supported by the project (see Annex H – Randomized Control Trials)	Survey data (see Annex H)	Communities are reluctant to adopt new land use practices and mangrove-supportive livelihood options due to, perceived risks to their income stability, and uncertainties over the market demand, and continue with activities which degrade mangrove areas.
Outcome 3 Integrated approaches to coastal adaptation adopted to contribute to protection of coastal populations and productive lands	Number of funding mechanisms in support of improved coastal watershed management	Potential revenue streams identified in NBSAP, as well as PPG assessment, but not yet explored or tested.	At least one financing mechanism or plan with committed resources extending at least 2 years after the project end date	Budget detailing costs of mangrove protection, re-afforestation priorities, going forward (beyond the scope of the project. Funds (public and other) earmarked for mangrove and watershed protection activities.	Failure to identify viable revenue streams or secure funding for long term maintenance of mangrove areas and coastal watershed management.
	% target population aware of role of mangroves in coastal protection and coastal watershed protection	There is little-to-no educational or public awareness material, especially targeted at youth, about the role of mangroves in coastal ecosystems.	Approximately 250,000 people area reached through various public awareness raising means	Print material, videos (TV), community events to raise public awareness about the role of mangroves and broader watersheds in coastal protection, reaching especially youth and school-aged population in coastal areas Surveys and community interviews on behavioural change. Annual Reports Independent Evaluations	Communication materials are not tailored to audiences or delivered in method appropriate to ensure outreach.

4. TOTAL BUDGET AND WORKPLAN

Award ID:	00092621	**Project ID(s):**	00097253
Award Title:	Timor-Leste: Building shoreline resilience of Timor-Leste to protect local communities and their livelihoods		
Business Unit:	TLS10		
Project Title:	Timor-Leste: Building shoreline resilience of Timor-Leste to protect local communities and their livelihoods		
PIMS Number:	5330		
Implementing Partner (Executing Agency)	UNDP		

SOF (e.g. GEF) Outcome/Atlas Activity	Responsible Party/ Implementing Agent	Fund ID	Donor Name	Atlas Budgetary Account Code	ATLAS Budget Description	Amount Year 1 (USD)	Amount Year 2 (USD)	Amount Year 3 (USD)	Amount Year 4 (USD)	Total (USD)	See Budget Note:
Outcome 1: Policy framework and institutional capacity for climate resilient coastal management established	**UNDP**	**62160**	**LDCF**	72100	Contractual Services – Companies	75,000	125,000	0	0	200,000	a
				71200	International Consultants	20,000	30,000	0	0	50,000	b
				71300	Local Consultants	10,000	20,000	0	0	30,000	b
				72100	Contractual Services – Companies	30,000	5,000	5,000	5,000	45,000	c
				75700	Workshop	15,000	20,000	20,000	20,000	75,000	d
				72100	Contractual Services – Companies	0	0	100,000	0	100,000	e
				61300	Salary Costs – IP Staff	40,000	40,000	40,000	40,000	160,000	f
				71200	International Consultants	0	40,000	0	0	40,000	g
				Total Outcome 1		**190,000**	**280,000**	**165,000**	**65,000**	**700,000**	
Outcome 2: Mangrove-supportive livelihoods established to incentivize mangrove rehabilitation and protection	**UNDP**	**62160**	**LDCF**	71200	International Consultants	0	200,000	0	0	200,000	h
				75700	Workshop	70,000	50,000	0	0	120,000	i
				71200	International Consultants	50,000	20,000	0	0	70,000	j
				72100	Contractual Services – Companies	50,000	600,000	600,000	80,000	1,330,000	k

				72100	Contractual Services – Companies	100,000	500,000	500,000	100,000	1,200,000	l
				71200	International Consultant	20,000	20,000	0	0	40,000	m
				71200	International Consultant	50,000	20,000	0	0	70,000	n
				71200	International Consultant	20,000	0	10,000	20,000	50,000	o
				71300	Local Consultants	30,000	0	0	30,000	60,000	p
				72100	Contractual Services – Companies	0	0	50,000	50,000	100,000	q
				74200	Audio Visual&Print Prod Costs	50,000	50,000	50,000	50,000	200,000	r
				74200	Audio Visual&Print Prod Costs	20,000	20,000	20,000	20,000	80,000	s
				72200	Equipment and Furniture	77,500	2,500	2,500	2,500	85,000	t
				75700	Workshop	10,000	0	0	0	10,000	u
				61300	Salary Costs – IP Staff	70,000	70,000	70,000	70,000	280,000	f
				74100	Professional Services	15,000	15,000	15,000	15,000	60,000	v
				71200	International Consultant	0	0	0	45,000	45,000	w
				Total Outcome 2		**632,500**	**1,567,500**	**1,317,500**	**482,500**	**4,000,000**	
Outcome 3: Integrated approaches to coastal adaptation adopted to contribute to coastal populations and productive lands	**UNDP**	**62160**	**LDCF**	71200	International Consultants	0	25,000	25,000	0	50,000	x
				61200	Salary Costs – GS Staff	30,000	30,000	30,000	30,000	120,000	y
				72100	Contractual Services – Companies	30,000	40,000	40,000	40,000	150,000	z
				71200	International Consultant	0	60,000	0	0	60,000	aa
				72100	Contractual Services – Companies	40,000	190,000	180,000	0	410,000	bb
				72100	Contractual Services – Companies	0	150,000	150,000	0	300,000	cc
				71200	International Consultants	0	0	30,000	30,000	60,000	dd

				74200	Audio Visual&Print Prod Costs	20,000	50,000	60,000	29,000	159,000	r
				71300	Local Consultants	90,000	90,000	90,000	90,000	360,000	ee
				61300	Salary Costs – IP Staff	75,000	75,000	75,000	75,000	300,000	f
				Total Outcome 3		**285,000**	**710,000**	**680,000**	**294,000**	**1,969,000**	
Project Management Unit	**UNDP**	**62160**	**LDCF**	61300	Salary Costs – IP Staff	15,000	15,000	15,000	15,000	60,000	f
				71600	Travel	16,540	16,540	16,540	16,540	66,160	ff
				73100	Rental and maintenance-premise	26,540	26,540	26,540	26,540	106,160	gg
				72800	Information Tech Equipment	19,540	14,540	14,540	14,540	63,160	hh
				74500	UNDP Cost Recovery	7,760	10,000	10,000	7,760	35,520	ii
				Total Management		**85,380**	**82,620**	**82,620**	**80,380**	**331,000**	
					PROJECT TOTAL	**1,192,880**	**2,640,120**	**2,245,120**	**921,880**	**7,000,000**	

Table 9: Summary of Funds[66]

	Amount Year 1	**Amount Year 2**	**Amount Year 3**	**Amount Year 4**	**Total**
LDCF	1,192,880	2,640,120	2,245,120	921,880	7,000,000
MAF	6,000,000	6,000,000	6,000,000	0	18,000,000
KOICA	3,000,000	3,000,000	0	0	6,000,000
WordFish	2,029,902	1,591,500	841,500	841,500	5,304,402
GIZ	780,000	780,000	780,000	0	2,340,000
TOTAL	**13,002,782**	**14,011,620**	**9,866,620**	**1,763,380**	**38,644,402**

[66] Summary table should include all financing of all kinds: GEF financing, co-financing, cash, in-kind, etc.

Budget Note	Description of Cost Item
General	For budgeting purposes, distinctions are made between international and national consultants. When capacity is available locally, preference will be for local consultants.
a	Coastal vulnerability assessment estimated at $200,000
b	International and local consultants to support development of coastal management and adaptation plan, MAF SOPs, and coastal resilience strategy. Costs estimated as $500/day for international and $300/day for local consultants for 100 days
c	Monitoring equipment (e.g. wave gauges $4,000/each, hydrological station $15,000/each), plus operations, maintenance and related training
d	Training and sensitization workshops for government staff on coastal management
e	Course design, and establishment of course in local university (UNTL), cost estimated at $100,000
f	CTA/Project Manager, costs split across outcomes. UNDP Proforma $200,000/year (P3). As the project is DIM, the budget code used is a UNDP staff code.
g	Midterm evaluation estimated at $40,000
h	Coastal mapping and ground truthing estimated at $200,000
i	Training-of-trainers for extension officers on coastal mapping and monitoring, roll out of related training to communities
j	International expert on mangroves and coastal ecosystems to draft guidelines on mangrove rehabilitation in Timor-Leste, estimated at $650/day 100 days plus travel
k	Mangrove rehabilitation using CBEMR, 1000ha. Cost estimates approx. $1330/ha to account for varying states of degradation and necessary rehabilitation, as well as necessary training for communities.
l	Livelihoods support to communities, including training and initial investments. Consultations with communities will define best approach. In cases where selected livelihood requires longer term expert guidance, such as aquaculture, the project may engage relevant institution such as WorldFish through an LoA.
m	Gender Specialist estimated at 90 days @ $400/day, plus travel
n	Economist to conduct analysis and financial modelling of livelihood options to inform decision-making, estimated @ $600/day, 100 days plus travel.
o	RCT economist to design survey instrument and conduct analysis on survey results estimated @ $400/day, 100 days plus travel.
p	Local consultants, local travel and DSA for enumerators to collect RCT data. To engage UNTL students to the extent possible under the guidance of the RCT economist, as part of youth participation in the project.
q	Course design and establish the course at UNTL, estimate cost $100,000.
r	Public awareness is a critical part of the project, a total of 5% of the total budget has been allocated for this purposes in Outcomes 2 and 3. This will include community awareness raising consultations and events, print material and videos (e.g. for schools and TV) for different age groups, and other creative means identified during project implementation.
s	Translation costs
t	Project vehicle and related maintenance expenses.
u	Inception workshop.
v	Audit costs, $15,000/year.
w	Final evaluation.
x	Innovative Finance Specialist, estimated at $500/day.

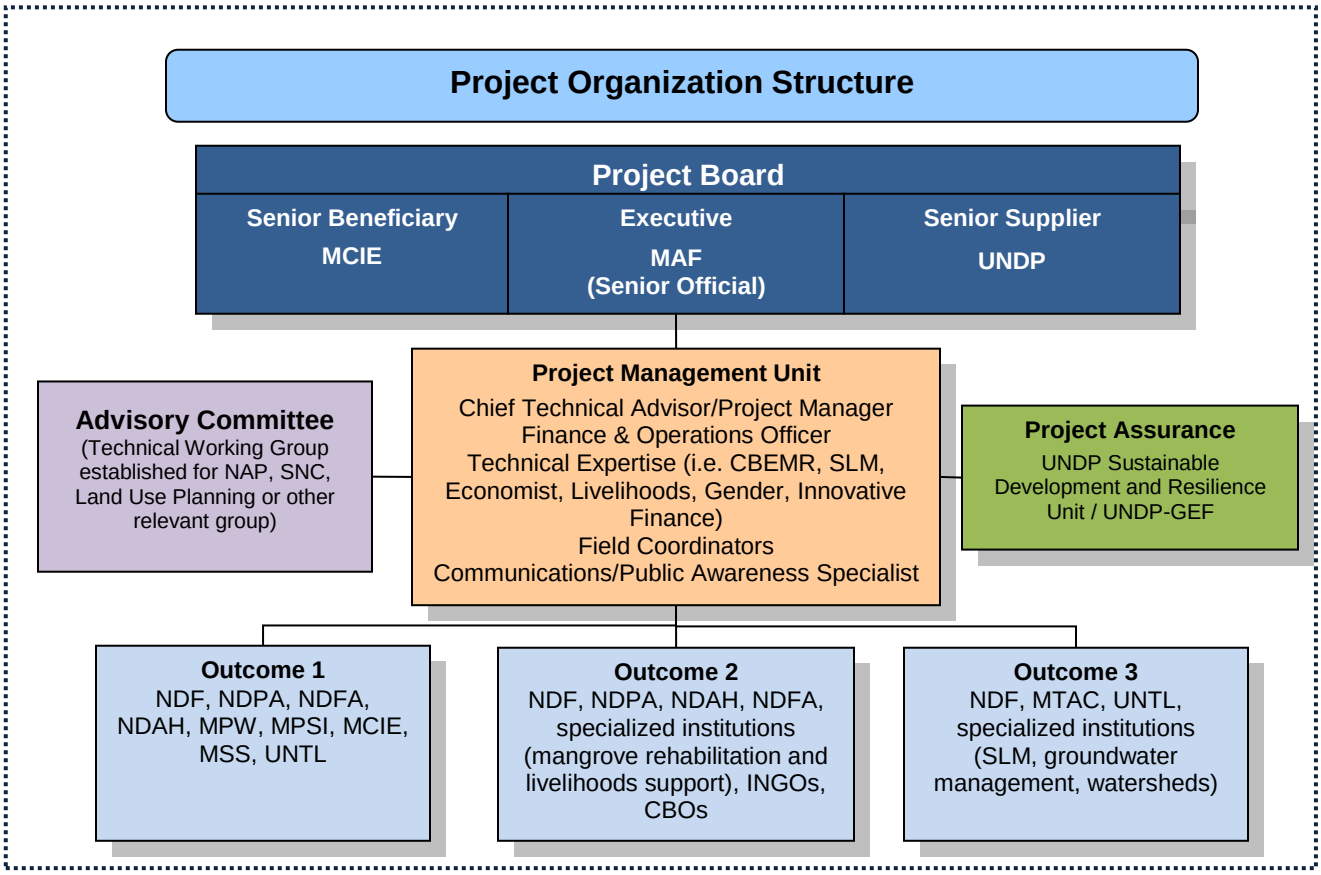
y	Finance Assistant, G7 level, $30,000/year.
z	Water monitoring equipment, training and regular monitoring. While it is budgeted under contractual services, it is likely that extension officers will likely do the regular monitoring.
aa	International consultant to conduct ground water recharge assessment and design plan. $600/day, 100 days. A team of intl and natl may be deemed more appropriate during project implementation.
bb	SLM expert and related land works such as contour/swale building, based on expert recommendations and MAF endorsement.
cc	Related to above, small scale reforestation.
dd	International consultant to support integrating ecosystem functions into school curriculum $500/day 50 days, plus travel.
ee	Field coordinators and related travel/DSA. Given that the project will have coverage on both the North and South coasts of the country, the PM will require support in ensuring regularity of visit to sites.
ff	Local travel and DSA for project manager
gg	Office running costs
hh	Computer equipment, software and maintenance
ii	Estimated UNDP Direct Project Costs for project execution services to support the procurement of goods and services, recruitment, payments, etc. The services are charged on an item-by-item basis against UNDP's Universal Price List. The estimated breakdown is described below. • Staff selection and recruitment: 12 @ $1,247.29 = $14,967.48 • Staff HR & Benefits Administration and Management: 12 @ $788.69 = $9,464.28 • Issuance of IDs: 16 @ $63.80 = $1,020.80 • Consultant recruitment: 4 @ $474.51 = $1,898.04 • Payment process associated with consultants: 4 @ $345.12 = $1,380.48 • Low value procurement (PSC meeting): 8 @ 410.11 = $3,280.88 • High value procurement and disposal of equipment process: 3 @ 1,166.78 = 3,500.34

5. MANAGEMENT ARRANGEMENTS

(SEE UNDP POPP FOR FURTHER DETAILS)

188. Per agreements between UNDP and the GoTL, Direct Implementation (DIM) will be used for all UNDP programmes in the country. As part of UNDP's institutional capacity development strategy for Timor-Leste, UNDP will, to the extent possible, be employing a National Implementation Modality (NIM) type approach under the overarching DIM management arrangements. This approach will utilize NIM advances, based on capacity assessments MAF, and assurance measures will be undertaken to mitigate capacity gaps. Letters of Agreement will be signed with the relevant government entities, as necessary, to act as "Responsible Parties" under UNDP rules and regulations.

The project operational structure is detailed below.



189. The **Project Board** is responsible for making management decisions for a project in particular when guidance is required by the Project Manager. The Project Board 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. It ensures that required resources are committed and arbitrates on any conflicts within the project or negotiates a solution to any problems with external bodies. In addition, it approves the appointment and responsibilities of the Project Manager and any delegation of its Project Assurance responsibilities. Based on the approved Annual Work Plan, the Project Board can also consider and approve the quarterly plans (if applicable) and also approve any essential deviations from the original plans, provided that any deviation is also approved by Regional Technical Advisor, UNDP-GEF.

190. In order to ensure UNDP's ultimate accountability for the project results, Project Board decisions will be made in accordance to standards that shall ensure management for development results, best value money, fairness, integrity, transparency and effective international competition. In case consensus cannot be reached within the Board, the final decision shall rest with the UNDP Project Manager.

191. Potential members of the Project Board are reviewed and recommended for approval during the PAC meeting. Representatives of other stakeholders can be included in the Board as appropriate. The Board contains three distinct roles, including:

1) **Executive**: individual representing the project ownership to chair the group.
2) **Senior Supplier**: individual or group representing the interests of the parties concerned which provide funding for specific cost sharing projects and/or technical expertise to the project. The Senior Supplier's primary function within the Board is to provide guidance regarding the technical feasibility of the project.
3) **Senior Beneficiary**: individual or group of individuals representing the interests of those who will ultimately benefit from the project. The Senior Beneficiary's primary function within the Board is to ensure the realization of project results from the perspective of project beneficiaries.
4) The **Project Assurance** role supports the Project Board Executive by carrying out objective and independent project oversight and monitoring functions. The Project Manager and Project Assurance roles should never be held by the same individual for the same project.

192. **Project Manager**: The Project Manager has the authority to run the project on a day-to-day basis on behalf of the Implementing Partner within the constraints laid down by the Board. The Project Manager'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.

193. **Project Support**: The Project Support role provides project administration, management and technical support to the Project Manager as required by the needs of the individual project or Project Manager.

194. Project audits are under the mandate of the UNDP Office of Audit and Investigation (OAI). The project audit regime is determined by the implementation modality. Expenditure incurred under the NIM modality may be subject to annual NIM audits, based on pre-determined risk and expenditure thresholds. Expenditure incurred under the DIM modality may be selected for audit by OAI based on annual risk assessments following UNDP audit policies. The cost of audits will be included within the project budget.

6. MONITORING FRAMEWORK AND EVALUATION

The project will be monitored through the following M&E activities. The M&E budget is provided in the table below.

Project Start

195. A Project Inception Workshop will be held within the first 2 months of project start with those with assigned roles in the project organization structure, UNDP country office and where appropriate/feasible regional technical policy and programme advisors as well as other stakeholders. The Inception Workshop is crucial to building ownership for the project results and to plan the first year annual work plan.

196. The Inception Workshop should address a number of key issues including:

- Assist all partners to fully understand and take ownership of the project. Detail the roles, support services and complementary responsibilities of UNDP CO and RCU staff vis-à-vis the project team. Discuss the roles, functions, and responsibilities within the project's decision-making structures, including reporting and communication lines, and conflict resolution mechanisms. The Terms of Reference (Annex F) for project staff will be discussed again as needed.
- Based on the project results framework and the relevant GEF Tracking Tool if appropriate, finalize the first annual work plan. Review and agree on the indicators, targets and their means of verification, and recheck assumptions and risks.
- Provide a detailed overview of reporting, monitoring and evaluation (M&E) requirements. The Monitoring and Evaluation work plan and budget should be agreed and scheduled.
- Discuss financial reporting procedures and obligations, and arrangements for annual audit.
- Plan and schedule Project Board meetings. Roles and responsibilities of all project organisation structures should be clarified and meetings planned. The first Project Board meeting should be held within the first 12 months following the inception workshop.

197. An Inception Workshop report is a key reference document and must be prepared and shared with participants to formalize various agreements and plans decided during the meeting.

198. Quarterly

- Progress made shall be monitored in the UNDP Enhanced Results Based Managment Platform.
- Based on the initial risk analysis submitted, the risk log shall be regularly updated in ATLAS. Risks become critical when the impact and probability are high. Note that for UNDP-GEF projects, all financial risks associated with financial instruments such as revolving funds, microfinance schemes, or capitalization of ESCOs are automatically classified as critical on the basis of their innovative nature (high impact and uncertainty due to no previous experience justifies classification as critical).
- Based on the information recorded in Atlas, a Project Progress Reports (PPR) can be generated in the Executive Snapshot.
- Other ATLAS logs can be used to monitor issues, lessons learned etc. The use of these functions is a key indicator in the UNDP Executive Balanced Scorecard.

Annually

199. Annual Project Review/Project Implementation Reports (APR/PIR): This key report is prepared to monitor progress made since project start and in particular for the previous reporting period (30 June to 1 July). The APR/PIR combines both UNDP and GEF reporting requirements.

200. The APR/PIR includes, but is not limited to, reporting on the following:

- Progress made toward project objective and project outcomes - each with indicators, baseline data and end-of-project targets (cumulative)
- Project outputs delivered per project outcome (annual).
- Lesson learned/good practice.
- AWP and other expenditure reports

- Risk and adaptive management
- ATLAS QPR
- Portfolio level indicators (i.e. GEF focal area tracking tools) are used by most focal areas on an annual basis as well.

Periodic Monitoring through Surveys and Site Visits

201. Surveys, as part of the RCTs (further described in Annex H), will collect data from households both receiving and not receiving livelihoods support from the project - to assess the success of livelihoods support provided by the project, and efforts to reduce community pressure on mangroves. Data will be disaggregated by gender and will detail age, and will thus be an important tool for identifying any gaps and challenges faced by women, youth and young adults, in the application of introduced livelihoods support and related training. Such information would lead to the refinement of project activities as necessary. To the extent possible, data will be collected at 3 intervals of project implementation:

- Baseline survey to capture basic characteristics before randomly administered alternative livelihoods support
- Mid-line survey (optional) to record characteristics and outcomes of interest – helps to capture dynamics
- End-line survey to record characteristics and outcomes of interest

202. UNDP CO and the UNDP RCU will conduct visits to project sites based on the agreed schedule in the project's Inception Report/Annual Work Plan to assess first hand project progress. Other members of the Project Board may also join these visits. A Field Visit Report/BTOR will be prepared by the CO and UNDP RCU and will be circulated no less than one month after the visit to the project team and Project Board members.

Mid-term of Project Cycle

203. The project will undergo an independent Mid-Term Evaluation at the mid-point of project implementation. The Mid-Term Evaluation 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. Findings of this review will be incorporated as recommendations for enhanced implementation during the final half of the project's term. The organization, terms of reference and timing of the mid-term evaluation will be decided after consultation between the parties to the project document. The Terms of Reference for this Mid-term evaluation will be prepared by the UNDP CO based on guidance from the Regional Coordinating Unit. The management response and the evaluation will be uploaded to UNDP corporate systems, in particular the UNDP Evaluation Office Evaluation Resource Center (ERC).

204. The relevant GEF Focal Area Tracking Tools will also be completed during the mid-term evaluation cycle.

End of Project Cycle

205. An independent Final Terminal Evaluation will take place three months prior to the final Project Board meeting and will be undertaken in accordance with UNDP and GEF guidance. 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 took 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. The Terms of Reference for this evaluation will be prepared by the UNDP CO based on guidance from the Regional Coordinating Unit.

206. The Final Terminal Evaluation should also provide recommendations for follow-up activities and requires a management response which should be uploaded to PIMS and to the UNDP Evaluation Office Evaluation Resource Center (ERC).

207. The relevant GEF Focal Area Tracking Tools will also be completed during the final evaluation.

208. During the last three months, the project team will prepare the Project Terminal Report. This comprehensive report will summarize the results achieved (objectives, outcomes, outputs), lessons learned, problems met and areas where results may not have been achieved. It will also lay out recommendations for any further steps that may need to be taken to ensure sustainability and replicability of the project's results.

Learning and Knowledge Sharing

209. Results from the project will be disseminated within and beyond the project intervention zone through existing information sharing networks and forums. The project will identify and participate, as relevant and appropriate, in scientific, policy-based and/or any other networks, which may be of benefit to project implementation though lessons learned. The project will identify, analyze, and share lessons learned that might be beneficial in the design and implementation of similar future projects. Finally, there will be a two-way flow of information between this project and other projects of a similar focus.

Communications and Visibility Requirements

210. Full compliance is required with UNDP's Branding Guidelines. These can be accessed at http://intra.undp.org/coa/branding.shtml, and specific guidelines on UNDP logo use can be accessed at: http://intra.undp.org/branding/useOfLogo.html. Amongst other things, these guidelines describe when and how the UNDP logo needs to be used, as well as how the logos of donors to UNDP projects needs to be used. For the avoidance of any doubt, when logo use is required, the UNDP logo needs to be used alongside the GEF logo. The GEF logo can be accessed at: http://www.thegef.org/gef/GEF_logo. The UNDP logo can be accessed at http://intra.undp.org/coa/branding.shtml.

211. Full compliance is also required with the GEF's Communication and Visibility Guidelines (the "GEF Guidelines"). The GEF Guidelines can be accessed at: http://www.thegef.org/gef/sites/thegef.org/files/documents/C.40.08_Branding_the_GEF%20final_0.pdf. Amongst other things, the GEF Guidelines describe when and how the GEF logo needs to be used in project publications, vehicles, supplies and other project equipment. The GEF Guidelines also describe other GEF promotional requirements regarding press releases, press conferences, press visits, visits by Government officials, productions and other promotional items.

212. Where other agencies and project partners have provided support through co-financing, their branding policies and requirements should be similarly applied.

Table 9: M&E Workplan and Budget

Type of M&E Activity	Responsible Parties	Budget US$ *Excluding project team staff time*	Time Frame
Inception Workshop and Report	▪ Project Manager ▪ UNDP CO, UNDP CCA	Indicative cost: $10,000	Within first two months of project start up
Measurement of Means of Verification of project results.	▪ UNDP CCA RTA/Project Manager will oversee the hiring of specific studies and institutions, and delegate responsibilities to relevant team members.	To be finalized in Inception Phase and Workshop.	Start, mid and end of project (during evaluation cycle) and annually when required.
Measurement of Means of Verification for Project Progress on *output and implementation*	▪ Oversight by Project Manager ▪ Project team	To be determined as part of the Annual Work Plan's preparation.	Annually prior to ARR/PIR and to the definition of annual work plans
ARR/PIR	▪ Project manager and team ▪ UNDP CO ▪ UNDP RTA ▪ UNDP EEG	None	Annually
Periodic status/ progress	▪ Project manager and team	None	Quarterly

Type of M&E Activity	Responsible Parties	Budget US$ *Excluding project team staff time*	Time Frame
reports			
Randomized Control Trials (RCTs)[67]	▪ Oversight by Project manager in consultation with MAF	To be determined as part of the Annual Work Plan's preparation Indicative cost: $20,000/survey (total $60,000)	At start, midterm and end of project
Mid-term Evaluation	▪ Project manager and team ▪ UNDP CO ▪ UNDP RCU ▪ External Consultants (i.e. evaluation team)	Indicative cost: $40,000	At the mid-point of project implementation.
Final Evaluation	▪ Project manager and team, ▪ UNDP CO ▪ UNDP RCU ▪ External Consultants (i.e. evaluation team)	Indicative cost : $45,000	At least three months before the end of project implementation
Project Terminal Report	▪ Project manager and team ▪ UNDP CO ▪ local consultant	None	At least three months before the end of the project
Audit	▪ UNDP CO ▪ Project manager and team	Indicative cost per year: $15,000 ($60,000 total)	Following DIM guidelines and procedures (budgeted annually)
Visits to field sites	▪ UNDP CO ▪ UNDP RCU (as appropriate) ▪ Government representatives	For GEF supported projects, paid from IA fees and operational budget	Yearly
Total Indicative Cost Excluding project team staff time and UNDP staff and travel expenses		**US$ 215,000** (upto 5% of total budget)	

[67] Please see Annex F for more details

7. LEGAL CONTEXT

213. This document together with the CPAP signed by the Government and UNDP which is incorporated by reference constitute together a Project Document as referred to in the SBAA [or other appropriate governing agreement] and all CPAP provisions apply to this document.

214. Consistent with the Article III of the Standard Basic Assistance Agreement, the responsibility for the safety and security of the implementing partner and its personnel and property, and of UNDP's property in the implementing partner's custody, rests with the implementing partner. The implementing partner shall:

a) put in place an appropriate security plan and maintain the security plan, taking into account the security situation in the country where the project is being carried;
b) assume all risks and liabilities related to the implementing partner's security, and the full implementation of the security plan.

215. UNDP reserves the right to verify whether such a plan is in place, and to suggest modifications to the plan when necessary. Failure to maintain and implement an appropriate security plan as required hereunder shall be deemed a breach of this agreement.

216. The implementing partner agrees to undertake all reasonable efforts to ensure that none of the UNDP funds received pursuant to the Project Document are used to provide support to individuals or entities associated with terrorism and that the recipients of any amounts provided by UNDP hereunder do not appear on the list maintained by the Security Council Committee established pursuant to resolution 1267 (1999). The list can be accessed via http://www.un.org/Docs/sc/committees/1267/1267ListEng.htm. This provision must be included in all sub-contracts or sub-agreements entered into under this Project Document.

217. The UNDP Resident Representative or his/her delegate in Timor-Leste authorized to effect in writing the following types of revisions to this Project Document, provided that s/he has verified the agreement thereto by the UNDP Regional Coordinating Unit and is assured that other signatories to the Project Document have no objections to the proposed changes:

- Revision of, or addition to, any of the Annexes to the Project Document;
- Revision which do not involve significant changes in the immediate objectives, outputs or activities of the project, but are caused by the rearrangement of the inputs already agreed to or by cost increases due to inflation;
- Mandatory annual revisions which re-phase the delivery of agreed project inputs or increased expert or other costs due to inflation or take into account agency expenditure flexibility; and
- Inclusion of additional attachments only as set out here in the Project Document

8. ANNEXES

Annex A: OFP Endorsement Letter

REPÚBLICA DEMOCRÁTICA DE TIMOR-LESTE (RDTL)
Ministério do Comércio, Indústria e Ambiente (MCIA)
Secretaria de Estado do Meio-Ambiente (SEMA)
Direitor Geral do Meio Ambiente
Edifício do Fomento, Rua D. Aleixo Corte-Real, Mandarin, Dili.

To : Ms. Mikiko Tanaka, UNDP Country Director

Cc : H.E. Mr. António da Conceição, Minister of Commerce, Industry and Environment
H.E. Mr. Abel da Costa Ximenes, Vice-Minister of Commerce, Industry and Environment
H.E. Mr. Numinando Soares Martins Buras, Secretary of State for Environment

Date : 30 of September 2013

No.Ref. :106/ IX /DGA/09/2013

Subject : **Letter of request for UNDP support in accessing funds under LDCF**

Dear Ms. Mikiko Tanaka,

In my capacity as GEF Operational Focal Point for Timor-Leste and I would like to request the support of UNDP-TL in accessing and programming Least Development Countries Fund (LDCF) resources available for Timor-Leste, in order to implement NAPA follow-up activities corresponding to the NAPA priority 5 on ecosystems that is to "maintain and restore mangrove and forest and promote awareness raising to protect coastal ecosystems from climate change impacts."

In view of our longstanding fruitful collaboration, I believe that UNDP will be able to further assist us in strengthening the resilience of Timor-Leste to climate risks and disasters.

Sincerely,

João Carlos Soares
GEF Operational Focal Point

Annex B: Co-Financing Letters

The co-financing letters are attached as a separate file.

Annex C: Risk Analysis

#	Description	Date Identified	Type[68]	Impact & Probability[69]	Countermeasures / Management Response	Owner	Submitted, Updated By	Last Update	Status
1	Coordination among the various directorates at the concerned ministries will remain limited and preclude an agreement over a consensus-based, multi-sectoral and integrated coastal management and adaptation plan.	PPG	Strategic	P: 3 I: 4	The stakeholder involvement plan will ensure consultations with the inter-ministerial steering committee for Land Use Planning, as well as other relevant technical working groups. This will not only ensure the input and consensus is sought from various sectors, but also, will give the project and its objective a high level of visibility in planning processes.	UNDP	UNDP, MAF	Oct 2015	
2	Ineffective coordination among the various MAF directorates, result in policies and plans which inadvertently impact the mangrove rehabilitation targets.	PPG	Organizational	P: 2 I: 4	A technical working group will be established and an SOP developed for directorates under MAF, detailing roles, responsibilities and a monitoring framework.	UNDP, MAF	UNDP, MAF	Oct 2015	
3	Coastal flood risk not adequately considered in coastal adaptation plan because tidal gauge information not adequately captured and applied. Mangrove protection and re-afforestation efforts result in low survival rates because tidal data is not appropriately	PPG	Operational	P:1 I:4	Tidal gauges will be installed, monitored and maintained with project resources during the project duration. Information collected during this time will inform all LDCF project activities. Training will be provided to government staff and to communities to monitor, record and report data.	UNDP	UNDP	Feb 2016	

[68] Organizational, Financial, Operational, Environmental, Strategic, Regulatory, Security, Political, Other
[69] Impact and Probability Scale, 1-5 (from very low to very high)

#	Description	Date Identified	Type[68]	Impact & Probability[69]	Countermeasures / Management Response	Owner	Submitted, Updated By	Last Update	Status
	considered.								
4	Mangrove protection and re-afforestation efforts result in low survival rates.	PPG	Operational	P: 2 I: 4	The LDCF project will employ international best EMR best practices, with community engagement to reduce related pressures on mangrove forests.	UNDP, MAF	UNDP, MAF	Oct 2015	
5	Communities are reluctant to adopt new land use practices and mangrove-supportive livelihood options due to, perceived risks to their income stability, and uncertainties over the market demand, and continue with activities which degrade mangrove areas.	PPG	Operational	P: 3 I: 4	Community consultations, robust economic analysis will precede introduction of alternative livelihood options. Training will be provided to communities to making the link between protection of ecosystems and economic/social value.	UNDP	UNDP	Oct 2015	
6	Rehabilitated mangrove areas are eventually degraded after the project close.	PPG	Operational	P: 3 I: 4	Guidelines on mangrove rehabilitation will be developed to inform appropriate species selection and technique. Innovative financial mechanism for long term maintenance of mangrove forests. This will be accompanied by financial analysis skill for government staff for cost efficient planning and securing of financial resources.	MAF	UNDP, MAF	Oct 2015	
7	Protection and re-afforestation efforts result in increases in the crocodile	PPG	Other	P: 2 I: 2	The project will seek advice and guidance from the Crocodile Task Force to ensure measures are taken to	UNDP, MAF	UNDP, MAF	Oct 2015	

#	Description	Date Identified	Type[68]	Impact & Probability[69]	Countermeasures / Management Response	Owner	Submitted, Updated By	Last Update	Status
	population.				protect coastal communities.				
8	Failure to identify viable revenue streams for long term maintenance of mangrove areas	PPG	Operational	P:3 I:2	The project will build on the work already conducted for the NBSAP, as well as the LDCF PPG stage, to identify potential revenue streams. An expert will be hired to further explore these options. Training on economic analysis will ensure that MAF is able to present the needs and proposed measures for mangrove activities, for public or other sources of funds, in a manner that proves economic value and cost-effectiveness.	UNDP, MAF	UNDP, MAF	Oct 2015	
9	Communication materials are not tailored to audiences or delivered in method appropriate to ensure outreach.	PPG	Operational	P:2 I:3	Communications will target groups with potential for greatest impact, especially coastal communities and youth, with specific consideration for the distribution possibilities which will maximize absorption and reach (i.e. books, events, print material, radio, TV in a language appropriate for the target audience, etc.)	UNDP, MAF	UNDP, MAF	Oct 2015	

Annex D: Stakeholder Involvement Plan

Project Outcomes and Outputs	Potential Stakeholder Involvement
<u>Outcome 1</u>: **Policy framework and institutional capacity for climate resilient coastal management established**	
Outputs 1.1. A comprehensive coastal management and adaptation plan developed and budgeted for the entire coast of Timor-Leste (as part and a direct contribution to NAP) 1.2. Coastal protection and resilience strategy for infrastructure planning, adopted and budgeted 1.3. Technical skills (through specialized trainings), hardware (at least two sets of hydro-meteorological stations and wave gauges), methods (economic valuation and cost-benefit analysis), solid value-chain analysis of livelihood options, and software introduced to monitor climate change induced coastal change and to plan management responses at policy levels. 1.4. Forestry, Protected Areas, Aquaculture and Fisheries Directorates under the Ministry of Agriculture and Fisheries have their roles, coordination, and planning mechanisms clarified and enforced for improved management of mangrove and other critical coastal habitats (as emerges from NAP consultation process)	MCIE, MPSI, MPW, MSS, MTAC and MoJ MCIE, MPSI, and MPW, steering committee/technical working groups for the Tibar Bay Port and Tasi Mane projects, JICA IUCN, UNDP (ECCA), and UNTL various directorates under MAF, including NDF, NDPA and NDFA
<u>Outcome 2</u>: **Mangrove-supportive livelihoods established to incentivize mangrove rehabilitation and protection**	
Outputs 2.1. At least 1000 ha of coastal mangroves and wetlands conserved or degraded mangrove areas rehabilitated through natural recruitment and restoration of hydrological regimes both in the northern and southern coasts with a direct employment of local coastal communities • Restore and monitor mangroves, using natural, ecological approaches, including restoration of hydrological regimes, enhanced propagule dispersal and livestock control • Establish maintenance protocols under MAF, with direct participation/employment of coastal communities, particularly women 2.2. Mangrove-supportive, diversified livelihoods/social businesses established in mangrove rehabilitation project sites, benefiting at least 1,000 households and empowering women 2.3. In project site sucos, development plans include mangrove-supportive livelihood support measures benefiting at least 20,000 people	MPW, steering committees/technical working groups for the Tibar Bay Port and Tasi Mane projects WorldFish, KOICA, INGOs, NGOs engaged in livelihood support at the community level
<u>Outcome 3:</u> **Integrated approaches to coastal adaptation adopted to contribute to protection of coastal populations and productive lands**	
Outputs	

Project Outcomes and Outputs	Potential Stakeholder Involvement
3.1. Upstream watershed replantation demonstrate risk reduction, (including reduction of excessive sediment loads) to downstream coastal waterways and areas	GIZ, Instituto Camões, JICA
3.2. Coastal wetland restoration and groundwater recharge plans developed and initiated to increase storm water absorption capacity and buffer seawater intrusion	
3.3. Based on economic valuation study of ecosystem services, infrastructure offset for coastal protection scheme (and other financial mechanisms, such as payment for ecosystem services - PES) devised to secure financial resources for coastal resilience	MTAC, private sector

Annex E: UNDP Social and Environment Screening

The completed template, which constitutes the Social and Environmental Screening Report, must be included as an annex to the Project Document. Please refer to the Social and Environmental Screening Procedure and Toolkit for guidance on how to answer the 6 questions.

Project Information

Project Information	
1. Project Title	Building shoreline resilience of Timor-Leste to protect local communities and their livelihoods
2. Project Number	PIMS 5330, Atlas Project ID 00097253
3. Location (Global/Region/Country)	Timor-Leste

Part A. Integrating Overarching Principles to Strengthen Social and Environmental Sustainability

QUESTION 1: How Does the Project Integrate the Overarching Principles in order to Strengthen Social and Environmental Sustainability?
Briefly describe in the space below how the Project mainstreams the human-rights based approach
The safety and well-being of coastal communities is the main goal of the project. Climate change is putting pressure on food security and water availability in Timor-Leste. The livelihoods options supported by the project are those which contribute to overall food production. By rehabilitating mangrove areas and related watersheds, groundwater quality and quantity can be improved. Further, mangroves provide a natural barrier between rising sea level and sea surges which impact coastal communities. Upland soil stabilization interventions will prevent soil erosion and excess rainwater runoff, which could result in landslides and flashfloods for coastal communities.
Briefly describe in the space below how the Project is likely to improve gender equality and women's empowerment
The livelihood support activities of the project set a target of 1000 households (or 5000 people) as beneficiaries, with 30% being women directly benefiting. Given the particular vulnerabilities of women in Timor-Leste, a gender specialist will be hired to ensure that consultations are conducted in a manner which is sensitive to these vulnerabilities, and that women are engaged in the planning, implementation and monitoring of project interventions.
Briefly describe in the space below how the Project mainstreams environmental sustainability
A significant portion of the budget is dedicated to mangrove rehabilitation, as a means of providing protection from climate change impacts such as rising sea level and sea surges. Outcome 1 will ensure that mangrove areas are considered in planning, and that infrastructure and development planning in particular do not inadvertently put coastal communities at risk by reducing mangrove coverage. Mangrove-supportive livelihood options will be introduced, and public awareness campaigns will be implemented to reduce community pressures on mangroves.

Part B. Identifying and Managing Social and Environmental Risks

QUESTION 2: What are the Potential Social and Environmental Risks? *Note: Describe briefly potential social and environmental risks identified in Attachment 1 – Risk Screening Checklist (based on any "Yes" responses). If no risks have been identified in Attachment 1 then note "No Risks Identified" and skip to Question 4 and Select "Low Risk". Questions 5 and 6 not required for Low Risk Projects.*	**QUESTION 3: What is the level of significance of the potential social and environmental risks?** *Note: Respond to Questions 4 and 5 below before proceeding to Question 6*			**QUESTION 6: What social and environmental assessment and management measures have been conducted and/or are required to address potential risks (for Risks with Moderate and High Significance)?**
Risk Description	***Impact and Probability (1-5)***	***Significance (Low, Moderate, High)***	***Comments***	***Description of assessment and management measures as reflected in the Project design. If ESIA or SESA is required note that the assessment should consider all potential impacts and risks.***
Sediment from earthworks related to mangrove rehabilitation and soil stabilization efforts may enter the marine environment or waterways.	I = 3 P = 2	**Moderate**		To ensure that the sediment is not mobilized through either wind, or more specifically, through water movement, an erosion control sediment plan will be prepared. The plan will contain aspects including but not limited to the installation of sediment curtains to reduce sediment movement and the covering of sediment where practicable.
Sediment movement may also expose acid sulfate soils, specifically within the mangrove areas.	I = 2 P = 2	**Moderate**		Prior to any excavation, sediments will be tested for their presence of acid sulphate soils and/or potential acid sulphate soils. If the analysis proves positive, the sediment can be treated by a range of techniques including but not limited to liming the sediment. Reference will be made to appropriate standards and guidelines. Every effort will be made to ensure there is no direct or residual impact following treatment.

	QUESTION 4: What is the overall Project risk categorization?		
	Select one (see SESP for guidance)		**Comments**
	Low Risk	☐	
	Moderate Risk	X	
	High Risk	☐	

	QUESTION 5: Based on the identified risks and risk categorization, what requirements of the SES are relevant?		
	Check all that apply		**Comments**
	Principle 1: Human Rights	☐	
	Principle 2: Gender Equality and Women's Empowerment	☐	
	1. Biodiversity Conservation and Natural Resource Management	X	
	2. Climate Change Mitigation and Adaptation	☐	
	3. Community Health, Safety and Working Conditions	☐	
	4. Cultural Heritage	☐	
	5. Displacement and Resettlement	☐	
	6. Indigenous Peoples	☐	
	7. Pollution Prevention and Resource Efficiency	X	

Final Sign Off

Signature	***Date***	***Description***
QA Assessor		UNDP staff member responsible for the Project, typically a UNDP Programme Officer. Final signature confirms they have "checked" to ensure that the SESP is adequately conducted.
QA Approver		UNDP senior manager, typically the UNDP Deputy Country Director (DCD), Country Director (CD), Deputy Resident Representative (DRR), or Resident Representative (RR). The QA Approver cannot also be the QA Assessor. Final signature confirms they have "cleared" the SESP prior to submittal to the PAC.
PAC Chair		UNDP chair of the PAC. In some cases PAC Chair may also be the QA Approver. Final signature confirms that the SESP was considered as part of the project appraisal and considered in recommendations of the PAC.

SESP Attachment 1. Social and Environmental Risk Screening Checklist

Checklist Potential Social and Environmental Risks	
Principles 1: Human Rights	**Answer (Yes/No)**
1. Could the Project lead to adverse impacts on enjoyment of the human rights (civil, political, economic, social or cultural) of the affected population and particularly of marginalized groups?	No
2. Is there a likelihood that the Project would have inequitable or discriminatory adverse impacts on affected populations, particularly people living in poverty or marginalized or excluded individuals or groups? [70]	No
3. Could the Project potentially restrict availability, quality of and access to resources or basic services, in particular to marginalized individuals or groups?	No
4. Is there a likelihood that the Project would exclude any potentially affected stakeholders, in particular marginalized groups, from fully participating in decisions that may affect them?	No
5. Is there a risk that duty-bearers do not have the capacity to meet their obligations in the Project?	No
6. Is there a risk that rights-holders do not have the capacity to claim their rights?	No
7. Have local communities or individuals, given the opportunity, raised human rights concerns regarding the Project during the stakeholder engagement process?	No
8. Is there a risk that the Project would exacerbate conflicts among and/or the risk of violence to project-affected communities and individuals?	No
Principle 2: Gender Equality and Women's Empowerment	
1. Is there a likelihood that the proposed Project would have adverse impacts on gender equality and/or the situation of women and girls?	No
2. Would the Project potentially reproduce discriminations against women based on gender, especially regarding participation in design and implementation or access to opportunities and benefits?	No
3. Have women's groups/leaders raised gender equality concerns regarding the Project during the stakeholder engagement process and has this been included in the overall Project proposal and in the risk assessment?	No
4. Would the Project potentially limit women's ability to use, develop and protect natural resources, taking into account different roles and positions of women and men in accessing environmental goods and services? *For example, activities that could lead to natural resources degradation or depletion in communities who depend on these resources for their livelihoods and well being*	No
Principle 3: Environmental Sustainability: Screening questions regarding environmental risks are encompassed by the specific Standard-related questions below	
Standard 1: Biodiversity Conservation and Sustainable Natural Resource Management	
1.1 Would the Project potentially cause adverse impacts to habitats (e.g. modified, natural, and critical habitats) and/or ecosystems and ecosystem services? *For example, through habitat loss, conversion or degradation, fragmentation, hydrological changes*	No

[70] Prohibited grounds of discrimination include race, ethnicity, gender, age, language, disability, sexual orientation, religion, political or other opinion, national or social or geographical origin, property, birth or other status including as an indigenous person or as a member of a minority. References to "women and men" or similar is understood to include women and men, boys and girls, and other groups discriminated against based on their gender identities, such as transgender people and transsexuals.

1.2	Are any Project activities proposed within or adjacent to critical habitats and/or environmentally sensitive areas, including legally protected areas (e.g. nature reserve, national park), areas proposed for protection, or recognized as such by authoritative sources and/or indigenous peoples or local communities?	Yes (project will rehabilitate mangrove areas)
1.3	Does the Project involve changes to the use of lands and resources that may have adverse impacts on habitats, ecosystems, and/or livelihoods? (Note: if restrictions and/or limitations of access to lands would apply, refer to Standard 5)	No
1.4	Would Project activities pose risks to endangered species?	No
1.5	Would the Project pose a risk of introducing invasive alien species?	No
1.6	Does the Project involve harvesting of natural forests, plantation development, or reforestation?	Yes (rehabilitation of mangrove areas, and small-scale reforestation in upland areas)
1.7	Does the Project involve the production and/or harvesting of fish populations or other aquatic species?	Yes (mangrove-friendly aquaculture development as livelihood)
1.8	Does the Project involve significant extraction, diversion or containment of surface or ground water? *For example, construction of dams, reservoirs, river basin developments, groundwater extraction*	No
1.9	Does the Project involve utilization of genetic resources? (e.g. collection and/or harvesting, commercial development)	No
1.10	Would the Project generate potential adverse transboundary or global environmental concerns?	No
1.11	Would the Project result in secondary or consequential development activities which could lead to adverse social and environmental effects, or would it generate cumulative impacts with other known existing or planned activities in the area? *For example, a new road through forested lands will generate direct environmental and social impacts (e.g. felling of trees, earthworks, potential relocation of inhabitants). The new road may also facilitate encroachment on lands by illegal settlers or generate unplanned commercial development along the route, potentially in sensitive areas. These are indirect, secondary, or induced impacts that need to be considered. Also, if similar developments in the same forested area are planned, then cumulative impacts of multiple activities (even if not part of the same Project) need to be considered.*	No
Standard 2: Climate Change Mitigation and Adaptation		
2.1	Will the proposed Project result in significant[71] greenhouse gas emissions or may exacerbate climate change?	No
2.2	Would the potential outcomes of the Project be sensitive or vulnerable to potential impacts of climate change?	No
2.3	Is the proposed Project likely to directly or indirectly increase social and environmental vulnerability to climate change now or in the future (also known as maladaptive practices)? *For example, changes to land use planning may encourage further development of floodplains, potentially increasing the population's vulnerability to climate change, specifically flooding*	No
Standard 3: Community Health, Safety and Working Conditions		

[71] In regards to CO_2, 'significant emissions' corresponds generally to more than 25,000 tons per year (from both direct and indirect sources). [The Guidance Note on Climate Change Mitigation and Adaptation provides additional information on GHG emissions.]

3.1	Would elements of Project construction, operation, or decommissioning pose potential safety risks to local communities?	No
3.2	Would the Project pose potential risks to community health and safety due to the transport, storage, and use and/or disposal of hazardous or dangerous materials (e.g. explosives, fuel and other chemicals during construction and operation)?	No
3.3	Does the Project involve large-scale infrastructure development (e.g. dams, roads, buildings)?	No
3.4	Would failure of structural elements of the Project pose risks to communities? (e.g. collapse of buildings or infrastructure)	No
3.5	Would the proposed Project be susceptible to or lead to increased vulnerability to earthquakes, subsidence, landslides, erosion, flooding or extreme climatic conditions?	No
3.6	Would the Project result in potential increased health risks (e.g. from water-borne or other vector-borne diseases or communicable infections such as HIV/AIDS)?	No
3.7	Does the Project pose potential risks and vulnerabilities related to occupational health and safety due to physical, chemical, biological, and radiological hazards during Project construction, operation, or decommissioning?	No
3.8	Does the Project involve support for employment or livelihoods that may fail to comply with national and international labor standards (i.e. principles and standards of ILO fundamental conventions)?	No
3.9	Does the Project engage security personnel that may pose a potential risk to health and safety of communities and/or individuals (e.g. due to a lack of adequate training or accountability)?	No
Standard 4: Cultural Heritage		
4.1	Will the proposed Project result in interventions that would potentially adversely impact sites, structures, or objects with historical, cultural, artistic, traditional or religious values or intangible forms of culture (e.g. knowledge, innovations, practices)? (Note: Projects intended to protect and conserve Cultural Heritage may also have inadvertent adverse impacts)	No
4.2	Does the Project propose utilizing tangible and/or intangible forms of cultural heritage for commercial or other purposes?	No
Standard 5: Displacement and Resettlement		
5.1	Would the Project potentially involve temporary or permanent and full or partial physical displacement?	No
5.2	Would the Project possibly result in economic displacement (e.g. loss of assets or access to resources due to land acquisition or access restrictions – even in the absence of physical relocation)?	No
5.3	Is there a risk that the Project would lead to forced evictions?[72]	No
5.4	Would the proposed Project possibly affect land tenure arrangements and/or community based property rights/customary rights to land, territories and/or resources?	No
Standard 6: Indigenous Peoples		
6.1	Are indigenous peoples present in the Project area (including Project area of influence)?	No
6.2	Is it likely that the Project or portions of the Project will be located on lands and territories	No

[72] Forced evictions include acts and/or omissions involving the coerced or involuntary displacement of individuals, groups, or communities from homes and/or lands and common property resources that were occupied or depended upon, thus eliminating the ability of an individual, group, or community to reside or work in a particular dwelling, residence, or location without the provision of, and access to, appropriate forms of legal or other protections.

	claimed by indigenous peoples?	
6.3	Would the proposed Project potentially affect the human rights, lands, natural resources, territories, and traditional livelihoods of indigenous peoples (regardless of whether indigenous peoples possess the legal titles to such areas, whether the Project is located within or outside of the lands and territories inhabited by the affected peoples, or whether the indigenous peoples are recognized as indigenous peoples by the country in question)? *If the answer to the screening question 6.3 is "yes" the potential risk impacts are considered potentially severe and/or critical and the Project would be categorized as either Moderate or High Risk.*	No
6.4	Has there been an absence of culturally appropriate consultations carried out with the objective of achieving FPIC on matters that may affect the rights and interests, lands, resources, territories and traditional livelihoods of the indigenous peoples concerned?	No
6.5	Does the proposed Project involve the utilization and/or commercial development of natural resources on lands and territories claimed by indigenous peoples?	No
6.6	Is there a potential for forced eviction or the whole or partial physical or economic displacement of indigenous peoples, including through access restrictions to lands, territories, and resources?	No
6.7	Would the Project adversely affect the development priorities of indigenous peoples as defined by them?	No
6.8	Would the Project potentially affect the physical and cultural survival of indigenous peoples?	No
6.9	Would the Project potentially affect the Cultural Heritage of indigenous peoples, including through the commercialization or use of their traditional knowledge and practices?	No
Standard 7: Pollution Prevention and Resource Efficiency		
7.1	Would the Project potentially result in the release of pollutants to the environment due to routine or non-routine circumstances with the potential for adverse local, regional, and/or transboundary impacts?	Yes (related to earthworks)
7.2	Would the proposed Project potentially result in the generation of waste (both hazardous and non-hazardous)?	No
7.3	Will the proposed Project potentially involve the manufacture, trade, release, and/or use of hazardous chemicals and/or materials? Does the Project propose use of chemicals or materials subject to international bans or phase-outs? *For example, DDT, PCBs and other chemicals listed in international conventions such as the Stockholm Conventions on Persistent Organic Pollutants or the Montreal Protocol*	No
7.4	Will the proposed Project involve the application of pesticides that may have a negative effect on the environment or human health?	No
7.5	Does the Project include activities that require significant consumption of raw materials, energy, and/or water?	No

Annex F: Terms of Reference

The following are general terms of reference for key functions and positions in the project, which will be further elaborated during the project inception and implementation stages.

A. Project Board

The role of Project Board is already described in Section 5: Management Arrangements. The Project Board shall meet semi-annually, as well as on an ad hoc basis when requested by the Project Manager.

The Project Board is the group responsible for making by consensus management decisions for a project when guidance is required by the Project Manager, including approval of project plans and revisions. Given UNDP's ultimate accountability, Project Board decisions shall be made in accordance to standards[73] that shall ensure best value to money, fairness, integrity transparency and effective international competition. In case a consensus cannot be reached, final decisions shall rest with the UNDP Programme Manager (i.e. the UNDP Country Director).

Project reviews by the Project Board are made at designated decision points during the running of a project, or as necessary when raised by the Project Manager. The Project Board is consulted by the Project Manager for decisions when project tolerances are expected to be exceeded[74].

Based on the approved annual work plan (AWP), the Project Board may review and approve project quarterly plans when required and authorizes any major deviation from these agreed quarterly plans. The Project Board may sign off the completion of each quarterly plan as well as authorizes the start of the next quarterly plan, ensuring that required resources are committed and arbitrating on any conflicts within the project and/or negotiating a solution to any problems between the project and external bodies.

The Project Board has specific responsibilities at different stages of the project. They include:

Defining a project

- Review and approve the Initiation Plan

Initiating a project

- Review the Progress Report for the Initiation Stage

Running a project

- Review and appraise detailed Project Plan and AWP, including Atlas reports covering activity definition, quality criteria, issue log, risk log and the monitoring and communication plan
- Provide overall guidance and direction to the project, ensuring it remains within any specified constraints
- Address project issues as raised by the Project Manager
- Provide guidance and agree on possible countermeasures/management actions to address specific risks

[73] UNDP Financial Rules and Regulations: Chapter E, Regulation 16.05: a) The administration by executing entities or, under the harmonized operational modalities, implementing partners, of resources obtained from or through UNDP shall be carried out under their respective financial regulations, rules, practices and procedures only to the extent that they do not contravene the principles of the Financial Regulations and Rules of UNDP. b) Where the financial governance of an executing entity or, under the harmonized operational modalities, implementing partner, does not provide the required guidance to ensure best value for money, fairness, integrity, transparency, and effective international competition that of UNDP shall apply.

[74] The Project Board has the responsibility to define for the Project Manager the specific project tolerances within which the Project Manager can operate without intervention from the Project Board. For example, if the Project Board sets a budget tolerance of 10%, the Project Manager can expend up to 10% beyond the approved project budget amount without requiring a revision from the Project Board.

- Agree on Project Manager's tolerances in the Annual Work Plan and quarterly plans when required
- Conduct regular meetings to review the Project Quarterly Progress Report and provide direction and recommendations to ensure that the agreed deliverables are produced satisfactorily according to plans
- Review Combined Delivery Reports (CDR) prior to certification by the Implementing Partner, as necessary
- Review each completed project stage and approve progress to the next
- Appraise the Project Annual Progress Report, make recommendations for the next AWP, and inform the Outcome Board about the results of the review
- Provide ad-hoc direction and advice for exceptions when tolerances are exceeded
- Assess and decide on project changes through revisions

At the end of the project

- Assure that all Project deliverables have been produced satisfactorily
- Review and approve the Final Project Report , including lessons learned
- Make recommendations for follow on actions to be submitted to the Outcome Board
- Commission project Evaluations
- Notify operational completion of the project to the Outcome Board

B. Chief Technical Advisor/Project Manager

The Project Manager will be accountable to both the MAF Senior Official and to UNDP Timor-Leste for the overall management of the project, including quality, timeliness and effectiveness of the services provided and the activities carried out, as well as for the use of funds. He/she will lead the project team on the technical aspects and strategic direction of the project, with guidance from the MAF Technical Advisor.

The project includes institutional capacity building activities, community consultations, vulnerability/technical/social studies in project sites, roll out of mangrove rehabilitation and upland soil stabilization efforts, and M&E to assess success of interventions. The Project Manager will ensure that workplans reflect the strategic direction of the project, while considering appropriate timing and challenges that could delay or disrupt project implementation.

The Project Manager should have a background in the technical aspects of the project (e.g. mangrove rehabilitation, mangrove-supportive livelihoods) in order to better guide the project implementation. Expertise will supplemented as needed through short term consultancy support. The Project Manager's responsibilities include, to:

- Ensure effective partnerships, including active engagement of national and sub-national MAF offices, as well as participation from sectoral and planning ministries, and collaboration with development partners
- Manage human and financial resources to achieve results in line with the outputs and activities outlined in the project document
- Lead the preparation and implementation of annual results-based workplans and the logistical framework, ensuring that the project appropriately reflects latest policy developments, as well as collaboration and synergy of efforts with ongoing efforts by government and development partners
- Day-to-day oversight and coordination of implementation of project activities

- Monitor project activities and financial management of the project, ensure the project is on-track and on-budget, ensuring also that monitoring systems are effective
- Report and provide feedback on project strategies, activities, progress and challenges to the Project Board
- Ensure reporting requirements are met in timely manner
- Applying evaluation criteria to past activities and make informed decisions on the way forward on the phased workplanning of the project, including recommendations to the Project Board
- Establishing and maintaining monitoring and tracking system
- Prepare regular reports on the project status, progress and challenges, as well as on risks and impacts of risk mitigation measures, per UNDP requirements.
- Coordinate inputs to reports as required (including Annual Progress Reports, Inception Report, Quarterly Report, and the Terminal Report)

C. Finance & Operations Officer

The Finance & Operations Officer will support the Project Manager in ensuring timely project delivery, transparent reporting and record keeping, as well as compliance with DIM/NIM policies and procedures. Responsibilities include, to:

Workplanning & Budgeting

- Research, and advise the Project Manager on, cost/time estimates to support project activities, ensuring efficiency and cost-effectiveness
- Regular review of the overall project balance ensuring that ultimately cumulative expenditure is within the overall project budget
- Preparation of annual budgets to support the planned activities, ensuring that budgeted amounts and expected disbursement schedules are reasonable, and remaining funds are sufficient
- Draft procurement/recruitment plan to support agreed workplan
- Inform Project Manager of financial/operational issues affecting project delivery, propose budget revisions/adjustments as necessary

Project Delivery & Reporting

- Execute procurement and recruitment plan, ensuring transparency, cost-effectiveness/efficiency, and compliance with DIM/NIM
- Manage payroll and cash reserves of the project
- Prepare necessary financial reports as part of regular DIM/NIM processes, as well as donor requests
- Manage financial and operational aspects of project assets, maintain registers for inventory of non-expendable equipment and ensure that the equipment is safe and in proper working condition, providing regular updates to inform further implementation (e.g. next phase of station installation)
- Prepare financial/operational progress reports for project team, Project Board, or other meetings
- Identify reporting challenges and make adjustments to internal reporting procedure as necessary to address problems (e.g. reporting timetable), ensuring that reporting requirements are met on time and are of high quality
- Ensure documentation and records are up-to-date and complete, meeting audit standards
- Support the regular monitoring, as well as evaluation and audit processes by providing reports, supporting documentation and other information as needed

- Provide information as needed for other purposes or ad hoc requests (e.g. UNDP or donor request, publications, communication materials, etc…)

D. Technical Expertise (i.e. CBEMR, Economist, Livelihoods, Gender, Innovative Finance)

Technical Experts will be recruited at key intervals during project implementation to support the Project Manager in assessing vulnerabilities and identifying appropriate ways forward, ensuring successful results of project interventions.

CBEMR Specialist
The CBEMR Specialist will support the Project Manager and MAF in conducting studies at mangrove rehabilitation sites, and supporting the design and implementation of the workplan for mangrove rehabilitation activities. Responsibilities include, to:

- Develop and deliver training to extension workers and communities on coastal mapping
- Conduct consultations with government and communities to inform (i) autecology selection of appropriate local varieties, considering their reproduction and growth specificities; (ii) hydrology types that may necessitate mangrove zonation; (iii) potential disturbance factors, including anticipated increased storminess that may require the plantation of mature species and establishment of nurseries for replacement
- Support Project Manager in developing the workplan for mangrove rehabilitation, informed by above
- Develop and deliver training to extension worker and communities on CBEMR
- Develop M&E framework for regular monitoring of CBEMR work
- In coordination with Innovative Finance Specialist, support with estimating economic value of mangroves
- Support work related sensitization of communities to value of mangrove areas

SLM Specialist
The SLM Specialist will support the Project Manager and MAF in conducting studies at mangrove rehabilitation sites, and supporting the design and implementation of the workplan for mangrove rehabilitation activities. Responsibilities include, to:

- Develop and deliver training to extension workers and communities on sustainable land management practices
- Conduct consultations with government and communities to inform (i) SLM interventions such as contouring and swale building (ii) species selection for small-scale reforestation efforts, considering potential for soil erosion prevention as well as contribution to livelihoods; (iii) potential disturbance factors, including anticipated increased intense rainfall that may require appropriate timing for the land works and plantation of mature species, as well as establishment of nurseries for replacement
- Support Project Manager in developing the workplan for SLM activities, informed by above
- Develop M&E framework for regular monitoring of SLM work
- In coordination with Innovative Finance Specialist, support with estimating economic value of sustainable land management, including water access, species selection for reforestation to support livelihoods (e.g. agroforestry, fuel wood)
- Support work related sensitization of communities to links between land use, groundwater quality/availability, and coastal areas

Economist
An Economist will be recruited to design and coordinate the RCT detailed in Annex E. Responsibilities include:

- Design gender-disaggregated household survey guidelines and instrument in close consultation with the Project Manager, considering as well inputs from experts employed during the PPG stage
- Define scope of gender-disaggregated household survey to ensure useful data collection and analysis for the baseline as well as subsequent survey
- Develop and implement work-plan for the conduct of gender-disaggregated household level surveys
- Provide training to enumerators, considering engagement with UNTL for data collection
- Oversee data collection, ensuring consistency of data parameters and adherence to the survey guidelines and instrument
- Conduct analysis and document baseline scenario and the impacts of project interventions
- Provide conclusions and recommendations based on findings

Livelihoods Specialist

Based on results of economic analysis of potential livelihood options at project sites, a Livelihoods Specialist will be recruited to support roll out of training and other intervention activities. The Livelihoods Specialist's background will reflect the selected livelihood, as appropriate. In cases, where an institution is present in the country which already successfully implements this support, an LoA may be signed with the institution (e.g. WorldFish for aquaculture-related interventions). Responsibilities must include training to communities on selected livelihood, with regular support and monitoring to ensure long term sustainability.

Gender Specialist

The Gender Specialist will ensure implementation of, and compliance with, the UNDP gender policy in general and the gender action plan developed for this project. The Gender Specialist should have regional experience and substantial knowledge of the social and gender issues facing Timor-Leste. Responsibilities include to:

- Prepare Gender Action Plan to effectively integrate gender concerns into the implementation of project activities, including strategies to ensure participation of women in the implementation of various project components and activities
- Assist the project team in facilitation of consultations with the communities targeted by the project, ensuring equal participation and rights for women in those communities
- Document gender considerations from community consultations and assist in prioritizing and implementing gender-equitable project interventions
- Assist and cooperate with other specialist members of the project team, such as assist with development and dissemination of outreach materials such as brochures, fact sheets and presentations, ensuring they are gender sensitive and promote gender equality
- Strengthen the understanding of the gender mainstreaming by providing appropriate training to PMU, government and other stakeholders, as required; and support the gender focal points in line ministries
- Assist the project team in preparing gender mainstreaming reports as part of project progress reports, as needed

Innovative Finance Specialist

The Innovative Finance Specialist will support the Project Manager in identifying and securing financing for the long term protection and maintenance of mangrove areas, including private and public financing arrangements. Responsibilities include to:

- Draft financing plan indicating costs of long term protection and maintenance of mangrove areas
- Conduct research to identify potential revenue streams, including willingness-to-pay for ecosystem services provided by mangroves (e.g. tourism sector).
- Identify partners/contributors and support in formalizing partnerships/agreements
- Support MAF in establishing a financial mechanism for the effective implementation and monitoring of the mangrove protection financing plan

E. Field Coordinators

As project sites are spread out across the country, Field Coordinators will be recruited as needed to directly support the functions of the Project Manager. The Field Coordinators will work closely with MAF extension officers to oversee implementation of the project, conducting regular site visits, providing technical support and reporting back to the Project Manager.

F. Communications/Public Awareness Specialist

The Communications/Public Awareness Specialist will be recruited to support the Project Manager in ensuring that the communications/public awareness efforts are well-designed, targeting the appropriate audiences.

- Develop communications/public awareness strategy for the project, including links to broader UNDP work and national programmes, as well as activities to promote the project's media coverage
- Identify and develop opportunities to raise awareness about mangroves and coastal ecosystems, as well as raise awareness about the project (e.g. organizing events)
- Provide support to project activities (e.g. workshops, community consultations) which provide opportunities to raise awareness or communicate about the project
- Produce and oversee production of media friendly communications products aimed at a) highlighting the important role of mangroves in coastal ecosystems and shoreline protection, b) means of protecting mangroves, and c) the project's role in this effort
- Support public awareness activities, such as the development of a children's book, printed materials (i.e. brochures, posters), TV public service announcements, informational web videos, website content, radio spots, etc.
- Work closely with UNDP CO and government to ensure related communications materials include information about the project; seek opportunities to highlight the project at related events

Annex G.1: Assessment of Coastal Ecosystem Vulnerabilities and Threats

The below is a summary of key points from the **Mangrove Ecosystems Report - Building shoreline resilience of Timor-Leste to protect local communities and their livelihoods**. The report is the result of a desk review, consultations with government and potential project site visits, conducted during the PPG phase of the LDCF project. The full report by Karen Edyvane, prepared with cost-sharing support from USAID-Adapt, is available upon request.

Assessment of Coastal Ecosystem Vulnerabilities and Threats

Biophysical Vulnerability.
Timor-Leste is a high standing, mountainous island, with highly erodible infertile soils, which has resulted in limited agricultural land, low productivity and a high susceptibility to land degradation - and also, exacerbated the impacts of climate hazards (ie. landslides, flash flooding). Timor-Leste is part of the Lesser Sunda Islands, which is situated between Australia and Indonesia. The country is approximately 14,874km^2 in area, with a coastline of 706km. While small in area, Timor-Leste is mountainous and characterized by rugged terrain and small narrow valleys. It is estimated that almost half (44%) of the country has a steep to very steep slope (greater than 40%) and slightly over half has a moderate slope (8% and 25%) (Barnett et al. 2007). Many of the mountains are above 2,000m elevation, Mount Ramelau the highest at 2,963m (Figure 1). Significantly, much of Timor-Leste's land surface is covered in shallow rocky soils that are alkaline and not particularly fertile. These soils do not store water and are easily eroded. The nature of the soils is a function of the geological substrate of Timor-Leste, which is largely limestone and coral, meaning that soil nutrients decompose faster than they accumulate. The soils of alluvial origin are confined to the coastal regions around Dili, Suai and Manatuto and are poorly drained soils. The most fertile soils are found in the river valleys, flat lands and along the south coast.

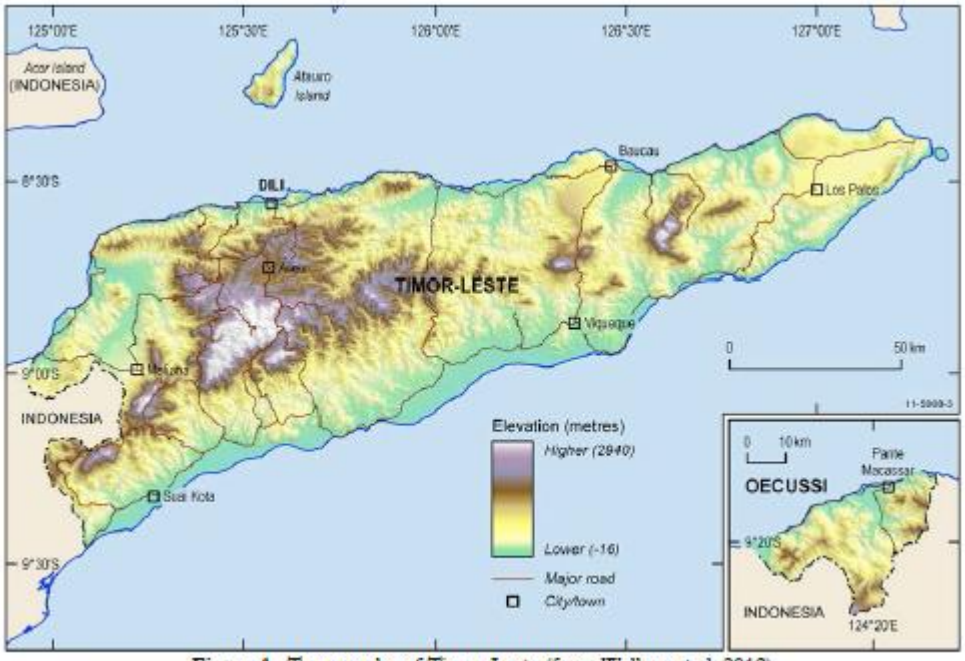


Figure 1 Topography of Timor-Leste (from Wallace et al. 2012).

As a high-standing island, shallow, nearshore coastal-marine habitats (mangroves, coral reefs and seagrasses) are limited in extent in Timor-Leste – predominantly due to the country's narrow continental margin and coastal physiography, including high profile coasts on the northern coast, and lack of near-shore, protected habitat on the wave-exposed southern coast (Boggs et al. 2009). Recent coastal habitat mapping indicates that the total estimated areal extent of near-shore coastal habitat in Timor-Leste, is just

121km^2. More detailed mapping, currently being undertaken by NOAA, using WorldView2, will refine this estimate further.

Coastal Hazards.
Timor-Leste's shorelines are highly vulnerable to a range of natural hazards and disasters. This includes frequent events such as strong tropical windstorms, heavy rain, drought, and the impacts of landslides as well as rarer (but potentially more deadly) disaster events such as earthquakes and tsunamis (ADCP 2012) (see Table 1). Timor-Leste is vulnerable to earthquakes and tsunamis, due to its geographical location, near the convergence zone of the Eurasian and Australian plates (a zone of active volcanism, great seismicity and the occurrence of tsunamis), and also, because the country has few means of risk prevention and mitigation (ADCP 2012). Within the Nusa Tenggara and Maluku region of which Timor-Leste is part, it has been estimated that 94% of the area could experience earthquakes of a least a magnitude of seven on the Richer scale. While the frequency of cyclones in Timor-Leste is low at 0.2 cyclones per year (Kirono 2010), increasing greenhouse gases are expected to alter the hydrologic cycle. Along with other recent predictions, (Kirono 2010) suggests that in future the frequency of cyclones and extreme rainfall events in Timor-Leste are likely to decrease, but the intensity of the cyclones (with high wind speeds) and extreme rainfall events will increase.

Hazard Type	Vulnerability in Timor-Leste
Cyclones	The entire country is located in a zone of cyclonic activity (0.2 cyclones per year); the South coast is the most exposed, with a probability of occurrence between 0 and 2 cyclones per decade.
Earthquakes	Timor-Leste is in a moderate risk area, but is very close (100km) to areas of high tectonic activity. Oecussi is the area where there is a higher probability of occurrence to earthquakes.
Tsunamis	Tsunamis are often associated with earthquakes, but can also occur due to landslide activity in the coastal zone. Both the North and South coast are at risk from tsunamis with events of more than 4 meters, are at the eastern end of Timor Island, including districts of Lautem, Baucau, Viqueque, Manatuto and Dili, and eastern Atauro Island. The entire coastline of Viqueque District is especially vulnerable because of the relatively wide shoaling stretch combined with a flat topography inland from the coast.
Floods	The more frequent floods are flash floods – which are extremely dangerous events due to their high speed and also, erosive and destructive potential. Flood risk is significantly greater on the South coast, relative to the North coast, due to the large number of rivers, and area of low-lying lands. Coastal flooding is exacerbated when combined with coastal inundation by storm surge and sea waves.
Landslides	Landslides, outside human loss, causes extensive physical damage, particularly with loss of agricultural land and the national road network, making access to the South coast extremely difficult, or even impossible in some cases. Baucau, Viqueque and Manatuto, are prone to large-scale landslides, due to soil type (i.e. clay complex). The debris flows are also a major threat and associated with high rainfall events.
Coastal Erosion	Areas vulnerable to coastal erosion area largely (but not exclusively) concentrated on the low-lying, wave-exposed, South coast. The entire coastline of some districts such as Alieu, Manufahi and Viqueque are highly susceptible to coastal erosion.

Table 1: Summary of natural disasters and coastal hazards in Timor-Leste (adapted from UNDP 2010, ADPC 2012)

Timor-Leste is particularly prone to floods, landslides and erosion, due to the combination of heavy monsoonal rain, steep topography and widespread deforestation. It also experiences the El Niño/ Southern Oscillation (ENSO) related weather anomalies associated with droughts and extreme rainfall events in this region (occurring in cycles every couple of years). These weather phenomena have a significant impact on Timor-Leste communities, both positive, in terms of improving agricultural production and water security, and negative in terms of increased flooding, landslides and erosion. With increasing climate variability and increased extreme events, due to climate change, Timor-Leste is likely to become increasingly vulnerable to cyclones, tropical storms, floods and landslides (NAPA 2010).

Strong winds, floods, landslides, and drought are the most prominent and frequent coastal hazard experienced in recent history in Timor-Leste (UNDP 2010, ADPC 2013). Over the period 2002-2013, an

estimated 254 flood events were recorded (Mercer et al. 2014). These events have increased over the past decade and further have had major negative impacts on local communities, due to high levels of food insecurity, high dependency on domestic food production and loss of (already limited) agricultural lands. Flooding in Timor-Leste occurs as riverine 'flash-flooding' when heavy seasonal rains in catchment basins converge in tributaries as they descend, resulting in a rapid rise of discharge in the water courses (UNDP 2010). The combination of high rainfall in watersheds with short rivers and very steep slopes, contribute to increase the risks of flooding. Flood mapping by UNDP (2010) indicates that, with larger numbers of rivers and also, greater expanse of low lying coastal lands, flood risk is significantly greater on the south coast, relative to the north coast, particularly when overbank and inundation are combined (see Figure 2). Flooding can also be a serious issue on north coast. As such, in a recent flood hazard assessment, Liquiçá district had the highest percentage (2.6% or 14.3 km^2) of flood inundation area, with a flood depth of over 2 meters ADCP (2012). This has major implications for coastal communities, infrastructure development, as well as mangrove and coastal reafforestation efforts.

Coastal areas most susceptible to coastal erosion are largely concentrated on the wave-exposed, south coast of Timor-Leste, this is largely due to prevailing wave conditions and also, the extent of low lying coastal lands (ADCP 2012) Further, the results from the coastal erosion hazard assessment by ADCP (2012) also found than the entire coastline of some districts such as Aileu, Manufahi and Viqueque are highly susceptible to coastal erosion. This has major impacts for coastal infrastructure development, as well as potential mangrove reafforestation efforts.

Figure 2 Areas at risk from overbank flooding and inundation in Timor Leste (OCHA & NDMD 2007)

Many coastal communities in Timor-Leste are at risk of tsunamis. The recent tsunami hazard assessment by ADCP (2012) identified the areas of the coastline of Timor-Leste that are susceptible to sustaining the highest tsunami waves. These areas are at the eastern end of Timor Island, including the districts of Lautem, Baucau, Viqueque, Manatuto and Dili, and eastern Atauro Island. The entire coastline of Viqueque District is especially vulnerable because of the relatively wide shoaling stretch combined with a flat topography inland from the coast (UNDP 2010). Past experience and scientific data relating to recent tsunamis indicate that islands surrounding Timor-Leste would offer little protection against a tidal wave or tsunami (ADCP 2012).

Coastal Pressures.
Shoreline and community resilience to climate change in coastal areas in Timor-Leste is impeded by a range of non-climatic human pressures, including human population growth and major changes in coastal

land-use (particularly proposed coastal infrastructure and aquaculture development). These underlying pressures and threats to coastal ecosystems (particularly mangroves) and populations are detailed below.

- *Non-Climate Impacts in Coastal Areas.* Rapid population growth, rampant economic development (including major proposed coastal infrastructure development), and resource exploitation, are among the most pressing challenges faced by Timor-Leste. Changing land use practices (particularly coastal salt production, coastal aquaculture, coastal rice production and intensification of agriculture,) have led to a rapid degradation of natural, coastal protective (and shoreline defense) features such as mangrove forests, particularly along the north coast, but also along the southern coast of the country, exposing vulnerable, food insecure coastal settlements to the greater risks of slow, onset sea-level rise and sudden/extreme storm surges. CTI-RETA (2010) identified a number of key challenges facing coastal and marine resources in Timor-Leste. These include (i) the rapid increase in the population and the direct demands on the natural resources for nutrition and the competition for resources to support the national GDP, (ii) conflicts between land allocation for cash crops such as coffee and subsistence cropping, which will drive the overuse of soils, and push agriculture into marginal slopes creating downstream impacts to the marine environment, (iii) short supply of land suitable for agriculture and inadequate irrigation schemes, which may result in further deforestation, (iv) increasing coastal populations, resulting in higher demand on the marine resources, (v) increasing tourism, which will create environmental management and cultural issues, which are not yet able to be identified, and (vi) climate change. Underlying risks and threats to coastal ecosystems (particularly mangroves) and populations are detailed below.

- *Changes in Coastal Populations and Settlements.* Coastal ecosystems in Timor-Leste are also threated by the significant expansion and migration of human settlements towards coastal areas. The population growth rate in the country is 2.44% and forecasted to reach 1.78 million by 2025 (World Bank 2008), based on an annual population of 3.0% in 2010. Trends in population distribution favor a shift to urban areas, particularly post-independence with new development and employment opportunities, improved roads and mobility of the population. The coastal capital Dili also attracts people from all over the country, as it offers new opportunities and better public services compared to the provinces. Bacau is another coastal city on the northern coast, attracting a growing number of people. These urban settlements represent about 40% of the total national population. Rapid urbanization and expansion of urban coastal settlements exert growing pressures on the coastline, such as contributing to further deforestation, disrupting sediment supply and accelerating the processes of coastal erosion and accretion.

- *Major Coastal Infrastructure Development.* Infrastructure developments such as roads, ports and electricity plants clear forest land and disturb coastal habitats. The country just emerged from a series of conflicts that caused heavy destruction to its infrastructure; now the government is re-constructing much of what was destroyed and building new infrastructure. The investments are financed by the country's petroleum fund, which is estimated to contain around US$10 billion. The government plans to upgrade about 3,000 kilometres of roads and build/upgrade 8 ports (3 national, 5 regional) (NSP 2014) (Figure 3). These programs are in line with the National Strategic Development Plan (2011-2030) that places a strong emphasis on infrastructure development. In the past two years, over half of the state budget was allocated to physical infrastructure related projects. For example, in 2011 the Infrastructure Fund invested US$599.3 million into 12 infrastructure programs including a Transport Program (roads, bridges, airport and ports), the contract value of which had only reached US$75 million as on 2013. Such massive rehabilitation and expansion of infrastructure networks inevitably result in clearing vegetation from the land, making the coastal area more exposed and vulnerable. Moreover, as coasts become more developed, the vulnerability component of the equation increases, as valuable asset are exposed to hazards.

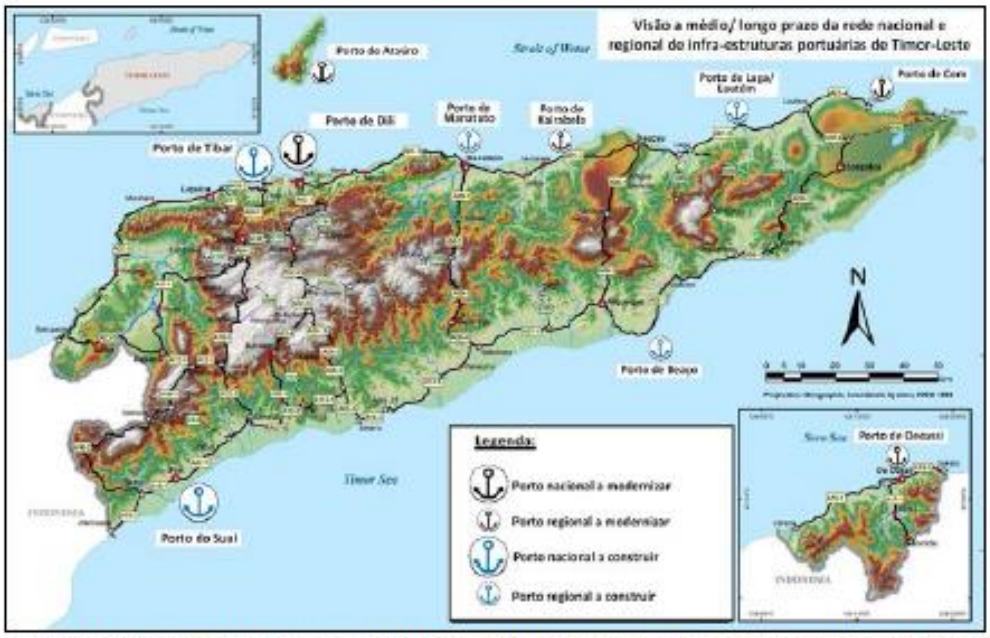


Figure 3 Proposed national and regional port infrastructure for Timor-Leste (from National Spatial Plan 2014).

- *Tibar Multi-Function National Port***.** Construction of the Tibar Multi-function National Port is expected to operate with a shipping capacity of 1 million tons per year, with the possibility of receiving commercial and passenger vessels - thus reducing demand on the Port of Dili. The project also involves the construction of a road of international standard between Dili and Tibar, construction of a jetty and onshore facilities, as well as drainage systems. The port will be developed in a phased-manner, as the port requirements increase and budget allocations are being provided. The port development will have a major footprint, and will result in loss of mangroves in the southern part of Tibar Bay, and also, likely impact on mangroves throughout Tibar Bay. As part of the EIA process for this development (EcoStrategic 2013, EcoLogical 2014), a number of offsets have been identified, including (among others): (i) planning and establishment of the Tasi Tolu Protected Area; and (ii) mangrove restoration and community livelihood programs.

- *Major Expansion of Coastal Aquaculture.* Food security is a national priority in Timor-Leste. With current very low levels of fish consumption and fisheries production, aquaculture has been identified as a major national development priority, to diversify and improving livelihoods, and build resilience among rural households and agro-ecological systems. To this end, the National Aquaculture Development Strategy and Action Plan 2012-2030 (MAF 2011) envisions a strong role for aquaculture, through increasing domestic fish supply and consumption, and sets ambitious national targets for aquaculture development. Under the NADS, per capita fish consumption in Timor-Leste is proposed to increase from 6.1kg to 15.0kg, by 2020 (closer to the global average annual per capita consumption of 17.8 kg[2]). The expectation is that aquaculture will by 2030 contribute up to 40% of domestic fish supplies, with the remainder coming from wild capture fisheries. Under this development strategy, a total area of 2,515 ha has already been identified for aquaculture development, with Metinaro, Manatuto, Same, Suai, Bobonaro and Viqueque, being identified as major districts suitable for aquaculture (Table 2). Several of these sites, particularly Metinaro and Manatuto and Suai, contain some of the largest, mangrove stands in Timor-Leste.

District	Sites	Potential Aquaculture Production (ha)
Oe-cusse		165
Bobonaro		190
Liquica		227
Dili	Metinaro	583

District	Sites	Potential Aquaculture Production (ha)
Manatuto		450
Baucau		90
Lautem		200
Viqueque		20
Manufahi	Same	260
Ainaro		30
Covalima	Suai	230
Ermera		40
Aileu		30
Total		**2,515 ha**

Table 2: Identified areas for potential aquaculture development in Timor-Leste (MAF)

Catchment Impacts.
As a high-standing island, catchment and watershed activities have had major impacts on coastal ecosystems in Timor-Leste.

- *Deforestation and land degradation.* Natural forests have been a major resource over the centuries, but exploitation of sandalwood, teak, and other hardwoods and the expansion of agriculture have left most of the island without forest cover. The continued use of fuel-wood as the main source of energy for cooking is a major cause of massive forest loss. The average fuel wood consumption in 2010 was estimated to be about 7.3 cubic meters per household. In rural areas, forestry activities that provide cash income for community members include fuel wood gathering, hunting, collection of palm wine, production of palm stem panel for house walling, collection of palm leaves for house roofing, harvesting of rattan and bamboo, thinning, nursery and gathering of honey. While comprehensive watershed and land-use planning, and spatial zonation have still to be completed, a draft National Forest Conservation Plan (2013) has been developed. Deforestation has now increased to 1.7% p/a, possibly the highest in the world. If this continues all forest will be lost within 60 years. Significantly, deforestation, conversion to agricultural land, and existing inappropriate agriculture practices, such as slash and burn and free grazing, have led to a rapid degradation of catchments and watersheds in Timor-Leste, increased vulnerability to flash-flooding, with downstream impacts on rivers, estuaries and coastal ecosystems.

- *Sedimentation of rivers and estuaries and coastal waters.* The sedimentation of rivers and streams due to ongoing sediment run-off (ie. from deforestation, poor catchment management, land degradation), also has major potential impacts on estuaries and coastal ecosystems in Timor-Leste, including mangroves (and also, coral reefs). Anecdotal reports suggest that riverbeds and estuaries in Timor-Leste have become significantly shallower and wider due to massive riverine sediment loads and riverbank erosion. Detailed studies by Alongi et al. 2009 of the Caraulun catchment on the south coast, estimated total sediment runoff at ~ 7976 t/km2/year for the Caraulun River. Further, these catchment sediment loads have resulted in the Caraulun 'delta' increasing twenty-fold over the last 100 years. As such, over the period 1996-2006, estuarine shoreline prograded seaward by 111m, resulting in the burial of mangroves. For potential mangrove conservation programs, this suggests that sediment supply may not be limiting in some estuarine areas, but rather a threat. It also underscores the strong connectivity of catchments and coastal ecosystems, and the need for effective soil conservation and effective watershed management in protecting and mangroves and other coastal ecosystems.

The Impacts of Climate Change

Climate Risks and Climate Change.
Climate risks in Timor-Leste include, both immediate variability in the occurrence and intensity of extreme weather events, as well as risks posed by more gradual and long-term climatic change. Sea level rise for the coast of Timor-Leste is projected to range 3.2 - 10.0 cm already by 2020, possibly reaching up to 18-79cm by end of the century (Kirono 2010, NAPA 2010, BoM & CSIRO 2011). Moreover, the most recent study by the Pacific Climate Change Science Programme indicated that sea level rise near Timor-Leste measured by satellite altimeters since 1993, is about 9mm per year on average, larger that the global average of 3.2 ± 0.4 mm per year (BoM & CSIRO 2011). While annual average wind speed is only

indicated to change slightly, climate change is expected to significantly change the frequency and intensity of extreme events, such as storms and floods (NAPA, 2010). Projected changes in tropical cyclones are subject to uncertainty inherent in climate change projections. Global climate models show few consistent changes in tropical cyclones, with results dependent on the model, although the models do show a consistent increase in rainfall intensity in future storms. Increased storminess, wave swells, sea surges and SLR will threaten the country's still fragile development gains.

These climate assessments have resulted in a range of adverse climate impact and coastal change projections for coastal populations in Timor-Leste (Barnett et al. 2007), including human and material losses in the wake of more intense cyclone and storm surges, landslides (in upper catchments), more frequent flooding disasters (UNDP 2010, ADCP 2013), increased sediment and riverine runoff, leading to burial of mangroves and congestion of coastal drainage systems (Alongi et al. 2009), reduction in fresh water availability in coastal communities, including increased groundwater salinization of coastal aquifers) (Wallace et al 2012), altered natural coastal geomorphological processes, increased, and increased coastal inundation and erosion (from storm surge and SLR), resulting in reduced protective functions of coastal ecosystems. The main impacts of climate change to coastal ecosystems as identified in the NAPA (2010) are summarized in Table 3, below.

Climate phenomenon	Impacts of climate change on coastal ecosystems
Sea Level Rise	• Increased groundwater contamination by salt water intrusion • Flooding and destruction of coastal settlements
Intensified cyclone and storm activity	• Reduced health, diversity and productivity of coastal and inshore marine ecosystems and species • Loss or destruction of coastal vegetation, species and habitats • Physical damage to coral reefs and mangroves by strong wave action • Increased erosion of beaches, shorelines and coastal land, loss of breeding and nesting habitats

Table 3: Key climate change impacts on coastal ecosystems (adapted from NAPA 2010)

Climate Change Impacts on the Coastal Ecosystems and Shorelines

Despite the current and projected impact of climate change (and long-term implications of sea-level rise) on the coastal ecosystems of Timor-Leste – no formal, baseline, coastal vulnerability assessment (CVA) has been undertaken. As such, the impacts of climate change on the coastal ecosystems, assets and shoreline of Timor-Leste is unknown. The susceptibility of the coastline will vary from place to place according to the physical nature of the coastal landforms (Ramsey, 2011), and the modulation of wave, tidal and storm surge processes (and exposure to infrequent tsunami). Socio-economic impacts are likely to be exacerbated by the current high levels of population growth, food insecurity and high dependency on coastal resources, and also, limited human resources and capacity and weak institutional frameworks and coastal governance (Barnett et al., 2007). A formal CVA provides an integrated measure of the biophysical and socio-economic impacts of climate change on coastal ecosystems. As such, it is an essential foundation for any mangrove restoration-coastal livelihood development program, and also, a critical input into the development of a national shoreline management and adaptation plan.

Climate Change Impacts on Coastal Communities

Climate change is having major and devastating impacts on coastal communities and human populations in Timor-Leste (Barnett et al. 2007). Riverine flooding (due to extreme rainfall events), strong winds and coastal inundation (from increasing SLR and storm surges), represent some of biggest climate risks, resulting in landslides, coastal erosion, and loss of agricultural land (Barnett et al. 2007, NAPA 2010, ADCP 2013). The coastal population of Timor-Leste is particularly vulnerable to the threats of sea level rise and extreme weather events. Along Timor-Leste coastline (~747 kilometers in length), approximately 40% of the population (~560,000 people) reside in coastal and lowland areas (with an elevation up to 500m). They are not only susceptible to flash floods and landslides (originating from the upstream hill areas), but subject to increased incidents of sea surges and storms. Significantly, the coastal zone (and habitats) of Timor-Leste are subject to a high degree of human dependency and resource use. To-date, approximately 64-70% of the rural population is food insecure (Oxfam 2008; Kunwar et al. 2010), relying heavily on natural resources, with agriculture and (semi-)subsistence fisheries being the major sources of

income for the population (Oxfam 2008, Molyneaux et al. 2013, Mills et al. 2013).. This includes strong reliance and dependency on mangroves and their natural-resources, for coastal livelihoods (ie. food, fuelwood, building materials, livestock grazing) (Alongi & de Carvalho 2008, Alongi 2014). Mangroves are regularly harvested for firewood, which is the primary source of energy for 98% of the population. The removal and clearance of mangroves, in turn, exacerbates the vulnerability of coastal populations with direct impacts on settlements and livelihoods, through increased risks of strong winds, storm surge, coastal inundation and erosion (ADCP 2012, 2013), and also, saltwater intrusion and salinization of critical groundwater resources (Wallace et al. 2012).

Climate Impacts on Groundwater Resources and Saltwater Intrusion.
Mangroves and coastal wetland ecosystems, as water dependent ecosystems, are highly influenced by hydro-ecological conditions, particularly riverine outputs and ground water aquifers. These coastal (intergranular) aquifers with smaller catchment areas have the highest level of vulnerability to climate change in Timor-Leste (Wallace et al. 2012). Coastal communities and the Timor-Leste economy are heavily dependent on surface and groundwater resources (Barnett et al. 2007). Groundwater is increasingly being seen as an essential alternative source to surface water supplies in recent years, due to prolonged drought. In many coastal communities in Timor-Leste, these vital freshwater groundwater and springs are also afforded special cultural significance as sacred land or '*tanah lulik'* . The effects of changes in climate on groundwater resources were highlighted in a recent DCCEE commissioned report for Timor-Leste which noted "*The most significant impact on the population during El Nino* [drought] *years is the reduced ground water availability"* (Australian Bureau of Meteorology and CSIRO, 2011). Climate change is expected to affect the availability and quality of groundwater in Timor-Leste through changes in temperature, rainfall and sea-level-rise. Sea-level rise has the potential to drive seawater intrusion into coastal freshwater aquifers, causing changes in groundwater flow and salinization of water used for drinking and agriculture (Barnett et al., 2007, Wallace et al. 2012)). Importantly, these coastal areas also have higher 'potential impact' from changes in rainfall and/or sea level rise, with limited 'adaptive capacity' to respond to climate change impacts.

Saline intrusion currently occurs primarily along the northern coast of Timor-Leste, representing a constraint on water use in the coastal zone – including potentially limiting supply to populations and also, development of new water consuming activities (Wallace et al. 2012). In many coastal regions of Timor-Leste, the impacts of saltwater intrusion on agricultural lands, particularly rice production (particularly on the south coast), small gardens and coconut farming, are already apparent. Low-lying, coastal areas, less than 5 m above sea level (i.e. between 0 and 5 m AHD), including Dili, the capital city, are potentially at threat from seawater intrusion (Wallace et al. 2012). These include large low-lying areas along the southern coast, but also, discrete locations along the northern coast (Figure 4). All these low-lying coastal communities reliant on groundwater supplies in Timor-Leste are potentially at risk but a detailed assessment is required to quantify the actual risk at each location. Water sources in Dili, Liquiça, Oecussi and Baucau are areas of high potential impact from climate change (Wallace et al. 2012).

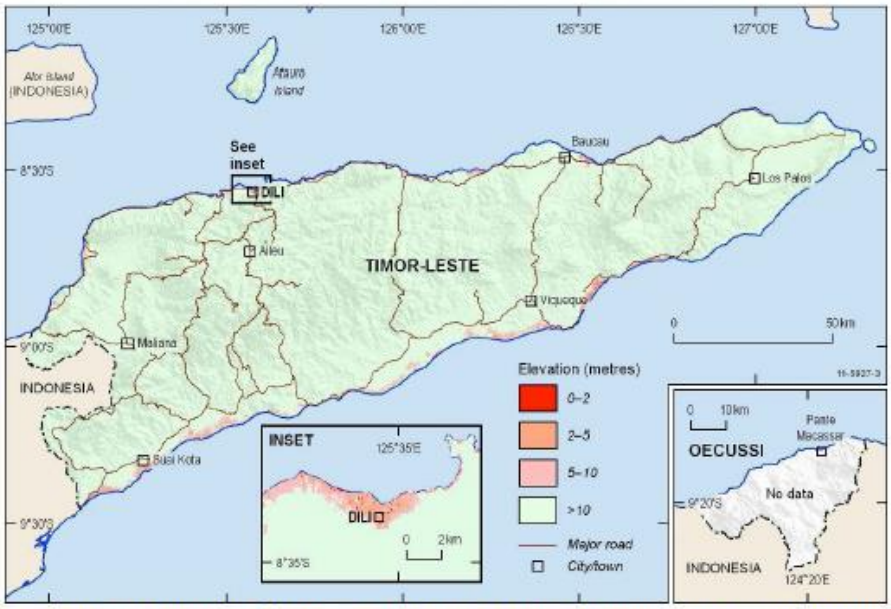


Figure 4 Low-lying coastal land in Timor-Leste with an elevation less than 10 m AHD, at risk from saltwater intrusion.

Mangroves, Coastal Protection, Ecosystem Services & Status

Mangroves, Coastal Protection and Ecosystem Services.
Coral reefs and coastal wetlands, particularly mangroves, play a key role in shoreline protection and climate change adaptation, protecting shorelines and coastal communities from erosion, and dissipating energy from storms (including strong winds, storm surges) and to some extent, tsunamis (UNEP-WCMC 2006). At least 70-90% of the energy of wind-generated waves is absorbed, depending on how healthy these ecosystems are and their physical and ecological characteristics (UNEP-WCMC 2006). In a tsunami, the buffering capacity of reefs and mangroves is more variable and often reduced because of the different structure and form of the waves and their much greater force. For mangroves specifically, their protective functions includes their capacity to reduce wave velocity and heights, stabilize sediments and protect shorelines and human populations from coastal erosion, storm surge inundation, strong winds, and potentially small tsunami waves (see reviews by Alongi 2008, Gedan et al. 2011, Marios & Mitch 2015). This is due principally to the interplay between mangroves and the complex, coastal hydrodynamic and geomorphological processes operating along shorelines. While wetlands cannot protect shorelines in all locations or scenarios (such as large-scale regional erosion, river meandering, and large tsunami waves and storm surges), the nonlinear relationship between wave attenuation and wetland size means that even small wetlands can afford substantial protection from waves (Barbier et al. 2008, Koch et al. 2009, Gedan et al. 2011). Further, it is against small, frequent, and economically damaging events such as tropical storms, coastal floods, and tidal waves that mangroves (and other coastal interface habitats) offer the greatest benefit in terms of storm protection (Barbier et al. 2008).

Importantly, mangroves protect and modify shorelines in ways that increase shoreline integrity over long timescales, and thus provide a lasting coastal adaptation measure that can protect shorelines against the ongoing impacts of accelerated sea level rise and more frequent storm inundation (Gedan et al. 2011). Further, combining man-made structures with mangroves and other coastal wetlands in ways that mimic nature is likely to increase coastal protection (Gedan et al. 2011). In addition to coastal protection, coastal wetlands also provide multiple ecosystem services and benefits for local coastal communities, such as provisioning services (e.g., timber, fuel wood, and charcoal), regulating services (e.g. protection against floods, storms and erosion control; prevention of saltwater intrusion), habitat (e.g. breeding, spawning and nursery habitat for commercial fish species; biodiversity), and cultural services (eg. recreation, aesthetic, non-use) (UNEP, 2006, Barbier 2007, TEEB, 2010). Mangroves also store an immense amount of carbon from the steady accumulation of organic matter over several millennia (Donato *et al*. 2011, Page *et al*.

2011). To this end, mangroves are among the most carbon-rich forests in the tropics, containing on average 1,023Mg carbon per hectare (Donato et al. 2011).

Coral reefs, as natural breakwaters, also play a major in reducing wave energy and protecting shorelines against storms, storm surge and coral erosion, and under some conditions, mitigating the impacts of tsunamis (UNEP-WCMC 2006). Like mangroves (and seagrasses), coral reefs are also sites of sediment accretion, and assist in stabilizing shorelines. In Sri Lanka, it has been estimated that with current rates of erosion and assuming that 1km of reef protects 5km of shoreline, 1 km^2 of coral reef can prevent 2000m^2 of erosion a year (Berg et al. 1998).

Extent, Significance and Status of Mangroves and Coastal wetlands.
Mangroves occupy only a small area of Timor-Leste (~1,300ha) both in absolute terms, and when compared with neighboring countries with very long coastlines, such as Indonesia and Australia (FAO 2005, Boggs et al. 2009, Alongi 2014) (see Table 4). This is due mostly to the coastal configuration and physiography of Timor-Leste, which unlike other islands of the Indonesian archipelago and the north coast of Australia, does not include the salient coastal contours, physiographic features and coastal processes, for significant mangrove development (i.e. extensive low-lying coastal plains, sheltered waters, sedimentary processes) (FAO 2005, Boggs et al 2009). Further, rivers in Timor-Leste flow intermittently and hence, large estuarine systems are generally absent.

Country	Area (ha)*	% world mangroves	No. of true mangrove species
Timor-Leste	1,802	0.001	19
Northern Territory	373,700	2.4	37
Papua New Guinea	410,000	2.7	37
Australia	1,451,411	10	37
Indonesia	3,062,300	19	43
*Figures from FAO 2007 and Timor Survey			
**Species showing high fidelity to mangrove communities: additional species found near or occasionally in mangrove communities to occur.			

Table 4: Regional comparison of mangrove extent and diversity (from Boggs, et. al., 2009)

Both, estuarine/river-delta and oceanic/fringe mangroves communities occur in Timor-Leste. Estuarine mangroves are situated on alluvial deltas, often with a protected lagoon, and predominate on the south coast; while oceanic mangroves are typically situated in marine-edge settings (often the coasts of islands with fringing coral reefs) and in Timor-Leste, are generally found on the sheltered, north coast. In Timor-Leste, mangroves are also found fringing coastal lakes. Nineteen true mangrove and 13 mangrove-associated species are found in Timor-Leste, with *Avicennia marina*, *Sonneratia alba*, *Rhizophora stylosa*, *Ceriops tagal,* and *Lumnitzera racemosa* being the most common. Most trees are stunted or <6–8m in height, although a few tall (>40 m) *Sonneratia alba* stands exist near Metinaro, the largest contiguous forest in Timor-Leste. The largest contiguous extent of mangroves in Timor-Leste (~12 km long) occurs in the Metinaro region, which contains almost one-half of the total mangroves in Timor-Leste (Boggs et al. 2009, Alongi 2014).

The national extent, significance and status of mangroves and coastal wetlands in Timor-Leste is unknown. Latest studies, indicate a national extent of approximately 1,300 ha (Alongi 2014). However, the current estimates of distribution, areal extent, and loss are inconsistent, due primarily to the lack of field ground-truthing data. While previous coastal-marine habitat mapping surveys have been undertaken (Boggs et al. 2009, Lieper et al. 2013), finer-scale, floristic surveys and ground-truthing (particularly on the south coast) are required to assess current condition, threats, conservation significance and importantly, the potential for restoration efforts.

Recent coastal mapping has revealed significant and ongoing loss of coastal mangroves in Timor-Leste. As such, it is estimated that the total mangrove area has been reduced from 9,000 hectares in 1940 to 3,035 hectares in 2000, to just 1,802 hectares in 2008 (Boggs et al. 2009). This equates to an 80% loss since 1940. However, most of the previous estimates have very likely overestimated total mangrove area,

due to the difficulty in distinguishing mangroves from freshwater swamps in the photo reconnaissance conducted in the last century (Alongi 2014).

Nevertheless, there is clear evidence of major mangrove loss in Timor-Leste, and also, major threats to current stands, with no evidence of new forests along either the north or south coast in the recent past (Along 2014). Future, anecdotal evidence indicates little evidence of natural regeneration, with mangrove stands on both, the north and south coast consisting of mature adults with little, if few, immature trees. As such, saplings have rarely been observed, even at the seaward edge, where one would most expect to see new recruits colonizing accreting mudflats (Alongi 20014). Further, coring operations in several coastal lagoons on the south coast, mangrove peat deposits were found beneath the sand dunes suggesting that mangroves have receded over time, perhaps buried by the increasing amounts of sand exiting rivers from catchments that have long experienced high erosion rates (Alongi 2014).

A major concern is the fragmented nature and small size of most mangrove stands, along the north and south coast. To this extent, these small, isolated stands are susceptible to the problem of being at, or below, critical patch size for natural recruitment of new seedlings. For these reasons, mangroves in Timor-Leste require urgent management and conservation. The largest stand of mangroves at Metinaro, may be just large enough to remain self-sustaining if conservation plans are put in place very soon (Alongi 2014).

Significantly, coastal communities have a long-standing and close connection with mangroves, both as a source of food and income, and also, for spiritual and cultural purposes (including traditional, harvest festivals) (McWilliam 2001, 2003). Humans have been harvesting marine resources in Timor-Leste, including within mangrove forests, for at least 42,000 years (O'Connor et al. 2011). Mangroves are common sites for small-scale, artisanal fishing, and grazing domestic livestock (cattle, goats, pigs); goats commonly feed on mangrove tree parts, especially *Sonneratia* pneumatophores (Alongi 2014). People, routinely enter the mangroves, on a daily basis, to harvest leaves, fruit, fallen wood, and algae growing on root and stem surfaces, with women and children commonly harvest small benthic invertebrates, such as crabs and molluscs.

Threats to Mangroves

Climate Change Impacts on Mangroves.
Mangroves and coastal wetlands are highly vulnerable to the projected impacts of climate change, particularly sea-level rise (SLR). The estimated sea level rise of 9 mm per year is three times the global average, and much greater than the average tectonic rise of Timor of 0.5 mm per year (Kirono 2010, CSIRO & BoM 2011). Along many parts of the north coast, evidence of sea level rise and 'mangrove drowning' is already very apparent (see Box 1), including the problem of 'coastal squeeze', ie. the lack of available land for mangrove to migrate upland (with SLR) - a major threat to mangroves in Timor-Leste. An estimated 80% of mangroves have been lost in Timor-Leste, since 1940 (Boggs et al. 2009, Alongi 2014), due to a combination of both, climate related risks (ie. sea level rise, increased storm events) and also, non-climate related anthropogenic impacts (ie. demand for fuel wood, building materials, salt production, rice production, uncontrolled grazing). While the relative contribution of these causal, climate and non-climate factors is unknown, anecdotal evidence (ie. the lack of natural regeneration in many areas), suggest SLR has had major impacts, particularly on the north coast. The loss of mangrove forests has resulted in greater exposure to sea surges, inundation, erosion and accretion processes. Similarly, loss in coastal wetlands disrupt the hydrology that not only, in certain areas support the mangrove stands, but also provide important storm water absorption role protecting the coast against inundation. Climate impacts on mangroves (and also, estuaries and coral reefs), are also exacerbated by significant (and increasing) non-climatic anthropogenic impacts (particularly coastal zone development, fueled by population growth). Recent surveys of Timor-Leste has identified 24 key wetland sites (including mangroves) in need of protection and improved management (Trainor 2005, 2011, NBSAP 2011), both to support habitat conservation and improve the coastal protection against sea storms and inundation.

Non-Climate Threats to Mangroves.
The major non-climate impacts on mangroves include large-scale, land clearance and conversion for rice farming and traditional salt production, and also, their use as fuelwood, for cooking and household income. The single, largest non-climate threat to mangroves in Timor-Leste is the large-scale, loss and destruction of mangroves and adjacent salt flats, for rice production and also, traditional salt production. Mangroves are also illegally cut for house construction, boatbuilding, and also, for fuel wood to support traditional salt-making livelihood activities. Significantly, the expansion of traditional salt farming activities on the North coast (Liquiça and Bobonaro Districts) and also, rice production (particularly on the South coast) have not only cleared mangroves, but also, reduce the potential for any future landward migration of existing mangroves, due to sea level rise. More recently, aquaculture ponds have also been established on coastal flats, reducing options for any coastal retreat of mangroves. Conversion of mangroves into salt pans and increased demand for fuel-wood for salt production has significantly reduced mangrove cover, undermining their functions as a natural, physical and protective barriers to coastline erosion, flooding and inundation, and also, as sedimentary stocks supporting shoreline integrity. Proposed major expansion of coastal aquaculture (NADS 2012) also has the potential to impact on mangrove ecosystems. Removal of mangroves and receding coastlines, increases soil and groundwater salinity, and soil mobility contributing to the further erosion and degradation of natural defenses.

Another major non-climate impact on mangroves is their use as fuelwood, for cooking, household income and also, traditional salt production and rice production. In 2010, it was estimated that a staggering 98.7% of all households still using fuel wood as their main cooking fuel (Census 2010) (see Table 5). Consumption rate of fuel wood is approximately 600,000 tons/year and this has resulted in the diminishing of forest cover particularly in areas surrounding Dili, but also in other places in Aileu, Manatuto and Liquica districts, which are the major supplier of fuel wood to Dili. The annual deforestation rate is estimated at 1.73% and the forest occupies about 60% of the total land area. The fuel wood and timber harvesting activity has significantly contributed to soil erosion and land degradation, including in coastal areas. The main trees used for firewood are ironwood, kou, Hawaiian giant, mesquite, mangrove and ai-nitas. Some families, particularly those living in the vicinity of the coastal cities of Dili and Baucau sell fuelwood to support their household income.

	Electricity	Cooking gas	Bio gas	Kerosene	Wood	Other
Timor-Leste	2.8	1.2	0.6	5.6	89.6	0.2
Ainaro	0.7	0.2	0.6	3.7	94.8	0.1
Aileu	0.8	0.3	0.4	3.5	94.9	0.0
Baucau	1.9	0.4	0.4	2.6	94.5	0.2
Bobonaro	1.1	0.4	0.5	3.6	94.2	0.1
Covalima	1.4	0.4	0.3	2.7	95.0	0.1
Dili	9.5	4.6	1.0	16.4	68.0	0.5
Ermera	0.6	0.4	0.7	3.0	95.2	0.1
Liquiça	1.5	0.5	0.6	2.3	95.0	0.1
Lautem	1.4	0.5	0.5	2.7	94.5	0.6
Manufahi	1.1	0.4	1.0	3.6	93.6	0.3
Manatuto	2.2	0.4	0.4	3.4	93.4	0.1
Oecussi	0.7	0.4	0.5	3.3	95.0	0.1
Viqueque	1.3	0.5	0.4	2.7	95.0	0.3

Table 5: Main source of energy for cokking by district in Timor-Leste (TL National Census, 2010)

Mangrove Re-afforestation and Conservation

Ecological Mangrove Restoration (EMR).
Many mangrove restoration attempts have failed worldwide (particularly in Indonesia) due to (i) poor understanding of the ecological and hydrological requirements of mangroves, particularly in establishment and early growth, and (ii) complex social-cultural, land tenure and ownership issues (Lewis, 2005, 2009). Direct seedling planting is also characterized by often, high mortalities (due to inappropriate siting and

handling) and when successful, the establishment of unnatural, low diversity, mangrove systems or plantations. Community-based ecological mangrove restoration (or EMR) is a local-scale, community-based approach to mangrove restoration that prioritizes natural regeneration and socio-cultural-political understanding, using participatory methods, common in sustainable development and coastal resource management programs (Brown et al. 2014) [see Case Study – Tanakeke Island]. Because of its emphasis on natural regeneration, EMR activities typically result in high diversity, near-natural ecosystems. In Indonesia, the proven effectiveness of the EMR process at small and medium scales has been its ability to resolve both, biophysical and socio-political issues underscoring mangrove forest degradation. Significantly, EMR adopts an adaptive, participatory approach to mangrove restoration, which prioritises natural regeneration, over direct seedling plantations. A rapid assessment uncovers the ecological, social and economic viability of mangrove generation at a proposed site. Principally, the rapid assessments help develop an understanding of the state of the mangrove system from an ecological and social perspective.

In Indonesia, EMR has been particularly successful in re-afforesting, disused shrimp ponds (or tambaks). Biophysically, this involved strategic breaching of dike walls, hand-digging of tidal creeks to encourage proper drainage of the site, and periodic propagule dispersal to encourage natural re-vegetation. In Timor-Leste, rice paddies have been established (unsuccessfully) on the margins of many mangrove forests (particularly on the south coast) – and like shrimp ponds, are directly amenable to restoration of hydrological regimes.

Past, Successive Failures in Mangrove Re-Afforestation in Timor-Leste.
There have been several major efforts over the past decade (2005-2008, 2010-2012), to restore mangroves in Timor-Leste. Most of these efforts have focused on the north coast (ie. Ulmera, Hera, Metinaro and Manatuto), by Haburas and also, local NGOs (eg. APEF) (funded by UNDP small grants scheme, JICA and MAF). However, these efforts have largely failed, due to poor understanding of the hydro-ecological requirements of mangroves, poor community support, limited maintenance and monitoring, and limited technical support or training in mangrove restoration. None of these previous 'restoration sites' were formally assessed for their hydro-ecological (or socio-cultural-political) suitability for long-term, mangrove restoration. Further all of the efforts have largely used seedling farming (nurseries) and direct seedling planting, rather than attempting natural regeneration (as per the EMR approach). Mangrove seedling nurseries were fenced, to limit grazing from goats, cattle and pigs, but fencing was poorly maintained, primarily due to lack of materials and cash incentives. Many locals also blame 'uplanders' and itinerants for ongoing, mangrove harvesting and also, ongoing livestock grazing in mangroves.

*Lack of Knowledge of Coastal Change, Particularly Surface Elevations***.**
The lack of baseline knowledge on coastal change and particularly surface elevation has been a major constraint to re-afforestation programs in Timor-Leste. On the north coast of Timor-Leste, anecdotal evidence suggests that mangroves are not keeping pace with current sea level rise (9mm per year). This may well be one of the key reasons why previous mangrove restoration efforts have failed. Worldwide, sea level rise (SLR), is considered one of the single greatest climate threats to mangroves and coastal wetlands (Gilman et al. 2008, Giri et al. 2011). The establishment and long-term stability of mangroves is determined by their tolerance to physical conditions, particularly tidal inundation. Tidal inundation will increase with sea level rise, which could "drown" mangroves if inundation increases beyond a threshold that mangroves can tolerate (Friess et al., 2012). Mangroves can survive if they can keep pace with sea level rise by increasing the elevations of their surface, by trapping sediment or by producing below-ground root organic matter. For this reason, a baseline assessment of coastal change, and particularly surface elevation, is essential to identify suitable sites and inform successful and sustainable – a scale that is too fine to be picked up by satellite remote sensing, so needs field-based measurements. The Rod Surface Elevation Table (RSET) is a simple, low-cost, standardized and repeatable method designed by Cahoon et al. (2002) [see Box 2]. As such, the RSET allows the monitoring of site vulnerability to sea level rise and highlights sites at potential risk. And importantly, can assess the long term viability of proposed mangrove re-afforestation and conservation efforts.

Lack of Incentives for Mangrove Conservation.
With high levels of food insecurity, limited cash income and limited knowledge of climate risks, the coastal protection benefits of mangroves, and broader ecosystem goods and services (EGS) benefits of mangroves, there are currently very limited incentives for coastal communities in Timor-Leste to protect and conserve mangroves. Further, restoration projects to-date have been short-term – too short for community learnings to take place, and for mangroves to have time to regenerate, before the project stopped paying and the community stopped protecting. In most restoration efforts, locals were paid US$10/per year/per seedling to grow mangrove seedlings from propagules. Women were typically responsible for raising and planting seedlings, while the men were responsible for fencing and maintenance of mangrove seedling nurseries. Fishermen and aquaculture farmers are generally acutely aware of the benefits of mangroves, in providing fish habitat and protection from strong winds and storm surge.

Community Knowledge of Climate Change Impacts and the Adaptation Benefits of Mangroves.
Community knowledge and appreciation of climate change risks (and future projections) and also, the coastal protection and adaptation benefits of mangroves (particularly how mangroves protect communities against specific climate change impacts), is essential in building community support for ongoing mangrove conservation and restoration efforts. While many community-based vulnerability and adaptation assessments have been undertaken in Timor-Leste, raising awareness of climate change risks, they have largely focused on disaster reduction and management, and agriculture and water sectors (NAPA 2010, Mercer et al. 2014).

Mangrove Governance in Timor-Leste

Poor Coordination, Clarity, Resources and Capacity in Mangrove Management.
Under Section 5 of *UNTAET Regulation No. 2000/19 On Protected Places,* all mangroves and wetlands in Timor-Leste are legally protected. This includes prohibition of: the pollution, the draining, or the destruction, of a naturally existing wetlands and mangrove areas. And also, the cutting, the damaging, or the removing, of a mangrove, is prohibited. Despite these legal protections, enforcement is poor, and mangroves continue to illegally harvested and subject to a wide range of direct and indirect human impacts.

Directorates of Forestry and Fisheries under the MAF have shared responsibilities for mangrove management. Significantly, there is no formal, administrative arrangements for mangrove management, resulting in lack of clarity and poor coordination. While the MAF Annual Action Plan for 2013 includes baseline survey, mangrove inventory and the establishment of mangrove nurseries for rehabilitation, the total annual budget for MAF is approximately US$600,000, and includes the four year Forest Management program. Despite the importance of mangroves for shoreline protection and coastal livelihoods, the current level of financial support is not proportionate to the scale of the issue, given mounting climate change risks, particularly increased storms and extreme weather events, flooding and prolonged coastal inundations.

Poor Representation of Mangroves in Protected Areas.
Protected areas are widely recognised an important tool for biodiversity conservation and also, building ecosystem resilience to climate change. Under the NBSAP 2011-2020, effective management of protected areas is seen as integral to managing biodiversity and building climate-resilient ecosystems. Mangroves are currently poorly reserved in Timor-Leste. However 50% of the current distribution has been identified for protection in Timor-Leste proposed Protected Areas Network (PAN) (Grantham et al. 2011). This includes the country's largest mangrove forest in Metinaro (ie. Behau Marine Protected Area). The NEGA and NBSAP recommend a national target of 80% reservation. Within the proposed PAN, the following 8 protected areas contain significant amounts of mangroves – all these sites (and particularly Behau) should be considered for potential mangrove conservation and/or reafforestation work with this project: Behau (marine), Atauro (marine), Lamsanak (marine); and Lake Welenas (proposed), Lake Moda Mahut (proposed), Mangal Citrana, Cristo Rei Protected Area and Tasi Tolu. Overall, the management system for the 30 declared protected areas in the PAN is still inadequate, due to weak institutional support to protected area management, coupled with inadequate national laws and regulations that

sometimes conflict with other traditional laws. As mentioned in the NEGA, the current protected areas budget, at US$60,000 per annum, is woefully inadequate for national protected area implementation. It is estimated at least US$500,000 per annum would be required to finance the protected area network based on rough estimates from DPANP (Grantham et al. 2011).

Mangroves and Coastal Wetlands of National and International Significance.
Several of these sites proposed for the TL protected areas with mangroves, have also been recognised as Important Bird Areas (IBAs) and wetlands of national importance (Trainor 2005, 2011, Trainor et al. 2007, NBSAP 2012). Coastal wetlands (both, brackish and freshwater), which often include mangrove communities, are important coastal features that provide both, a range of coastal protection functions (against storm surge, coastal erosion, strong winds), as well as ecosystems services to support coastal livelihoods (ie. water, food, fisheries, timber resources, cultural/spiritual values). In Timor-Leste, coastal wetlands (and particularly the avifauna) have been relatively well-studied by BirdLife International, including bird surveys of 93 inland and coastal wetland sites(Trainor 2005, Trainor et al. 2007, 2011). Sixteen of these sites were identified and nominated as internationally, Important Bird Areas (IBAs) – four of which contain mangroves (Sungai Clere, Be Malae, Tasitolu and Areia Branca). A total of 24 key wetland sites were identified as environmentally significant at the national scale, and in need of conservation and improved management, both to support threatened and near threatened birdlife, also, to protect wetland habitat and improve the coastal protection against sea storms and inundation (Trainor et al. 2007, NBSAP 2010)/ Twelve of these sites contain mangroves.

Of all the 93 wetlands surveyed by Birdlife International (Trainor 2005, Trainor et al. 2007, 2011), 16 sites recorded mangroves (see Table 6). All these sites should be considered as potential project sites for EMR assessment and mangrove protection, and restoration. Including recognized IBA sites and wetlands of national significance for protection and conservation management, also has the potential in the medium to longer-term, for the consideration of formal accession and access to global wetland management expertise and resources, under the global, RAMSAR Convention on Wetlands (Ramsar, Iran, 1971).

Site No.	Site	District	Wetland Habitats
76	Oecussi swamp	Oecusse	Mangroved-lined floodplain and short grass
8	Lake Be Malae (part of IBA)	Bobonaro	Shallow saline lake, estuary
17	Lake Maubara	Liquica	Shallow saline lake
7	Tibar aquaculture	Liquica	Mudflats, mangroves, fishponds
1	Tasitulo (IBA)	Dili	Saline lakes, mudflats, beach
21	Areia Branca beach (IBA)	Dili	Saline lakes, mudflats, beach
23	Hera	Dili	Saline lakes, mudflats, sandflats
6	Manatuto mudflats	Manatuto	Mudflats, mangroves, fishponds
87	Manatuto Lake/mangroves	Manatuto	Saline mudflats
2	Seical estuary	Baucau	Mangroves, mudflats
4	Lake Laga	Baucau	Saline lake, beach
10	Lore Coast (IBA)	Lautem	Beach, exposed reef
22	Lake Modo Mahut (IBA)	Manufahi	Freshwater lake
83	Lake Welada (IBA)	Manufahi	Freshwater lake, mangrove-lined
84	Lake Welenas (IBA)	Manufahi	Freshwater lake, mangrove-lined
86	Lake Naan Kuro	Manatuto	Saline coastal lagoon, mangrove-lined

Table 6: Total number of surveyed wetlands with mangroves confirmed present (based on Trainor et al 2007, 2011)

Incorporating Other Nearshore, Coastal Features in Building Shoreline Resilience.
As major coastal features, coral reefs and seagrasses, also potentially play an important role in coastal protection (UNEP-WCMC 2006) – building shoreline resilience to climate risks, particularly reducing coastal erosion and the impacts of storm surge and flooding. Like mangroves, coral reefs and seagrasses are limited in extent in Timor-Leste, predominantly due to the country's narrow continental margin and coastal physiography. Although coral reef habitat is limited in extent (Table 7), some well-developed fringing reefs are situated at Atauro Island (Dili district), Tibar (Liquiça district), Beacou and Batugade (Bobonaro district), Suai (Covalima district), Betano (Manufahi district), and Beaço (Viqueque district)

(Lieper et al. 2013). Seagrass habitats are also limited in extent (~8km^2) and are largely located on the sheltered, north coast, generally associated with coral reef flats (Boggs et al. 2009). As such, there are significant opportunities to protect adjacent, coral reefs and seagrasses areas, as well as mangrove forests, in these regions. Protecting these nearshore submarine features will not only strengthen shoreline resilience (against climate impacts), but will also ensure reefs continue to provide critical fisheries and food resources for local communities. Coral reefs and seagrasses are also recognized as important coastal wetlands under the RAMSAR Convention.

Habitat Types	Total Area (km^2)	Data Sources	Publication
Coral Reefs	100	MCRM	Grantham et al 2011
Mangroves	13	Boggs 2009	Alongi, 2014
Seagrass	8	TNC	Grantham et al 2011
Total	**121**		

Table 7: Total estimated shallow, coastal-marine habitat in Timor-Leste

Incorporating Mangroves into Coastal Planning and Management.

With increasing sea-level rise, mangroves also, critically, require area for landward migration. With the very narrow and limited area of coastal wetland plains in Timor-Leste (particularly on the north coast), sensible and rational land use is required to provide buffer zones for future mangrove landward migration. Currently, the vast majority of coastal wetland plains are the focus of major rice production and/or proposed major expansion of salt harvesting activities and aquaculture ponds. As such, the critical shoreline protection functions of mangroves are currently not recognized in coastal land-use planning, including for infrastructure development. Without adequate buffer zones or integration of mangroves into livelihood development – mangrove forests are unlikely to survive in many coastal areas of Timor-Leste, particularly along the north coast. Similarly, large-scale infrastructure projects, such as ports, major roads, currently do not incorporate SLR and provide coastal buffer zones for mangrove retreat, in coastal development assessment processes.

Annex G.2: Assessment of Gender Issues in Timor-Leste

The below is an excerpt, summarizing key points from the **Gender Report - Building shoreline resilience of Timor-Leste to protect local communities and their livelihoods**. The report is the result of a desk review, consultations with government and focus group discussions (FGDs) with communities, conducted during the PPG phase of the LDCF project. The full report by Silva Larson, prepared with cost-sharing support from USAID-Adapt, is available upon request.

Assessment of Gender Issues in Timor-Leste

This section provides an overview of the relevant background information and sets a context to the gender issue in Timor-Leste.

Men and women are often impacted differently by climate change because there are differences among women and men, depending on their household assets, social status, resilience, and the like. The key areas of gender-based inequalities relevant to climate change adaptation projects (Diamond and Lellement, 2014) and addressed in this section are: Women's education and health; Land and assets ownership; Employment and income; Division of labor; Decision making and women's empowerment; Climate change adaptation and wellbeing, including existing knowledge systems and skills and perceptions of risk and resilience.

In international terms, Timor-Leste falls in the category of least developed countries, with a 'low human development' score for most of the indicators recorded.

The Human Development Index (HDI, UNDP) is a composite measure of three basic dimensions of human development: health; education; and income, with higher HDI scores indicating higher development status of the country. As a composite measure HDI represents a broader definition of national well-being, and is an alternative to conventional measures of national development, such as level of income and the rate of economic growth. Overall HDI for Timor-Leste is 0.576, well below the East Asia and the Pacific regional average of 0.683 (Table 1), giving the country a rank of 134 out of 187 countries in the world with the comparable data. The HDI for Timor-Leste is highest in the area of health (0.677), followed by income (0.590), but is very low for education (0.480). Adult literacy rate in Timor-Leste is 58.3% only, with an adult, on average, receiving 4.4 years of schooling - very low educational levels by international standards.

TABLE 1. THE HUMAN DEVELOPMENT INDEX (HDI) FOR TIMOR-LESTE, WORLD COMPARISON

HDI	TIMOR-LESTE	REGIONAL AVERAGE*	WORLD AVERAGE
Overall	0.576	0.683	0.694
Health	0.677	0.780	0.788
Income	0.590	N/A	N/A
Education	0.480	0.627	0.647

*East Asia and the Pacific region

The World Health Organization (WHO) Global Burden of Disease Report (based on 2010 data) estimated Timor-Leste male life expectancy at birth similar to world average (67.8 versus 67.5 years, respectively); while female life expectancy at birth was significantly lower than the world average (69.7 for Timor-Leste compared to world average of 73.3 years).

Gender Inequality Index value is not available for Timor-Leste.

Gross National Income (GNI) per capita (in purchasing power parity terms, constant 2005 international $) was reported as $5,446, with the GDP per capita (2005 PPP) of $1,393. In 2007, Percentage of

population living under 1.25 and 2 dollar (purchasing power parity) a day was estimated at 37.5% and 72.8%, respectively. Percentage of population living below national poverty line was reported by the World Bank in 2007 at 50%, with CIA estimates in 2009 of 41%.

Percentage of population living in multidimensional poverty (weighted deprivation score based on household deprivations in education, health and living standards) was estimated at over 68% of total population. Multidimensional poverty index (MPI) for Timor-Leste was calculated by UNDP in 2012 at 0.36, highest in the East Asia and the Pacific region, and well above the regional average of 0.127.

The next sections present relevant key findings of the National Demographic and Health Survey (NDHS) conducted in 2009-10. The survey findings indicate that 45% of the population is under age of 15, representing a small improvement over 2003 survey results in which 51% of the population was under age 15. Such age structure is typical of a young population characterized by high fertility. This type of population structure imposes a heavy burden on social and economic assets of a country. The total fertility rate for Timor-Leste for the three years preceding the survey is 5.7 births per woman, the highest in South East Asia and in Asia. At this level, it is estimated that the population will increase to over 2.5 million people by the year 2050 (World Bank, 2008). In addition, it is estimated that currently about 750,000 people or 70% of the total population live in the rural areas, with rural population density of between 33–74 inhabitants per km2 (National Statistics Directorate 2010). Predicted increases in population would bring rural population density to about 200 per km2, twice the developing country average (World Bank, 2008).

Almost nine in ten (88%) households are headed by males. The mean household size in Timor-Leste is 5.8 persons, and a sizeable proportion of households (15%) have 9 or more members, with urban households slightly more likely to be large than rural households.

WOMEN'S EDUCATION AND HEALTH

Education

37% of women in Timor-Leste have never been to school. About 30% have some primary education, 26% have some secondary education or have completed secondary school, and about 2% of women have more than secondary school education.

The data shows that the proportion of women with no education increases with age, suggesting some improvement in education over the years (Figure 2, from page 17 of the NDHS report):

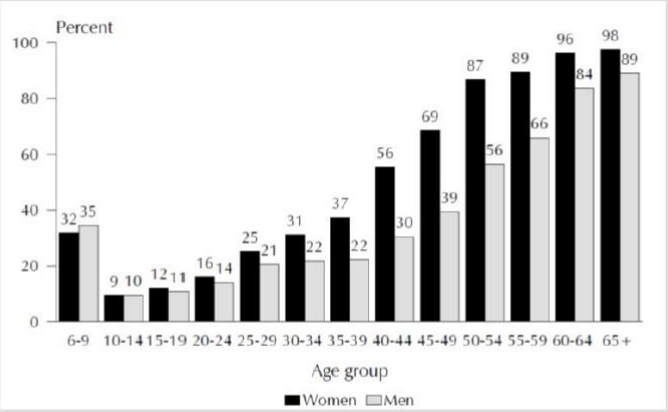


FIGURE 2

Percentage of women and men with no education, by age group

SOURCE: page 17 of the NDHS (2011) report.

There has been a steady increase in the percentage of population who have attended school in each sequential age cohort. Rapid increases in school attendance among women start in the cohort of women who were age 50-54 in 2010 - at the time of the Indonesian invasion in 1975, these women were age 16-20.

Although education results for Timor-Leste are very poor, continuous improvement in data is notable. The government has set as a target the completion of primary school by all children by 2015 (National Statistics Directorate, 2007).

Fertility levels and trends
Fertility levels in Timor-Leste, at 5.7 births per woman, is the highest in Asia.

The marked increase in fertility, from 4.4 to 7.8 children per women, was recorded in the period of 1995-2003. This increase can be attributed to a virtual collapse of the overall health system, and particularly the family planning program, following the struggle for independence from Indonesia and the ensuing chaos.

Fertility is considerably higher in rural areas, with rural women having on average about one child more than urban women. The rural-urban difference in fertility is most pronounced for women age 20-24 (236 births per 1,000 women in rural areas versus 187 births per 1,000 women in urban areas). The level of fertility is inversely related to women's educational attainment, decreasing rapidly from 6.1 births among women with no education to 2.9 births among women with more than secondary education. Fertility is also inversely associated with wealth, with poorest women having, on average, about three children more than the wealthiest women. For most rural women birth interval is about 2 years. Adolescent (women aged 15-19 years) fertility rate remains high, at 65.8 births per 1,000 women aged 15-19.

Maternal and child health
Maternal mortality in Timor-Leste remains relatively high, although it has dropped from around 1,000 in 1990 to 557 (with the confidence intervals of 408 to 706) in 2010 (deaths of women per 100,000 live births).

Under-five mortality was reported as 6,400 deaths per 100,000 live births, dropping from 7,900 for the 2000-2005 period. Nutritional status of children remains poor: 45% of children under age 5 are underweight, and 15% are severely underweight. Further, 58% of children under age 5 are stunted (33% severely stunted) while 19% wasted (7% severely wasted).

In addition, 27% of women were found to be malnourished, a decrease from 38% in 2000. However, malnutrition among women remains a serious public health concern in Timor-Leste.

Orphanhood
A very high proportion of households in Timor-Leste with orphans or foster children reflects the political turmoil in the country over the past two decades. Rural households are slightly more likely to have orphans or foster children than urban households. A total of 23% of surveyed households reported having orphans or foster children under age 18. Percentages of male and female orphans or foster children are similar.

Domestic violence
The survey also included a series of questions that focus on specific aspects of domestic and interpersonal violence, including acts of physical, sexual, and emotional violence. Perceptions and attitudes towards violence are a rather good indicator of overall gender relations in the country.

Nationally, more than one-third of women (38%) have experienced physical violence since age 15, with 28% experiencing physical violence sometime in the past 12 months. Percentages of women who have ever experienced physical violence vary significantly based on their domicile location (district). The main perpetrator of violence in all cases is current husband (74%).

Attitudes towards wife beating are particularly telling (Table 2). More than 80% of all men, and 86% of all women surveyed, agree that a husband is justified in hitting or beating his wife in certain circumstances. For man (Table 2), the agreement with domestic violence is lowest in districts of Aileu (47.8%) and Liquiça (53.7%). Among women, only 59% of women in Viqueque District believe that a husband is justified in beating his wife for at least one specified reason.

TABLE 2. PERCENTAGES OF RESPONDENTS WHO AGREE WITH WIFE BEATING FOR AT LEAST ONE SPECIFIED REASON*, WOMEN AND MAN IN EACH DISTRICT AS A PERCENTAGE OF ADULT POPULATION (NDHS, 2011)

DISTRICT	AGREE, % OF FEMALES	AGREE, % OF MALES
Aileu	86.5	47.8
Ainaro	64.5	87.8
Baucau	83.2	93.9
Bobonaro	88.7	99.6
Covalima	87.6	94.7
Dili	89.8	86.0
Ermera	96.2	76.6
Lautem	92.0	94.6
Liquiçá	88.7	53.7
Manatuto	83.0	1.7**
Manufahi	91.0	91.4
Oecussi	92.3	91.3
Viqueque	59.1	82.5

* 'Reasons' specified in the survey included: Arguing with the husband; Going out without telling husband; Neglecting the children; Refusing to have sexual intercourse; and Burning the food. Going out without telling husband and Neglecting the children were two most likely reasons justifying beating a wife.

** This low percentage is not clarified in the National Demographic and Health Survey Report

Greater self-esteem noted among women in Viqueque District, including their attitudes towards domestic violence, are linked low prevalence of dowry payment for wife in this district (NDHS, 2011).

Experience of sexual violence is much lower, at 3%. The main perpetrators of sexual violence against ever-married women are current husbands/partners (71%). About one in five women (24%) who experience violence seek help.

Such high levels and acceptance of domestic violence have implications well beyond physical and physiological trauma for women. Among other considerations, talking about equality in joint decision-making and women's empowerment in the community, in a society where women understand all too well consequences of disagreement, is concerning.

LAND AND ASSETS OWNERSHIP

According to CIA World Factbook, Timor-Leste's economy is one of the poorest in the world, still suffering from the aftereffects of conflict. The country faces great challenges in continuing to rebuild infrastructure and strengthen the civil administration. The only major economic project is the Joint Petroleum Development Area (JPDA), from which Timor-Leste receives 90% of the revenue from petroleum production, and Australia receives the remaining 10%.

Land and asset ownership is an unresolved issue in Timor-Leste. The World Bank (2014) 'Doing Business' report ranks Timor-Leste 172nd out of 189 countries surveyed, for overall business environment. However, in terms of property registrations, Timor-Leste is ranked last, as land titles are not necessarily registered.

Although the constitution grants equal rights in terms of ownership to both men and women, this constitutional right is rarely exercised by women. Traditional patriarchal asset control prevails, with all assets (land, house etc.) belonging to a husband, and being inherited by male descendants only. In personal interviews, it was reported that the head of household will leave land to sons only; and should he have only daughters, assets will pass to the ownership of a male relative rather than to daughters.

Lack of ownership is likely the most significant handicap for rural women (World Bank, 2014). They have no financial security and thus depend entirely on male members of the family. Situation of single mothers can be even more precarious – although in FGDs conducted for the purpose of this study, widowed women did not report any specific hardships and had access to land. The lack of ownership also precipitates high incidence of domestic violence: wives have no independence and hence cannot leave the husband, as he will retain control of all assets including house, and she will have to leave the house. Even more significantly, married women seeking separation have no fallback position within their birth family: dowry system is extremely pervasive and once woman is married, she is considered 'property' of the husband's family and hence cannot seek return to her birth family. As discussed in previous section, in Viqueque District where dowry payment are much less pervasive, women's perceptions of rights and ability so speak out are higher.

EMPLOYMENT AND INCOME

The National Demographic and Health Survey (NDHS) of 2010 found that the majority of men (85%) and about two-fifths (40%) of women were employed at the time of survey. Not surprisingly, the majority of rural population is employed in agriculture and rate of employment is reported as higher than in urban areas. However, rates of employment in a society with high rates of subsistence farming may not be especially meaningful. Four-fifths or 80% of all 'working' women reported not being paid for their work. This percentage is highest for women engaged in agricultural work (Table 3).

TABLE 3. TYPE OF EARNINGS FOR WOMEN AS PERCENTAGE OF 15-49 AGE POPULATION, NATIONAL AVERAGES*

TYPE OF EARNINGS	AGRICULTURE	ALL OTHER
CASH	2.6	47.7
IN-KIND	1.1	0.5
NOT PAID	96.2	51.7

*in 12 months preceding NDHS 2010 survey

The issue of limited household access to cash, and in particular women's access to cash, remains pervasive (Mills et al, 2013). This issue is particularly relevant in terms of lack of access to cash for large purchases (e.g. fishing gear), investments (e.g. starting small businesses) and opportunities in other alternative livelihood activities. In discussions, this issue was raised predominantly by women who felt they wanted to – and were unable to - engage in livelihoods that were not solely dependent on the men fishing.

Almost half of Timor-Leste population is under 15 years of age. Rapid increase in numbers of people seeking employment– some 20% of population is estimated to be in 15-24 years of age bracket – is one of the key vulnerabilities facing Timor-Leste economy and social stability in forthcoming years (UNDP Social Business Project, 2015).

DIVISION OF LABOR

Rural men and women in Timor-Leste often share productive workload, although some of the activities are gender specific. For example, Mills et al (2013) report the primary livelihood activities in coastal

communities on Atauro Island as fishing and agriculture, with both women and men directly involved in both activities. Fishing is primarily done close to shore by means of spear fishing and use of gill nets from canoes (paddle or small engine), with women gleaning for shellfish and seaweed. In agriculture, women are responsible for planting, cleaning and harvesting gardens, while men only engage in agricultural activities at certain times of the year (maize harvest). Mills et al (2013) also report that most women interviewed were involved in selling either fish or agricultural produce at the market. Fish which is not sold fresh is dried and salted by women for consumption or sale at later date. Some women also purchase fresh fish from Indonesia to dry and sell.

Primary data collected for this LDCF project in the potential project areas reveals similar division of labor. Fishing from boats was reported as man's activity, while women and children engaged in gleaning for shellfish and seaweed. Women were mainly responsible for the sale of fish, which in these communities was mainly done at roadside stalls – although both men and women participated in this activity (Figure 3). Fish processing (drying and grilling) was also reported by women, in particular in Metinaro sub-district of Dili District and in Manatuto District communities (Figure 3). There was little interest in fish processing recorded in Liquiça District communities.

FIGURE 3: WOMEN AND THE FISH

Women and girls selling fresh fish at the road side, Suco Vemasse, Baucau District.

PHOTO CREDIT: B. Ficcadenti.

Women are engaged in both fish grilling and sale of the grilled fish at the road side, Metinaro sub-district of Dili District.

PHOTO CREDIT: S. Larson.

In FGDs, families living along the coastal strip reported owning land on the hillside, where they mainly grow firewood, maize, cassava and sweet potatoes. In the wet season they also grow vegetables (tomatoes, beans, watermelons, etc). This production is for household consumption only, as water scarcity is pervasive in many coastal communities and prevents more significant horticultural activities. Vegetables can only be grown in the wet season – when pests are at the peak and frequently spoil yields.

Communities in Manatuto District also reported rain-fed rice planting. Overall, due to widespread lack of water, agricultural work occurs in wet season only and is shared by men and women. Women are mainly

responsible for gardens and for planting and harvesting crops; while men's responsibility is weeding, and assisting women with fence maintenance. Livestock observed in coastal communities consisted of pigs, goats, chickens, and some cattle, with buffalo also present in rice growing areas. These animals are mainly used for cultural purposes (goats in particular) and as an asset when cash is needed.

The main issue reported is lack of water, both in wet but particularly in dry season. In dry season even water for drinking is a problem in many coastal areas.

Women were also observed weaving baskets (Figure 4) and reported interest in other handicraft activities. Salt production is practiced at several locations along the cost (Figure 4) and is mainly women's activity, although men also get involved when at home during the dry season.

FIGURE 4.
OTHER ACTIVITIES

Women weaving a basket, Suco Ulmera, Bazartete sub-district of Liquica District.

PHOTO CREDIT: B. Ficcadenti.

Salt production:

Women cooking salt using firewood, Metinaro sub-district of Dili District (left).

Preparation for salt processing, Suco Ulmera, Liquica District (right).

PHOTO CREDIT: B. Ficcadenti and S. Larson.

Handicrafts and luxury items:

A selection of luxury items produced by various womens' groups, available at tourist shops in Dili

PHOTO CREDIT: S. Larson.

However, in terms of the domestic or reproductive sphere, there is generally little change from traditional gender roles where women care for children, cook and clean and pay attention to household food security. Addressing the burden of work shouldered by women within the household is essential in order to enable them to participate in other community – and cash generating - activities. Women's and men's roles mean they will be affected differently by climate change with women likely to be more concerned with the health and household food security impacts (discussed further in the next section).

Participation in any community activity has a high opportunity cost for the households, and in particular for women, and hence project will need to adapt to their specific needs. Where women do participate in community level activities, for the most part, they either need to complete domestic tasks beforehand or a daughter in the household must take on their tasks – missing the school as a result.

One proposition for the transformative approach to women's engagement in the projects would be to focus on reproductive workload, seeking a way to share household responsibilities more equitably. This would allow women to participate in project activities, as well as to be available to participate in decision making activities on the community level (discussed further in the next section).

"Men don't stop us coming to meetings, we just have too much to do. We have to wait for husband to come and take the kids, we couldn't come until he does that"
(Women's Focus Group Discussion, Liquiça District, Harvey 2012 for Care International)

"Sometimes one of us cannot attend to her (fish producing group) duties because children are sick or she has to do something in the house. Then she sends one of the children to let us know and we do work for her"
(Women member of the Fish Farm Group in Aldeia Manuleu, Suco Duyung, Metinaro sub-district of Dili district; primary data collection for this project)

According to the national Census, about 38% of rural households in Timor-Leste have water on premises, 24% need to walk less than 30 minutes to collect it, while 34% walk more than 30 minutes to collect water. The key responsibility for water provision is with women (42%) and girls (8.5%). However, MAKA'AS report (Harvey, 2012) found that children play the major role in the collection of water, with children (both boys and girls) comprising 50% of the primary water carries in the survey. Further, participants confirmed that once a child reaches 7 or 10 years old he or she is considered fit to take on adult work. Villages participating in our primary data collection had either communal well or piped water (from the well) that could be used for drinking. As mentioned above, even drinking water would become brackish in the dry in some communities. There was no water available in the dry season for gardening or watering the plants.

Firewood is used as the only cooking fuel in 99% of rural households, with the estimated national firewood consumption of around 800,000 tonnes per year, or 2.2 kilograms per day, per person (Henriques et al, 2011). Wood is collected by both men and women, and often by children; however ensuring that sufficient firewood is available is a responsibility of women. Firewood was reported as increasingly scarce in the communities interviewed. In Liquiça district, women reported spending around four hours a day each day looking for firewood. This hardship is exacerbated by most communities having some form of ban on chopping of the trees for firewood – only "dead" branches can be used. Although ecologically sound, such bans increase women's hardship and vulnerability. Chopping of branches of entire trees – including mangroves - for fencing and construction of houses is common.

Wood is also burnt in the traditional salt production (Figure 4, above). In FGDs it was reported that wood is mainly bought in from uplands, and one truckload of wood (at costs of 50$) is sufficient for one month of salt production.

DECISION MAKING AND WOMEN'S EMPOWERMENT

Timorese society assigns strict gender roles for men and women that lead to discriminatory practices against women. In daily life, cultural norms in Timor-Leste assign the dominant role to men (patriarchal

system) in planning or decision-making, where tradition and customary law favors men over women (Henriques et al, 2011). The existing patriarchal system undermines women vis-à-vis men and subsumes their contribution to society even when they are educated or come from wealthy households.

As discussed in the previous sections, in addition to experiencing high levels of domestic violence, women lag behind men in educational attainment, literacy, and exposure to mass media - which are all critical to women's empowerment and can exert considerable influence on their development and their ability to strengthen their position within the household and in society in general. Although employment is assumed to go hand in hand with payment for work, very few women in Timor-Leste receive earnings for the work they do. Four in five employed women do not receive any form of payment for their work, these women are mostly involved in agricultural work and are predominantly working for a family member or are self-employed.

Three in four men (75%) and about two in three women (68%) say that husband and wife decide jointly how the cash earnings are used (NDHS, 2011). Rural men and women are more likely to say that decisions about how the husband's cash earnings are spent are made jointly by the husband and wife. Based on National survey finding, it appears that for most decisions, the majority of currently married men age 15-49 think that the husband and wife should have equal say in making decisions. This is especially true for decisions about the number of children to have (94%), decisions on major household purchases (88%), and visits to the wife's family or relatives (84%).

At a community level, the participation of women is limited by social norms, their own expectations and tradition. Women hold very few leadership positions within the districts: in 2011, there was only one female governor in a sub-district and none in the districts; and only 3% are Suco chiefs (Head of village; an elected position) were women (JICA, 2011). Reportedly, even where women do participate in local level planning, the numbers are very low compared to men and most women do not feel confident to put forward an opinion and feel that they are not really listened to. Women's associations, organizations or collectives at *suko* and *aldeia* level in Timor-Leste remain scarce, and the work of NGOs in this sphere is invaluable.

Mills et al (2013) reported that number of women who attended activities organized for their project, *Developing Timor-Leste's coastal economy: Assessing potential climate change impacts and adaptation options*, was minimal. The team experienced difficulties in eliciting information from the women's groups and individual participation was low. On the other hand, community groups formed as a part of Timor-Leste – Mud Crab and Fish Cultivation project (ACDI-VOCA, 2015) reported good collaboration between men and women on the project, with 4 out of 10 group members being women. Local NGOs interviewed for this project reported 'preparation' of the community for involvement of the women in the project as one of the key factors of any project success.

Response rate of women for the primary data collection for this project was very good, with 61% of all participants being women.

CLIMATE CHANGE ADAPTATION AND WELLBEING

Community planning exercises funded by donor agencies have been or are currently being undertaken in more than 100 villages in Timor-Leste. For example, Oxfam conducted vulnerability and disaster risk management planning in more than 80 sucos; while CARE is implementing its Climate Vulnerability and Capacity Analysis (CVCA) in more than 33 aldeias (Larson, 2014). In addition, several other projects have conducted their own climate change vulnerability, adaptation, or risk management assessments in a range of contexts and with the number of Timorese communities.

For example, in the context of coastal communities, detailed participatory adaptation planning was undertaken by WorldFish (Mills et al 2013) in two sites: sub-district Atauro and sub-district Balibo, employing a diverse set of field and workshop-based participatory methods. Lack of fish and income from fishing was identified as a critical natural resource issue currently facing communities, and was linked to declining reef resources and lack of access to deep water fishing. Lack of access to fresh water and

decline in agricultural production were also critical issues at both sites. Water access problems differed between upland and coastal communities, but restricted access was common for both. Decline in agricultural production was linked to variable rainfall, pests and lack of modern technologies for improving yields. A shift in the predictability of the rainy season, has been negatively influencing seasonal agricultural livelihoods and food security in recent years.

Communities highlighted that the impacts of climate change on seasonal activities will most directly affect agriculture, but that this will have direct flow-on effects on fisheries. The most concerning impact was reduced production of staple crops (rice and maize) which rely on the timing of the wet season. It was suggested that the indirect impact of reduced agricultural production would be a greater reliance and effort on marine resources both by fishing communities, but also by communities traditionally focusing on agriculture.

Another example is MAKA'AS project implemented by Care International (Harvey, 2012) in Liquiça District, with the goal to increase resilience to impacts of climate change through improved water management and water resource protection, improved land management and agricultural practices at micro-to-meso level. This project found that women were more concerned about impacts on health, education and access to markets; while men were more concerned about destruction of houses and loss of large animals (Harvey, 2012). These differing perceptions are in line with the division of labor and differing responsibilities of men and women in the household.

Women's vulnerabilities to climate change are thus similar to those of men. In addition, however there are also some specific concerns, mainly:

- Provision of water and firewood;
- Food security;
- Destruction of and damage to the home gardens;
- Diseases and access to clinics;
- Closing of schools.

As elsewhere, women's concerns are related more broadly to overall family wellbeing. Such findings suggest benefits of adopting a more integrated approach to climate change adaptation that takes into account wellbeing overall rather than just livelihoods concerns (Larson, 2013).

The implications of these differences are that women's workload is likely to increase following climate change induced livelihood shocks, as their caring responsibilities and work related to household food security increase. In addition, supplying water and firewood may become more time-consuming as a result of climate changes. Also, the climate change and the changes and stresses that may accompany it can have an impact on household relations and can precipitate violence within the family (Gamez Arias et al, 2014).

Also, UNDP Small Infrastructure project conducted a number of CVCAs in the coastal communities, however, these document were not available and hence are not reviewed in this document. Relevance of these CVCAs should therefore be assessed during implementation stage.

However it is important to stress that climate change adaptation cannot be promoted in isolation of the issues that currently face communities, and the nation overall, including among others demographic boom (with half population under age of 15, Molyneux et al, 2012), soil loss (about 2.5 times higher than the world average) and high annual rate of deforestation (four times the world average, Henrique et al, 2011). If such trends are not reduced, the flow of goods and services that the natural and semi natural ecosystems still currently perform, will progressively decrease in the near future, with unpredictable consequences in ecological, economic and social aspects (Mota 2002).

In addition, data available to measure the income generated from, or the quantity of the goods and services consumed from the natural and semi natural ecosystems, remains scarce or non-existent (Henriques et al, 2011).

Participants of the FGDs conducted for the purpose of this LDCF project reported increased 'water hardship', with shorter more intense rainy season. This has negative impact on agricultural production, resulting in lower, less reliable yields. Agriculture in coastal areas is of subsistence nature, however, when harvest is weak, there is an increasing pressure on other activities to generate income to purchase food items (predominantly rice, currently sold for $12 per 25kg bag in Dili but observations in the field of $18 per 25kg bag). Increased fishing effort, firewood collection, salt production and handicrafts (mainly baskets) were the observed during primary data collection as ways of increasing family cash flow.

In summary, the key vulnerability perceived in relation to climate change in both our and the work by Mills et al (2013), was a decline in agricultural production. Respondents clearly articulated that when agriculture goes down, pressure on other resources – and fisheries and forests in particular - will go up.

SUMMARY OF MAIN SOCIAL, ECONOMIC AND GENDER ISSUES FACING COASTAL COMMUNITIES OF TIMOR-LESTE

In summary, the main identified areas of concern based on statistics and the stakeholder consultations, in terms of gender equality, can be summarized as:

- Lack of education and extremely low literacy levels;
- High maternal and child mortality and malnutrition;
- High fertility rates and high number of dependent children;
- Lack of cash income; and
- Lack of inheritance and land ownership rights; both resulting in
    - overdependence on husbands
    - inability to escape domestic abuse and violence
    - inability to raise cash and proceed with potential business ideas;
- Very high levels of domestic violence and its wide-spread acceptance;
- Low decision making rights in relation to major decisions and assets, within the household;
- Low decision making rights, very low level of women organizing, and no acknowledgment of women as drivers of transformational change in the community and the society;
- Sole responsibility for reproductive work (household duties) but equal responsibility for productive work and sale of produce; creating work overload for women.

Women's vulnerabilities to climate change are similar to those of men. In addition, however there are also some specific concerns, linked to their key responsibilities of provision of water and firewood and food security. As elsewhere, women's concerns are also related more broadly to overall family wellbeing, including health and education. Such findings suggest benefits of adopting a more integrated approach to climate change adaptation that takes into account wellbeing overall rather than just livelihoods concerns.

Limited information on women's specific vulnerabilities and adaptation capacities is available for the proposed project areas. It is therefore recommended that collection of relevant primary data be instigated. Also, ways in which past interventions have increased women's adaptive capacities are not clear. The research conducted for the purpose of this project suggests that the key aspect of gender interventions would be, through the increase in women's capacities, to increase the capacity of community overall. The monitoring and evaluation framework, targets and indicators have been developed to capture financial, economic, social and cultural costs and benefits to the women and their communities.

Annex G.3: Mangrove Economic Valuation and Payment for Economic Services Report

The below is an excerpt, summarizing key points from the **Mangrove Economic Valuation and Payment for Economic Services Report**, developed as part of PPG activities for the **Building shoreline resilience of Timor-Leste to protect local communities and their livelihoods** project. The report is the result of a desk review, consultations with government and other experts. The full report, by Sennye Masike, is available upon request.

1.1. INTRODUCTION

The section of the report details economic valuation of mangrove ecosystems in Timor-Leste Coastal areas. Ecosystem valuation involves putting a monetary value on mangrove products, functions and services. This is mainly done under the auspices of TEV concept. Valuation exercise forms an important basis for optimal management of ecosystems such as mangroves as it enables integration of costs and benefits in economic decision making. The environmental benefits of ecosystem valuation include:

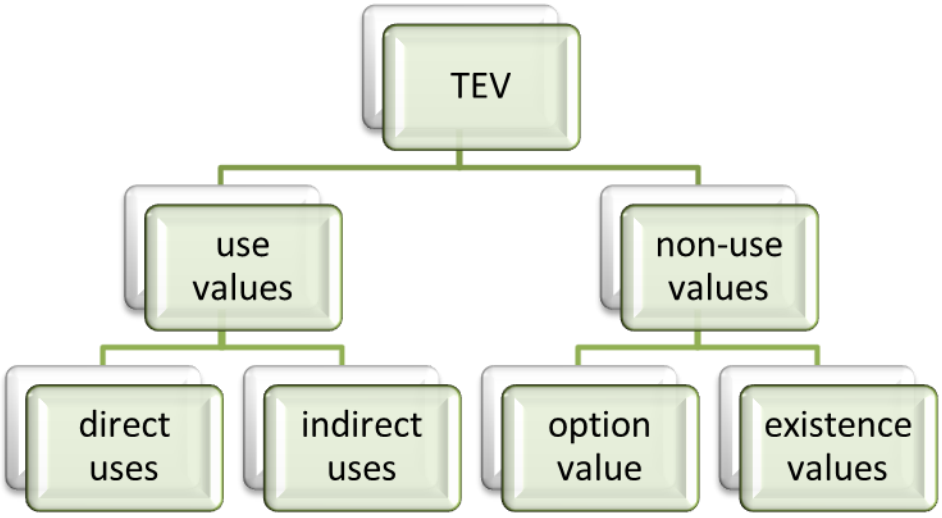
- It forms a platform for ecosystem benefits maximisation and costs minimisation hence sustainable management of the environmental resources such as mangroves.
- It gives a strong supportive argument for ecosystem conservation as it enables comparison of costs and benefits of loss verses conservation initiatives
- Values of ecosystems can be integrated into national accounts to demonstrate the contribution of ecosystems to the national wealth hence present an opportunity for mainstreaming values into national budgets.
- It creates a platform for development of Payment for Ecosystem Services (PES) programmes.

It is thus envisaged that the outputs from the analysis would create a conducive environment for improved mangrove management in the country. Importantly, the outputs could possibly facilitate improved budgetary allocations for mangroves conservation in the country.

1.2. METHODS AND APPROACHES

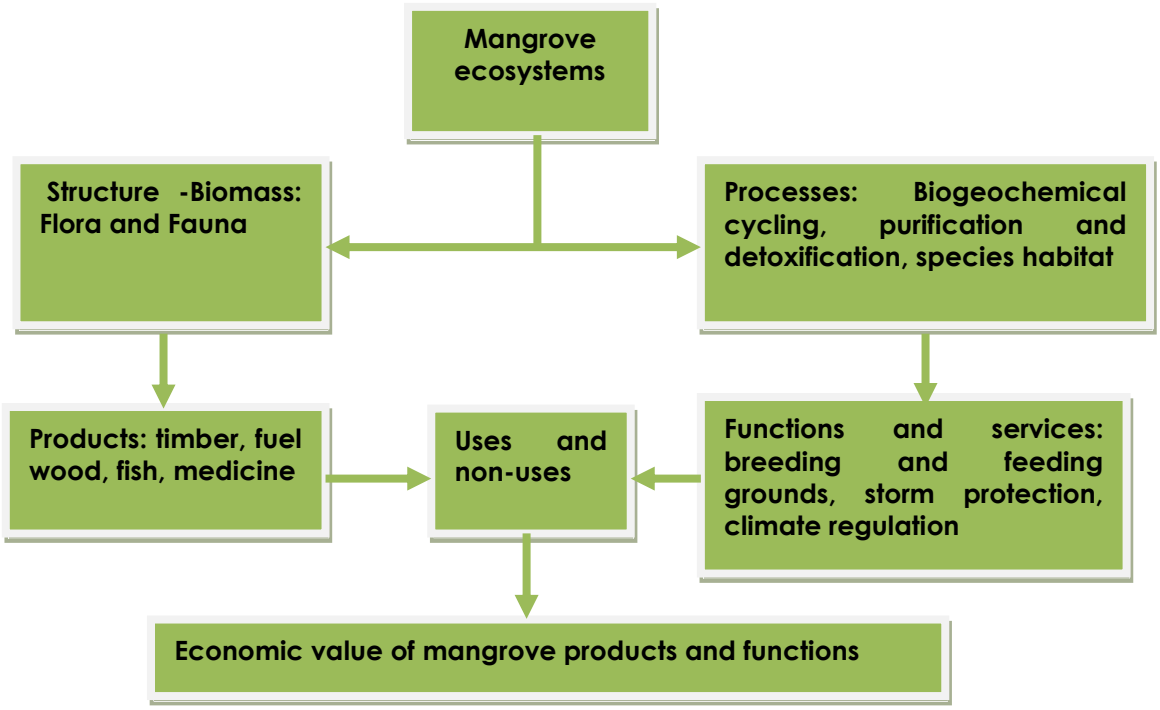
Mangrove ecosystems are multi-functional, providing a wide range of products, functions and services that are beneficial to both the economy and connected ecosystems. The appropriate approach towards ecosystem valuation is by taking into account all the uses and non-use benefits associated with the mangroves. This approach is based on the Total Economic Value (TEV) concept. TEV is simply defined as a summation of all the uses and non-use values associated with ecosystems' functions and services (figure 1)

Figure 1: TEV Framework for Mangrove Valuation



User values are the benefits derived from direct and indirect consumption of mangrove ecosystems' goods and services. On the other hand, non-use values are those values that have no association with utilisation of mangrove products and services; they include option and existence values.
Based on the TEV concept, Figure 2 below depicts a schematic approach that was adopted for valuation of the mangrove ecosystems.

Figure 2: Mangroves ecosystem valuation approach



Using the concept of TEV as depicted in Figure 2 above, below is a valuation of the various products, functions and services of the mangrove ecosystems in Timor-Leste.

Uncertainty in economic valuation
Caution must be applied in interpretation of the economic valuation results as they have high levels of uncertainty for the following reasons:

- Economic valuation requires comprehensive survey on utilisation of the ecosystem/environmental resources. However, in the assignment surveys were not undertaken and hence more assumptions were made. Additionally, inferences were made to studied done elsewhere,
- Economic valuation of ecosystems has various problems and high level of uncertainty due to the complexity of ecosystems. In many instance, the problems are inherent within the valuation techniques,
- Incompletes markets and lack of markets for some environmental goods and services makes it impossible to compare the derived economic values of ecosystems goods and services.

It is thus for this reason that caution must be applied in interpretation of the derived economic values as there is high level of uncertainty.

1.2.1. Fuelwood

Fuelwood is the most predominant source of energy in rural Timor-Leste. For the majority of the communities residing within the coastal zones, mangrove is the main source of fuelwood. This is collaborated by the FAO (Undated) and NBSAP report that mangroves have been unsustainably

exploited for fuelwood. It was estimated that by 2010, the average household fuelwood consumption was approximately 7.3 m^3 per year.

As fuelwood has a market and also has substitutes such as electricity and cooking gas, the value of mangroves can be easily inferred based on either its market price or surrogate market price. In order to estimate the value of fuelwood, it is critical that total quantity of fuelwood harvested be estimated.

Determining the economic value of mangrove as source of energy requires the following information:

- Annual total fuelwood harvested as a function of total population and per capita consumption.
- Market prices for substitute
- Production costs (labour, transportation, packaging)

Alingo (2014) through observation concluded that on daily basis members of community go to the mangrove to harvest fallen wood amongst other products. It was further conceded that despite their relatively small size mangroves are heavily used as a source of food and wood for housing and fuel.
Due to lack of data on quantities of fuelwood harvested from the mangroves, the spatial size of mangroves in relation to pastures (another source of fuelwood) was used to estimate the proportion of fuelwood collected from the mangroves. Based on the estimated size of pastures and mangroves of 200,000 ha and 1300 ha respectively it was estimated that mangroves represents 0.65% of the fuelwood harvested by households. However, based on the findings by Alingo (2014), the estimated percentage contribution of fuelwood from mangrove could be too low hence 20% is adopted as being a moderate proportion of fuelwood harvested from mangroves. According to Bajgain and Lemos (2010), average fuelwood consumption in the country is 7kg per day per household (Bajgain and Lemos, 2010). This translates into 238466 tons annual consumption in the coastal areas of Timor-Leste based on a population of 560 000. Based on the assumed 20% contribution of mangroves, total harvest is estimated at 47693.2 tons of fuelwood. Table 1 depicts the economic value of mangroves as a source of energy.

Table 1: Value of Mangrove as source of energy for coastal communities

Quantity harvested	Price per kg (USD)	Value as source of timber (US$)
47693.3 tons	0.05	2,384,650.00

1.2.2. Charcoal

This is another source of energy that originates from mangroves. Studies have indicated that relative to other charcoals, mangrove charcoal has the highest calorific values and thus favoured by households. This assessment is not in a position to infer to the value of charcoal due to lack of data on production of charcoal in the country, specifically charcoal originating from the mangrove ecosystem.

1.2.3. Timber

In addition to providing fuelwood, mangrove is globally used by the coastal communities as a source of timber for house, boats and kraal construction (National Biodiversity Working group, 2011). This function is regarded as highly important as it provides shelter to the communities and simultaneously provides a direct means of livelihood through fishing. Correspondingly, timber poles have a market and thus a price. Therefore, the price can be used to infer to the economic value of mangroves as a source of timber. The economic value is a function of quantity harvested and the net market price. Alongi (2014) noted that despite the relatively small size of the mangrove in the area and their disjunct distribution, they are heavily used as timber for housing construction in addition to fuel. Due to lack of information on timber harvesting and the annual timber harvested in the Timor-Leste mangrove, an inference was made from the other studies of similar setting in coastal zone mainly Mozambique and Philippines. These countries were adopted for the following reasons:

- Both countries are developing with high level of poverty especially in the rural areas
- Unemployment rates are high
- Mangrove ecosystems are harvested for fuelwood and timber for house and boats construction

Therefore, in this analysis, it is also assumed that timber harvesting will be lower for the following reasons:

- It is occasionally harvested during either house or boat construction
- Boat and house construction are infrequently undertaken possible once in a year.

In the Philippines, Walter (2005) found that mangrove fuelwood harvest far exceed timber harvested for house or fence construction. His findings were based on the fact that Mangrove firewood is consumed by many homes every day for general domestic cooking. Additionally, consumption is dramatically increased during fiestas and other holidays when households collect it specifically for pig roasting (called lechon). His estimate was that in some plots timbers harvest constituted 2% of total wood harvest. In Mozambique, household survey on mangrove utilisation revealed that timber harvest constitutes less than 1% of the total wood harvested in the Limpopo mangroves.

Therefore based on findings in other countries, it was assumed that timber harvesting represents less than 1% of fuelwood. This translates into approximately 476 tons per year. Table 2 shows the economic value of mangroves as source of material for construction.

Table 2: Economic Value of Mangroves as source of timber for coastal communities

Quantity (Tons)	Price (USD/pole)	Value as source of timber (USD)
476	5	2,380,000

1.2.4. Livestock grazing

Mangroves are an important source of grazing for livestock such as camels, goats and other browsers. Additionally, mangroves play a critical role in reducing the community's vulnerability to drought episodes as livestock browse the lush vegetation. Estimating economic value as source of fodder was based on the surrogate market price for fodder. Similarly, the avoided cost of supplementary feeding by farmers can also be used to solicit the economic value of mangroves as source of fodder. Observation by Alingo (2014) is that "on a daily basis, cattle and other domestic animals routinely enter the mangroves to harvest leaves, fruit, and goats commonly feed on mangroves tree plants especially Sonneratia pneumatophores". Estimating the total contribution of the mangroves to the livestock annual feed intake was based on the assumption that livestock graze at two sources (mangroves and native pasture). It was assumed that contribution of the two livestock grazing sources is a function of size of the ecosystems. Therefore, ecosystems with higher spatial coverage would constitute a higher proportion to livestock grazing. According to Cruz (2003), pasture for livestock foraging occupies approximately 200,000 ha while mangroves occupies approximately 1300 hectares. Therefore, the proportion on mangrove contribution to grazing is assumed to be equal to the percentage size of mangrove to the pasture which is estimated at 1%. It is important to note that these assumptions could be highly undervaluing the true economic value of the mangrove as noted by Alingo (2014) that livestock feed on the mangroves on daily basis. Additionally, the discussions with the stakeholders indicate that mangroves are ideal habitats for water buffaloes.

Based on this assumption, the market price of supplementary feeds mainly hay and the annual livestock intake was used to estimate the value of mangroves as source of feed for the livestock. Table 3 depicts livestock ownership which was used to estimate the value of mangrove as source of fodder.

Table 3: Livestock ownership per household and estimated livestock population in coastal area

Types of livestock	Number per household	Livestock population in Coastal areas
Buffalo	5	466667
Cattle	3.8	354667
Goat	3.3	308000
Sheep	6	560000

It is estimated that livestock takes approximately 2.4% of its body weight on daily and based on this figure table 4 depicts fodder intake from the mangroves assuming that mangroves account for 1% of the forage intake and this rest is accounted for by pasture.

Table 4: Estimated forage intake from mangroves

Type of livestock	Weight (kg)	livestock number	intake from mangrove per annum (tons)
Buffalo	300	466667	12264
Cattle	300	354667	9320
Goat	50	308000	1349
Sheep	50	560000	2452
Total forage			25386

Thus, using the surrogate market price of hay as a substitute for mangrove forage, it is estimated that the value of mangroves as source of forage is approximately $25 million annually.

1.2.5. Traditional medicine

Mangrove forests have traditionally been used as a source of medicine by the local communities. Some of the ailments that have claims of being cured by medicine extracted from mangrove trees such as *Avicennia africana* include; cancer, thrush, gangrenous wounds, lice, mange, ring worms, skin parasites, tumors and ulcers (Abeysinghe, 2010; Bandaranayake, 1998; Agoramoorthy et al., 2007). Therefore, these ecosystems have a huge economic value as a genetic pool for healing local communities. For instance, Bandaranayake (1998) noted that in India and Australia, mangroves are used extensively by some local communities for healing and treatment of certain ailments.

Evidently, there are various approaches to infer to the economic value of mangroves as source of medicine and medical genetic pool. The most reliable approach with less distortion is the surrogate market approach and the avoided costs incurred in travelling to the modern medical facilities. Information on utilisation of the mangrove for traditional medicine is unavailable and therefore this direct use value of mangrove cannot be inferred to.

1.2.6. Pharmaceutical products

Pharmaceutical products include wellness products extracted from the mangroves mainly by pharmaceutical multinational companies. These include medicine and beauty/cosmetic products. For instance, it is reported that the knee root also known as breathing roots have been used for making perfumes. Similar to traditional medicines, mangroves have a great potential as a source of pharmaceutical products and genetic resources. Currently, there are no pharmaceutical companies that are engaged in exploitation of mangrove products for pharmaceutical or cosmetic products in the country. However, there are huge potentials for sustainable production of pharmaceutical products in the future. Therefore, the economic value of the mangroves as a pool for pharmaceutical products cannot be inferred.

1.2.7. Apiculture

Apiculture is the production of honey and mangroves are highly suited for this activity due to the prolific presence of flowering mangrove plants particularly *Apis mellifera*. This is an indirect economic use of the mangrove as bees extract nectar from the flowers. It is important to note that this service of the mangrove can occur over 5 kilometres from the mangrove sites as the bees are known to travel over several kilometres searching for nectar for honey production. The value of mangrove through its contribution to the honey production is a function of total annual production in the mangroves and the price of honey. However, currently there is lack of information on the honey production to infer to this value.

1.2.8. Total Direct Use Value

Total direct use value of mangroves is estimated at US$29.7 million per year.

1.2.9. Indirect uses of mangroves and their values

1.2.10. Offshore fishery

Mangroves play a critical role in supporting commercial fishing by providing nursery, breeding and hatching environments to offshore fisheries which migrate offshore (Blaber, 2007; Salem and Mercer, 2012). In addition, the ecosystem protects highly productive ecosystems mainly coral reefs and Sea grass ecosystems through regulating sedimentation loads into these ecosystems. Thus, estimating the economic value of mangroves as contributing to commercial offshore fishing involves determining the dependency rate of offshore fisheries to mangroves. Based on the dependence rate, the value of mangroves can be estimated as a proportion of total annual value of commercial fishing. Globally, various studies have been undertaken to estimate the dependency rate of offshore fisheries to mangroves which estimates the dependence rate at between 30 to 80% (Ronnback, 2001; Spurgeon, 2002). Therefore, a proportion of total value of fish is attributable to the mangroves. It is estimated that offshore commercial fishing is highly limited in the country, majority of which goes into neighbouring countries mainly Australia and Indonesia. Thus, some of the benefits and hence economic value of the mangroves are realised by these countries. Based on the estimate of offshore fishing of 2010, table 5 depicts the value of mangroves to offshore fishing. Obviously, the estimated value is significantly low as it is dependent on harvest.

Table 5: Economic value of mangroves as contributing to offshore fishing

Value of commercial offshore fish (USD million)	Dependency rate of offshore fishing to mangroves (%)	Value of mangroves (USD million)
6	0.3	1.8

1.2.11. Carbon sequestration

Mangroves are an important source of carbon sink and carbon sequestration. It is insinuated that mangroves are among the most carbon-rich ecosystems on the planet with estimates that they have double living biomass as compared to tropical rainforests (Sitoe et al., 2014). Consequently, mangrove ecosystems are an important ecosystem for mitigating climate change and associated impacts.

Three ways of estimating the economic value of mangrove ecosystems as a source of carbon sink and sequestration include:

- market price approach
- damage cost avoided
- replacement costs

However, due to lack of information on cost associated with emissions per ton of GHGs, the market price approach is preferred. Application of the market price approach involves the following:

- quantifying the carbon stored per hectare
- annual carbon sequestrated per hectare
- total area coverage of mangroves
- market price of carbon

Based on recent mangrove coverage mapping, table 6 depicts mangrove spatial coverage.

Table 6: Mangroves status and area coverage in Limpopo

Mangrove status	Area (ha)
Total area of mangroves	1300

Source: Alongi (2014)

Various studies have been conducted on mangrove carbon store regionally and internationally (Sitoe et al., 2014; Fatoyinbo et al., 2008). Alongi (2014) estimated the aboveground tree biomass to be

approximately 237 t DW ha^{-1}. Additionally, due to extensiveness of the mangrove root systems, studies estimate belowground biomass from the mangrove to account for 70-85% of total biomass. Therefore belowground biomass for mangrove is estimated at 360 mg ha^{-1}.

Estimating carbon sequestration was based on the findings that mangrove primary productivity is 2.5 g carbon m^{-2} day^{-1} translating into 9.125 mt ha^{-1} $year^{-1}$. It is assumed that this figure accounts for both above and belowground biomass.

Table 7 shows estimated carbon stored in mangrove forest in the country. It is assumed that carbon sequestration is extremely low as the existing mangrove trees are old.

Table 7: Estimated carbon store and sequestrated in the mangroves

	Hectares	Biomass per hectare (t)	Total biomass (t)	Carbon stock (t)
Aboveground	1300	237	308,100.00	154,050.00
Below ground	1300	414.75	539,175.00	269,587.50
Total				423,637.50

Table 8 depicts the total value of carbon stored within the mangrove ecosystem in the country.

Table 8: Economic value of mangroves as source of carbon store

Total carbon (Mt)	Price (USD/Mt)	Value of carbon (US$)
423,637.5	10	4,236,375.00

1.2.12. Flood and flow control/shoreline protection function

Mangrove ecosystems dissipate wave energy and thereby protect the shoreline and prevent coastal erosion. Economically, this ecological function is important for agricultural production as it protects agricultural lands from salty water intrusion. Evidently, without the mangroves, agricultural productivity would be significantly affected. Additionally, mangroves reduce the impacts associated with extreme events mainly hurricanes, cyclones, tsunamis and storm surges.

Estimating the value of mangroves as providing defensive system against wave energy can be done through damage costs avoided and replacement costs approaches. Damage costs avoided is based on the notion of estimating the damage costs that could have been incurred had the system being breached or absent. A logical approach to apply the damage cost avoided is by deriving the damage cost curve based on degraded mangroves or coastline where there are no mangroves and extrapolate the findings to the site of interest.

Replacement costs method on the one hand is a valuation technique that is based on estimating the costs of repairing the damage after the incident. It is synonymous to construction of seawalls to prevent the damage.

Due to lack of information on properties, agricultural lands and their values, it is not possible to estimate the protective function of mangroves.

1.2.13. Storm buffering/ sediment retention

Mangroves regulates sedimentation load to productive marine ecosystems mainly coral reefs and sea grass. This ecological function has an economic value as coral reefs are used extensively by tourist for diving amongst others. Estimating the economic value of mangroves as protecting coral reefs and sea grass can be achieved through the damage avoided costs and replacement costs approaches. Secondly, revenue generated through diving can be attributed to the protective functions of the mangroves.

However, due to lack of data on revenue generated from tourism diving in the coral reefs, it is not possible to estimate the value of mangroves.

1.2.14. Fish and shellfish resources

Fish resources are one of the most important products that have a direct relationship with mangrove ecosystem. Mangroves provide a habitat for various fish species which are harvested by the local communities ((Cannicci et al., 2009; Samoilys et al., 2008; Taylor et al., 2003). Estimating the value of mangroves as habitat for fish requires information on fish catch, number of people engaged in fishing activities and the market price of fish.

Based on the national fish consumption figure of 2.0 kg per person per year, and the average market price of fish at US$5 (National Biodiversity Working Group, 2011), table 9 depicts the economic value of mangrove as a habitat for spawning fish and nutrient cycling for fish.

Table 9: Economic value of mangrove as habitat for fish

Type	Quantity (Kg)	Price (US$)	Subtotal (US$)
Fish	2,240,000.00	5.00	11,200,000.00
Crustaceans	1,680,000.00	5.00	8,400,000.00
total			19,600,000.00

1.3. Total indirect use value

Total indirect use value is estimated at US$25.4 million per year.

1.4. Total use value

Total use value which constitutes direct and indirect uses of the mangroves is estimated at approximately US$ 55.1 million. Uses that contribute significantly to this total economic value of mangroves are fuelwood, livestock grazing, fish, and crustaceans. The economic value of Timor-Leste per hectare is approximately US$42,384.00.

1.5. Non-use values

Conversely, non-uses as the name implies are non-economic activities that are not associated with consumption of ecosystem products. Inference to the non-use values of the mangrove is achieved through survey where individuals are directly asked their WTP or WTA for conserving or allow mangrove deforestation. Additionally, it can be achieved by asking the individuals to participate in mangrove reforestation. Their contribution to afforestation will be deduced as their WTP for conservation of the mangrove. As no surveys were undertaken, it is not possible to estimate the non-use values of the mangroves.

2.0. Offsetting schemes and Payments for Ecosystem services

2.1. Introduction

The section of the report aims at identifying the best offsetting schemes for Timor-Leste mangroves with emphasis on international best practises for offsetting schemes. Offsetting scheme in this context is defined as undertaking a restoration programme in another location to compensate for the damage/destruction caused by a developmental project or infrastructural development. Two mainly forms of offsetting schemes include carbon offset schemes such as REDD+ and Biodiversity offset schemes. Other types of offset schemes are biodiversity Offset and these are conservation activities that are designed to give biodiversity benefits to compensate for losses during developmental processes where the damage could not be avoided. Therefore, this section discusses approaches to encourage mangrove rehabilitation in Timor-Leste through the offset schemes.

2.2. Mangrove Offsetting Schemes

Offsetting schemes for infrastructural development involves reforestation programmes in an identified mangrove site to compensate for the loss incurred where an infrastructural development have been

undertaken. An example in hand in Timor-Leste would be the planned Port of Tibar bay construction. Consequently, the planned loading bay will be constructed on the existing mangrove forests and inevitably the standing mangrove plants will be deforested. Offset scheme would thus involve compensating for the lost mangrove through reforestation on another identified location. Other example would involve construction of fish ponds, salt production ponds and thus results in mangrove forest loss. Therefore, it is important that losses of mangroves during infrastructural developments are matched or countered by restoration to ensure that mangroves coverage remains constant in the country. The goal of offset schemes is no net loss or net gain in ecosystems. However, in this report, it is emphatically discouraged to deforest the mangrove on the pretext of implementing an offsetting scheme for the following reasons:

- Though mangroves are highly stable in terms of withstanding impacts, their resilience is assessed to be extremely low. This observation is made from the dominance of the old trees in mangrove ecosystems implying that the regeneration rate is extremely low. Therefore, reforestations are likely going to have a low success rate.
- Secondly, deforestation in a particular site will result in irreversible losses to the mangrove ecosystem, and thus affecting other ecosystems such as coral reefs and Sea grass. Additionally, the communities which are dependent on the mangroves will also be irreversibly affected. Thus, deforesting the mangroves and compensating through reforestation in another area is not a solution to other ecosystems where deforestation has occurred.
- Lastly and probably most importantly there is no guarantee that the offset scheme would be a success. For instance, most of the mangrove reforestation programmes in Timor-Leste have not been a success.

However, in the case of the Port of Tibar bay, it is recommended that the Biodiversity offset scheme be adopted. Biodiversity offset scheme is based on the following guiding principles:

- No net loss: Mangrove offset project must be designed to ensure that there are no net losses and emphasis must be placed on net gain of biodiversity. As it is difficult to achieve fauna no net loss, the areas coverage of the lost mangroves must be compensated for through mangrove reforestation programme.
- Limits to what can be offset: in many instances, it is possible to fully compensate for the loss incurred at the original and therefore, these limits must be explicitly indicated in the design programme.
- Landscape context: the offset programme must be designed and implemented in a landscape context to achieve the expected measurable conservation outcomes taking into account available information on the full range of biological, social and cultural values of biodiversity and supporting an ecosystem approach.
- Stakeholder participation: In areas affected by the project and by the biodiversity offset, the effective participation of stakeholders should be ensured in decision-making about biodiversity offsets, including their evaluation, selection, design, implementation and monitoring.
- Equity: A biodiversity offset should be designed and implemented in an equitable manner, which means the sharing among stakeholders of the rights and responsibilities, risks and rewards associated with a project and offset in a fair and balanced way, respecting legal and customary arrangements.
- Long-term outcomes: The design and implementation of a biodiversity offset should be based on an adaptive management approach, incorporating monitoring and evaluation, with the objective of securing outcomes that last at least as long as the project's impacts and preferably in perpetuity.
- Transparency: The design and implementation of a biodiversity offset, and communication of its results to the public, should be undertaken in a transparent and timely manner.
- Science and traditional knowledge: The design and implementation of a biodiversity offset should be a documented process informed by sound science, including an appropriate consideration of traditional knowledge.

Based on the above guiding principles, the following steps must be followed in the design and implementation of the biodiversity offset scheme for infrastructural development.

Stage 1: Review of the project scope and activities: this stage will involve thorough assessment of the project in terms of size and location of the project. Additionally, all activities will be identified and described. It is at this stage where the impacts of the proposed project on the mangroves will be established.

Stage 2: Review the legal framework for biodiversity offset: the stage will involve identification of the existing policies, Acts and strategies that guide the implementation of the offset scheme. Thus, all acts including Environmental Impact Assessment Acts will be reviewed in the context of implementing an offset scheme.

Stage 3: Establishing a stakeholder participation process: this is an important stage as one of the guiding principles of offset scheme is stakeholder participation. It is at this stage that all affected parties will be identified and engaged in terms of how the offset should be undertaken and implemented. Incidentally, it is at the stage that stakeholders' roles and responsibilities are identified.

Stage 4: Determine the need for an offset based on residual adverse effects. This stage involves estimating the costs and benefits to the local and national stakeholders of implementing the project and its residual impacts and offset options. Consequently, a cost benefit analysis would be undertaken to demonstrate and justify the need for an offset scheme.

Stage 5: Selection of the appraisal method to calculate loss/gain and quantify the residual losses- the stage is linked to the above stage and it involves selection of an appraisal techniques either CBA, Cost Effectiveness Analysis (hereinafter CEA) and also quantification methods to quantify the residual losses and gains.

Stage 6: Review the potential offset locations and activities and assess the biodiversity gains- this stage would involve identification of potential sites for undertaking mangrove offset schemes. In addition, all the activities to be undertaken will be identified in terms of their scope. This stage will also involve checking that the preliminary offset recommendations are compliant with the Cost Benefit requirements.

Stage 7: Calculate offset gains and select the appropriate offset locations and activities- this stage will involve quantification of the environmental gains of undertaking offset programmes for the identified potential sites. Based on the estimated gains per site, the most suitable site will be identified.

Stage 8: Design the implementation plans- implementation plan generally entails phases of the project, activities under each phase, duration of the phase and activities and the responsible agent. In addition, the project would also entail a detailed budget for project implementation.

2.3. Payment for Ecosystem Services

Payment for Ecosystem Services (PES) involves charging ecosystem users a fee/charge and distributing the revenue generated to the members of the communities in the proximity of the ecosystem as a way of incentivising them to conserve that particular ecosystem. Thus PES is a mechanism for benefits distribution to the members of the communities. Consequently, ecosystem users' encompasses a wide spectrum of uses ranging from the local, regional to the international. These present a huge opportunity for PES as there are various users.

PES is an important conservation tool that can be implemented for the mangrove conservation in Timor-Leste. For instance, by charging the users (local, regional and international) and redistributing the benefits to the communities residing in the proximity of the mangroves, this can increase their income. Consequently, communities could afford alternative sources of energy (such as cooking gases and connection to national electricity grid) and thus alleviate pressure from the mangroves as a source of

energy. Most importantly, PES would increase a sense of ownership and results in better management of the mangroves.

There are three main feasible ways through which the PES can be implemented in the Timor-Leste as discussed below:

- Mangrove carbon credits: mangroves are some of the highly productive ecosystems in the planet and are known to store carbon more than the tropical rainforest by hectare. Therefore, these present ample opportunities for PES. The PES would involve development of the carbon credit market for the mangroves and the benefits can be distributed to the communities in the proximity of the mangroves. The mangrove carbon credit market is currently initiated in Kenya where it is envisaged that carbon credit earned through preserving the mangroves swamps would be sold to the companies and individuals aiming at offsetting their carbon emissions and also improve their green credentials (Marshall, 2013). Initially, it is proposed that the project will cover approximately 117 hectares and generate revenue in excess of $12,000.00 per year. Thus, given the significant coverage of the Timor-Leste mangroves, a substantial income can be generated from the carbon credit. Therefore, it is critical that measures are put in place to set up carbon credits for Timor-Leste mangroves. The revenue can be used to alleviate poverty and simultaneously reduce pressure from the mangroves. Additionally, some of the revenue can be retained for mangrove reforestation and rehabilitation. Assessment in the Solomon Islands indicates that mangrove ecosystems have huge potential to provide a direct economic benefit through payment for mangrove ecosystem services mainly through the REDD+.
- Tourism levy: this is another potential avenue for PES for the Mangroves and it involves setting a levy or a charge for tourism activities in the proximity of the mangroves. In order to implement this charge, it is imperative that functions and services of the mangrove to the tourism activities be identified. Based on the functional relationship between mangroves and the activities, a charge will be established and implemented for tourism operators. Discussions with the tourism operators and experts reveal that mangroves in the country have huge potential particularly those with thermal springs. Therefore, it is important that a survey be undertaken on those mangroves which have the potential to raise significant revenue through PES. It is also important that efforts must be concentrated on marketing the tourism potential of the country to increase the potential of the mangrove. For instance Kenny (undated) noted that coral reefs, mangroves and sea grass beds provide essential functions and services which support the tourism industry yet they are not integrated and charged amongst the tourism industry activities.
- Offshore fishing levy: similar to the tourism industry, commercial fishing is highly dependent on mangroves as spawning grounds, protecting the coral reefs and Sea grass ecosystem. It is estimated that offshore fishing dependence ratio to the mangroves is between 30-80% whilst for shrimp is 100%. As commercial fishing industry is benefiting from the functions of the mangroves, it is crucial that a levy be established which can be used to conserve the mangrove for fishery sustenance. The revenue generated can be distributed among communities as incentives for mangrove conservation. Globally, fish industry is worth billions of dollars and therefore, there is huge opportunity to raise revenue through PES by introducing a mangrove levy.

3.0. SUMMARY OF FINDINGS

Based on the assessment of the economic valuation, analysis of the offset schemes and PES, the following are summary of findings of the assignment:

- Total economic value of the mangrove is estimated at $55.1Million and this value excludes functions such as protective functions of the mangroves, sedimentation loads regulation, absorbing and breaking down harmful nutrients and the non-use values
- Feasible PES mechanisms include carbon credits markets, tourism and Fishery Levy.
- The most suitable offset scheme for infrastructural development is biodiversity offset scheme which entails both flora and fauna

4.0. RECOMMENDATIONS

Based on the findings of this assignment, the following recommendations were made:

- There is need to do a comprehensive economic valuation of the mangroves informed by surveys
- A thorough assessment be undertaken to quantify the exact amounts of carbon stored which can be used as basis for development of carbon credit markets for mangroves in the country
- Biodiversity Offset Schemes must be undertaken as the last resort and they should aim for mangroves no net loss
- Land use plans must be developed for all the mangroves in the country to incorporate migration routes for the mangroves

Annex H: Randomized Control Trial Methodology to Assess Livelihoods Support to Communities

This annex outlines the potential and design of a randomized control trial (RCT) to evaluate the causal effects of activities related to the UNDP/LDCF project titled "**Building shoreline resilience of Timor-Leste to protect local communities and their livelihoods**". The intention is to measure the impact of strategic interventions, such as supporting financially viable livelihoods options which reduce community pressure on mangroves, and any highlight gaps which require further support.

Randomized Control Trials

A major challenge in evaluating any intervention is establishing its real impact. One approach can be to look at the outcomes of a group before and after an intervention – if the outcomes of interest have changed after the intervention, the intervention may be responsible for the changes. However, looking at the outcomes of only the target group before an intervention, and comparing them with outcomes after the intervention, can yield false results. This is because there could be a natural change over time in the target group that results in changed outcomes (i.e. the intervention alone may or may not be responsible for the change in the outcomes and we have no way of knowing). Therefore, it is important to have a group that acts as a control – a control group with which the intervention group can be compared. When we have an outside point of comparison, we can look at the difference between the outcomes of the control and treatment groups attributing the difference to the intervention.

Randomized control trials (RCT) are a rigorous way to test the impact of an intervention of interest. Originally used in medicine to test the impact of medical interventions, this methodology has increasingly been adopted in economic science to test the impact of a policy or social intervention. The basic construct of an RCT is quite straightforward. Two groups of people are randomly selected in a population of interest, where one is designated the control group and the other is designated the treatment group. The policy of interest is implemented on the treatment group and after it has run its course, the difference in outcomes of interest is recorded in both control and treatment groups. This way, the pure effect of the policy is established because of the random nature of control and treatment group selection[75].

The two groups, the control and the trial group, should be equivalent. Even if there is a control group (i.e. a group that did not receive the livelihoods support), there is still the issue of selection. There could be something about the two groups that innately results in changed outcomes rather than the intervention. Therefore, it is important to not only have a control group but a randomly chosen target population that receives the intervention and a randomly chosen part of the target population that acts as a control group (i.e. do not receive the livelihoods support).

Possible Themes of Interest

The document "**Building shoreline resilience of Timor Leste to protect local communities and their livelihoods**" provides for an integrated set of outcomes to strengthen resilience of coastal communities by the introduction of nature-based approaches to coastal protection:

Outcome 1: Policy framework and institutional capacity for climate resilient coastal management established

Outcome 2: Mangrove-supportive livelihoods established to incentivize mangrove rehabilitation and protection

Outcome 3: Integrated approaches to coastal adaptation adopted to contribute to protection of coastal populations and productive lands

[75] For more information, visit the Abdul Latif Jameel Poverty Action Lab (J-PAL) website: http://www.povertyactionlab.org/methodology

A priority of the GoTL is to improve shoreline resilience without adversely impacting income generation in coastal communities. With this in mind, one particular activity type has the potential for an RCT evaluation. Outcome 2 includes support in the identification and support to livelihoods which reduce the pressure of communities on effective mangrove coverage to protect the shoreline. By using RCT, an evaluation can be made on the success of livelihoods support received by farmers, and how this has improved the vitality of the mangroves.

The phased approach of the project creates opportunities to select target sucos based on those receiving support from the project in the form of mangrove rehabilitation efforts and livelihoods support. Potential sucos to select as trial provinces may therefore include the priority mangrove sites indicated by MAF and endorsed by the technical working group.

Study Design

Intervention: Mangrove Rehabilitation Efforts and Livelihoods Support
The intervention will be randomly administered livelihoods support to coastal communities. Because coastal communities, whose livelihoods impact mangroves (e.g. salt farmers), are being targeted by the intervention, the evaluation will need to capture at least one production season if not more. At least one annual cycle of production should be accounted for, and ideally more than a year so that dynamic effects can be captured too – communities may require a season or two of getting accustomed to the intervention before behavioral changes can be measured.

Possible Outcomes of Interest
As the goal of the intervention is to introduce a livelihood which both relieves pressure on mangroves, and contributes positively to household income. The two prominent outcome types are therefore:

1. Primary outcomes: Change in net income (i.e. has the livelihoods support provided by the project had an impact on household income)
2. Secondary outcomes: Coverage of mangroves (i.e. has the project intervention been successful in reducing pressure from communities on mangroves)

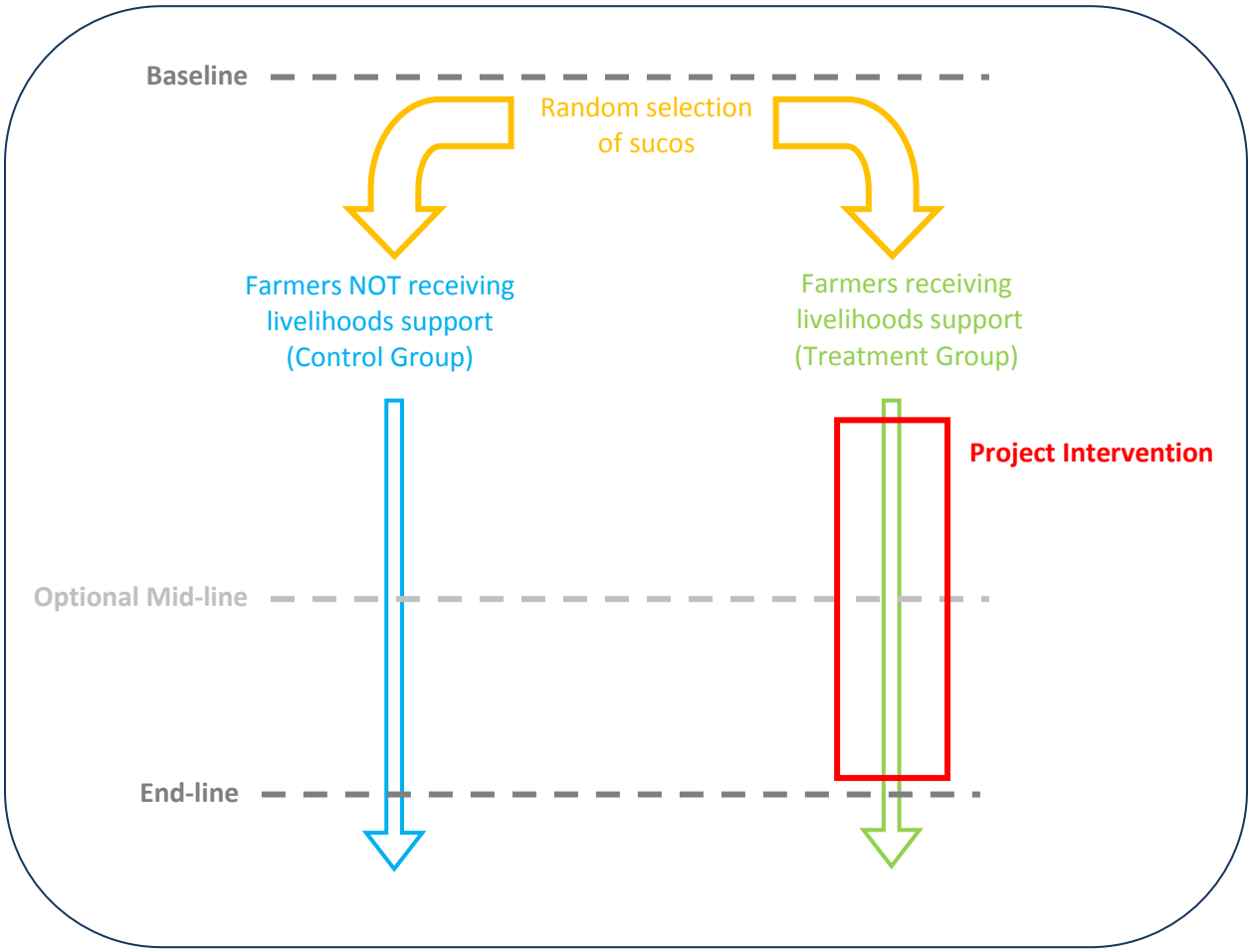
Information Capture
Finally, the right kind of information must be captured at the right times and from the correct group. The basic survey sequence is:

- Baseline survey to capture basic characteristics before randomly administered alternative livelihoods support
- Mid-line survey (optional) to record characteristics and outcomes of interest – helps to capture dynamics
- End-line survey to record characteristics and outcomes of interest

All surveys must be administered to both control and treatment groups simultaneously. The baseline survey should be administered before the project is rolled out for the intervention group. The end-line survey will capture outcome information at the end of an agricultural production cycle. If the evaluation program intends to work over multiple cycles, then the end-line could be conducted at the end of each cycle that is part of the evaluation plan or project duration.

Given the LDCF project's focus on livelihoods support in coastal communities, and the particular needs of women and youth in Timor Leste, surveys must be gender-disaggregated while detailing the role of youth in household income generation, in order to appropriately measure the project's results against its objective. An important consideration in this analysis is the external social benefits/costs of the intervention. For instance, if the intervention has resulted in an increased workload which forces the involvement of the family's children, keeping them from school, this would be a negative external social cost, and the intervention would need review and/or adjustment.

Basic Sequence of RCT Study



Annex J: Local Project Appraisal Committee Meeting Minutes

MINUTES

Local Project Appraisal Committee (LPAC) Meeting

Project: **Building shoreline resilience of Timor-Leste to protect local communities and their livelihoods (Mangrove Project)**

07 January 2016 09:00 - 12:00

Ministry of Agriculture and Fisheries Conference Room

Dili, Timor-Leste

Participants:

No.	Name	Position	
1	Acacio Guterres	Director General for Fisheries of MAF	(Chair) GoTL
2	Mario Riberio Nunes	Director General for Forestry, Coffee and Industrial Plants	GoTL
3	Gild da Costa	ACD/Head of Sustainable Development Unit	UNDP
4	Manuel Mendes	National Director for Forestry Management and Hydrology	GoTL
5	Horacio Amaral dos Santos	National Director for Aquaculture	GoTL

6	João Antalmo Ferreira	National Director for Natural Conservation	GoTL
7	Augusto Fernandes	National Director for Fisheries and Resource Management	GoTL
8	Lourenco dos Reis Amaral	National Director for fish inspection	GoTL
9	Livio Xavier	Programme Officer for Sustainable Development Unit	UNDP
10	Carla Maria Marques	Assistant of Director General for Environment	GoTL
11	Carsiliano Oliveira	Programme Associate for Sustainable Development Unit	UNDP

1. Opening remarks

The Director General of Fisheries, Ministry of Agriculture and Fisheries, Mr. Acacio Guterres, welcomed the participants to the Local Project Appraisal Committee (LPAC) Meeting for Building **shoreline resilience of Timor-Leste to protect local communities and their livelihoods (Mangrove Project)**. The Director General of Fisheries apologized for delaying the LPAC meeting due to an urgent call for a meeting with H.E. Minister; he also informed the participants of the purpose of the meeting to discuss further the Mangrove Project which is prepared and supported by UNDP. Mr. Guterres mentioned the importance of the Mangrove project which will bring valuable benefits to the country but also is essential in protecting of marine biodiversity; therefore discussion and valuable comments are needed as a way forward to implement this project smoothly. DG also mentioned that the country is facing many challenges in relation to climate change impact, such as natural hazards that happen everywhere, but by working together with UNDP we can overcome some issues.

Mr. Guterres formally requested the UNDP Programme Officer, Mr. Livio Xavier, to make the presentation as prepared.

2. Presentation of the Mangrove Project

The presentation covered the project background, objectives, key activities, expected outputs and outcomes as well as the project management arrangements and explained the role and responsibility of the project board. It also presented a structure; that UNDP Country office of Timor-Leste will facilitate the implementation of the project on behalf of GEF and provide support services to the project in accordance with UNDP Procedures. These services will be including a sub-contract arrangement with experts/professionals with capacity to support the project.

Discussion

2.1. After the presentation the Director General of Fisheries expressed appreciation to UNDP for presenting the overview of the Mangrove Project, that it was clear, and called for discussion after giving an opportunity to Mr. Mario Ribeiro Nunes, the Director General for Forestry, Coffee and Industrial Plants, to give his comments and observation.

2.2. DG Mr. Nunes expressed, as mentioned earlier, that the Mangrove Project related activity was very important for our land and coast line; basically they had done some observation, particularly in the south coast areas, and realized that there is significant mangrove degradation that communities were addressing through local "Tara Bandu" activities by themselves. In Hera beside Hera Cemetery there is a company wanting to demolish all mangrove trees for investments purposes if the government authorizes it; therefore from

the Forestry side they were proposing a technical assistant to conduct an assessment of this issue before the government agrees with company's proposal.

2.3. Mr. Nunes highlighted the process of providing support to Government, especially MAF through GEF funding support, technically the components covered everything, and he personally was more interested in the activity of watershed management as it was very important for forestry, since the mangroves in the lowland are affected by upstream sedimentation due to soil erosion where, as a consequence, all the material naturally moves downstream, destroying the mangroves. Along north coast there are many dead mangroves caused every year by sedimentation from upland areas, so watershed management is very important. Even though we have activities for rehabilitation in the coastal areas, we have not considered the upland areas that contribute to damage downstream. It was noted in the presentation for water infiltration and water harvesting system that building check dumps from vegetation will resolve this issue. The project gives us significant benefits and opportunities to do this by providing US$ 7M.

2.4. At the Director General's office there is a coastal protection department, and he believes they can cooperate and work together. Mr. Nunes also commented that because the institutional support or key project partners for the watershed management were not in the Directorate of Protected Areas but the Directorate for Conservation of Nature, this may need modification. There were some recommendations on the correction of the composition of key project partners for the sake of effective communication and involvement.

2.5. The National Director for Natural Conservation, João Antalmo Ferreira, adding his experience that there is significant pressure on mangroves caused by their destruction. As an example, in 2013 as chief of the Department for Protection, he conducted an assessment at the north coast and south coast and at that time his team produced a temporary map, therefore he would like to recommend to the Mangrove Project to identify the total functionality of mangrove areas. Mr Ferreira also commented that the Metinaro

site was still in a good condition even though there was pressure during the 2006 political crisis.

2.6. The National Director for Fisheries and Resource Management, Mr. Augusto Fernandes, thanked the meeting for the opportunity to initiate this important meeting for the greater cooperation within MAF and UNDP. He mentioned that GoTL is already planning two big constructions, Port Tibar Bay and South Coast Supply Base, and these will create another threat to their work, however, through this project they can reduce the pressures on TL natural resources. Secondly, the SOP is very important and it will guide them and enhance their experience; from his observation the outcome of the project is well covered. Mr. Augusto pointed out that some national directorate names have changed, particularly on the Key project partners, therefore an adjustment is necessary so there is a clear line of communication and coordination.

2.7. The Director General for Forestry, Coffee and Industrial Plants added that social, economic and demographic factors and the expansion of population settlement put pressure on mangroves, that there was active watershed management even though missing technical information, and he believed that through adding this component we can resolve many issues. Mr. Nunes also recommended including the National Directorate for Research, Statistics and Information Geography, as this ND will also need to do any additional research on new species.

2.8. The National Director for Forestry Management and Hydrology, Mr. Manuel Mendes commented that, based on previous studies of mangroves in Timor-Leste, 400 years ago Timor-Leste had 9,000 ha. However recent studies indicated that Timor-Leste has less than 2,000 ha and it means around 80% have been lost, and there is a trend of rapid mangrove degradation, therefore as a small island state we need to ensure our coast line is protected and conserved. Mr. Mendes also mentioned sedimentation and soil erosion as the main factors from upland to the coast line which were destroying not only mangroves but other marine biodiversity; also it was realized that TL is small country affected by sea level rises from time to time, as indicated by many reports e.g. NAPA, INC etc.

The Project is very important for TL and not only for mangrove rehabilitation but also community livelihoods as mangroves create the conditions for marine biodiversity and other species protection. Another pressure on mangroves was community use of mangrove wood as cooking fuel as happened in Metinaro during the 2006 crisis with IDPs. Mr. Mendes also mentioned that there was a need to involve the National Directorate for Livestock in relation to animal grazing and that it was very fortunate that the National Defense Force of Timor-Leste was utilizing the area for military training purposes, thus denying access to the community.

Mr. Mendes also mentioned that mangroves in Timor-Leste have 19 species and will identify more details at the implementation phase to ensure the successful rehabilitation of the mangrove. Mr. Mendes suggested a forum on watershed management composed from other agencies who are directly contributing to this work and also a National Commission for Mangroves, thus involving all the key project partners in order to have clear ideas for this specific work.

2.9. National Director for Fisheries and Resource Management added that the involvement of National Directorate for Livestock is very critical at this moment.

The National Director for Aquaculture, Mr. Horacio Amaral dos Santos, commented that one of the issues is fishpond construction which is creating an additional burden on mangroves, for example in Indonesian time the Tibar Fishpond was constructed even though it was useless. He agreed with DG Nunes that sedimentation moving from upland to lowland was a problem but also other factors such as cultivation on the upland areas also affected mangroves. Mr. Horacio mentioned that there is ongoing discussion with Mr. Joao Antalmo about the mangroves in Suai district, particularly at Beco, which is a green area with beautiful views but if it is compared to other places is almost all affected by upland sedimentation. In addition an alternative livelihood is cultivating the seagrass, however the local community do not support this activity to conserve all. There is a need for discussion, with the sectoral-crosscutting within the international agencies to be made aware of it as well. Mr. Horacio was also concerned about the Key Project Partners and he

recommended that the Ministry of State Administration needed to be included as all Municipalities are under State Administration and since the project location is located in each municipality including the local authority at the Suco level. He also supported the idea of establishing a commission or forum for mangroves in order to create a proper working group under this project. The objective of this commission would be to look at a national perspective of conserving and protecting mangroves; and its agreeable????, we can coordinate this matter in detail with UNDP upon implementation of this project.

DG Mr. Nunes said that the forestry will established a forestry forum focus on watershed management, and it has been initiated, particularly at the border between Indonesia and TL to re-organize the watershed management within these two territories e.g. river-flow. They had several meetings and agreed to assess the 10 watershed managements. This is a good opportunity to establish a forum for mangrove management and the members of this forum will be composed from Government, NGOs, CBOs, Agencies and as well as universities in Timor-Leste.

2.10. Mr. Horacio also would like to know the project management unit e.g. how many consultants or technical experts will be recruited for this project.

2.11. The UNDP Programme Officer, Livio Xavier explained that according to the ProDoc an International Consultant will recruit 6 experts in each of the technical areas such as CBERM, SLM, Economists, Livelihoods, Gender and Innovative Finance. The programme officer of UNDP further explained that details can be discussed during the inception workshop after the approval of the Mangrove Project Document and there will still be room for comments and suggestions to be included in the final ProDoc but importantly the draft ProDoc needs to be read by all directors before the coming inception workshop. Mr. Carsiliano, gave his additional thoughts by informing to the NDs that all comments and suggestions made should reflect the GEF requirements.

The Director General for Fisheries, Mr. Acacio, added that, there is significant funding from agencies but the implementation doesn't giving substantial benefit to the population or community and this need to be discussed deeply, how to create sustainability, and all international consultants must transfer their skills before the contract ends as the project would paid them a high salary and the East Timorese must absorb their skills.

2.12. The National Director for Fish Inspection, Mr. Lourenco dos Reis Amaral commented that there are some activities undertaken by the MAF, but they can be reinforced with the local "Tara Bandu" which all East Timorese are aware of. In contrast Mr. Horacio, said that Tara Bandu were initiated with a good will but there has been no significant impact on community life, however, community involvement in the mangrove rehabilitation is necessary and the government must recognised their success story by giving an award especially to the communities who live in coastal areas of Timor-Leste; the award can be giving by the President of Republic as the highest level in the country.

2.13. The Assistant of Director General for Environment, Ms. Carla Maria Marques, commenting on the Key Project Partners, suggested the National Directorate for Cooperation, Pollution Control and Environment be included.

3. Conclusion

3.9. Prior to the closing of the LPAC meeting the Director General of Fisheries, Ministry of Agriculture and Fisheries, Mr. Acacio Guterres alerted LPAC members to future discussion and said that many of the communities in the coastal areas faced threats to their daily life. The LPAC members participated very actively in the Mangrove Project LPAC meeting and provided very useful ideas. Mr. Livio (UNDP) also suggested participants read the ProDoc and any comments or suggestions would be included at the inception workshop in order to finalizing the ProDoc. Mangrove Project Document will be translated into Tetum for those people who do not speak English to facilitate their understanding of the content of the ProDoc.

3.10. Before closing the meeting, Director General of Fisheries, Ministry of Agriculture and Fisheries, Mr. Acacio Guterres thanked all the participants for the productive meeting and encouraged the LPAC members to work together to facilitate the implementation of the project. He also thanked UNDP efforts in helping GoTL to implement the **Building shoreline resilience of Timor-Leste to protect local communities and their livelihoods (Mangrove Project)** in Timor-Leste.

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