



DEMOCRATIC REPUBLIC OF TIMOR-LESTE
MINISTRY FOR ECONOMY AND DEVELOPMENT
SECRETARY OF STATE FOR ENVIRONMENT

NATIONAL ADAPTATION PROGRAMME OF ACTION (NAPA) ON CLIMATE CHANGE

DECEMBER 2010





Message from the Prime-Minister

Since independence Timor-Leste has undertaken a process of peace building and State building. While experiencing some difficult periods, and high levels of poverty, the nation has moved to consolidate peace and stability. This has provided a foundation to address the health and education needs of the people and to move towards the eradication of extreme poverty. In recent years, Timor-Leste has not only enjoyed peace but has emerged as a fast growing economy with great potential. To realise this potential and achieve our vision of a prosperous, healthy and well educated population our Strategic Development Plan 2011-2030 sets out our path for the future.

An important part of the Strategic Development Plan is the section on the environment. This section notes that the people of Timor-Leste have a strong relationship with the natural environment and that for generations we relied on the environment for the essentials of life. Regrettably, our environment has suffered with over-logging, erosion, threats to wild life, and pollution. The Strategic Development Plan 2011-2030 also identifies climate change as one of our greatest environment challenges.

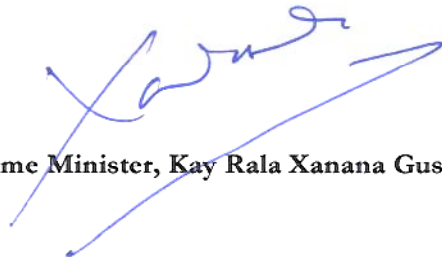
While on a per person basis we are one of the smallest carbon dioxide emitters in the world, and we make only a tiny contribution to climate change, our nation is particularly vulnerable. The potential impact of climate change on Timor-Leste includes rising sea levels threatening coastal areas and critical infrastructure and extreme weather events, including long droughts resulting in fires and food shortages and excessive rain leading to flooding. Our marine biodiversity and coral reefs, which are some of our great assets, are also at risk with rising sea temperatures. These impacts will also have profound consequences for agricultural production, food security, the tourism industry, the incidence of natural disasters, and the well being of our people.

The Strategic Development Plan 2011-2030 commits Timor-Leste to developing a National Adaptation Program of Action to identify national priorities to address climate change adaptation and to monitor the implementation of adaptation measures. I am pleased that the finalisation of this National Adaptation Program of Action delivers on one of the key commitments of the Strategic Development Plan 2011-2030, as well as of the United Nations Framework Convention on Climate Change, and most importantly provides a critical basis for addressing the risks associated with a changing climate.

Timor-Leste National Adaptation Programme of Action to Climate Change

The National Adaption Program of Action is a result of a two year participatory process and focuses on the addressing the most immediate climate related risks. The Program seeks to build community awareness, increase monitoring and risk forecasting and support the adaption of government policies and strategies to improve climate change resilience among vulnerable groups. This Program will guide our collective action and support a coordinated approach to addressing the multiple challenges of climate change.

On behalf of the Government and the people of Timor-Leste I would like to congratulate all the people and organisations that supported the preparation of the National Adaption Program of Action and ensured that this Program truly reflects the position of our nation. The critical task now ahead of us is to implement the National Adaption Program of Action with vigilance and dedication. Only in this way can we all work collectively, and in solidarity, to mitigate the impacts of climate change and secure a brighter future for our people and our nation.



Prime Minister, Kay Rala Xanana Gusmão



Message from the UN Resident Coordinator/UNDP Resident Representative

Climate change is a global issue affecting all nations, rich or poor. It knows no boundaries, which means that solutions must be sought through regional and global coordination and collaboration. The United Nations Framework Convention on Climate Change (UNFCCC) provides a framework for intergovernmental efforts to reduce greenhouse gas emissions and adapt to the expected impacts of climate change. It also provides guidance to member states on developing and implementing national climate change strategies, incorporating both adaptation and mitigation actions. Timor-Leste became a signatory to the UNFCCC in October 2006. As a least developed country, the focus of Timor-Leste is primarily on identifying measures to reduce climate change-induced vulnerabilities for the poorest and most vulnerable communities, namely those that are dependent on natural resources through agriculture, forestry and fisheries for their livelihoods, making up about 70 percent of the total population. These are the sectors that are estimated to be affected considerably from decreased production due to unpredictable rainfall patterns, increased incidence of forest fires and rise in sea temperatures, to name just a few.

Climate change presents significant threats to the achievement of the Millennium Development Goals especially those related to eliminating poverty and hunger. Food security is one of the most critical challenges facing Timor-Leste today and this is likely to be compounded by the effects of climate change on agricultural production. Climate change also impacts on health, water availability, biodiversity and infrastructure. This is why this National Adaptation Programme of Action (NAPA) has identified nine areas for immediate action with proposed adaptation measures. The participatory formulation process was led by the Ministry of Economy and Development and the State Secretariat for Environment with support from the Least Developed Countries Fund and UNDP and engaged stakeholders from Government and civil society. This document is of vital importance, not just because it complies with the obligations set forth by the UNFCCC, but importantly, because it is a planning tool for the Government and development partners in Timor-Leste, to identify and implement priority activities on the ground in all relevant sectors.

I would like to congratulate the Government of Timor-Leste for the work that it has done in leading the NAPA process and ensuring that it has been fully participatory, bringing together a wide range of stakeholders at all levels. I expect that the NAPA document will become an important tool for the Government and development partners to address future climate risks and increase the resilience of the economy and livelihoods of the nation. The Government has already recognized its value in the Strategic Development Plan 2011-2030, in which it commits to meeting UNFCCC targets

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channeled locally through the NAPA framework. Thus, the NAPA process will prove an important step in the Government of Timor-Leste's journey towards achieving low-emission, climate-resilient, and sustainable development.

The United Nations system will continue to support the Government in its efforts to tackle the adverse effects of climate change and promoting sustainable social and economic development.



Finn Reske-Nielsen
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Acronyms

AusAID:	Australian Agency for International Development
CC:	Climate Change
CO2:	Carbon dioxide
CRS:	Catholic Relief Services
CVTL:	Cruz Vermelha de Timor-Leste
DCCEE:	Department for Climate Change and Energy Efficiency
EBA:	Endemic Bird Area
EIA:	Environmental Impact Assessment
ENSO:	El Niño/Southern Oscillation
EWS:	Early Warning System
FAO:	Food and Agriculture Organization
GDP:	Gross Domestic Product
GEF:	Global Environment Facility
GoTL:	Government of Timor-Leste
HDR:	Human Development Report
IAS:	Invasive Alien Species
IOD:	Indian Ocean Dipole
IPCC:	Intergovernmental Panel for Climate Change
IUCN:	International Union for Conservation of Nature
IWRM:	Integrated Water Resource Management
LCCS:	Land Cover Classification System
LDC:	Least Developed Countries
LEG:	LDC Expert Group
MAF:	Ministry of Agriculture and Fisheries
MCA:	Multi-Criteria Analysis
MDG:	Millennium Development Goals
MED:	Ministry of Economy and Development
MOI:	Ministry of Infrastructure
MSS:	Ministry of Social Solidarity
NAPA:	National Adaptation Programme of Action
NDES:	National Directorate for Environmental Services
NDIEA:	National Directorate for International Environmental Affairs
NDMG:	National Directorate for Meteorology and Geophysics

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NDMO:	National Disaster Management Office
NDP:	National Development Plan
NGOs:	Non-Governmental Organizations
NHDR:	National Human Development Report
NICDP:	National Institutions Capacity Development Project
PIU:	Project Implementation Unit
PSC:	Project Steering Committee
PWC:	Project Working Committee
SDP:	Strategic Development Plan
SEMA:	Secretary of State for Environment
SWGs:	Sector Working Groups
UNCBD:	United Nations Convention on Biodiversity
UNCCD:	United Nations Convention to Combat Desertification
UNDAF:	United Nations Development Assistance Framework
UNDP:	United Nations Development Programme
UNFCCC:	United Nations Framework Convention on Climate Change
USAID:	United States Agency for International Development
WHO:	World Health Organization
WWF:	World Wildlife Fund

EXECUTIVE SUMMARY

Following the turmoil of its emergence as an independent nation, Timor-Leste continues to be faced with enormous development challenges. Climate change represents an additional risk with the potential to cause further set-backs by undermining progress made on key development indicators, in particular food security. Due to its recent history, there is a limited store of scientific knowledge and research specific to Timor-Leste which might help to characterize the likely impacts of climate change. However, in common with its neighbors in South-East Asia and the Pacific, it is anticipated that Timor-Leste will face significant challenges as a result of climate change. In particular it is anticipated that the nation's vulnerability to climate change will be intensified by its extremely high dependency on the natural resource base, inadequate infrastructure and lack of institutional capacity.

This National Adaptation Programme of Action (NAPA) has been prepared by the State Secretariat for Environment located within the Ministry of Economy and Development (MED), Government of the Democratic Republic of Timor-Leste. The preparation process has closely followed the guiding principles outlined in the annotated guidelines of the Least Developed Countries (LDC) Expert Group (LEG) established under the United Nations Framework Convention on Climate Change (UNFCCC). A central element of the Timor-Leste NAPA has been the establishment and active participation of six dynamic Sector Working Groups on food security, water, health, disasters, biodiversity and infrastructure. Members were drawn from across government, universities, national and international NGOs, donors, the private sector, international organizations and youth. Focal points from these groups were also actively engaged in consultation at the district level.

The Sector Working Groups adopted a two-step workshop process in order to identify the likely vulnerabilities and impacts of climate change on their individual sectors and to consider potential actions to address these impacts. Across all sectors, the main concerns raised related to changes in rainfall and temperature patterns and their effects on drought, flooding and landslides. These concerns were mirrored at consultations in the five Districts of Baucau, Bobonaro, Ermera, Manufahi and Oecusse, which were selected to represent the full range of possible climatic and agro-ecological conditions. The agricultural and water sectors were the two felt to be most heavily affected by climate change.

The overarching vision set out in the NAPA is to make the Timorese people more resilient to climate change, recognizing their high vulnerability in an economy that is dominated by subsistence agriculture. Adaptation measures will be focused on reducing the adverse effects of climate change and promote sustainable development. These measures will build on existing strategies and plans across all sectors within Timor-Leste including the National Priorities process. The following priority adaptation measures are proposed by Timor-Leste:

- **Food Security:** Reduce the vulnerability of farmers and pastoralists to increased drought and flood events.
- **Water Resources:** Promote Integrated Water Resource Management (IWRM) to guarantee water access in a climate change context.
- **Human Health:** Enhance the capacity of the health sector and communities to anticipate and respond to changes in distribution of endemic and epidemic climate-sensitive diseases, and reduce the vulnerability to infection of populations in areas at risk from expansion of climate-related diseases.

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- Natural Disasters: Improve institutional and community (including vulnerable groups such as women and children) capacity to prepare for and respond to climate change induced natural disasters.
- Forests, Biodiversity and Coastal Ecosystems: Maintain and restore mangrove and forests and promote awareness raising to protect coastal ecosystems and forests from climate change impacts.
- Livestock Production: Improve planning and legal framework for the promotion of sustainable and balanced food for livestock production.
- Physical Infrastructure: Improve regulations, standards and compliance for climate-resilient infrastructure.
- Supporting the ambitious national poverty reduction target in relation to the expected increased storm intensity at sea by improving the capacity to forecast and adapt offshore oil and gas infrastructure to withstand strong storms and waves.
- A ninth priority area, underpinning all others, focuses on developing National Institutional Capacity for Climate Change through which overarching programme level coherence will be ensured.

Taken collectively, these activities provide a coherent programme which, if implemented as an integrated programme, would significantly reduce the vulnerability of Timor-Leste's critical development sectors to climate-related risks.

1.0 INTRODUCTION AND SETTING

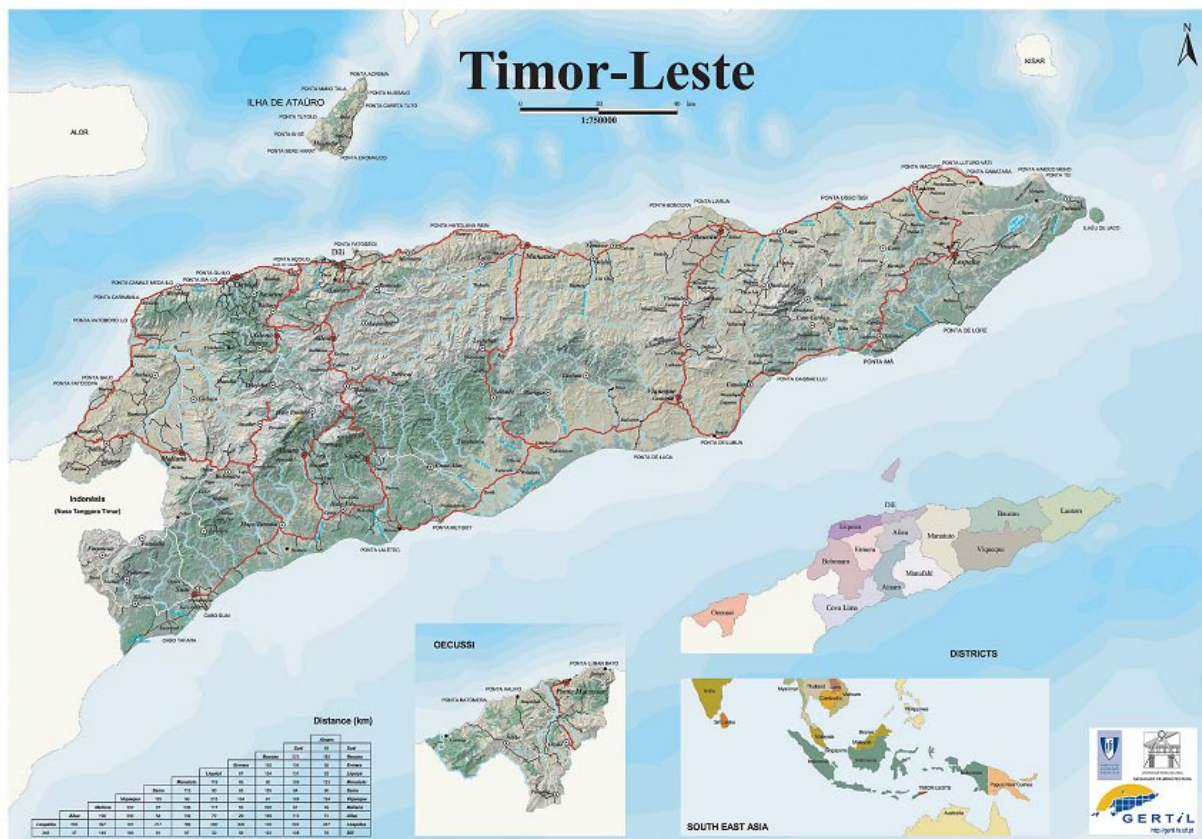
1.1 Background and National Geography

Timor-Leste restored independence in 2002 after 450 years as a colony of Portugal, 24 years occupation by Indonesia and two years UN transitional administration. Despite facing serious challenges, such as limited human resources and high levels of poverty and unemployment, the country has made significant progress in building an institutional framework to support economic development and promote macroeconomic stability.

Timor-Leste ratified the United Nations Framework Convention on Climate Change (UNFCCC) in October 2006, the Kyoto Protocol to the UNFCCC in October 2008, the Convention to Combat Desertification (UNCCD) in August 2003, and in January 2007 became a party to the Convention on Biological Diversity (UNCBD). The country has started its Initial National Communication to the UNFCCC with the support of the Global Environment Facility, the Australian Agency for International Development (AusAID) and the United Nations Development Programme (UNDP). Climate change and environmental sustainability issues are becoming an integral part of national planning policies. The Secretariat of State for Environment is currently developing a short, medium and long-term environmental strategic plan to better address environmental services as stated in the National Constitution. After approval by the Council of Ministers, this plan will provide guidance in annual operational planning for 10 years, with short, medium and long-term goals. This plan also endorses the current work for preparation and implementation of the National Adaptation Programme of Action (NAPA) under the UNFCCC. The Timor-Leste NAPA aims to identify key impacts, vulnerable sectors and groups, as well as adaptation measures to address the impacts of climate change, and integration of UNFCCC guidance into national policy, programs and actions. These national priorities were reiterated in an overview of where Timor-Leste stands in terms of achieving the Millennium Development Goals (MDGs) presented to the United Nations MDG Summit in September 2010.

Location	Eastern part of the Timor Island at the eastern end of the Indonesian archipelago. Between latitudes 8'15 and 10'30 south, and longitudes 124'50 and 127'30 east.
Area	14,874 km including the enclave of Oecusse on the north coast within Indonesian West Timor, and the two smaller islands, Atauro to the north and Jaco on the eastern tip.
Surroundings	Bordered by West Timor on one side, it is otherwise surrounded by water. North: Savu Sea and Straits of Wetar, moving into the Banda Sea beyond. South: the Timor Sea fills the less than 400 nautical mile distance between Timor-Leste and Australia.
Topography	Diverse and dramatic: a steep, central east-west mountain range declining sharply and flanked by riverine and/or coastal plains, terminating in wide, braided streams or sometimes coastal cliffs. Several peaks > 2,000m above sea level: Mount Ramelau (2,963m), Mount Matebian (2,373m), Mount Curi (1,300m), Mount Paitchau (995m) and Mount Manucoco (970m) on Atauro Island.

Table 1 - Basic geographical information for Timor-Leste



Map 1 - The Democratic Republic of Timor-Leste

The original *vegetation* of Timor Island was a diversity of lowland and mountainous ecosystems dominated by forests and woodlands of various structural and floristic types. The natural environment, forests and woodlands however are now significantly degraded and altered by a combination of natural and anthropogenic (resulting from or produced by humans) factors. The fragile physical conditions of the environment in tandem with an extended period (over 5,000 years) of human exploitation and unsustainable land management practices has transformed the natural environment into a predominantly rural agricultural landscape surrounding remnant pockets of natural vegetation, high mountain grasslands and degraded savannah rangelands. The use of fire as a tool for agriculture (swidden) and livestock feeding and historic broad scale deforestation for timber has had a significant impact in this transformation. Logging has been banned since 2000 and currently the major threats to the natural environment are uncontrolled burning, 'swidden' agriculture and timber cutting for fuel wood.

To date no *forest* inventory or classification system exists and there are currently major discrepancies in estimates of forest distribution, cover and degradation. However, a national forest inventory currently underway with the assistance of multiple donors should resolve this. A recent land use and land degradation study, using the Food and Agriculture Organization (FAO) Land Cover Classification System (LCCS) provisionally classifies 57% of the estimated 1.5 million hectares of land in Timor-Leste, as forest or woodland. However, this category ranges from sparse open savannah woodlands through to dense forests and includes palm plantations, heavily degraded and secondary forests and woodlands. Although the forest and woodlands of Timor-Leste are significantly reduced or degraded, small but significant stands of natural forests can still be found in the districts of Manatuto, Viqueque, Lautem, Manufahi, Bobonaro and Covalima. In addition to inland forest, the country also has small but significant stands of mangrove forest on the north coast and around river outlets in the south.

While the *biodiversity* of Timor-Leste is thought to be diverse and unique, it is poorly studied and there is very limited current baseline information, most data being historical and outdated. However, this is gradually changing with increased interest from the government and the implementation of several internationally supported projects and programmes with a focus on biodiversity, such as the Coral Triangle Initiative (CTI), the Arafura and Timor Seas Ecosystem Action Programme (ATSEA), the Programme of Works on Protected Areas (PoWPA) and the National Biodiversity Strategy and Action Plan project (NBSAP). Five generalized ecological zones have been identified including: (i) marine and coastal zone, (ii) arid lowland areas, (iii) mountainous areas, (iv) highland plains, and (v) wetlands and lakes (UNDP, 2006).

Of the *terrestrial fauna*, birds are most well studied and recent work has shown a high degree of endemism and diversity. At least 262 species are known including 39 threatened or restricted range species, eight of which are endemic to Timor. Timor and its associated islands have been designated by BirdLife International as an Endemic Bird Area (EBA).

Marine and coastal areas provide habitat for mangroves, coral reefs and sea grass. There may be in excess of 500 species of coral occurring in Timor-Leste waters (Veron et al., 2000). The tropical flora has similarities with the northern Australian and Malaysian floras. Recent surveys in Timor-Leste have recorded more than 1,000 plants species, and assessments based on a comparison with other similar islands indicate that around 2,500 species might exist on Timor Island (Trainor et al., 2007).

The *coastal zone* of Timor-Leste, stretching over 700 km, includes unique resources both on land and in the sea. This ecosystem is at present in pristine condition. If utilized in a non-destructive and well-planned manner, it will provide great possibilities for economic development, while providing necessary products to sustain the coastal population. If not controlled, economic interests relating to the coastal zone, particularly oil exploration and tourism, will constitute significant threats to this resource.

The *fresh water resources* of Timor-Leste comprise both surface water and groundwater. There are 28 major river basins in Timor-Leste. Little is known of the flows in each river as data from the six hydrometric stations constructed in the 1980's has been lost (ADB: 2004). Small amounts of water are stored in one major lake (Iralalero) in the east, and a number of small lakes, mainly in the south. Groundwater resources are contained in a variety of aquifers, covering about 50% of the country. Groundwater in storage is over 100 years of recharge and may be considered as drought-proof. The water demand comprises; domestic water (drinking and sanitation), irrigation, and other uses (coffee processing, fisheries, water bottling, tourism and petrochemicals).

1.2 Socio-Economic Circumstances

Timor-Leste has a population of approximately 1.1 million over half of which are under 18 years old (GoTL, 2009a) and is one of the fastest growing in the world, with an average national fertility rate of 5.7 (Department of Health Services, 2009) children per woman. Despite significant increases in revenue due to receipts from petroleum and coffee exports, it is still the poorest country in the Asia-Pacific region and has been ranked 120 of 169 countries in the 2010 UNDP Human Development Index (UNDP, 2010). The GDP per capita for 2009 is estimated at US\$492 by the World Bank¹. One third of the total population lives in the urban centers, Dili and Baucau, with more than 60% of that number living in the capital, Dili.

Timor-Leste is a predominantly agrarian (subsistence) economy with over 80% of the population depending on the agricultural sector as the main source of income, yet the sectors contribution to the economy is approximately only 30% of non-oil GDP (GoTL, 2009). Historically, the predominant

¹ <http://data.worldbank.org/indicator/NY.GDP.PCAP.CD>

form of agriculture was rain-fed shifting agriculture with some sedentary agriculture developing where soil and water conditions were more favorable, such as on riverine and coastal plains. From the 1960's, under foreign administrations there was a slowly increasing development towards more modern and intensive practices. However, this remained limited geographically and socially and was exploited by Indonesian transmigrant immigrants. Since the violent withdrawal of Indonesia 1999 and the corresponding massive destruction of infrastructure, agricultural practices have returned to, and remained at, subsistence levels. Progress has been limited by capacity, resources, technical knowledge, limited quality data and a long history of land degradation.

The main crops are *rice*, *maize* and *cassava*, while *coffee*, *coconut* and *candlenut* are grown commercially in lesser quantities. Maize is the most abundant and accessible food crop, making it the most important source of food security. In most places, maize is grown in shallow soils on steep slopes using shifting cultivation that results in deforestation. Rice is the second most important food crop, and areas that are able to produce at least one rice crop per year tend to experience higher food security than those that cannot. While the majority of the population depends on subsistence agriculture, the food produced is not sufficient for the population (30-40% of food needs are imported), and the country does not produce significant quantities of marketable agricultural surpluses, with the exception of coffee.

Apart from the agriculture sector, other economic activities are limited. Two surveys conducted in 2001 and 2007 show that the number of people in the agricultural and public sectors increased by 32.4% and 100% respectively. However, the workers of the industry sector increased by 1% per year while those working in the services sector has decreased. The cost of doing business remains very high. Inadequate infrastructure and the absence of an appropriate enabling environment remain as two considerable obstacles. The Strategic Development Plan (SDP) 2011-2030 will go some way towards strengthening the country's communications, transportation and financial infrastructure to attract private sector investment. An improvement in the regulatory framework to attract private sector investment is also recognized as being necessary. For example, a foreign investment law is being drafted which will assist in attracting investment and generating employment outside of the agricultural sector. This is also anticipated to encourage rural entrepreneurship.

Health standards in Timor-Leste are currently very low, and access to health facilities is difficult, especially in rural areas, with no guarantee that a doctor or nurse will be available as these personnel often operate more than one health facility. Respiratory and diarrheal disease is widespread, and malaria and dengue fever are endemic, mainly attributable to unsafe water sources, poor sanitation and hygiene. These diseases become particularly problematic during the wet season and are particularly life threatening for children. There is no system for treating sewage water which is commonly disposed of in rivers, fields and gardens, leading to contamination of shallow wells. Indoor air pollution is another major health hazard, as more than 90% of the population uses firewood for household needs (World Bank, 2007).

Timor-Leste's Strategic Development Plan (2011-2030) sets out that the next decade will focus on providing the basic conditions for development in all areas and infrastructure is one of the areas that is highlighted. The Indonesian withdrawal in 1999 resulted in extensive destruction of Timor-Leste's infrastructure. Since this time, addressing the huge infrastructural constraints has been on the Government of Timor-Leste (GoTL) agenda but given the extent of destruction, along with the particular geographical circumstances in the country, this has been expensive. Such difficulties include the mountainous terrain and the construction of roads along the sea where they are more exposed to the elements and erosion. Future plans foresee significant investment in infrastructure – roads, ports, airports, communications and electricity. At the same time oil and gas has become an important sector for Timor-Leste and is seen as the platform from which major economic

development can be achieved in the coming years. This infrastructure is mainly located at sea and it too is vulnerable to the elements.

1.3 The Climate

Rainfall Patterns

Timor-Leste has a monsoon climate with a differentiated effect between the North and South of the country. The northern part of the country, influenced by the Northern Monomodal Rainfall Pattern, has a 4-6 month wet season from December to April or June. The southern part experiences the Southern Bimodal Rainfall Pattern leading to a seven to nine month wet season with two peaks, one in December and the other in May (Figure 1) (Barnett et al., 2007).

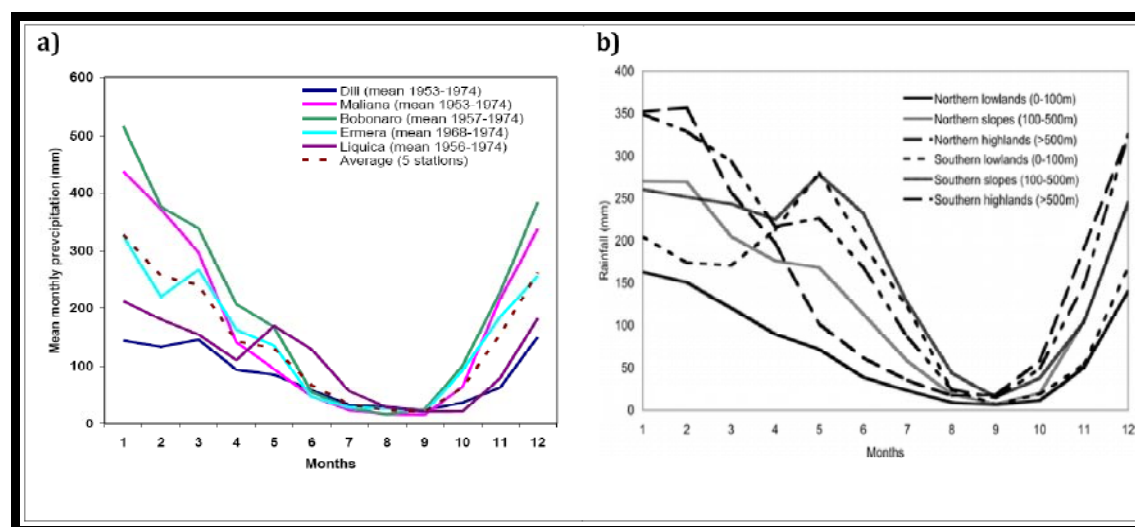


Figure 1 - Mean monthly rainfall in key regions of Timor-Leste (1950-1974) (Barnett et al 2007; AK-2010)

However, zonation according to altitude, location and aspect does not provide the complete picture of variability in rainfall in the country. There are some exceptions to the ‘higher-altitude-higher-rainfall’ general rule. For example Liquiça and Viqueque, which are low altitude districts (25m and 46m respectively), experience relatively high annual rainfall (1349 mm and 1610 mm respectively). Significant rainfall variability also occurs from one rainy season to another and even within rainy seasons from month-to-month (Fox, 2003).

Exceedingly heavy rainfall is a further feature of Timor-Leste’s weather pattern. Maximum daily rainfall has been recorded at 275 mm in Dili, 398 mm in Lospalos, 217 mm in Suai, and 267mm in Lolotoi (Crippen International, 1980, quoted in Monk et al., 1997). Sandlund (et al., 2001) remarked that “This means that in Dili, nearly 30% of annual mean rainfall may fall in one day as in 2001”. The greatest intensity of rainfall in Timor-Leste is found during the North West Monsoon in the December – March period, with a particular focus in the northern areas. In the south, the highest maximum daily rainfall events are found in the May-August period (Keefer, 2000). To sum up, relative humidity is high in Timor-Leste throughout the year. Variability of mean monthly relative humidity across the different geographic areas is not very significant with 69-78% in the north coast, 73-80% in the south coast and 75-78% in the highlands (Yance, 2004).

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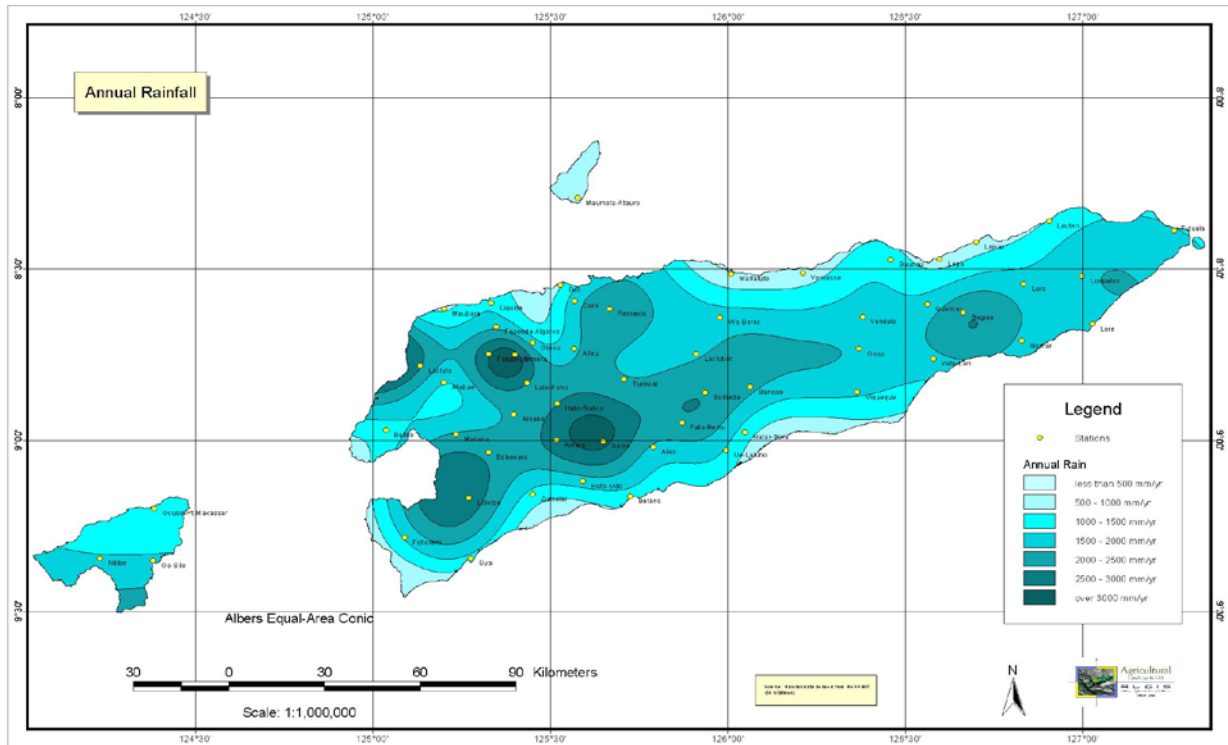


Figure 2 - Spatial distribution of annual rainfall across the country
(Source: Timor-Leste Agriculture Network and Virtual Library 2004)

Temperature

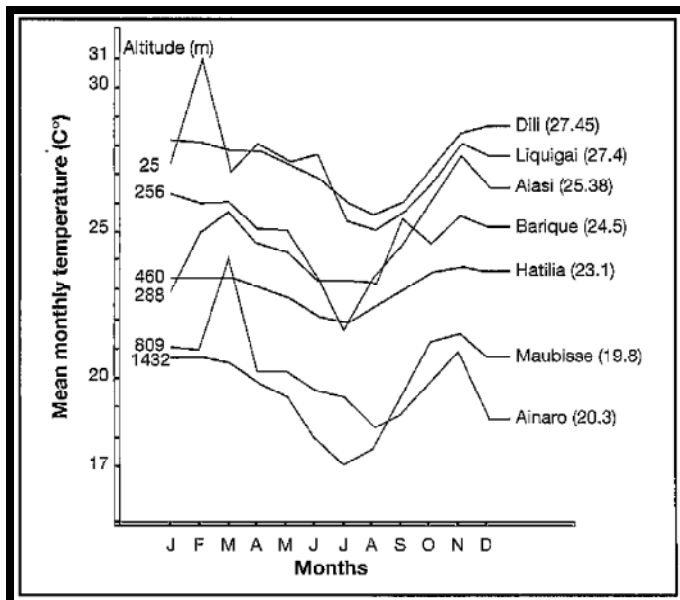


Figure 3 - Mean monthly temperature at selected sites
(Source: Monk et al. 1997, quoting Felgas 1956)

Temperature in Timor-Leste follows the common trend in tropical countries with little variability throughout the year; the mean monthly temperature in the coastal areas is 27°C, whilst in the highlands it is 25°C. It has been documented that diurnal variation is higher than this with variability depending on the altitude and on the season. For example, in Godo and Sumbawa Besar, Sumbawa in Nusa Tenggara Barat, Indonesia, greater diurnal variability is felt towards the end of the dry season – between 7°C and 13°C, whilst wet season ranges are mostly 7°C to 9°C (Monk et al., 1997).

ENSO

The El Niño Southern Oscillation² (ENSO) is an important influence on the variability of Timor-Leste’s climate. The ENSO phenomena leads to a shift in the weather patterns by associating to a weaker Walker circulation, impacting upon the circulation of warm and cold ocean currents and winds, influencing atmospheric pressure. The figure below illustrates how the Walker circulation is weakened and its impacts in the region.

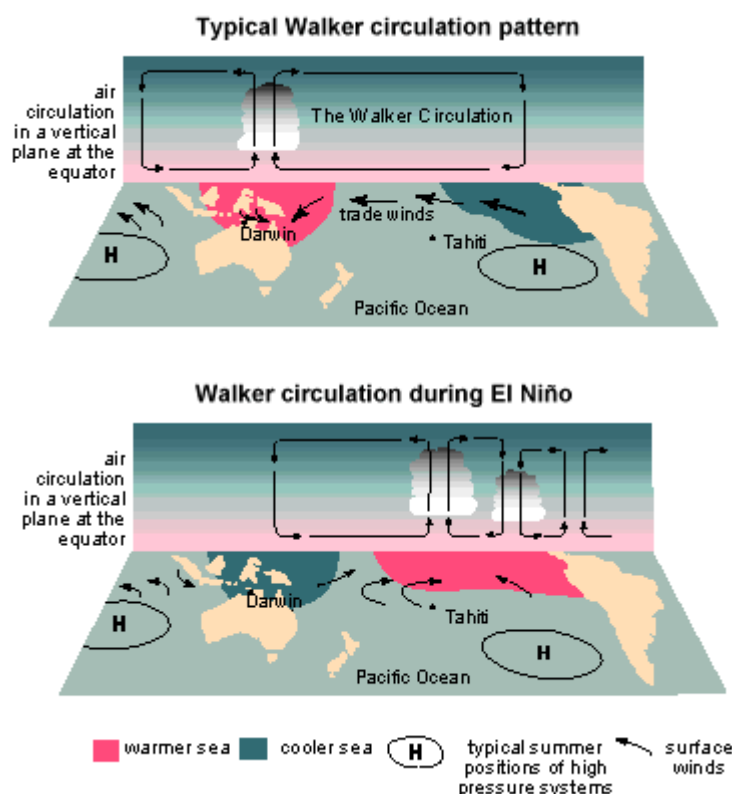


Figure 4 – The impact of El Niño on the Walker circulation (BoM, 2008)

Some key features of the ENSO’s influence in Timor-Leste are described below:

- Climate variability is significantly influenced by the El Niño Southern Oscillation which, in El Niño years, changes the timing and volume of rainfall (BMRC, 2003). In 2010, meteorologists linked that year’s exceptionally long rainy season to La Niña. In addition, during 2010 Timor-Leste’s capital, Dili received 76% more rainfall by August than for 2009 as a whole (IRIN, 2010).
- In some places, such as Ainaro, Lolotoe, Lore, and Los Palos annual rainfall is up to 50% less than average in El Niño years (Barnett et al., 2007).
- In others, such as Baucau and Oecussi, annual rainfall in El Niño years is greater than average (Barnett et al., 2007).
- In all places El Niño causes reduced rainfall in the January – March wet season, with some places experiencing reduced rainfall in comparison to the amounts usually received in these months, in non-El Niño years. In general, the wet season is delayed by two to three months in El Niño years, with implications for crop planting and food security (Barnett et al., 2007).
- In the year following an El Niño, rainfall can be higher than the annual average, with implications for flooding (Barnett et al., 2007).

² ENSO is an air-sea interaction in the Pacific that affects climate variability in the Indo-Pacific region, with a cycle of 3-7 years. An El Niño event can also occur when the eastern tropical Pacific is much warmer (cooler) than normal which is called La Niña.

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- Recently, the country has experienced El Niño-related droughts in 1963–64, 1969–70, 1976–77, 1977–78, 1986–87, 1987–88, 1994, 1997–98, and 2002–3.
- One in four years there is a drought year. In these times the November wet season begins at the usual time, but rainfall is significantly less.
- In El Niño years the sea level is 20 cm below normal, while in a La Niña event it is 10-20 cm above normal, over the area of Lombok and Sumbawa (Anonym, 2010).
- Wave height increases in La Niña years by 1-2.5 m in the north coast and by up to 3 m in the south coast; relative to a normal wave height of 1.5m.

Recent studies indicate however that the Indian Ocean Dipole (IOD)³ may also have a significant influence on rainfall variability⁴ and that it can counteract the reducing impact of El Niño on rainfall (Lasco and Boer, 2006).

Tropical Cyclones

The tropical cyclone season in the Timor Sea normally runs from November to April. Many tropical storms and cyclones originate or pass through the Timor Sea. Between 1964 and 2002, 25 cyclones were recorded (BOM, 2010). Tropical cyclones are characterized by very strong winds and driving rain with high waves and storm surges which batter coastlines. Studies have shown that tropical cyclone activity near Timor-Leste is lower in El Niño years and higher during La Niña events. This has been further confirmed through an analysis of the Australian tropical cyclone database indicating that since the 1970s, and largely due to an increase in El Niño events, there has been a decrease in the number of tropical cyclones in the region (Kuleshov et al., 2008). However, studies also indicate that the strongest tropical cyclones are getting stronger (Elsner et al., 2008). These tropical cyclones are usually formed in the Banda, Arafura, Timor or Sawu Seas surrounding the island of Timor and then move in a South-Westerly direction.

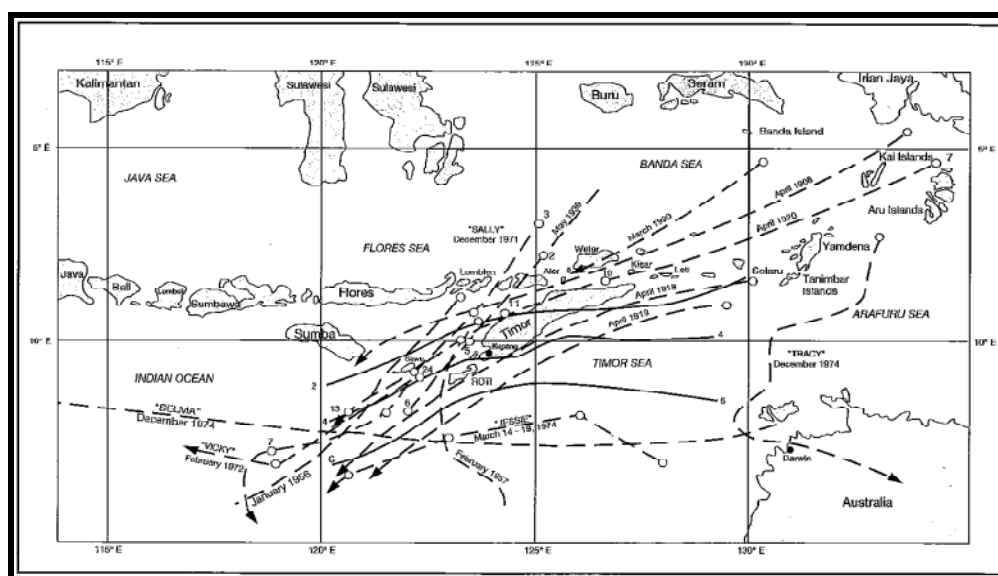
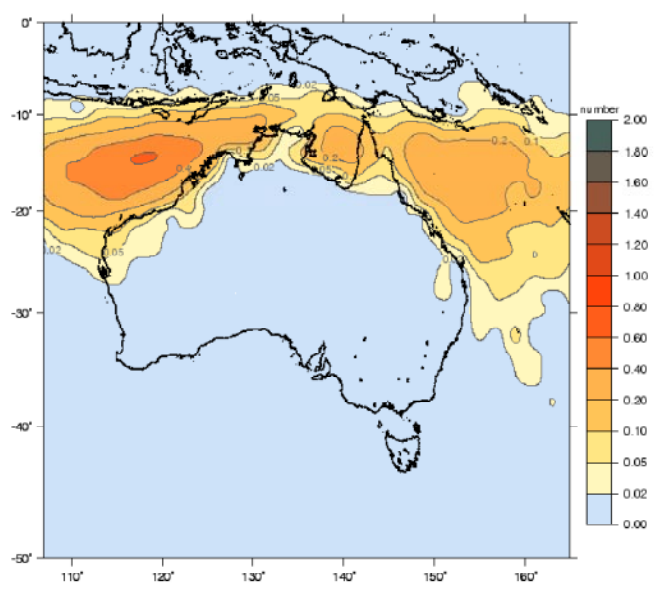


Figure 5 - Occurrence and direction of tropical cyclones in the past over Timor-Leste region (Monk et al., 1997)

³ Ocean-Atmosphere phenomenon leading to anomalous cooling and warming of Sea Surface Temperatures in the Indian Ocean.

⁴ In Indonesia, including West Timor.

Cyclone occurrence shown in Figure 6 below is calculated based on the number of occurrences of cyclones per year in a 2x2 degree grid cell.



**Figure 6 - Annual distribution of cyclones in the Australian region.
(Abbs, 2010, based on BoM dataset.)**

Has the Climate Changed Already?

Though there are no national country-specific studies and insufficient historical weather data for Timor-Leste to provide comprehensive analysis and evidence of how its climate has changed. A number of preliminary studies, including analysis of data from West Timor, can be used to provide indication of possible changes in climate in the region, and in addition, global models are also used to extrapolate information to Timor-Leste level. IPCC global models indicate that in South-East Asia extreme weather events associated with El-Niño have been both increasing in frequency and intensity in the past 20 years (IPCC, 2007). This has had an impact on Timor-Leste climate patterns with estimated decreases in mean rainfall indexes, in particular for the dry season and increased incidences of extreme weather events (Kirono, 2002; Laso and Boer, 2006).

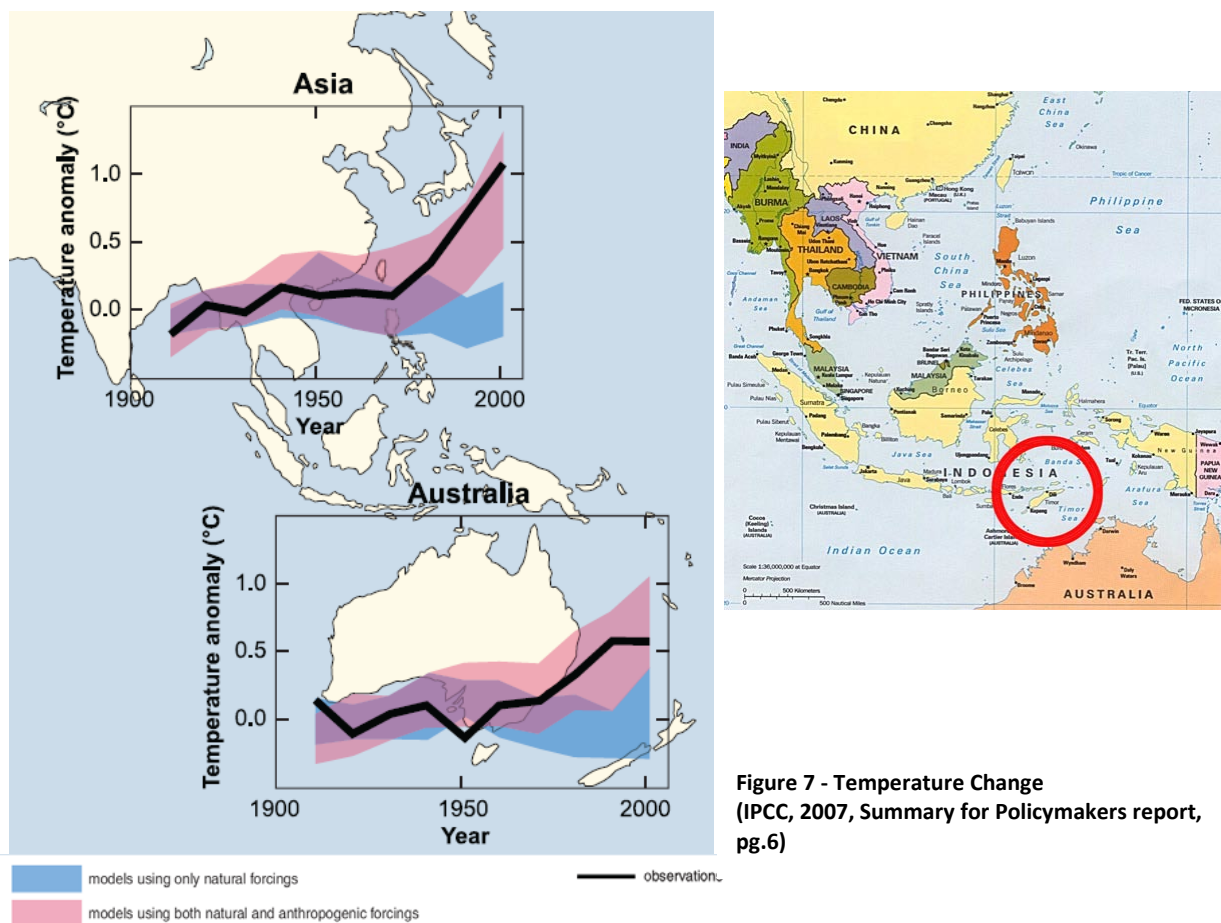
Given the lack of baseline climate data in Timor-Leste, most of the following section, which describes the current variability and projected climate change, is based on a brief prepared by the Government of Australia's Department for Climate Change and Energy Efficiency (DCCEE). This brief (Kirono, D. 2010) is a first output of analysis of a number of models from the region and precedes the development and analysis of a more detailed model for Timor-Leste.

2.0 FRAMEWORK FOR AN ADAPTATION PROGRAMME

2.1 The Current Climate Variability and Projected Climate Change

Current Climate Variability

An analysis of global data by the IPCC shows that in the Timor-Leste region, temperature from 1901 -2005 has increased 0.5 – 0.8°C over the century, while data for 1979-2005 suggests a lower decadal increase of 0.1-0.3°C with a mild acceleration over the later decades.



Monk (et al., 1997) also notes that year-to-year variability in total rainfall can be large and that rainfall is not equally distributed during the wet seasons, with great variability in intensity and most of the rain falling in torrential downpours. Studies conducted on Indonesian average rainfall for the periods of 1961-1990 (Hulme and Sheard, 1999) and for 1879 – 1999 (Kirono, 2002) indicate that there is a reduced rainfall index for both the dry and wet seasons, though the decline in the wet season rainfall is statistically insignificant (Kirono, 2002).

Analysis of total rainfall in Timor-Leste indicates a reduction in mean annual rainfall from 1961-1990 as compared to the 1931-1960 period, the decrease being mostly felt in the December-February rain period (Kaimuddin 2002, cited in Lasco and Boer, 2006). This analysis is further supported by other studies reviewed by Chang (et al., 2004) indicating that since 1976 there has been a tendency for the El Niño - La Niña normal alternation to be dominated by El Niño events that have a known negative correlation with Indonesia monsoon rainfall.

Projected Climate Variability

The AK-2010 of the CSIRO-CCAM regional simulation models provided a more comprehensive review and analysis based on both coarse-resolution Global Circulation Models (GCMs) and medium-resolution downscaling (Katzfey et al., 2010). With regard to the GCM database, a total of 136 climate simulations data from 22 GCMs with different emissions scenarios and simulation runs were analysed for 30 year time slices centred on 2020, 2050 and 2080, and changes were calculated relative to the reference period 1961-1990. The AK-2010 projections for temperature indicate a trend towards temperature increases for the target years of 2020, 2050 and 2080 in the order of 0.8°C, 1.5°C and 2.2°C respectively – see table 2 below – in relation to the 1961-1990 reference period. No significant variability across the different seasons is expected.

Period average	Projected changes (°C)		
	2020	2050	2080
Annual	+0.8	+1.5	+2.2
December to February	+0.7	+1.5	+2.2
March to May	+0.8	+1.5	+2.2
June to August	+0.7	+1.5	+2.1
September to November	+0.9	+1.5	+2.1

Table 2 – Median estimate of projected temperature for Timor-Leste (AK-2010)

Extreme temperature events are also expected to increase. The AK-2010 analysis of the CSIRO-CCAM regional simulations models indicates that by 2050, 7-day or 30-day heat wave events can be expected to increase by up to 2.3°C and that the length of such events can be expected to increase by two days (Katzfey et al., 2010).

Rainfall is also expected to increase, in relation to the 1961-1990 reference period, by 2%, 4% and 6% by 2020, 2050 and 2080, respectively. The AK-2010 analysis indicates seasonal differences with mild drying effect for Timor-Leste over the June-August period by 2080 as indicated in figure 8. These projections are again in agreement with the IPCC 2007 report, based on the changes between 1980 and 1999. Kirono (2010) notes here that an overall increase in rainfall contradicts the current projections for Indonesia but is in agreement with a trend showing an increase in rainfall in the northern part of Australia (see Smith, 2004). Given limited information on observed rainfall trends in Timor-Leste, these differences may be attributed to the poor resolution of current models and this analysis should be treated with caution.

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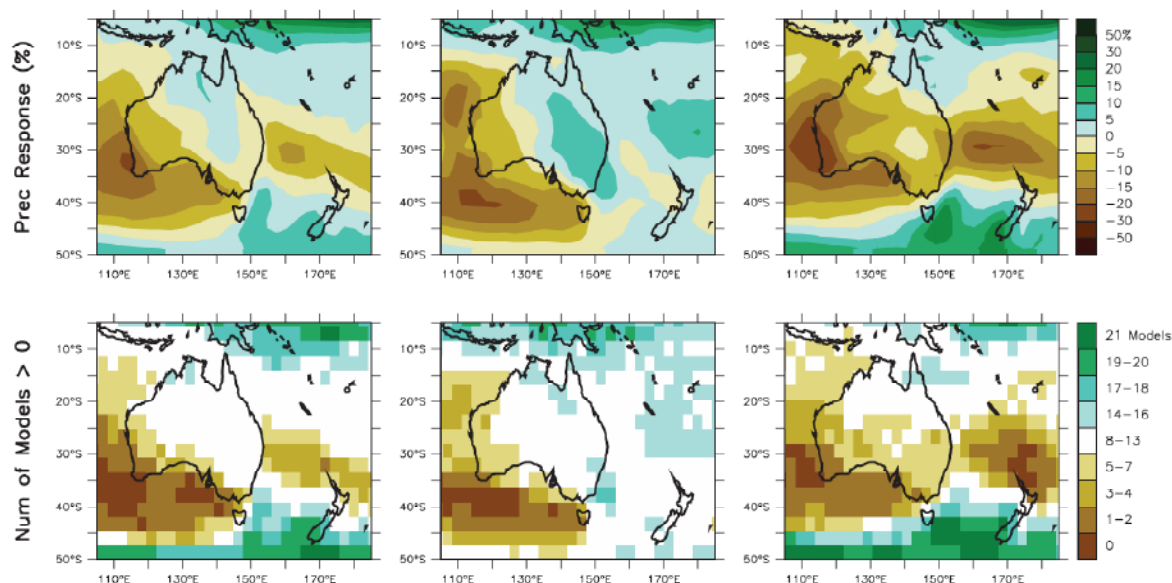


Figure 8 – Projected changes in rainfall between 1980-1999 and 2080-2099
 (Source: Kirono, 2010 modified from IPCC 2007, Working Group 1, Chapter 11, Figure 11.17)

Figure 8 above shows changes in rainfall:

Left - Annual **Middle** - December to February **Right** - June to August

Top - changes (%) averaged over 21 models

Bottom - Number of models out of 21 that project increases in rainfall.

In addition to an expected overall increase in rainfall for Timor-Leste, extreme rainfall events are expected to increase across the different monthly periods (see table 3). Overall AK-2010 analysis suggests that rainfall events are expected to become less frequent but more intense.

It is also relevant to note that there is an expected increase in the inter-annual variability of the Asian monsoon rainfall (IPCC, 2007). Table 3 below provides the median estimate of projected rainfall for Timor-Leste based on AK-2010 projection with extreme daily rainfall (99th percentile) projections that are derived from 15 climate models (CSIRO and BoM, 2007).

Period average	Projected changes			Rainfall intensity projections
	2020	2050	2080	
Annual	+2%	+4%	+6%	+1-2%
December to February	+3%	+5%	+6%	+2-4%
March to May	+4%	+5%	+5%	+2-4%
June to August	0%	0%	-5%	+6-8%
September to November	0%	0%	-1%	+4-6%

Table 3 – Median estimate of projected rainfall for Timor-Leste based on 22 climate models (AK-2010).

As described in chapter 1.3, trend analyses indicate that the number of tropical cyclones in the Australian region has decreased. The CSIRO-CCAM simulation for the Australian region that included Timor-Leste showed that the expected number of cyclones for the period 2051-2090 may be 50% lower than those simulated for 1971-2000 with a decrease in the duration of the tropical cyclones by 0.3 days (Abbs, 2010). However, it is expected that a larger percentage of these events will produce high wind speeds.

Sea Level Rise

Sea level rise figures for Timor-Leste are expected to be close to the global averages, with a variation of only minus 0-1cm when reviewing 17 global climate models (O'Farrell, 2008). However, it should be taken into consideration that Timor-Leste is estimated to have an annual uplift of 1cm given tectonic activity (Bird and Ongkosongo 1980, quoted in Monk et al., 1997). CSIRO (2010) and Hunter (2010) refer to IPCC global projections with the following scenario for sea level rise - relative to 1990 data:

- 3.2 to 10 cm by 2020,
- 8.9 – 27.8cm by 2050,
- 18-79cm by 2095.

In Steffen's assessment (Steffen, 2009) the possibility that sea level rise is larger than the 0.5 – 1.0 m range by 2100, relative to 1990 values, cannot be ruled out, for though there is considerable uncertainty surrounding estimates of future sea level rise, nearly all of the uncertainties indicate that corrections could be for higher rather than lower estimates.

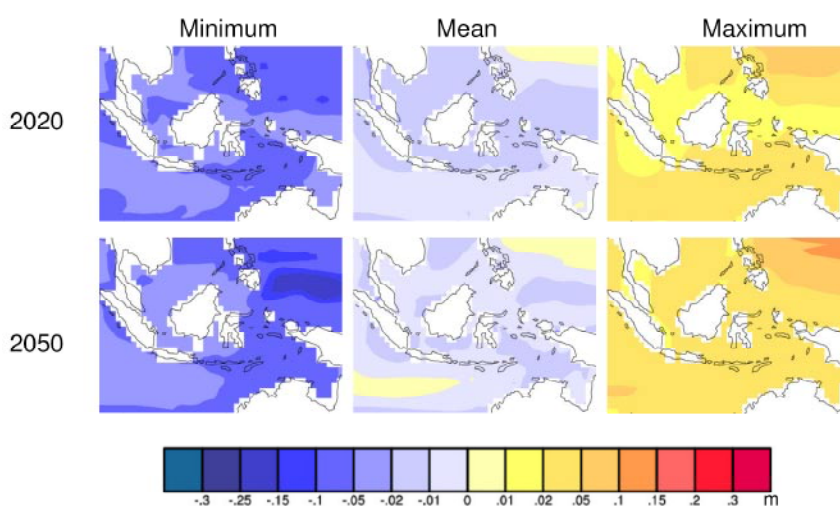


Figure 9 – Projected regional sea level rise (m) relative to 1990
(Modified from O'Farrell, 2008, based on 17 global climate models for the A1B emission scenario)

It is also expected that given an increase in absorption of carbon dioxide (CO₂), sea water pH will lead to acidification (McNeil et al., 2003), impacting upon marine life. CSIRO and BoM (2007) projections indicate a pH decline of -0.16 to -0.17, by the 2070s, relative to 1990s in the Timor-Leste region.

Solar Radiation, Relative Humidity and Potential Evaporation

The best approximate projections on solar radiation, relative humidity and potential evaporation are models for Darwin, Australia provide the following results:

- Annual solar radiation – based on 20 climate models: -1.1 to +1.3% by 2030 (CSIRO and BoM, 2007);
- Annual relative humidity change – based on 14 climate models: -0.5% (varying between -1.0 to +0.0%) for 2030 and -0.8% (varying between -1.7 to +0.0%) for 2070;
- Annual potential evaporation – based on downscaled simulation of three global climate models: - 0.5-0 mm/day for the period December-February, in terms of change in the period 2081-2100 relative to 1970-2000. For other seasons, the change may be up to 1mm/day (Katzfey et al., 2010).

ENSO

Though evidence of the changes in ENSO exists and analyzing palaeoclimatic data shows that ENSO has had significant changes, different projection models illustrate different trends – some that indicate a strengthening of the phenomena will be felt, others that a dampening will occur (Meehl et al., 2007). It is therefore difficult to project what impact ENSO will have on the changes in climate to be felt in Timor-Leste, but given past evidence it is important to consider extreme scenarios.

To conclude, reviews of studies and analysis of climate change models suggest that the impacts of climate change on Timor-Leste are likely to include changes that are summarized below.

Parameters	Changes
Temperature	Overall increase without significant variability across the seasons. Extreme temperature events are expected to increase in intensity and length.
Rainfall	Expected increase in mean rainfall values. Dry season expected to become drier. Extreme rainfall events expected to increase in intensity and decline in frequency.
Sea level rise	Increase in line with global projections is expected.
Tropical cyclones	Expected to decrease in frequency and length of event, but expected to be more intense in their nature.
Ocean	Expected to become more acidic.

It is important to note here that the level of uncertainty in the current projections is still quite high given the large resolution of current climate models and unavailable climatic data for Timor-Leste.

2.2 Vulnerability of Key Sectors

The perceptions of Timorese citizens on climate change during the NAPA process were another important element considered in identifying vulnerabilities from climate and climate change and establishing a pathway to adaptation actions in the society. As set out below a number of methods were used to identify vulnerabilities and adaptation options. These included: focused Sector Working Group workshops, district level consultations, and a review of existing community-based participatory assessments of climate variability including observed changes, current coping practices, enhanced adaptation needs, and an analysis of other secondary information. Sectoral vulnerabilities identified both locally and centrally and supported by secondary sources were as follows:

The Agroforestry, Agriculture and Livestock Sector

NAPA stakeholders consistently identified a wide range of concerns for the *agroforestry, agriculture and livestock sector* as a result of climate change. There was recognition of the importance of reliable water resources and the potential increased stress that climate change posed for these. Stakeholders also voiced a concern at the potential far-reaching impacts of climate induced natural disasters on agricultural productivity and livelihoods. Participants at both local and national level also expressed concerns over the increased challenges to the sustainability of current farming systems and methods. At this point participants did not expressly distinguish between direct and indirect impacts, although in their deliberations they did think through the cause. The impact chain was in turn later used to identify urgent needs in addressing adaptation. The impacts which were identified are further set out in Table 4.

Phenomena and events of climatic nature	Climate change impacts
Increased air temperature, changes in moisture.	<ul style="list-style-type: none"> • Warmer conditions can reduce crop yields by preventing pollination (e.g. rice yields can decrease by as much as 10% for every 1°C increase in minimum temperature during the growing season.). • Increased CO₂ in the atmosphere may have a positive fertilization effect on some crops (rice and grasses). • Current knowledge and practice may no longer be effective. • Adaptation requires changes in techniques, species and varieties; some will become unsuitable and will need to be substituted. • Increased frequency of water shortages for agriculture as well as rising demand through increased evapotranspiration, coupled with rising water needs for livestock. • Increased incidence of damaging pest populations. • Reduced livestock productivity; reduced fertility and reproduction leading to decreased income, and to increased price of products. • Weakening of immune systems; increased disease; reduced health and growth. • Decomposition of products (milk, eggs, etc.).
Changes in rainfall pattern and intensity, and more intense storm activity.	<ul style="list-style-type: none"> • Increased degradation and loss of agricultural land and of soil fertility. • Decreased agricultural productivity caused by storm damages to seeds, changed pattern of crop pests and diseases. • Decreased farm incomes and increased price of food supply products. • Increased damage to infrastructure used by the agriculture sector and community. • New plant varieties needed as well as changed cropping patterns. • Reduced dry season flows affecting inland fisheries.
Rise in sea level.	<ul style="list-style-type: none"> • Salt-water intrusion and seawater flooding of coastal lands reducing crop yields as well as viable cropping area.

Table 4 - Climate phenomena in the agroforestry, agriculture and livestock sector and associated impacts (NAPA project, July 2010)

These findings were supported by interviews conducted at sub district (called ‘suco’) level by the United Nations Integrated Mission in Timor-Leste (UNMIT) Military Liaison Group (MLG). Of the 430 responses obtained from suco chiefs, 58% reported that there are food shortages in their villages. When questioned on the causes of food shortage, answers given revealed that varying climatic conditions affected food security. Too little or too much rain, and associated natural disasters such as floods and drought, are two major causes of current food shortages, followed by strong winds, which is a common cause of loss of harvests. Existing levels of food insecurity and its root causes clearly indicate incapability of farmers to cope with the current climate variability. Changing weather patterns and increased intensive weather events due to climate change is likely to amplify the impact on food security and human security.

The Water Sector

Water is a critical resource. Water supply, and in particular lack of water in the dry season, is the most important environmental constraint on agricultural production. Farmers identify rainfall and water availability as the two principal environmental constraints on production. Communities face dwindling access to water during the dry season when the largely natural springs that they rely on may reduce considerably in flow or cease altogether. Groundwater resources, which exist in abundance in some areas, remain largely unexploited. Climate change could result in an increased amount of rain received throughout the year. However, the wet season may be slightly drier and the dry season may be slightly wetter. Rainfall may come in the form of fewer but more intense events. El Nino events which result in delayed rain and less rain may become more severe. This has far-reaching implications relating to drought, floods, access to water and water quality as set out below.

Phenomena and events of climatic nature	Climate change impacts
Changes in rainfall pattern and intensity.	<ul style="list-style-type: none"> • Limited water infiltration to the soil due to the steep terrain, shallow and thin soils and sparse vegetation, increasing risk factor with climate change. • Potential contamination of domestic water sources (springs, wells, storage and treatment tanks, piping). • Increased flooding will damage land, crops, infrastructure (including homes, schools and roads) and irrigation systems - reducing farming viability, profitability, employment, livelihoods and food security; and will increase food prices, malnourishment, poor health, poverty and urban migration.
Increased air temperature	<ul style="list-style-type: none"> • Evaporation, which is already high, will increase. Relatively little water lies on the surface (in streams, rivers, lakes) and rapid run-off will increase with climate change conditions. • Reduced availability of water supplies for irrigation and watering of crops, and for livestock and fish-ponds. • Increased air temperatures will increase the water requirements of crops, livestock and fish-farms.

Phenomena and events of climatic nature	Climate change impacts
	<ul style="list-style-type: none"> • Water storage – reservoirs, tanks – can lose large volumes through evaporation under climate change conditions. • The development of some industries: food-processing; hydropower generation; large-scale tourism – may not be feasible or acceptable in some locations because of water scarcity and costs.
Rise in sea level	<ul style="list-style-type: none"> • Increased ground water contamination by salt-water intrusion.
More intense storm activity	<ul style="list-style-type: none"> • Sewage systems can also be damaged, and may also contaminate the domestic water supply. • Potential damage to domestic infrastructure/plumbing resulting in the loss of water supplies and contamination of water. • Reduced pressure in water supply systems can increase infiltration by contaminants. • Water treatment and monitoring costs may increase. • Water scarcity and increased costs of development, operation and maintenance of water systems and infrastructure that will increase the costs of supplying water to consumers and reduce access to water for users.

Table 5 - Climate phenomena in the water sector and associated impacts.

In addition to the work carried out by the Water Sector Working Group, a group of geoscientists from Geoscience Australia working closely with the National Directorate for Water Resource Management also point to three additional groundwater concerns.

First they note that climate change and seasonal climate variations are likely to cause rapid impacts to Timor-Leste groundwater resources, such as seawater intrusion and lowering of water levels. Current variations in natural springs and groundwater levels show that, in many areas, groundwater availability relies on regular recharge from the rainfall of each wet season. The rapid groundwater response to seasonal climate variations shows the impacts of climate change are likely to affect groundwater over a short time period (i.e. over a period of months) in many areas of Timor-Leste.

Second, the sustainability of current groundwater use in Timor-Leste is currently unknown. Without a targeted groundwater monitoring framework or understanding of aquifer systems, groundwater quantity and quality could currently be under immediate threat on local or regional scales. Without adequate groundwater monitoring for seawater intrusion and falling water levels, there will be no warning before groundwater resources are depleted or contaminated until these impacts reach extraction wells.

Finally, they note that the current management response to threats on groundwater resources appears to be reactionary only. Management of resources to prevent the onset of threats of seawater intrusion and falling water level is of immediate importance and will require ongoing monitoring and knowledge of the driving processes. Without adequate management plans to circumvent threats, Timor-Leste’s groundwater resources are currently at risk due to climate change.

The Biodiversity (forests, freshwater aquatic, marine and invasive alien species) Sector

Particular concerns were expressed in relation to the coastal zone, with a combination of more frequent and intense storms and a potential rapid rise in sea level being identified as having the most adverse effects.

Phenomena and events of climatic nature	Climate change impacts
Increased air temperature	<ul style="list-style-type: none"> • Reduced surface water (rivers, wetlands, lakes) and de-oxygenation of water leading to temporary or permanent loss of aquatic ecosystems, increased stress and/or local extinction of species, impacts on productivity. • Stresses on forest ecosystems & species causing the reduction of overall health, diversity and productivity. • Increases numbers of some species including pests, weeds & pathogens. • Migration/displacement to locations with more suitable environmental conditions. • Loss or destruction of coastal vegetation, species and habitats. • Loss of health, diversity and productivity of inshore marine systems and fisheries.
Changes in rainfall patterns and intensity	<ul style="list-style-type: none"> • Direct damage by floods and increased sedimentation reducing aquatic reproduction, productivity, habitat area and causing local extinctions. • Increased contamination and pollution by runoff from human settlements, industry and roads impacting on aquatic biodiversity. • Stress on freshwater ecosystems and species causing the reduction of overall health, diversity and productivity. • Temporary or permanent increases in surface and ground water leading to increased aquatic productivity, including fish.

Phenomena and events of climatic nature	Climate change impacts
	<ul style="list-style-type: none"> • Destruction of freshwater and shallow marine habitats and species by increased river flows, run-off, flooding and sedimentation. • Smothered sea-bed habitats by siltation. • Damaged coastal saline habitats including wetlands and mangroves due to flooding.
More intense storm activity	<ul style="list-style-type: none"> • Direct physical damage to forest and terrestrial ecosystems. • 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.
Rise in shallow seawater temperatures, rise in sea level, and seawater acidification	<ul style="list-style-type: none"> • Loss or destruction of coastal vegetation, species and habitats. • Reduced health, diversity and productivity of offshore marine ecosystems, fisheries and marine megafauna. • Reduced survival of many species due to loss of plankton productivity (base of food chains). • Impacts on reproduction and survival of young. • Stalination of soil, freshwater, coastal lands, infrastructure and agriculture by seawater intrusion. • Reduced health and survival of many marine species due to increased acidity of seawater.

Table 6 - Climate phenomena in the biodiversity sector and associated impacts (NAPA consultations, July 2010)

The Health Sector

The main areas of concern for the health sector are related to the impact of increased variability in rainfall patterns and intensity, as well as increases in air temperature. In particular, concern was raised over the interaction between increases in temperature and increases in the incidence of flooding leading to knock-on effects for disease vectors and their breeding grounds. This cross-over is evident from the table below.

Phenomena and events of climatic nature	Climate change impacts
Increased air temperature	<ul style="list-style-type: none"> • Increased incidence of pneumonia, asthma and other lung and nasal diseases. • Increased incidence of respiratory and associated infections. • Increased risk of malnutrition, hunger and water shortage. • Increased risk of eye cataracts and skin cancers. • Increased incidence of heat stroke, sun-burn, dehydration, heat exhaustion and sun stroke.
More intense storms and changes in rainfall patterns and intensity	<ul style="list-style-type: none"> • Increased incidence of waterborne diseases and infections. • Increased incidence of vector-borne diseases, particularly dengue and malaria. • Increased occurrence of accidental injuries and deaths. • Increased incidence of mental illness including increased anxiety and stress. • Increased risk of food contamination.
Increased sea water temperature	<ul style="list-style-type: none"> • High sea water temperature leads to toxic algal blooms.

Table 7 - Climate phenomena in the health sector and associated impacts

The Infrastructure Sector

As noted above, Timor-Leste’s infrastructure is still at an early stage of development. However, taking into account the potential for changes in terms of increased air temperature, in rainfall patterns and intensity, and in frequency and strength of storm activity, stakeholders expressed concern that climate change poses further obstacles to the development of the nation’s infrastructure. Particular concern was expressed for coastal infrastructure as set out in table 8.

Phenomena and events of climatic nature	Climate change impacts
Increased temperatures and dry conditions	<ul style="list-style-type: none"> • Damage to electricity and telecommunications transmission cables during extreme heat events. • Damage to road surface/pavement during extreme heat events. • Hazards to fuel storage facilities from increased occurrence of fires.

Phenomena and events of climatic nature	Climate change impacts
	<ul style="list-style-type: none"> • Road traffic and aviation hazards due to increased incidence of fires. • Impacts on building materials through heat related stresses. • Increased electricity consumption and demand for energy for cooling and refrigeration. • Threatened hydropower operation on account of reductions in water availability. • Increased cost of urban water supplies and increase cost of water for construction.
Increased storm activity and changes in rainfall pattern and intensity	<ul style="list-style-type: none"> • Damage to transmission cables (power and telecommunications) and poles and towers from wind, fallen trees and land erosion. • Damage to water capture, storage and distribution structures in communities and urban centres. • Changes in rainfall patterns undermining the viability of critical water supply infrastructure in communities and urban centres. • Damage to and difficulties in accessing flooded power plants, waste management sites and other key strategic installations. • Increased damage to and destruction of bridges, roads, roadsides, culverts, drainage structures and river embankments. • Increased risk of damage to offshore oil and gas infrastructure and disruption to operations. • Increased risk of accidents, spills, leaks and pollution resulting from flooding and wind damage to fuel storage facilities and other installations housing hazardous materials. • Damage to schools, homes and community buildings such as churches and health clinics.
Rise in sea level rise and storm surges	<ul style="list-style-type: none"> • Damage and disruption to coastal power stations and transmission infrastructure through erosion, flooding and saltwater damage. • Flooding and destruction of coastal settlements and coastal protection measures.

Table 8 - Climate phenomena in infrastructure sector and associated impacts

Disasters – Cross-cutting

In terms of the interaction of climate change and natural disasters, there was some concern that disasters already being witnessed in Timor-Leste had the potential to become more frequent and widespread thereby bringing about further destruction of property, livelihoods and injury to persons than is currently witnessed. The main impacts identified are set out in table 9 below.

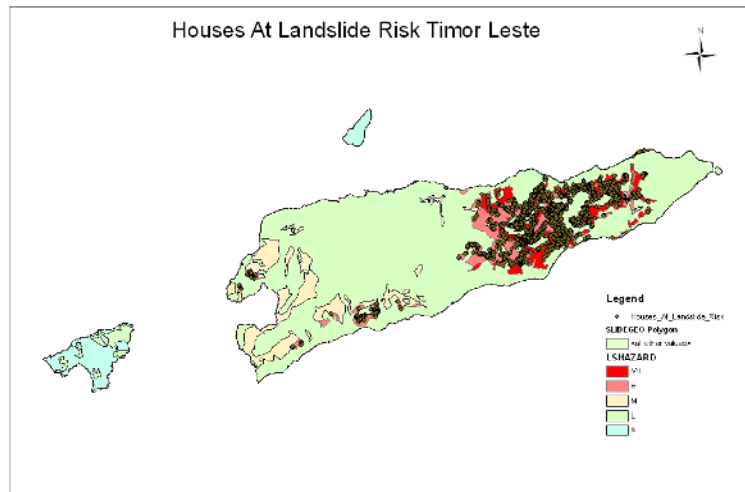
Phenomena and events of climatic nature	Climate change impact
More intense storms and changes in rainfall patterns and intensity	<ul style="list-style-type: none"> • Increased incidences of injury and deaths. • Rivers, water quality and downstream habitats endangered by more landslides and flooding. • Landslides damaging homes and blocking access to schools, markets, etc. • Displacement due to flooding. • Increased damage to infrastructure including homes, schools, business facilities, health facilities, roads, power infrastructure, agricultural facilities and water supply. • Increased damage to natural resources. • Increased degradation of agricultural resources including land and livestock. • Soil erosion and soil fertility damaged leading to decreased agricultural productivity, decreased farm incomes and increased price of food supply products.
Increased air temperature	<ul style="list-style-type: none"> • Fires causing decreased air quality. • Drought causing loss of water and food security, hygiene and health impacts. • Drought and wildfire leading to loss of biodiversity. • Increased injuries and deaths due to fires. • More frequent impact on human lives and livelihoods in terms of health, wealth and comfort.

Table 9 - Climate phenomena across sectors related to disasters and associated impacts

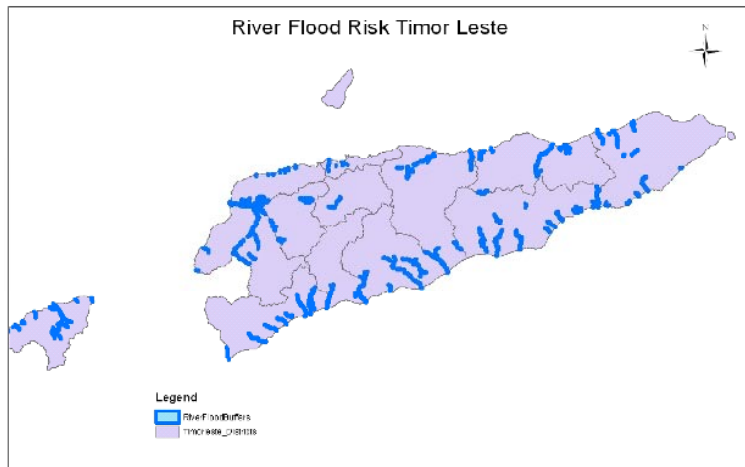
In addition to the group work carried out in Dili with Sector Working Group members and district consultations, a review of 11 assessments carried out since 2004 was conducted, leading to the following results (Hogan, 2010):

- 1) Natural hazards, mainly climate-related, especially droughts, floods and high winds, are the most common problems faced by Timorese people. All reviewed assessments indicated these issues or associated hazards as the key vulnerabilities of communities across the country.
- 2) Geographical and topographical areas differ in their vulnerability to climatic and physical hazards.
- 3) The most vulnerable people are isolated in terms of accessibility and communications; mountain dwellers, rural people with low cultivable acreage, the elderly, female-headed households, children, and people with no other enterprises that can support them in preparing for a climate event.
- 4) The expected impacts of climate change are already being felt by vulnerable communities and some are able to assign them to climate change. However, further verification through vulnerability analysis is required.
- 5) Awareness of climate change as an exacerbating factor is high and communities propose solutions that can reduce their economic vulnerability in the context of climate-event vulnerabilities they face.
- 6) Capacity in terms of human innovativeness and resilience is strong, whereby some communities' sources of income is being diversified and in others coping strategies are in place to address their highest vulnerabilities.
- 7) Capacity in terms of organizational structures and strength appears variable across the districts, depending on village involvement activities that support a local organizational structure, as well as the degree of local conflict.
- 8) Capacity in terms of technical and financial resources is still low, though progress is being seen across the country. Increased access to technology, improved communications and financial resources are required for fast-tracking adaptation.

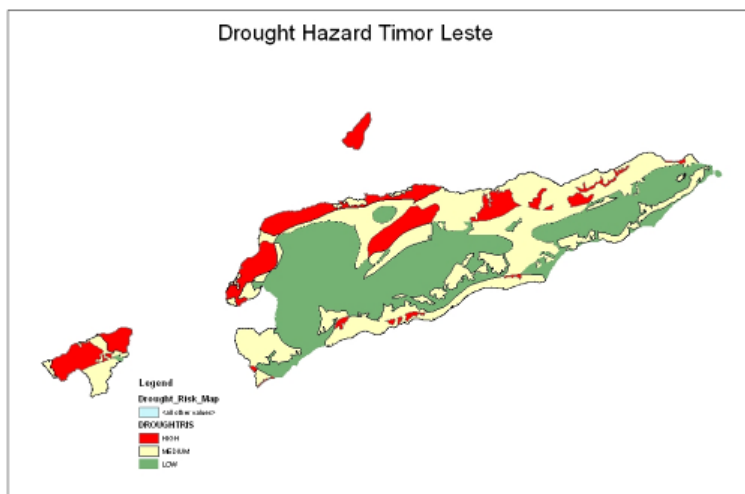
This study is illustrated with the three following maps that show the geographical distribution of key exposure to risks.



Map 2 - Houses at landslide risk Timor-Leste (NDMO, 2010)



Map 3 - River flood risk Timor-Leste (NDMO, 2010)



Map 4 - Drought hazard Timor-Leste (NDMO, 2010)

Throughout the Timor-Leste NAPA process concern was voiced as to the urgent need to increase the resilience of vulnerable groups and to support them to understand, avert and manage disasters. Children and youth in particular were felt to be important as they represent the largest vulnerable group (and represent half the population) and have much to offer in terms of developing and implementing adaptation strategies (especially at the community level). They are also likely to be the most affected by climate change impacts both in the short term (high rates of malnutrition, no knowledge of Disaster Risk Reduction (DRR), more susceptible to diseases) and in the long term (they will live with the impacts of climate change the longest).

2.3 Relation of NAPA to Timor-Leste's Development Goals

Over the period 2002-2006 the Government of Timor-Leste addressed a range of development challenges towards pro-poor growth in the National Development Plan (NDP). In the course of developing a new strategic document, the current Government has developed an annual planning process by establishing National Priorities. The 2010 National Priority 2 on Food Security included the completion of the Timor-Leste NAPA as a goal. The 2011 National Priorities are now being developed with strong engagement across Government on climate change resulting from the NAPA process. The Government is now also working on formulating a Strategic Development Plan (SDP) for the period 2011-2030, which will present a comprehensive vision for the country's economic development. It is expected that the priorities over the coming decade will focus on major investments and developments in infrastructure, education and training, health, agricultural productivity and food self-sufficiency, sustainable urbanization, and a number of key industrial and service sectors. It is expected that climate change issues will feature in related sectoral planning. In response to the 2011-2030 SDP all National Directorates are drafting their 5-10 year strategic planning documents. These are designed to complement the current annual planning and budgeting process and have been recognized as an opportunity to incorporate climate change, energy and other cross cutting issues into planning.

2.4 NAPA Vision

The Timor-Leste NAPA supports the goals of the strategic plan by seeking to ensure that the needs of those most vulnerable to climate change are fully reflected in the development goals and aspirations of the country. The Timor-Leste NAPA recognizes and addresses the fact that climate change will have wide-ranging impacts within and across multiple sectors and that the knowledge and capacity to respond is lacking. The Millennium Development Goal Report for 2010 prepared by the Government of Timor-Leste therefore sets out the vision of the NAPA as being to make the Timorese population resilient to climate change (MDG, 2010). In addition, in the Draft Environmental Strategic Plan 2010-2030, the State Secretariat for Environment sets out the importance of NAPA in identifying all climate change impacts and ensuring the most vulnerable sectors and groups are well adapted to these impacts (Draft Environmental Strategic Plan, 2010).

2.5 Objectives of the NAPA

The NAPA is the first national document that identifies urgent and immediate climate change adaptation needs of the most vulnerable groups. It provides a starting point from which climate change adaptation can be mainstreamed into development plans as a key strategy for attaining sustainable development and poverty reduction (MDG, 2010). The objectives of the Timor-Leste NAPA are:

- To develop and implement immediate and urgent project based activities to adapt to climate change and climate variability,
- To increase awareness of climate change impacts and adaptation activities in communities, civil society and government, and
- To provide a road-map for the State Secretariat for Environment to follow in working across all climate change vulnerable sectors to assist the integration of adaptation concerns into policies, strategies, programmes and activities (Draft Environmental Strategic Plan, 2010).

2.6 Limitations and Potential Barriers to Implementation

- **Climate Data Limitations:** Due to the lack of consistent climate data for Timor-Leste, it is a challenge to examine climate risk with accuracy. During the Portuguese period, several stations measured rainfall/climate data for varying periods from 1914 to 1975. It is unclear how much data was recorded during the following period of Indonesian control until 1999. Since 1999, there has been insufficient meteorological or hydrological services available in the country due to the destruction in 1999 of most infrastructure (including meteorological) by retreating Indonesian forces. Currently, the country lacks capacity to forecast potential threats of large scale disasters and has little preparedness to respond and cope with such disastrous events. Any data collected is currently forwarded to the Australian Bureau of Meteorology and there is no management of this or historical data carried out in Timor-Leste, making it difficult to reconstruct an accurate picture of climatic variability in the country (World Bank, 2008). Furthermore, this lack of data also means that there is not enough information to develop detailed spatial mapping to allow for adequate planning for risk reduction.
- **Human and Financial Capacity Limitations:** As a newly independent country, Timor-Leste, is restrained by human and financial capacity, hence its ability to respond and cope with natural disasters and long-term environmental change is very limited. Technical capacity constraints and the fragmentation of responsibilities for climate change, natural resources and disaster risk reduction pose challenges for the effective implementation of the NAPA. Furthermore, planning tends to be uncoordinated and short term while the necessary management systems to support coordination, consultation, data gathering and monitoring are largely absent (UNDP, 2007).
- **Institutional Limitations:**
 - 1) As of now there is neither a climate change unit nor a climate change secretariat in place,
 - 2) Climate change is a new but growing concern within Timor-Leste and the framework of regulation is lagging; there are no specific climate change provision laws, regulations, policy, plans or programmes in place. There is a lack of capacity within related institutions to formulate climate change related laws and regulations, policies and programmes,
 - (3) Coordination among relevant institutions remains a challenge due to the absence of legal mechanisms or a basis for cooperation, though there appears to be an understanding that departments should be working in a closer and more coordinated manner (World Bank, 2008).

3.0 IDENTIFICATION OF KEY ADAPTATION NEEDS

The identification of key adaptation needs is a crucial element in the overall NAPA process. Such identification enables the establishment of priority adaptation activities against the key vulnerabilities in each sector. This section summarizes how Timor-Leste’s immediate adaptation priorities were derived.

3.1 The Identification Process

A comprehensive list of adaption needs/options for each key sector, baseline development activities, and potential adaptation measures were identified in a national consultation process (see Annex 2). They were defined in a community based-participatory process in five representative districts and consolidated by the NAPA team. This list of potential measures was sorted in two categories; one related to major investments and policy planning, and the other related to capacity building, awareness raising and other cross-cutting measures. The NAPA team agreed that for the purposes of prioritization, the focus would be on measures related to major investments and policy planning needs. It was agreed however that the awareness raising and capacity building elements, a cross cutting recurrent need, would be incorporated into every final concepts during their development phase.

3.2 Consolidation Process of the Proposed Adaptation Needs

Using the full list of adaptation options generated during the consultative process as a starting point (see Annex 2), three priority adaptation activities per sector were selected during a workshop held in Dili in September 2010 (see also Section 5.5). The selection was based on representatives of each SWG debating one by one the relative importance of each major investment and policy measure before reaching consensus on the top three for each sector. Although, at this point the participants had already discussed and agreed criteria for prioritization as set out below, they did not apply criteria in a step-by-step manner in this initial short listing, but their discussion was broadly guided by principles such as the extent to which the action addressed key vulnerabilities, benefited the greatest number of people, and complemented existing baseline activities. Table 10 shows the results of this first round of short listing from 57 down to 18 activities.

Sector	Proposed key adaptation options
Agroforestry, Agriculture and Livestock	<ul style="list-style-type: none"> • Develop integrated sustainable land management promoting fixed/permanent agriculture, reduce burning, reduce erosion, and increase soil fertility. • Develop integrated agro-forestry and watershed management including climate change dimension. • Improve planning and legal framework for sustainable and balanced food for livestock production under climate change conditions.
Water Availability, Accessibility and Quality	<ul style="list-style-type: none"> • Build climate consideration and environmentally friendly infrastructure to protect water sources (springs, streams, wells, etc) in order to provide safe water supply during climate change extreme event periods.

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Sector	Proposed key adaptation options
	<ul style="list-style-type: none"> • Create/enhance water harvesting model, water distribution system and management system at all levels to avoid water shortages caused by climate change. • Control of quantity of water use by industry, and water pollution control standardization (medium) including coffee processing waste management in a climate change context.
Terrestrial, Freshwater and Marine Ecosystems and Biodiversity.	<ul style="list-style-type: none"> • Education and awareness - conduct a pilot demonstration of sustainable agriculture and sustainable forest management that increases resilience and reduces climate-related impacts of shifting cultivation and unsustainable upland farming practices. • National legislation – strengthening implementation of forest laws and regulations to reduce illegal logging and burning and to strengthen customary law; as well as ownership by local communities. • Reforestation of degraded lands with fuel-wood plantations; rehabilitate degraded land and soils and reduce deforestation by providing sustainable fuel-wood source.
Human Health	<ul style="list-style-type: none"> • Strengthen SISCA (Integrated Community Health Services) especially on climate change related health issues and diseases. • Strengthen integrated early warning system in community on airborne and vector-borne diseases and epidemics. • Review existing guidance and standards issued by the Minister of Health on respiratory, airborne and vector-borne diseases to take climate change into consideration.
Human Settlement and Infrastructure	<ul style="list-style-type: none"> • Viability study and pilot project to lay underground cables and other equipment exposed to climate change. • Review existing laws, regulations and standards to enhance Climate Change (CC)-resilient infrastructure. • Pass new legislation to strengthen and guarantee national regulations on quality of materials, building codes and practices and law enforcement. • Protect offshore infrastructure against strong wave damage that impacts the distribution of gas and oil, and reduce accidents and destruction of offshore oil and gas infrastructure; including: i) early warning system equipment; ii) data information to show occurrences; iii) equipment protection.

Sector	Proposed key adaptation options
Disaster Management	<ul style="list-style-type: none"> • Physical infrastructure - civil engineering and natural vegetation methods to prevent landslides in hill sites, roads and river banks. • Establish early warning systems in areas identified as vulnerable to risks of disasters such as floods and storms. • Enhance government strategies on responding to drought exacerbated by climate change.

Table 10 - Initial short-list of proposed adaptation options

3.3 Criteria for Ranking at Country and Community Level

The process for selection and application of criteria is described in sections 5.7 and 5.8. Following a review of the full list of 213 activities on the first day of the two-stage articulation and ranking process, participants discussed and agreed on ranking criteria. The opinions expressed by the participants during the districts consultation were added as an additional criterion alongside the six identified centrally. The complete list of resulting criteria was therefore:

- Urgent and immediate needs related to climate change and the degree of contributions to poverty reduction to enhance adaptive capacity - this criterion recalled the vulnerability matrix that the participants put together where they mapped vulnerable people, places and sectors.
- Cost effectiveness - this criterion assesses the extent to which activities are cost-effective and realistic to produce, feasible and sustainable in the long term.
- Acceptability to local populations – this criterion seeks to ascertain the acceptability of the proposed adaptation activities/projects to local populations. In particular, concern was voiced that actions should not challenge local cultural beliefs.
- Ease of implementation - this criterion examines the level and type of difficulty that will be faced by the implementing agency and government. It was recognition of issues such as the poor standard of infrastructure in the country, poor coordination between ministries, and human capacity constraints.
- Addressing gender equality – there was much debate on the inclusion of this criterion. Participants spent a great deal of time discussing the unequal opportunities that existed for women in becoming involved in public activity due to the traditional patriarchal culture in Timor-Leste. They also recalled that throughout the NAPA process, women had been consistently identified as one of the most vulnerable groups. For this reason, the group felt that activities which made a contribution to gender equality should be prioritized.
- Sustainable development - this criterion reflects the imperative that the NAPA is mainstreamed into national plans and policies in order to support sustainable development goals. It was also important for participants to ensure that the benefits of the proposed activities/projects would be sustainable in the long term and would not be of a type open to easy manipulation by groups or individuals for their own benefit.
- Whether the activity would address the concerns raised by participants at the district workshops - the basic principle applied here was that the more widespread the concern (measured by the number of times it was mentioned), the greater the importance should be attributed to the action seeking to address it.

3.4 Ranking Activities

Prior to undertaking the ranking process, further work was done within the group to consolidate activities. Representatives from each sector considered all 18 activities in turn and through a process of comparison were able to integrate and consolidate similar and related activities to come to a final list of eight. One activity relating to legal development was eliminated (as the activity is already under way) and was replaced with the next highest priority for that sector. The ranking process, based on the criteria listed above (further described in chapter 5) was then run on these eight activities. Table 11 shows ratings that were awarded.

Criteria Adaptation Options	Address urgent & immediate CC needs*	Contributions to poverty reduction*	Cost effectiveness*	Local Ownership*	Ease of implementation*	Gender equality*	Sustainable Development*	Reference in Districts Consultations 0 = None 1 = 1-2 2 = 3-4 3 = All	Total
Food Security	3	3	3	3	3	2	3	3	23
Livestock	2	3	3	2	2	1	2	2	17
Water and CC	3	3	3	3	2	3	3	3	23
Coastal zone/ Mangroves	3	2	3	2	2	2	3	2	19
Health and CC	3	3	3	3	3	3	2	1	21
Infrastructure climate change proofing	3	1	3	2	1	1	3	3	17
Oil and Gas Sector CC proofing	1	2	2	2	1	1	1	0	10
Disasters and CC	3	3	3	3	2	1	3	3	21

*Legend: Criteria scoring: 3 - High 2 – Medium 1 – Low

Table 11 - Results of the ranking exercise

Table 12 below shows the resulting ranked adaptation options after the addition of the scoring exercise by the Sector Working Groups. The two groupings representing food security and water resource management scored equally and hence were ranked first with a) and b). Health issues also scored equally with the Disasters concept and are also marked a) and b).

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Rank	Proposed adaptation options articulated into a programmatic approach
1.a	<ul style="list-style-type: none"> • Develop integrated agroforestry and watershed management including climate change dimension. • Develop integrated, sustainable land management to promote fixed/permanent agriculture, prevent burning, erosion control and soil rehabilitation. • Reforestation of degraded land to prevent landslides and provide sustainable source of fuel wood. • Improve physical infrastructure/civil engineering and natural vegetation methods to prevent landslides in hill sites, roads and river banks. • Education and awareness for communities and government – conduct a pilot demonstration of sustainable agriculture and sustainable forest management that increases resilience and reduces climate-related impacts of shifting cultivation and unsustainable upland farming practices.
1b	<ul style="list-style-type: none"> • Build climate considerations and environmentally friendly infrastructure to protect water sources (springs, streams, wells, etc.) in order to provide safe water supplies during periods of extreme climate change events. • Enhance government and community strategies to respond to drought exacerbated by climate change. • Create/enhance water harvesting models, water distribution and management systems at all levels to avoid water shortages due to climate change. • Control of quantity of water use by industry, and water pollution control standardization including coffee processing waste management in a climate change context.
2a	<ul style="list-style-type: none"> • Strengthen SISCA (Integrated Community Health Services) especially climate change related health issues and diseases. • Strengthen integrated surveillance and early warning systems (EWS) in community on airborne, waterborne and vector-borne diseases and epidemics. • Review existing guidance and standards issued by the Minister of Health on respiratory, airborne, waterborne and vector-borne diseases to take climate change into consideration.
2b	<ul style="list-style-type: none"> • Establish early warning systems in areas identified as vulnerable to risks of disasters such as floods and storms.
3	<ul style="list-style-type: none"> • Maintain and rehabilitate mangrove ecosystems and conduct awareness raising to protect coastal ecosystems from impacts of sea level rise and other climate change impacts. • Include ecosystem management in national planning to develop sustainable, ongoing programme, nurseries and community awareness.
4	<ul style="list-style-type: none"> • Improve planning and legal framework for sustainable and balanced food for livestock production under climate change conditions.
5	<ul style="list-style-type: none"> • Review existing laws, regulations and standards and enhance climate change-resilient infrastructure - pass new legislation to strengthen and guarantee national development and to regulate the quality of materials, building codes and practices, and law enforcement.
6	<ul style="list-style-type: none"> • Protect offshore infrastructure against strong wave damage that impacts the distribution of gas and oil, and reduce accidents and destruction of offshore oil and gas infrastructure; including: i) early warning system equipment; ii) data information to show occurrences; iii) equipment protection.

Table 12 – Ranked adaptation options

3.5 Priority Adaptation Activities

Based on this ranking, project profiles were developed to reflect the overall outcomes of each integrated project. This process was done in close collaboration with relevant Government Departments to ensure they were rooted in existing baseline activities. Further integration to follow a programmatic approach will happen during the discussion of funding at the NAPA implementation phase.

The adaptation activities presented in Table 13 below represent the results of the ranking process carried out by the multi-disciplinary NAPA team. They were combined into coherent key sectors reflecting core national development priorities, ranked from one to eight, with a further set of cross-cutting activities related to ‘National Institutional Capacity Development’ also proposed during the NAPA process. Such institutional and capacity development activities were recognized as a supporting activity underpinning all other areas and consequently did not need to be included in the ranking process.

Collectively, these adaptation options provide a coherent programme which, when implemented in parallel, would significantly reduce the vulnerability of Timor-Leste’s critical development sectors to climate-related risks over the immediate to medium term. While each activity area can be implemented individually, programme level coherence will be retained through the activities linked to national institutional capacity development. Individual project profiles for each activity area are further developed in Annex 4. The project profiles are provided in the format suggested in the annotated guidelines for the preparation of NAPAs (LEG, 2002). The profiles contain a basic outline of the proposed actions. In the further elaboration of these concepts following NAPA submission, every effort will be made to ensure that the design adequately addressed the needs of the most vulnerable groups in society as set out above.

Rank	Adaptation Options	Activities
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.	<ul style="list-style-type: none"> • Develop integrated agroforestry and watershed management including climate change dimensions. • Based on existing national action plans on sustainable land management, implement integrated, sustainable land management promoting fixed/permanent agriculture, reduced burning, reduced erosion, and increased soil fertility. • Reforestation of degraded land to prevent landslides and provide a sustainable fuel wood source in priority areas with high vulnerability to climate-related risks. • Improve physical infrastructure/civil engineering and natural vegetation methods to prevent landslides in hill sites, roads and river banks. • Education and awareness and conduct a pilot demonstration on sustainable agriculture and forest management that increases resilience and reduces climate-related impacts of shifting cultivation and unsustainable upland farming practices.
2.	Water Resources: Promote Integrated Water Resource Management (IWRM) to guarantee	<ul style="list-style-type: none"> • Build climate proofed and environmentally sustainable infrastructure to protect water sources (springs, streams, wells, etc.) in order to provide safe

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Rank	Adaptation Options	Activities
	water access for food production, sanitary uses, ecosystems and industry development.	<p>water supplies during climate change extreme event periods.</p> <ul style="list-style-type: none"> • Enhance government and community strategies to respond to drought exacerbated by climate change. • Create and enhance water harvesting model (capture and storage), water distribution system and management system at all levels to avoid water shortages due to climate change. • Control of quantity of water use by industry, and water pollution control standardization including coffee processing waste management in a climate change context.
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.	<ul style="list-style-type: none"> • Strengthen SISCA (Integrated Community Health Services) especially on health issues related to climate change related diseases. • Strengthen integrated early warning system (EWS) at community level in relation to airborne and vector borne diseases and epidemics with disease surveillance. • Review existing guidance and standard issues by Minister of Health on respiratory, airborne and vector diseases to take climate change into consideration.
4.	Natural Disasters: Improve institutional and staff capacity in the disaster sector in relation to climate change induced disasters.	<ul style="list-style-type: none"> • Establish early warning systems in areas identified as vulnerable to disasters such as floods and storms. • Integrate of climate risk information into traditional disaster risk reduction and management.
5.	Forests, Biodiversity and Coastal Ecosystems Resilience:	<ul style="list-style-type: none"> • 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 - 1st year assessment, 2nd year plan, 3rd year implementation and maintenance.
6.	Livestock Production:	<ul style="list-style-type: none"> • 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.	<ul style="list-style-type: none"> • Review existing laws, regulations and standards to enhance CC-resilience of critical infrastructure. • Pass new legislation to strengthen and guarantee national development through improved regulation

Rank	Adaptation Options	Activities
		of the quality of materials, adapted building codes and practices and law enforcement.
8.	Oil and Gas Production: Strengthen and protect valuable offshore oil and gas infrastructure against climate change impacts.	<ul style="list-style-type: none"> • Protect offshore infrastructure against strong wave damage that impacts the distribution of gas and oil, and reduce accidents and destruction of offshore oil and gas infrastructure; including: i) early warning system equipment; ii) data information to show occurrences; iii) equipment protection.
	National Institutional Capacity Development for Climate Change:	<ul style="list-style-type: none"> • Strengthen the mandate of the cross-sectoral national climate change team to improve coordination and engagement. • Establish a Climate Change Unit with necessary staffing and budget to engage in and support national policy development and programming activities. • Capacity development support for key non-governmental institutions in low emissions and climate resilient development planning, including national NGOs and research/educational institutions. • Develop a national climate change strategy and action plan. • Promote sub-national capacity development for improved adaptation planning and implementation. • Strengthen national hydro-meteorological department to collect, compile, analyze and disseminate climate-related data.

Table 13 – Priority Adaptation Options

3.6 NAPA Implementation

This NAPA, which aims to reduce the vulnerability of Timor-Leste to the consequences of climate change in the sectors described above, will be implemented through three cross-cutting strategic approaches:

- Capacity development and institutional strengthening for stakeholders in matters related to adaptation to climate change and climate variability,
- The demonstration of new ideas and techniques through field based interventions, that improve the resilience of the population and ecosystems, and,
- Information, education and communication campaigns for stakeholders on the risks due to climate change and climate variability.

This cross-cutting approach has allowed the very large number of project ideas that emerged from the district and local consultations to be rationalized without losing the main priorities emerging from these consultations. It is clearly intended that each sectoral programme area emerging from the NAPA process will include these three types of activities.

4.0 NAPA FORMULATION PROCESS

The NAPA formulation process was based on the annotated guidelines for the preparation of NAPA (LDC Expert Group, UNFCCC, 2002) including seven key steps as follows:

- Build the NAPA team and multidisciplinary team,
- Synthesize available information including past assessments, strategies, and consultations,
- Carry out participatory, rapid assessment of vulnerability and potential increases in climate hazards and risks,
- Conduct public consultation in five districts that are representative of the different climatic conditions in the country to identify potential adaptation activities,
- Undertake criteria prioritization and ranking,
- Rank projects and activities and integrate into national policies and programmes,
- Develop project profiles and submit the NAPA.

4.1 Guiding Principles

The seven steps applied in formulating the Timor-Leste NAPA were further guided by elements contained in paragraph 7 of the Annex to UNFCCC Decision 28/CP.7; as follows:

Multidisciplinary Approach

The establishment and involvement of six sectors of the Government and various other stakeholders ensured the participation and ownership of the entire NAPA process including the vulnerability and adaptation assessment process, as well as the selection, prioritization and ranking of the projects and adaptation activities.

Participatory Approach

The five district consultations of Timor-Leste with various representations from the district, sub-district, hamlet and village departments within the government and civil society organizations encouraged and provided opportunity for all levels to voice their local knowledge and to promote a mutual learning process between grassroots communities, NGOs, tiers of government and the national NAPA team with regard to climate change.

Complementary Approach

The information used to develop the NAPA is based on available national priorities, programmes and policies of Timor-Leste. The process compliments both national and international documents such as the National Priorities process 2010 (specifically National Priority 2 on Food Security), the 'MDGs: Where are we Now?' document of 2010, the Timor-Leste National Human Development Report 2006, and the draft Timor-Leste Strategic Development plan 2010-2030, which recognizes climate-related risks to agriculture, water supply and sanitation and the need for research and higher education in these areas.

Sustainable Development

The mainstreaming of the NAPA into national priorities, programmes and policies that support sustainable development goals has been considered in the process. Sustainable development was one of the country driven criteria used in the prioritization and ranking activities to identify priority projects.

Gender Equality

Throughout the Timor-Leste NAPA process, the active participation of women, youth and representatives of communities and marginalized groups was pursued both at central and district level. The culmination of the recognition of their specific needs was witnessed by the inclusion, following a meeting of all Sector Working Groups, of gender equality as one of the seven criteria for prioritization and ranking of adaptation activities.

Country Driven Approach

This was achieved through five district level consultations and the establishment of a multidisciplinary integrated team (Sector Working Groups) from six key development sectors, thereby encouraging a wide stakeholder view and participation.

Simplicity

The NAPA team made significant efforts to present the process clearly and simply at all levels. The annotated guidance provided by the LDC expert group, including its seven step approach was frequently used. At the district level a significant amount of time was spent in setting the context to ensure that substantive and more detailed discussions on vulnerability issues would be well understood and focused on immediate needs. Each district level consultation was carried out in an identical matter in order to simplify the aggregation of results. At the national level, Sector Working Group consultations were carried out as a series of structured workshops, each building on the previous one and leading to one overall prioritization and ranking exercise.

Cost Effectiveness

The development of project profiles took into account ongoing government programmes and the need to integrate climate risk issues into these programmes in order to ensure promotion of sustainable development principles leading to not only more immediate cost effectiveness but also securing longer term development benefits.

4.2 Building the NAPA Team and Multidisciplinary Team

The NAPA and multidisciplinary teams consisted of diverse stakeholders (Government ministries and State Secretariats, non-governmental organizations, donors and private sectors) from the outset. The government bodies, NGOs, civil society organizations and others involved in preparation of the NAPA, and potentially in its implementation phase, were as follows: the Office of the Prime-Minister Ministry of Economy and Development, the Ministry of Social Solidarity, the Ministry of Agriculture and Fisheries, the Ministry of Health, the Ministry of Tourism, Commerce and Industry, and the Ministry of Infrastructure. Active participation from NGOs included Haburas, Lao Hamutuk, Luta Hamutuk, Halarae, Permatil, Plan International, CARE, Oxfam, Caritas, CVTL and CRS. Key donors and other organizations included WFP, FAO, WHO, AusAID, USAID and UNDP.

The NAPA team was structured as follows:

- A Project Steering Committee (PSC) was established to be the governing body for the NAPA preparation process, providing guidance on all major policy decisions and receiving and reviewing progress reports. It was composed of senior officials from all key Governmental institutions and was chaired by the Secretary of State for Environment. The PSC will have met on 4 occasions by the end of the process.
- A NAPA Project Implementation Unit (PIU) supervised by the National Director for International Environment Affairs (NDIEA) was responsible for the project implementation. This unit consisted of a National Project Manager and Assistant and a National Consultant to assist with the more technical aspects of the project. An International Consultant was also recruited to provide assistance as necessary to the PIU and the Sector Working Groups.

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- A Project Working Committee (PWC) was established and made up of technical level staff from the core ministries to coordinate, manage and implement the NAPA development process including the Ministry of Economy and Development, Ministry of Agriculture and Forests, Ministry of Health, Ministry of Infrastructure and Ministry of Social Solidarity.
- A Multidisciplinary Integrated NAPA team was established and composed of the six Sector Working Groups (SWGs) on: Food Security and Agriculture, Water, Forests, Coastal Ecosystems and Biodiversity, Human Health, Human Settlement and Infrastructure, and Human and Natural Induced Disasters. Each SWG was led by a focal point from each respective Ministry and NGOs; donors and UN Agencies were also actively engaged in the SWGs. These SWGs were instrumental in producing the input for every section of the NAPA. Facilitated by the PIU, they led the identification of major climate change impacts on their specific sectors and potential actions for addressing these. The SWGs were extremely active throughout the process, engaging both in review and analysis at the national level, as well as participating in district-level consultations.

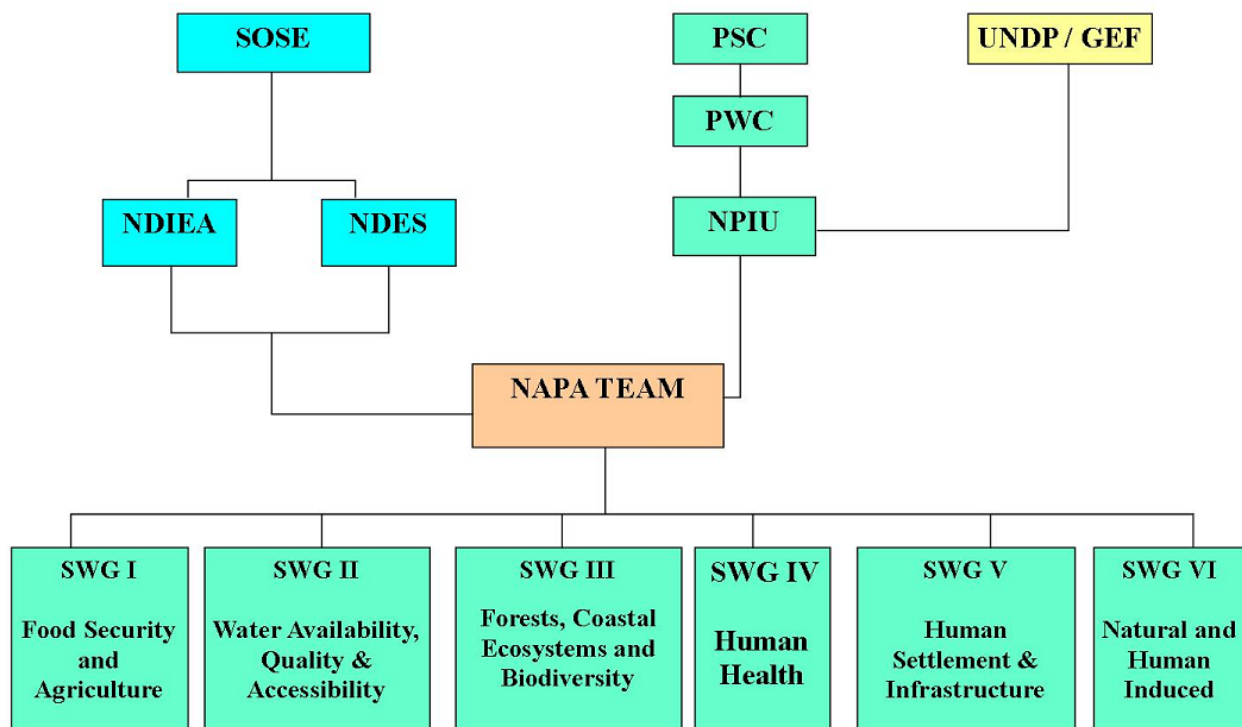


Figure 10 -Organizational chart for the Timor-Leste NAPA process

The above chart illustrates how these various groups interacted with each other. Given the wide variety of stakeholders involved in the process, the PIU sat at the centre to ensure effective coordination between all levels. The PIU worked in close cooperation and under the direction of the National Directorate of International Environmental Affairs (NDIEA) at all times. The PIU reported back to the Project Working Committee and Project Steering Committee on a regular basis to ensure that the project was on track and satisfactory progress was being made.

4.3 The NAPA Vulnerability and Adaptation Assessment Process

The NAPA Vulnerability and Adaptation Assessment process was completed over a six month period between March and September 2010. It consisted of the following:

- A joint workshop where all six Sector Working Groups (SWGs) compiled and synthesized available sector related information and data to avoid duplicating work already completed. This led to the establishment of an extensive database of NAPA related documents held by the Project Implementation Unit. Important data that was required to complete the vulnerability and adaptation assessment process included existing vulnerability assessments carried out by numerous NGOs in the country over recent years (Hogan, 2010). This information was also further supplemented by data gathered on a regular basis through the UN system. The Military Liaison Group (MLG) of the United Nations Integrated Mission in Timor-Leste (UNMIT) engages in daily patrols to districts (sucos) throughout the country. The purpose of these patrols is to carry out interviews with local representatives in pursuit of their mandate, which is to monitor the security situation in Timor-Leste. The standard questionnaire administered includes several questions that help shed light on potential vulnerabilities from climate change, particularly relating to food security and health. Data received in this manner is recorded in a daily Situation Report (SitReps). The NAPA process analyzed this data in order to supplement inputs on potential vulnerabilities from climate change collected in National and Regional Consultations. The data covered the period between 5 January 2010 and 23 August 2010 and all 13 districts in the country and 366 sucos therein. Due to a number of limitations with this information, for example the fact that food security is not defined, the irregular timing of visits etc., this information was used purely in a supplementary manner.
- A workshop per sector during which SWG members identified current and potential climate change impacts for their sector. They also considered the most vulnerable groups likely to be affected by increasing climate change.
- A workshop per sector during which SWG members identified possible adaptation responses, taking into account existing government programmes. A number of needs and gaps were identified during these workshops.
- Five District Consultations in Baucau, Ermera, Maliana, Manufahi, and Oecusse. Districts were selected to ensure coverage of the range of agro-climatic conditions and vulnerable groups in Timor-Leste. These consultations, the first of its kind in Timor-Leste, were very effective in increasing levels of awareness and ownership of the NAPA process both within government and among community representatives.
- A synthesis of all the above information was then produced and was used as input to a final two day prioritization and ranking workshop, held in Dili in September 2010. This workshop was attended by a multidisciplinary team drawn from the six NAPA SWGs, inclusive of civil society organizations and government officers.

Throughout national and regional consultations, a large number and diverse range of adaptation activities were proposed.

4.4 The Countrywide Consultation Process

Local level input was critical in informing national level analysis of vulnerability and identification of adaptation activities. Five representative district consultations, in Baucau, Ermera, Maliana, Manufahi and Oecusse, were held based on natural and climatic factors, geography and topography. The main aim of the district consultations was to identify grassroots perceptions of climate variability and change and its impacts on livelihoods. The consultations also identified the characteristics of each impact area, the most vulnerable locations and people, how people were coping with impacts, and what their priority needs were in terms of longer term adaptation.

The consultations were facilitated by the national NAPA team and supported by the Office of District Administration and Secretary of State for Environment staff in the five districts. One representative from each SWG actively engaged in the process by leading discussions and answering questions from participants about the process to date and concerns of relevance to their sectors. In terms of participation, there was a strong representation by local government officers, particularly local staff of the State Secretariat for Environment and the local Natural Disasters Office; church representatives, women's organizations, village and hamlet chiefs, NGOs and youth organizations. In addition, two NGOs participated as observers and their feedback on the consultations was instrumental in refining the process (See Annex 3 for full list). This participatory process led to the formulation of a total of 213 activities. In moving from the list of 213 to the final list of eight the following steps were taken:

- The NAPA team analyzed the 213 activities and consolidated activities when there was an obvious overlap. The activities identified were also tested for their relevance to increasing resilience to climate change. Some activities that did not satisfy the test that they would not be implemented in the absence of additional climate stresses were also removed. The resulting list had 93 activities.
- The NAPA team then carried out some further work to divide the 93 activities into those that represented major investments and policies and those that related to the cross-cutting issues of capacity development and awareness raising. This resulted in 57 activities related to major investments and policies and 35 capacity development and awareness-raising related activities. This list together with an explanation of the process of consolidation was presented and agreed at day one of the two-day prioritization and ranking workshop in Dili.
- During the first day of the two day workshop, the participants from all SWGs discussed and agreed on ranking criteria as set out in section three above. As the list of 57 major activities was still too long, these activities were reviewed further and shortened to 18 activities across six sectors. In particular, they focused on their relevance to increase resilience to climate change and to address urgent and immediate needs. They also considered ongoing government programmes to support their decision to select three top activities in each sector.
- During the second day of the two-day workshop, participants further discussed these 18 activities and were able to consolidate some and agree on the removal of others from the list.
- The eight final priorities were then ranked using seven agreed criteria described in the following section.

4.5 The Criteria Development Process

The NAPA team proposed three selection criteria recommended by article 15 of the UNFCCC decision 28/CP.7 and four additional country driven criteria which were developed and agreed as set out in section 5.5 above. The agreed criteria were as follows:

1. Urgent and immediate needs related to climate change
2. Degree of contributions to poverty reduction to enhance adaptive capacity
3. Cost effectiveness
4. Acceptability to local populations
5. Ease of implementation
6. Addressing gender equality
7. Sustainable development

A further criterion was added to reflect preferences expressed at district and community level consultations. It was agreed that all criteria would be of equal weighting.

4.6 The Ranking Process

Selection, prioritization and ranking of adaptation activities were undertaken according to the following four steps:

1. Selection of criteria (Section 5.7),
2. Consolidation of proposed adaptation activities to form 8 priority projects (Section 5.5),
3. Priority options were analyzed against the criteria and awarded scores of 1 for low fulfillment of the criterion, 2 for medium and 3 for high. As the criteria were not weighted the scores were simply added,
4. Based on the total scores received per project they were ranked in order of priority.

4.7 Evaluation and Monitoring

The implementation strategy of the NAPA requires full proposals for its project profiles to be developed by the implementing agencies. One of the requirements of the proposals is submission of its plans with clear outcome indicators that will allow for monitoring and evaluation of the project. The NAPA Project Steering Committee is responsible for future evaluation of the NAPA including its project-based activities underlined in the nine proposed project profiles. The monitoring and evaluation of the NAPA process is subject to government audit requirements, protocol and procedures at all times.

4.8 The Government Endorsement Process

The NAPA team conducted a final workshop in order to allow final comments to be provided by the multidisciplinary integrated team as well as the Secretary of State for Environment and Ministry for Economy and Development. The final NAPA document will be submitted to the Council of Ministers for approval prior to submission to UNFCCC.

4.9 Implementation Strategy

In line with the annotated guidelines for the preparation of the NAPA, as well as a country driven approach towards the implementation of the proposed project profiles, it is envisaged that following endorsement of the document by the Council of Ministers, the Government of Timor-Leste will begin to prepare project profiles for submission to the LDCF and other donors. The State Secretariat for Environment will take the lead on coordinating identification of key activities for funding from each available source of funds. At this point the potential consolidation of different related priorities will be considered. Specifically the following steps will be taken:

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- Launch the NAPA and its priorities nationally through an outreach programme to be supported under the UNDP implemented NAPA project.
- Hold follow up discussions with potential international development partners including Australia, Japan, UN system, Global Environment Facility, EU and the Multilateral Development Banks on funding and implementation opportunities.
- For each of the project areas, develop more detailed project proposals once a suitable source of funding has been identified, based on the priority profiles presented in the NAPA document. These project proposals will establish the specific technical and geographical scope and content in each area, necessary institutional and management arrangements, monitoring and evaluation requirements, and key partnerships to ensure successful achievement of project outcomes.
- Ensure that each project proposal is grounded in an understanding of community based concerns and will deliver visible impacts at this level. Strengthening sub-national level planning capacity to address climate risks will also need to be a visible component in each case.
- Strengthen the existing multidisciplinary climate change adaptation team and retain the existing Project Steering Committee to provide continuing oversight for NAPA implementation linked to the stated priority on National Institutional Capacity Development on climate change.
- Continue to use the NAPA document, process and structure as the country's principle framework for adaptation needs to climate-related risks over the medium term.

ANNEXES

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Annex 2. Climate Change Impacts Related to Relevant Ongoing Development Activities and Potential Adaptation Measures

AGRICULTURE, AGRO FORESTRY and FOOD SECURITY		
Issues/Impacts/Vulnerabilities	Existing development activities	Potential Adaptation Measures
<p>Current <i>knowledge and practice</i> may no longer be effective: adaptation needs changes in <i>techniques, species and varieties</i>; some will become unsuitable; and will need to be substituted (Changes in temperature, moisture, variability. E.g. varieties of coffee grown at different altitudes)</p> <p>Increased degradation of <i>loss of agricultural land and of soil fertility</i>.</p> <ul style="list-style-type: none"> - increased landslides, floods, - soil erosion caused by water and wind, - increase air temperature, drought conditions, - salt-water intrusion and seawater flooding of coastal lands, - decreased agricultural productivity caused by storm damages to seeds, changed pattern of crop pests and diseases, - decreased farm incomes and food supply increased price of product. <p><i>Increased shortages of water</i> for agriculture</p> <ul style="list-style-type: none"> - reduced surface water and lowering of groundwater table, - scarcity of water for crops, irrigation and livestock, - leading to increased conflicts over water access, - reduced food production; reduced incomes and increased price of product. <p><i>Increased damage to infrastructure</i> used by the agriculture sector and community</p> <ul style="list-style-type: none"> - caused by increased storm activity (strong winds and rain), increased floods and landslides, - damage to roads restricts access to markets, and access for farm supplies etc. 	<ul style="list-style-type: none"> • Improve rural agribusiness through capacity building. • Increase agricultural production through diversification of products; use of machinery. • Improve irrigation system. • Increase farm production through research/laboratory service. • Enhance production practices of pasture for animals. • Improve livelihoods. 	<p>Policy and Investments – Substantial Issues</p> <ol style="list-style-type: none"> 1. Promote alternative energy (especially fuel) to reduce tree cutting and cooking with fuel wood. 2. Develop long term roads plan for improved market access taking climate change into account. 3. Integrated agro-forestry and watershed management including climate change dimension. 4. Develop sustainable land management promoting fixed/permanent agriculture, reduce burning, reduce erosion, and increase soil fertility. 5. Develop farmer strategies, specifically crop losses in storage, conservation agriculture, water harvesting. 6. Develop projects and agricultural systems through a consistent and relevant integrated planning an National policy planning for mainstreaming climate change to reach a clearly defined programme for agro-forestry policies among state institution. 7. Produce guidelines to introduce sustainable and adequate management systems taking climate change into consideration. 8. Implementation of agroforestry activities and community forestry. 9. Improve planning and legal framework for sustainable and balanced food for livestock production under climate change conditions. 10. Research programme on the impact of climate change on livestock production. <p>Capacity Development, Awareness, Knowledge, Monitoring (will constitute part of final programme)</p> <ol style="list-style-type: none"> 11. Improve monitoring and verification; better information leading to more accurate targeting of

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<p>Reduced <i>livestock productivity</i>; reduced fertility and reproduction</p> <ul style="list-style-type: none"> - caused by heat stress and dehydration of animals, - caused by reduced livestock feed and reduced nutritional value of feed, - weakening of immune systems; increased disease; reduced health and growth, - leading to decreased income, and to increased price of products. <p><i>Decomposition of products</i> (meat, milk, eggs, etc.)</p> <ul style="list-style-type: none"> - because of increases in temperature, moisture, variability. 		<p>interventions; increasing staff - specific to Suco level –about food security monitoring; build their capacity to obtain accurate and relevant information.</p> <ol style="list-style-type: none"> 12. Improve capacity of the Ministry of Agriculture and Fisheries’ (MAF) to adapt work plans to climate change issues (low costs). 13. Awareness raising programme about agroforestry methods and systems to raise awareness in order to provide understanding and information to farmers - Uplands and hillsides. 14. Train technical staff to improve livestock resilience to climate change in the long term and reduce impact of illness. 15. Train and community campaign for climate change adaptation systems for livestock management. 16. Spread community capacity to facilitate agroforestry systems.
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WATER AVAILABILITY, ACCESSIBILITY and QUALITY		
Issues/Impacts/Vulnerabilities	Existing development activities	Potential Adaptation Measures
<ul style="list-style-type: none"> • Rainfall is generally sporadic, with occasional heavy rain alternating with dry conditions. It varies widely across the country, from south to north, with altitude and topography, and also with time and season. Increased variability with some places receiving more rain overall and others less. • High evaporation that will increase with rise in air temperature. Relatively little water lies on the surface (in streams, rivers, lakes) rapid run-off that will increase with climate change conditions. • Limited water infiltration to the soil due to the steep terrain, shallow and thin soils and sparse vegetation, increasing risk factor with climate change (more rain). • The water-retaining capacity of most of the country’s catchments/watersheds is reduced by deforestation and land degradation (also increasing, mainly through poor 	<ul style="list-style-type: none"> • Provide access to drinking water, sanitation. • Research on water resources, monitoring of water levels. • Improve water supply management. 	<p>Policy planning and Investments for core Issues</p> <ol style="list-style-type: none"> 1. New legislation and enforcement to protect critical surface and groundwater resources in an integrated manner leading to resilience to climate change. 2. Climate proofing of infrastructure to protect water sources (springs, streams, wells, etc) ensuring safe water supply during climate-related extreme events. 3. Create/improve Emergency Preparedness Plan for waterborne and vector-borne disease to reduce incidence of water and vector borne disease due to increase/decrease in availability of domestic water because of climate change risks. 4. Change crops and improve water use efficiency to

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<p>land-use) will be exacerbated by climate change factors.</p> <ul style="list-style-type: none"> • Increased stress on 19 of the country's 34 river basins because of water extraction, particularly for irrigation agriculture, than is available. • Rural households and communities relying on local wells (and springs) will be impacted by underground water condition with climate change impacts. • Lack of proper knowledge about quantity, qualities and accessibility of water stored deep underground. • Increased groundwater contamination by salt-water intrusion driven by sea level rise and increased storm (wave) activity. • No facilities for extracting fresh-water from sea-water. High price of reverse osmosis for producing drinking water from sea-water, requiring high electricity consumption from relatively low volumes of fresh-water produced. <p><u>Water for Domestic use – Availability and Quality Issues caused by Climate</u></p> <ul style="list-style-type: none"> • Domestic water sources (springs, wells, storage and treatment tanks, piping) can be contaminated (flooded) by storm activity and torrential rain (which are likely to increase). Sewage systems can also be damaged, and may also contaminate the domestic water supply. • Domestic infrastructure/ plumbing can be damaged during storm and flood events (which are likely to increase), resulting in loss of water supply and contamination of water. Reduced pressure in water supply systems can increase infiltration by contaminants. <p><u>Water for Agricultural Use – Availability and Quality Issues caused by Climate</u></p> <ul style="list-style-type: none"> • Sporadic and variable rainfall and extended drought periods will reduce availability of water supplies for irrigation and watering of crops, and for livestock and fish-ponds. • Increase in flooding will damage land, crops and 		<p>adapt to climate change.</p> <ol style="list-style-type: none"> 5. Create/enhance water harvesting model and water distribution system as well as management system at all levels to avoid water shortage due to climate change. 6. Improve of water collection, storage and distribution infrastructure. 7. Control of quantity of water-use by industry and water pollution control standardization including coffee processing waste management in a climate change context. 8. Create low land and up land water sources management legislation and pollution control legislation including climate change impacts. <p>Capacity Development, Awareness, Knowledge, Monitoring (will constitute part of final programme)</p> <ol style="list-style-type: none"> 9. Training and means to improve water source data collection and monitoring including meteorological data, water quality, water sources depletion and long term water sources availability in a climate change context dissemination of rainfall data and prediction to help manage water uses for agriculture. 10. Raise people's awareness and increase capacity on natural and human-made water harvesting and recycling to reduce depletion of water resources (ground water, surface water) including the creation of information, education and communication as a mean to improve resilience to climate change impacts (IEC). 11. Develop institution and human capacity to adapt to the negative impacts of the climate Change on water resources 12. Coordinated collection, monitoring and develop capacity of Farmer Associations to discuss and implement water efficient practices and changing
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<p>irrigation systems.</p> <ul style="list-style-type: none"> • Increased air temperatures and drought conditions will increase the water requirements of crops, livestock and fish-farms. • Loss of crops and production will <u>reduce</u> farming viability, profitability, employment, livelihoods and food security; and will <u>increase</u> food prices, malnourishment, health, poverty, urban migration. <p><u>Water for Industrial uses – Availability and Quality Issues caused by Climate</u></p> <ul style="list-style-type: none"> • The development of some industries – food-processing; hydropower generation; large-scale tourism – may not be feasible or acceptable in some locations because of water scarcity and costs- • Strict water efficiency measures for businesses and industries may be required. <p><u>Water Sector Management & Infrastructure – Issues caused or heightened by Climate</u></p> <ul style="list-style-type: none"> • Damage of water supply and sewerage infrastructure – storage reservoirs, tanks, treatment plants, piping, pumps – by climate change impacts, for example increased flooding or land erosion. Improvements to design, siting, engineering and maintenance standards and procedures may need to be made, which will increase costs. • Increased contamination of water supplies by Storms and floods. Water treatment and monitoring costs may increase. • Water scarcity and increased costs of development, operation and maintenance of water systems and infrastructure which will increase the costs of supplying water to consumers and reduce access to water for users.. • Little man-made water storage capacity in the country (e.g. few farm dams, or domestic tanks). Water storage – reservoirs, tanks – can lose large volumes through 		<p>of farming methods.</p> <ol style="list-style-type: none"> 13. Increase state institution and people capacity of water resources management and uses. 14. Integrate gender into water management, particularly addressing vulnerable people’s rights including women in water related legislation making and its management.
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<p>evaporation under climate change conditions (temperature increase).</p> <ul style="list-style-type: none"> No water recycling or re-use of domestic used water. 		
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TERRESTRIAL, FRESHWATER, MARINE ECOSYSTEMS and BIODIVERSITY		
Issues/Impacts/Vulnerabilities	Existing development activities	Potential Adaptation Measures
<p><u>Forest and terrestrial ecosystems:</u></p> <ul style="list-style-type: none"> Stresses on forest ecosystems & species causing the reduction of overall health, diversity and productivity by impacts of increased temperature, reduced rainfall, increased storm activity causing: <ul style="list-style-type: none"> Increase in drought conditions, reduced water availability. Increase in fires (increased flammability) Reduced tolerance to drought conditions due to severe temperature change. Increased drought/heat stress reducing health, growth, reproduction & survival. Increase in some species including advantaged pests, weeds & pathogens. Migration/ displacement to locations with more suitable environmental conditions. Direct physical damage. Increase in landslides & floods. 	<ul style="list-style-type: none"> Develop policy & legislation on biodiversity, protected areas and parks. Raise environmental awareness and provide community education on environmental issues. Community reforestation. Capacity development for watershed management (SEE PROPOSED ACTIVITIES IN WATER AVAILABILITY, QUALITY & ACCESSIBILITY). Fishery rehabilitation. Develop and produce systems for the quarantine services for Invasive Alien Species (IAS). Terrestrial and marine conservation programmes - Protected Areas, biodiversity, species, habitats. Eco-tourism initiatives. 	<p><u>Forests and terrestrial ecosystems:</u> Policy and Investments – Substantial Issues</p> <ol style="list-style-type: none"> Establish national research center on sustainable forestry, agriculture and fire management to increase resilience and reduce climate-related impacts by preventing the uncontrolled use of forest resources and degradation of agricultural lands by fuel wood collection, shifting cultivation and forest fires. Education and awareness - conduct a pilot demonstration of on sustainable agriculture and forest management that increases resilience and reduces climate-related impacts of shifting cultivation and unsustainable upland farming practices. National legislation – strengthening implementation of forest laws and regulations to reduce illegal logging and burning and to strengthen customary law; as well as ownership by local communities. Reforestation of degraded lands with fuel wood plantations to rehabilitate degraded land and soils and reduce deforestation by providing sustainable fuel wood source. <p>Capacity Development, Awareness, Knowledge, Monitoring (will constitute part of final programme)</p> <ol style="list-style-type: none"> Capacity building and training on agroforestry and sustainable forest management systems to improve capacity and knowledge of forest

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		<p>managers and farmers to defend against climate-related risks.</p>
<p><u>Freshwater ecosystems (rivers, wetlands, water sources):</u></p> <ul style="list-style-type: none"> • Stress on freshwater ecosystems & species causing the reduction of overall health, diversity and productivity by impacts of rise in air temperature, changes in rainfall, increased storm activity causing: <ul style="list-style-type: none"> – Reduction in surface water (rivers, wetlands, lakes) and de-oxygenation of water leading to temporary or permanent loss of aquatic ecosystems, increased stress and/or local extinction of species, impacts on productivity. – Temporary or permanent increase in surface and ground water leading to increased aquatic productivity, including fish. – Direct damage by floods and increased sedimentation reducing aquatic reproduction, productivity, habitat area and causing local extinctions. • Increased contamination and pollution by runoff from human settlements, industry & roads impacting on aquatic biodiversity, productivity & human health 		<p>Policy and Investments – Substantial Issues</p> <ol style="list-style-type: none"> 6. Mangrove plantations and awareness raising to protect coastal ecosystems from impacts of sea level rise). 7. Water conservation regulations and socialization to adapt to increasing drought and unreliable rainfall. <p>Capacity Development, Awareness, Knowledge, Monitoring (will constitute part of final programme)</p> <ol style="list-style-type: none"> 8. Research and survey - biodiversity of freshwater and saline ecosystems to understand the impacts of climate change. 9. National awareness raising campaign to increase awareness and understanding of the importance and function of freshwater systems. 10. Raise capacity and knowledge of technical and professional staff to respond adaptively to impacts of climate and climate change on freshwater ecosystems. Impacts on water source and quality for all. 11. Improve systemic and institutional capacity and ability in forest and water management - work planning, human resources in technical areas; coordination etc.

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<p>Coastal and marine ecosystems:</p> <ul style="list-style-type: none"> • Reduced health, diversity and productivity of coastal and inshore marine ecosystems and species by rise in air temperatures, changes in rainfall, rise in shallow seawater temperatures, increased storm activity, overall rise in sea level and seawater acidification causing: <ul style="list-style-type: none"> – Loss or destruction of coastal vegetation, species and habitats, due to drought stress, increased erosion, soil and water salinity. – Destruction of freshwater and shallow marine habitats and species by increased river flows, run-off, flooding and sedimentation. – Physical damage to coral reefs, mangroves by strong wave action. – Increased erosion of beaches, shorelines and coastal land, loss of breeding and nesting habitats. – Smothering of sea-bed habitats by siltation. – Loss of health, diversity & productivity of inshore marine systems and fisheries, salination of soil, freshwater, coastal lands, infrastructure, and agriculture by seawater incursion. – Reduced health and survival of many marine species due to increased acidity of seawater. • Reduced health, diversity and productivity of offshore marine ecosystems, fisheries and marine megafauna by rise in shallow seawater temperatures and seawater acidification causing: <ul style="list-style-type: none"> – Reduced survival of many species due to loss of plankton productivity (base of food chains). – Impacts on reproduction and survival of young. 		<p>Policy and Investments – Substantial Issues</p> <ol style="list-style-type: none"> 12. Develop appropriate physical infrastructure (sea walls, jetty etc) in target vulnerable areas to defend against impacts of sea level rise (loss of land, seawater intrusion, etc). 13. Form climate change research institution with strategy to research and monitor climate change impacts, ensure informed management in response to CC and coordination of actions, awareness and community participation. Target at university and school level to ensure community participation in data collection. Long term. 14. Form cross-sectoral climate change taskforce & Minister for Climate Change Strategy to ensure effective communication, cooperation and sustainable & effective intervention. Aim to ensure mainstreaming of climate proofing incorporated across all sector policies and planning (land use, infrastructure, urban & tourism planning, etc) to reduce vulnerability of communities. 15. Create artificial habitats to enable migration of critical coral reef, fisheries, fishery nursery habitats and shallow marine ecosystems as sea levels and sea temperatures rise. 16. Livelihood methodology and products adaptation and diversification to increase resilience and reduce dependence in face of sea level rise and increased storm impacts.
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<p><u>Invasive Alien Species - IAS</u> (weeds, pests, pathogens)</p> <ul style="list-style-type: none"> • Displacement, destruction and out competition of native species and habitats by increased occurrence of invasive alien species (plants, pests, pathogens) in land, freshwater and marine ecosystems. 		<p>Policy and Investments – Substantial Issues</p> <p>17. National programme and strategy to combat IAS in relation to climate change: include research and laboratory, civic education, quarantine strengthening capacity (law & regulatory frameworks, capacity, institutional) and national programme of civic education, improve capacity of technical staff in relation to IAS Research IAS in relation to climate and climate change to reduce impact on land, water, marine ecosystems and productivity (Cost: \$2million).</p>
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HUMAN HEALTH		
Issues/Impacts/Vulnerabilities	Existing development activities	Potential Adaptation Measures
<ul style="list-style-type: none"> • Increased public health issues require better resource and capacity on Public Health Management. • Increased incidence of respiratory and associated infections: <ul style="list-style-type: none"> - greater incidence of pneumonia, asthma and other lung and nasal diseases (direct result of the more variable and extreme conditions of humidity and temperature) - Increased respiratory infections, allergies and cardio-vascular diseases can be expected as an indirect result of changing climatic conditions • Increased incidence of water-borne diseases and infections as consequence of increased storms and torrential rainfall. • Increased incidence of vector-borne diseases particularly dengue and malaria. • Increased risks of malnutrition, hunger, water shortage and food contamination caused by: <ul style="list-style-type: none"> - Unreliable, sporadic rainfall and periods of drought. - High temperatures and humidity can affect food safety and seed viability; high sea water temperature leads to toxic algal blooms; increased populations of pests can destroy food and seeds. 	<ul style="list-style-type: none"> • Develop and implement health policies, regulations, guidelines and compliance. • Strengthen health information and epidemiological surveillance systems. • Expand community-level nutrition programmes. • Improve implementation of programmes for transmissible (malaria, dengue, TB, etc) and non-transmissible diseases. • Strengthen strategies for vector control, water, basic sanitation and food security. • Improve laboratory services. • Cross check with Ministry and WHO. 	<p>Policy and Investments – Substantial Issues</p> <ol style="list-style-type: none"> 1. Review existing guidance and standards issued by the Minister of Health on respiratory and associated diseases; standard on controlling water and food quality/hygiene standards to take climate change into consideration. 2. Improve school curriculum and educative activities on vector borne diseases (malaria & dengue) in relation to climate change. Develop integrated national curriculum on Climate change issues. 3. International consultant on policy draft. 4. Pass new legislation to create school green environment with climate change perspective. 5. Develop TL website on malaria and dengue. 6. Establish an early warning system for malnutrition and food security. 7. Develop contingency planning. 8. Enforce traditional regulatory framework of Tara Bandu, particularly to protect water resource sources (wells, springs etc.). 9. Revise the food security and nutrition strategies to include the climate change variabilities. 10. Annual seminar on climate change.

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HUMAN HEALTH		
<ul style="list-style-type: none"> - Human activities degrade the health and productivity of ecosystems in T-L forests, rivers, mangroves and coral reefs. • Effects of increased UV radiation: <ul style="list-style-type: none"> - Caused eye cataracts and skin cancers as well as reduced the body's immune system. - Increased occurrence of accidental injuries and deaths the climatic conditions are important factor in the incidence of accidents leading to injury or death: majority of natural disasters are climate-related; damaged property, fields and crops, infrastructure; storm winds, heavy rain and strong waves. • Increased incidence of mental illness: <ul style="list-style-type: none"> - Extreme weather events and their diverse impacts on human lives are likely to contribute to increased anxiety, stress and mental illness among the Timorese population. • Increased incidence of heat stroke: <ul style="list-style-type: none"> - Sun-burn, dehydration, heat exhaustion and sun-stroke. 		<ol style="list-style-type: none"> 11. Budget allocation for responding to natural disasters. 12. Establish national education and training center on climate change, food processing, health issues and cross-sector issues. <p>Capacity Development, Awareness, Knowledge, Monitoring (will constitute part of final programme)</p> <ol style="list-style-type: none"> 13. Research on human resource capacity in public health in order to find qualified person to work in the area of public health management. 14. Research on relevant policy appropriate for TL. 15. Develop strategies and enhance human resources on capacity enhancement (training and courses for focal points on climate change, respiratory diseases and other climate change related diseases, health treatment, impacts of UV radiation, evacuation training, fumigation (insecticide training for mosquito reduction) and knowledge on maternity and children health. 16. Public information campaign on water-borne diseases, healthy living socialization programme, healthy and quality water resource usage, clean water for mother and children under five; and prevention to water-borne diseases, prevention on malaria and dengue; food diversification & information on other climate change related health impacts circulated by national television, radio, newspaper, website and health volunteers. 17. Awareness raising on climate change in relation to water shortage in dry season, food shortage and another impacts on human health. 18. Public information, education and communication (IEC) materials: what to do in case of emergency (early warning systems, training of trainer for the resource person, evacuation guide and practices.

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HUMAN HEALTH		
		19. Establish research study group, focus group discussion on climate change related impacts (FGD). 20. Comparative study tour and training on the climate change dimension of health. 21. Training on medical studies specialist on skin disease in connection with climate change risks. 22. Conduct regular monitoring of vulnerable locations for emergency evacuation. 23. Enhance surveillance of Vector borne diseases climate related.

HUMAN SETTLEMENT and INFRASTRUCTURE		
Issues/Impacts/Vulnerabilities	Existing development activities	Potential Adaptation Measures
<p>Power Infrastructure: electrical power generation and transmission</p> <p>Increased temperatures will:</p> <ul style="list-style-type: none"> • Damage transmission cables. • Increased demand on grid electricity for cooling. <p>Increased storms (winds, waves, rain, local floods) will:</p> <ul style="list-style-type: none"> • Damage transmission cables and poles and create difficulties in accessing flooded power plants. • Increased droughts will threaten hydropower operation. • Sea level rise and storm surges will damage to coastal power stations and transmission infrastructure. 	<ul style="list-style-type: none"> • Biogas programme. • Human resource development programme. • Develop policy and legislation on EIA & pollution control. • Improve basic infrastructure in rural areas. • Develop national rural development policies and strategies. 	<p>Policy and Investments – Substantial Issues</p> <ol style="list-style-type: none"> 1. Viability study and Pilot project to lay underground cables and other exposed equipment to climate change. 2. Build a vegetation barrier (mangrove) to minimize erosion impacts. 3. Review existing laws, regulations and standards and enhance CC-resilient infrastructure Pass new legislation to strengthen and guarantee national development for regulations quality of materials and building codes and practices. 4. A study on the standardization of telecommunication equipment to create national mobile phones/license networks systems to enhance the ability to respond to climate events. 5. Joint research across ministries on the impact of GHG air emissions due to transportation – land, sea, air, their reduction with pollution control and identification of vulnerable areas in urban cities. 6. Research on environmentally friendly building materials, standard for cement asphalt and metal).

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		<p>Capacity Development, Awareness, Knowledge, Monitoring (will constitute part of final programme)</p> <p>7. Overall public awareness raising on urban planning and management.</p>
<p>Telecommunications Infrastructure fixed line networks, trunk lines to exchanges, mobile network transmission towers.</p> <ul style="list-style-type: none"> • Increased temperatures will damage cables. • Increased storms (winds, waves, rain, local floods) will damage cables, poles and towers from wind, fallen trees, land erosion. • Create flood damage to on-ground installations. • Create disturbance of mobile frequencies. • Sea level rise and storm surges (erosion, coastal flooding, and saltwater damage) will destroy coastal lines and poles. 		
<p>On Transportation Infrastructure (roads, bridges, airports; ports, jetties, piers, seawalls)</p> <ul style="list-style-type: none"> • Increased temperatures and dry conditions will damage road surface/pavement. • Generate hazard to fuel storage facilities from increased occurrence of fires. • Hazard to road and plane traffic from increased fires and smoke. • Increased storms (winds, waves, rain, local floods) will increase damage and destroy roads, bridges, roadsides, culverts. • Damaged/destroyed transport and coastal infrastructure • Disrupted maritime transport – commercial, fishing, recreational, military. • Increased number of vehicle accidents (due to infrastructure damage). 		<p>Policy and Investments – Substantial Issues</p> <p>8. Study to on the critical situation of the main International airport runway due to its location and the climate change impact; creation of an inter-ministerial group to agree on international standards.</p>

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<p>Buildings and Settlements: residential, commercial, industrial, parks, community and public spaces</p> <ul style="list-style-type: none"> • Increased temperatures. • Indoor temperatures increase. • Damage to some building material. • Increased electricity consumption for cooling and refrigeration. <p>Increased storms will:</p> <ul style="list-style-type: none"> • Impact materials and construction • Damage from floods, erosion, landslides. <p>Increased droughts will:</p> <ul style="list-style-type: none"> • Increase cost of urban water supplies. • Increased cost of maintenance of urban parks and trees • Increased cost of water for construction. • Sea level rise and storm surges will generate flooding and destruction of coastal settlements. 		<p>Policy and Investments – Substantial Issues</p> <ol style="list-style-type: none"> 9. Establish an urbanization research centre to identify vulnerable areas (especially coastal) to formulate climate resilient urban planning. 10. Promote the use of climate resilient building material including local plantations etc. <p>Capacity Development, Awareness, Knowledge, Monitoring (will constitute part of final programme)</p> <ol style="list-style-type: none"> 11. Information campaign on climate-resilient urban management. 12. Training of national authorities and staff on climate resilient urban management including reforestation urban areas. 13. Reinforce legislation for climate resilient urban management.
<p>Effects of Climate on Oil & Gas industry Infrastructure (gas, oil extraction; refining and distribution)</p> <p>Increased storms will:</p> <ul style="list-style-type: none"> • Increase risk of damage to offshore infrastructure, • Increase risk of accidents, spillage, leakage and pollution, • Disrupt offshore operations, • Damage onshore infrastructure and operations, similar to other industries. 		<p>Policy and Investments – Substantial Issues</p> <ol style="list-style-type: none"> 14. Protect offshore infrastructure against strong wave damage that impacts the distribution of gas and oil, and reduce accidents and destruction of offshore oil and gas infrastructure; including <ul style="list-style-type: none"> ▪ Equipment for detecting early warning system, ▪ Data information to show occurrences, ▪ Equipment protection.

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NATURAL and HUMAN-INDUCED DISASTERS		
Issues/Impacts/Vulnerabilities	Existing development activities	Potential Adaptation Measures
<ul style="list-style-type: none"> • Increased Injury and death to humans from: <ul style="list-style-type: none"> - flying debris, drowning and exposure from anticipated more frequent storms - landslides triggered by predicted increasing heavy rainfall and more frequent storms - drowning incidences due to floods - fires due to predicted prolonged drought periods and lightening storm activity • More frequent impact on human lives and livelihoods in terms of health, wealth and comfort from: <ul style="list-style-type: none"> - extreme weather events causing disruption, - landslides damaging homes and blocking access to schools, markets etc., - displacement due to flooding, - drought causing loss of water and food security, hygiene and health impacts, - fire outbreaks decreasing air quality. • Increased damage to man-made infrastructure including homes, business facilities, health facilities, roads, power infrastructure, agricultural facilities, water supply from: <ul style="list-style-type: none"> - increased incidence of extreme weather such as strong winds and rain, - landslides, - flooding damaging, - Fire • Increased damage to natural resources: <ul style="list-style-type: none"> - forests, mangroves reefs and beaches in danger from stronger storms and rain, - rivers, water quality and downstream habitats endangered by more landslides and flooding, - damage to coastal saline habitats including wetlands and mangroves due to flooding, - drought and wildfire leading to loss of biodiversity. • Increased degradation of agricultural resources including land and livestock: 	<ul style="list-style-type: none"> • Supply food and non-food items for the vulnerable. • Strengthen response systems between agencies of MSS and development partners to provide social and humanitarian assistance to victims and vulnerable groups. • Monitor and observe the weather. • Disaster risk reduction and preparedness. 	<p>Policy and Investments – Substantial Issues</p> <ol style="list-style-type: none"> 1. Reduce the impact of storms and flooding by reforestation in coastal and mountain areas. Focus on mobilizing communities. 2. Integrate public interest in the management of natural disasters through design of an appropriate policy mechanism. 3. Physical infrastructure –civil engineering and vegetation methods - to prevent landslides in hill sites, roads, and river banks. 4. Establish early warning systems in areas identified as vulnerable to risks of disasters such as floods and storms. 5. Develop government strategies on responding to drought. <p>Capacity Development, Awareness, Knowledge, Monitoring (will constitute part of final programme</p> <ol style="list-style-type: none"> 6. Research and monitoring in the area of agriculture to identify the seeds / crops that can withstand strong winds, torrential rain and drought. 7. Establish improved coordination and information sharing between relevant ministries and stakeholders. 8. Raise awareness, improve knowledge and understanding amongst community on how to avert and manage disasters of all types (fire, flooding, and landslides) at Suco, sub-district and district levels. 9. Data collection and confirmation on current incidence of fires with a focus on preventing future fires. 10. Establish regional relationships to carry out information exchange, joint research and joint action on Invasive Alien Species.

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NATURAL and HUMAN-INDUCED DISASTERS		
<ul style="list-style-type: none"> - increased landslides and floods, - soil erosion caused by water and wind, - soil fertility damaged by drought, - decreased agricultural productivity caused by storm damages to seeds, changed pattern of crop pests and diseases, - fire destroys crops and livestock, - invasive species, - decreased farm incomes and food supply increased price of product. 		<p>11. Increase individual and institutional capacity across Ministries on reducing risk of and managing disasters.</p>

Annex 3: List of Participants to District and Central Level Consultations

Sector Working Group Members

Government Representatives

No	Name	Organization
1	Ivo Guterres	National Director of Environmental Health Department, MoH
2	Rui Daniel Carvalho	Director of Quarantine, MAF
3	Calistro C Varela	Director of Livestock & Veterinary, MAF
4	Rui Pires	Head of Multilateral & Environmental Agreement
5	Nick Molyneux	Seeds of Life
6	Norberta da Costa	SoS for Natural Resources
7	Lino Correia	State Secretariat for Energy Policy
8	Pedro Sarmiento	State Secretariat for Energy Policy
9	Manuel da Silva	Director of Forestry MAF
10	Vicente S. Soares	National Directorate for Forestry, MAF
11	Laurentino do Carmo	Ministry of Social Solidarity
12	Paulo S Esposto	Fire Brigade
13	Saekani	Children Fund
14	Luis Godinho	National Director of Coffee & Forestry, MAF
15	Francisco Hornai	National Director of Treaties, Ministry of Foreign Affairs
16	Eusebio da Costa	National Directorate of Rural Development, MoED
17	Maria Lourdes de Sousa X	Researcher
18	Jose Diaz Quintas	National Director of Tourism
19	Manuel Mendes	National Director of Protected Areas & National Park
20	Henrique S Barreto	MAF
21	Moises Tilman	Researcher, MoED
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25	Sebastiao da Silva	Director of DNMO
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30	Rosa Amaral Vong	National Director of Housing, Building
31	Milton Ramanata	National Director of Road, Bridges
32	Alencio	State Secretariat for Public Works
33	Jose Piedade	General Director for Roads, Infrastructure
34	Fernando Cruz	General Director of Infrastructure
35	Nicolau Santos Celestino	Director ARCOM/SETEC
36	Rui Fraga	Post
37	Celso M.H. da.O	Ministry of Infrastructure

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40	Rui Hernani	SETEC
41	Flavio C Neves	SETEC
42	Luis da Costa F	SHC
43	Joaquim Ximenes	National Director for Water Resource (DNGRA)
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45	Crescencio A Lopes	State Secretariat for Public Works
46	Dino da Silva	ANP
47	Saturnino Gomes	State Secretariat for Public Works
48	Januario Ribeiro	State Secretariat for Public Works
49	Virgilio Guterres	General Director of EDTL (Electricity of East Timor)
50	Ralph Lariviere	Director of Distribution, EDTL
51	Gil N Pinto	Assistant Director of Distribution, EDTL
52	Duarte Sarmento	National Directorate for Water and Sanitation (DNSAS)
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54	Elisa LSPC	National Directorate for International Environmental Affairs
55	Helder Martins	State Secretariat for Energy Policy
56	Gil Rangel	National Director for Crop production, MAF
57	Augusto Fernandes	National Director of Fishery, MAF
58	Matias Tavares	Head of Livestock Department, MAF
59	Jose Ferreira Martins	Ministry of Tourism, Commerce and Industry
60	Luis dos Santos	National Directorate for Environment
61	Jose Domingos Martins	National Director of Energy Policy
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70	Maria Pascoela Pereira	MAF
71	Arlindo Silveira	State Secretariat for Environment
72	Joao DCS	Geologist, State Secretariat for Natural Resources
73	Joaquina Barbosa	Geologist, State Secretariat for Natural Resources
74	Francisca Assis	Chief of Department, MAF
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84	Adolfo da Costa	DNSAS
85	Sigia O. Patrocinio	Ministry of Health
86	Daria	Ministry of Economy and Development
87	Fernando da Silva	MAF
88	Bendito Trindade	MAF
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Representative from Donors, NGOs and UN Agencies

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6	Fabrizio Cezarretti	FAO
7	Jun Kukita	UNICEF
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9	Shin Furuno	Environment & CC Advisor to APHEDA
10	Luis Pedro	CVTL
11	Anne Turner	Free Flow
12	Cornelio de Deus	CVTL
13	Sabina Fernandes	Sharis Haburas Comunidade (SHC)
14	Juvinal Diaz	La'o Hamutuk
15	Maximu Tahu	La'o Hamutuk
16	Paul Joicey	Oxfam International
17	Jessica Mercer	CCA Coordinator, Oxfam
18	Maria dos Reis	Prog. Support Manager, Oxfam International
19	Joanna Pinkas	Plan International
20	Jill Salmon	Care International
21	Jan Bojo	World Bank
22	Laurindo Pires Santos	FAO
23	Jose Nelson Salsinha	Dean Faculty of Agriculture, UNTL
24	Wade Freeman	Caritas Australia
25	Atilio da Costa	Caritas Australia
26	Wook Freemon	Caritas Australia
27	Florentino Sarmento	CRS
28	Rui Pinto	Coral Triangle, CTSP
29	Paulo Amaral	Halerae
30	Swein Ingar Semb	Hydropower programme officer, Norwegian Water
31	Carlos dos Reis	USAID
33	Dinorah Granadeiro	Ex Dir of NGO Forum
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42	Jesuiinho Gregorio	World Vision
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45	Piedade Soares	HASATIL
46	Dinesh Bajracharya	Water Aid
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48	Atai Ximenes	Permatil
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54	Joanico Tilman	Agromanist, FAO
55	Pedruco Capelao	National Counterpart, IOM
56	Julio Barros	M&E Coordinator, Care Intl
57	Gil H Boavida	Haburas
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District Consultations

Ermera District

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2	Adelino Rojario	National Directorate for Forestry, MAF
3	Afonso s. Lemos	Suco Chief of Raimera, Ermera
4	Agostino S. Guterres	Department of Food Production, MAF
5	Alberto de Oliveira	Suco Chief of Fatu-Quero, Railaco
6	Alberto Salsina	Letefoho Sub-District
7	Alexandre dos Santos	Aldeia Chief, Ermera Sub-District
8	Americo Soares	Sub District Administrator Letefoho
9	Amilcar M.	Gleno
10	Antonino S.	Betulala, Ermera
11	Bacelar M. Correia	Sub District Administrator Railaco
12	Carlos D Ly M.	Student, Gleno
13	Cesaltino J.D.	
14	Costodio S. A.	Sub District Administrator Hatulea
15	Cristalina Quintão	Suco Chief of Rai Laco – Leten
16	Diamantino Soares	Suco Chief
17	Domingos de Deus	District Water and Sanitation Department
18	Domingos Soares	Teacher
19	Duarte Martins	Youth representative from Hatulia
20	Edelmino Jose de Deus	District Environment Office

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21	Elsa Goncalves de Araujo	Tirilolo, Atsabe
22	Ermelindo	Youth representative from Letefoho
23	Eurico M.	Fatubesi, Ermera
24	Eusebio A. Maia	Suco Chief
25	Felisberto das Neves	Suco Chief Ermera Sub-District
26	Felisberto S.M.X	FAAD NGO
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28	Gil L. Pereira	Suco Chief of Matata, Railaco
29	Graciano M. Hornai	Sub District Administrator – Atsabe
30	Graciano S. Tilman	Suco Chief of Letefoho
31	Jacob S. Martins	Student – Letefoho
32	João de Deus	Suco Chief
33	Justino M. Martins	District Environment Office
34	Laurindo Soares	Suco Chief of Eraulo
35	Ligia Dias Ximenes	Bet. Bor, Ermera
36	Manuel de Araujo	Community District Officer Atsabe
37	Manuel S. do Ceu	Conselu do Suco Rihau, Ermera
38	Marcelino de Deus	Suco Secretary
39	Natalino de Araujo	Gleno
40	Osorio Babo	District Water and Sanitation Department
41	Regiana Maria Soares	Student – Letefoho
42	Teotonio D. Araujo	Suco Chief of Catrai-leten
43	Zosimu dos Santos	LOUMO, Hatolea (NGO)
44	Zulmira da Silva	Trocaire (NGO)

Bobonaro District

No	Name	Organization
1	Adelino Afonso	Suco Chief
2	Aderito dos Santos	Technical Support Office, Bobonaro
3	Adriano Tito	Aldeia Chief, Odomao
4	Albertino M.	Suco Chief
5	Alberto A.F.	Suco Chief, Raifun
6	Alberto F.	Suco Chief, Atabae
7	Alcino P.	Ministry of State Administration and Territorial Planning
8	Alfredo da Costa	Sub-District Administrator Cailaco
9	Alfredo Soares	Local Irrigation Department, MAF
10	Alvaro dos Santos	Suco Chief
11	Antonio de Jesus	Suco Chief, Colimau – Bobonaro
12	Antonio Santa Cruz	Suco Chief, holsa
13	Antonio Soares	Ministry of State Administration and Territorial Planning
14	Apolonio L. de A.	Ministry of State Administration and Territorial Planning
15	Arcanjo R. Tilman	Ministry of State Administration and Territorial Planning
16	Arlindo Silveira	Directorate of Environment, Dili
17	Armindo M. Vicente	Disasters Department, Ministry of Social Solidarity
18	Augusto dos S.	Local Water and Sanitation Department
19	Casimiro da C.	Security
20	Deolindo M.	Suco Chief
21	Dinis do Nascimento	Information Department – MAF

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22	Dominggos L	National Directorate for Local Administration
23	Domingos Marques	Security
24	Egídio Dos Santos	Aldeia Chief
25	Engrasia Marques	Pessoal Suco, Holsa
26	Esteves B	Suco Chief, Bobonaro
27	Faustino Bere	Secretary of State for Environment
28	Faustino Maubere	Suco Chief, Cailaco
29	Feliciano B.M	Suco Chief, Sibonia – Bobonaro
30	Felicidade d. S.	Representative of Saburai Women
31	Fernando F.	Ministry of Justice
32	Francisco Leite	Suco Chief, Lolotoi
33	Hevio Godinho	Aldeia Chief
34	Januario F.	
35	Januario G.	NGO Belun
36	Januario Ramos	Pessoal Suco
37	Joana Soares	Youth representative
38	João B. G. Amaral	Maliana Fire Department
39	Jonas C.L.	Reporter TVTL Maliana
40	Jose Bere Soares	Chief of Operations PNTL
41	Jose F. Martins	School Inspector, Maliana
42	Jose H.	Digital Terrestrial Televeision
43	Jose Orlando	Director, MAF
44	Jose Pereira	Ministry of State Administration and Territorial Planning
45	Julião M. Paulo	Aldeia Chief
46	Justino. S. B.	Suco Chief, Atabae
47	Leonardo Mau	Suco Chief
48	Lourenço B.	Suco Chief
49	M. Bili	Official
50	Manuel X.	Suco Chief
51	Maria Barros	Secretary of Administration
52	Maria Olandina	Environment Coordinator
53	Mariano Ferreira	Lao Hamutuk (NGO)
54	Mariano V. Amaral	Ministry of State Administration and Territorial Management
55	Mario Barreto	NGO, Maliana
56	Martinho de Fatima	Aldeia Chief
57	Martinho P. F,	District Administration
58	Martinho Vicente	District Administration
59	Mateus Gomes	Aldeia Chief
60	Maximus Tahu	Researcher / Lao Hamutuk
61	Natalina do R. V. C.	Ministry of State Administration and Territorial Management
62	Natalino Araujo	Civil Security
63	Paolino Viegas T.	DSCO Bobonaro
64	S. de Jesus dos S.	Coordinator
65	Sebastião Sequeira	Suco Chief, Bobonaro
66	Silvina Gomes	Women’s Representative, Maliana
67	Simão Bras	Gerador Maliana
68	Sinonio Freitas	Sub-District Administrator Atabae
69	Thomas Gomes	Aldeia Chief

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70	Tito Gomes	Logistics
71	Venancio da Cruz	PAAS, Odomao
72	Xavier Barreto	Suco Chief, Tapo
73	Zeferino Soares	Suco Chief, Cailaco

Baucau District

No	Name	Organization
1	Abrão D.	Directorate for Environment
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3	Alexandre Freitas	Activist
4	Antonio Alves	Coordinador for Disaster Management, MSS
5	Antonio Belo	Suco Chief, Buruma
6	Antonio C.	Administrator
7	Apolinario	Caritas Diocese (NGO)
8	Avelino Gaio	Education –Cultural Regional
9	Baltazar B.	Focal Point DDC
10	Cesaltino Ximenes	UNMIT/CPIO
11	Cipriano M. F.	DM-CBRR CVTL (NGO)
12	Domingos Castro	Directorate for Environment
13	Domingos R.	Farmer
14	Domingos N.	Coordinador Naroman
15	Duarte da Silva	District Disasters Management Committee
16	Faustino Miguel	UNDP
17	Fernando A.	Suco Chief, Venilale
18	Francisco Belo	Sub-District Administrator – Laga
19	Francisco M.	Suco Chief, Laga
20	Francisco Ximenes	Suco Chief, Buibau/ Baucau
21	Gregorio F.	National Directorate for Local Administration
22	H. Nurgadi	Centre of the Islamic Community in Timor-Leste (CENCISTIL)
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24	Ines Martins	Researcher La’o Hamutuk
25	Jaime Lemos	Suco Bucoli
26	Januario Belo	Administration Baucau
27	Januario Pereira	Directorate for Environment
28	Jorge Geraldo	Secretario P. Fretelin Laga
29	Jose Antonio D. C.	Chefe Suco, Caibada
30	Jose Da Costa	Tirilolo
31	Jose Ximenes	Suco Bucoli
32	M. Pinto	CRS (NGO)
33	Manuel dos Reis	National Directorate for Local Administration
34	Margarida Fatima	Cailalo, Baucau
35	Maris Belo	State Secretariat for Youth and Sport
36	Nelson Nunes	District Disaster Management Committee
37	Olimpio G.	District Officer – IOM
38	Pacoal Belo	
39	Pe. A B. Palomo	Baucau Church
40	Rui M. Belo	Alola Foundation (NGO)
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42	Sabino S.	National Directorate for Local Administration
43	Tomas Freitas	National Directorate for Local Administration

Manufahi District

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2	Abril dos Reis	NGO LBM
3	Adão Mendes	ASD Same
4	Adelino De A. Costa	National Division of Social Reinsertion
5	Agustino dos Santos	Youth – Rotuto
6	Alarico Dos Santos	Suco Chief – Rotuto
7	Alexandre T	Suco Chief – Daisua
8	Alexandrino	FUTURA (NGO)
9	Andi A.R.	Swasta
10	Antoninho Sarmento	Human Rights Monitoring
11	Aquino Brandão	NGO Sharis Haburas Comunidade
12	Augusto Tilman	Pessoal Suco Babulu, Same
13	Bendito Amaral	CDS Tutuluro
14	Carlos da Costa	NGO IMM Fatuberlio
15	Carlos dos Reis	NGO LBM
16	Carlos Pereira	NGO LBM
17	Casmiro Borges	ASDT Political party
18	Daniel S.	Coord. National Directorate for Environment
19	Francisco da Costa	ASDT Party Leader
20	Gordan Pestano	UNV
21	Hendrique Pereira	Suco Chief representative – Betano
22	Hornai dos Reis	Youth representative
23	Isabel C. Costa	Gender Focal Point Same
24	Januario Rodrigues	NGO LBM
25	João Bosco	Aldeia Chief – Susurai
26	João da Costa	District Police (PNTL)
27	Julio de Oliveira	Director 1912
28	Julio Guterres	Journalist Timor Post
29	Laurindo Fernandes	NGO ALTA-SUL
30	Maximus Tahu	NGO La’o Hamutuk
31	Me. Cristina CIJ	JAF
32	Me. Joaquina CIJ	JAF
33	Nicolao Barreto	Student SMU 1912, Same
34	Orlando Pacheco	Rep. Suco
35	Rodolfo S.	Catholic Youth Group
36	Shona Hawkes	NGO La’o Hamutuk
37	Valente da Silva	Suco Chief, Grotu

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Oecusse District

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2	Amavel B. Carbafo	AHCAE NGO
3	Americo Carvalho	District Environment Office
4	Anastasia da Silva	CFEO (NGO)
5	Armando Santos	Oxfam
6	Blasius Colo	Caritas Australia
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8	Edmundo Pereira	Business Development Centre
9	Elias Sipa	CECEO (NGO)
10	Fernando da Costa	Education Directorate
11	Francisco Sofa	FPWO (Youth Organisation)
12	Imaculada da Cruz	District Environment Office
13	Inacio Faria	Caritas Australia
14	João Pala	Cruz Vermelha Timór-Leste (NGO)
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7	Claire Martin	Environment Unit, UNDP
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Annex 4: Project Profiles

4.1 Project Profile 1 – Building Resilience of Rural Livelihoods to Secure National Food Security

RATIONALE

Around 80% of the active population of Timor-Leste is engaged in food production through agricultural activity, much of which is subsistence based. The sustainability of existing farming systems are under threat from a combination of declining soil fertility, insufficient available land resulting in cultivation on steep slopes, insufficient dry season water supply, physical access constraints, as well as under investment in supporting activities such as agricultural extension services and post harvest processing. Achieving food security is a key issue for the country and is recognized in the annual development planning process under national priority 2 on food security.

The NAPA consultations underlined the vulnerability of Timor-Leste’s traditional rain fed rural livelihoods system to increasing climatic variability, particularly its upland farming systems. Concerns were raised over increases in the occurrence and severity of natural disasters, including extended drought events, flooding and tropical cyclones. Too much water occurs during the rainy season and not enough during the dry season. With existing farming systems and methods already under threat from poor land management, it was universally felt that existing climatic variability combined with longer term impacts of climate change would inevitably undermine the entire sector. For these reasons the need for comprehensive measures to reduce vulnerabilities of farmers to climatic variability and change was ranked 1 in the list of NAPA priorities. This priority area was also acknowledged to be closely linked to priority area 2 on water resources.

DESCRIPTION

Component	Short-term Outputs	Potential Long-term Outcomes
Policy and Planning	<ul style="list-style-type: none"> Engage climate vulnerable farmers and other key stakeholders in the formulation of local and district-level development plans. Introduce integrated agro-forestry and watershed management planning principles to district and community stakeholders⁵. Strengthen national and sub-national capacity to engage with community and integrate climate risk analysis into community level development planning processes. 	<ul style="list-style-type: none"> Climate risks integrated into national sectoral strategies and district planning for rural development, food security and agriculture (including livestock management).
Physical Investment and	<ul style="list-style-type: none"> Reforestation of degraded lands in high-risk areas (hill sites, roads and riverbanks) to prevent landslides and provide sustainable 	<ul style="list-style-type: none"> Farmer organisations and other rural stakeholders able to develop and apply adaptive

⁵ The Government of Timor-Leste has recently developed guidance and training materials for sustainable land management which provide a starting point for this work.

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Demonstration	<p>fuel wood sources.</p> <ul style="list-style-type: none"> • Demonstrate, through localized interventions, sustainable land management measures (reduce erosion, increase soil fertility, reduce crop losses, reduce burning) to increase resilience to climate risks. • Demonstrate measures to diversify rural household income, including agro-forestry based livelihoods models. 	practices to enhance agricultural productivity and promote economic diversification in rural livelihoods.
Awareness and Information Sharing	<ul style="list-style-type: none"> • Community based (with a focus on farmers) education and awareness measures on climate risks and food production. • Provision of improved seasonal early-warning system (easily accessible and understandable) for food security providing forecasts for farmers, extension workers and planners. 	<ul style="list-style-type: none"> • Effective climate risk information supplied, understood and adopted by end users at the appropriate scale to protect rural livelihoods from the impacts of climate change.

DEVELOPMENT CONTEXT

The GoTL is currently implementing the Second Rural Development Programme for Timor-Leste (RDP II) with support from the Europe Union (EU) and GTZ, with the objective of promoting food security and poverty reduction within the context of a transition from subsistence to market oriented agriculture. This supports the Ministry of Agriculture and Fisheries' (MAF) stated policy direction as set out in its earlier Policy and Strategic Framework (2004) and the National Food security Policy (2005). A further RDP programme is under preparation with a focus on rural infrastructure and further strengthening of agricultural extension services.

In addition to market-oriented approaches, the Government is beginning to focus on diversification strategies, particularly for upland farmers, such as agro-forestry based livelihood models which incorporate watershed management. The FAO has been supporting MAF in the development of a strategic programme for promoting agricultural growth and sustainable food security (2010). The primary target of this programme is marginal and small-scale subsistence farmers with limited access to irrigation water and cash crops.

IMPLEMENTATION

Project Duration: 4 years

Lead Agency: The Ministry of Agriculture and Fisheries

Other Key Stakeholders: Ministry of Infrastructure, Ministry of Economy and Development, EU/GTZ, FAO, UNDP, Mercy Corps Timor-Leste, Caritas, Hasatil, Oxfam, Halerae, Seeds of Life, World Vision, UNPAZ (Faculty of Agriculture), UNTL.

The Ministry of Agriculture and Fisheries is the best suited lead government agency for implementation of this project profile in close collaboration with the Ministry of Infrastructure, which is responsible for water resources management and water supply. Other key stakeholders and interests groups include the EU/GTZ, which is supporting implementation of several phases of the Rural Development Programme, FAO and UNDP, which have been engaging with the GoTL on sustainable land management policy and planning.

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Risks and Barriers: Current agricultural sector approaches promote market orientation based on rice production and a few other high value crops over diversification and building household level resilience. Upland farming systems, which are not so conducive to market-oriented approaches, require additional support as a result. Farmers and local communities are not able to interpret or access up to date weather related forecasts (weekly or seasonal). Collection and processing of weather related data is currently fragmented and there are overlapping mandates between key ministries. There are limited effective cross-ministerial coordinating mechanisms in place to ensure that climate risks can be built into rural development sector strategies.

FINANCIAL RESOURCES

Indicative Budget: (TA and Investment): USD 3.5 million

Component	Cost (USD)
Policy and Planning	0.4 million
Physical investment and demonstration	2.7 million
Awareness and information sharing	0.3 million
Project Management	0.2 million
Total	3.6 million

4.2 Project Profile 2 –Promotion of Integrated Water Resource Management (IWRM) to Guarantee Water Access to People in the Context of Increasing Climate Risks.

RATIONALE

As set out in the main part of the Timor-Leste NAPA document, climate change could result in an increased amount of rain received throughout the year. However, the wet season may be slightly drier and the dry season may be slightly wetter. Rainfall may come in the form of fewer but more intense events. El Niño events, which result in delayed onset of rainfall and less rainfall at certain times of the year, may also become more frequent and severe in effect. This may have far-reaching implications on the incidence of drought, floods and water quality within the context of a sector which, in Timor-Leste, remains largely under-developed. Progressive climate change is also likely to affect the yield of groundwater resources and potential contamination, with significant variation likely from year to year. In coastal areas sea level rise is likely to increasingly affect ground water resources through coastal erosion, surface inundation and seawater intrusion into coastal aquifers.

In relation to water resource management and protection, the NAPA consultations revealed a number of specific concerns, notably the inability to capture and contain intense rainfall events leading to flooding that damages land, crops, water supply schemes, and irrigation systems. This trend is frequently combined with water scarcity resulting from delays in rainfall onset and an extension in the dry season. Consequently, the need for protection of water resources through more integrated and strategic approaches was ranked equal first (1) in the list of NAPA priorities. Priority adaptation measures that emerged from the consultations included the need for protection of critical water sources (such as springs, streams and wells) during extreme events such as floods, as well as improvements in water harvesting and distribution systems to reduce vulnerability during dry season water shortages.

DESCRIPTION

Components	Short-term Outputs	Potential Long-term Outcomes
Policy	<ul style="list-style-type: none"> • Climate risk and vulnerability assessments with a specific focus on drought prone areas. • Groundwater and surface water resource data collection and monitoring. 	<ul style="list-style-type: none"> • Integrated Water Resource Management policy developed based on climate risk information and approaches.
Institutional Development	<ul style="list-style-type: none"> • Establishment of a government-led participatory mechanism for water sector coordination based on IWRM principles, with a specific focus on the agriculture sector. • Capacity development in climate-induced impacts on water resources for policy makers and planners at national and district level. • Control of quantity of water used by industry, and water pollution control standardization in key productive sectors. 	<ul style="list-style-type: none"> • Institutions strengthened for cross-sectoral formulation and implementation of climate resilient integrated water resource management plans, policies and strategies.
Physical Investment and Demonstration	<ul style="list-style-type: none"> • Create and enhance household and village based water harvesting models (capture and storage) and water distribution systems. • Physical protection of critical water sources (springs, streams, wells, etc) to provide safe water supply during climate change extreme events. • Capacity development for ongoing monitoring and maintenance of village and household level water supply systems. 	<ul style="list-style-type: none"> • Improved access to safe water and sanitation under the conditions of changing climate by adoption of new technologies and participatory water management at household and village level.

DEVELOPMENT CONTEXT

Water is a critical resource that is under-developed in Timor-Leste. At the village level, water supply is primarily provided through springs and small scale distribution systems. During the dry season these sources sometimes reduce significantly in flow and this often leads to local communities needing to travel further each day to access alternative sources. Agricultural water is largely provided from surface water and represents a significant constraint on production. Gravity-based irrigation systems are subject to significant seasonal changes in the flow and course of Timor-Leste’s river systems. For example, intake points for these systems frequently have to be re-engineered annually to take into account shifts in the stream bed. Groundwater resources, though available in many locations, are largely underexploited either for domestic or agricultural uses.

At present the government’s main focus is on the provision of urban and rural water supply and sanitation. In rural areas, provisioning is largely contracted out to NGOs and communities. However, these village or multi-village based distribution schemes suffer from limited oversight and

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monitoring, and frequently fall into disrepair. The Ministry of Infrastructure is beginning to engage in water resources management with support from AusAid and the Norwegian Government, including the establishment of a new National Directorate on Water Resources, an assessment of groundwater potential (including hydro-geological mapping) and the development of a water resources policy based on IWRM principles. The proposed project profile is designed to add on to this development baseline and support it in ensuring climate resilience measures are effectively built in.

IMPLEMENTATION

Lead Agency: The Ministry of Infrastructure

Other Key Stakeholders: Ministry of Agriculture and Fisheries, Ministry of Social Solidarity, Ministry of Economy and Development, AusAid, The Norwegian Government, UNICEF, Care International, Water Aid (Australia), USAID, JICA, Caritas, World Vision, CARE, UNFPA, Plan International.

The lead agency for this priority area will be the Ministry of Infrastructure, in particular the National Directorate for Water Supply and Sanitation and the National Directorate for Water Resources Management from MAF. As the lead agency on national disaster management, the Ministry of Social Solidarity has an important role to play in ensuring that measures to secure critical water sources are integrated into community level disaster prevention planning. Other key organizations active in the water resources sector include AusAid, The Government of Norway and UNICEF. The Ministry of Economy and Development is the lead Ministry on Climate Change responsible for overarching NAPA implementation, monitoring and evaluation.

Risks and Barriers: Water resources and water supply issues do not have sufficiently high visibility in government owing to a predominant belief that water is a free resource that is basically available to all people. The National Directorate for Water Resources is newly established and has limited staff and technical capacity. Furthermore, there remains significant work to be done in clearly defining the role of this new Directorate in relation to other institutions involved in water resources management. The Ministry of Infrastructure currently has limited responsibility for maintenance and monitoring of rural/village based water supply schemes. Current water supply legislation may need to be revised to ensure that responsibility is extended to rural areas. Local communities have limited willingness and capacity to operate and maintain community-based waters supply schemes and which regularly fall into disrepair as a result.

FINANCIAL RESOURCES

Indicative Budget: Proposed budget (TA and Investment): USD 3.7 million

Component	Cost (USD)
Policy and planning	0.2 million
Institutional development	0.3 million
Physical investment and demonstration	3.0 million
Project management	0.2 million
Total	3.7 million

4.3 Project Profile 3 – Enhancing Capacity of the Health Sector to Anticipate and Respond to Changes and Reduce Vulnerability of the Population at Risk from Expansion of Climate-related Disease.

RATIONALE The main health sector concerns arising from the NAPA process were linked to expected changes in temperature patterns and the likely increase in intense rainfall events leading to destruction of vital infrastructure, increased incidence of waterborne and vector-borne (dengue and malaria) diseases, and health risks associated with increases in malnutrition, hunger and water shortages. Additional impacts that can be expected include increased respiratory infection and skin diseases associated with decreased access to clean water, and increased UV radiation and heatstroke.

At present the health sector is not equipped to assess the scale of the additional risks from climate change to community health and to adjust its policies and strategies accordingly. Nonetheless, human health-related risks from climate change were ranked as a high priority (priority 3) for immediate action in an assessment that included ministry of health officials as part of the NAPA team Sector Working Groups. There is a specific need to strengthen capacity to detect key climate and health-related linkages and disease incidences, and to ensure that these linkages are reflected in sectoral planning with a number of key ministries covering health, food security, water supply and sanitation and rural infrastructure.

DESCRIPTION

Components	Short-term Outputs	Potential Long-term Outcomes
Policy Reform	<ul style="list-style-type: none"> Review ministry of health sector guidance and standards on respiratory, airborne and vector diseases for integration of climate risk-related factors. National health vulnerability assessment to identify and monitor potential hotspots for climate sensitive disease incidence, particularly malaria and dengue. 	<ul style="list-style-type: none"> Increased health sector understanding and capabilities in integrating climate risk factors into health sector policies, plans and strategies.
Awareness Raising and Demonstration	<ul style="list-style-type: none"> Integrate climate-related health concerns into the CISCa programme 6 steps community health process Strengthen early-warning system (EWS) and public health preparedness at community level in relation to airborne, vector-borne diseases and epidemics with disease surveillance, as well as nutrition status. Targeted disease prevention measures piloted at community level to promote awareness and understanding. 	<ul style="list-style-type: none"> Improved community awareness and understanding and preparedness of health related climate risks.
Institutional	<ul style="list-style-type: none"> All senior- and mid-level health sector 	<ul style="list-style-type: none"> Improved coordination and

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and Capacity Development	<p>policy makers and planners trained in detecting links between climate change and disease incidence.</p> <ul style="list-style-type: none"> • Establish mechanism between key ministries for joint planning to address health sector climate risks. • Integration of climate and health related linkages in school and tertiary education curriculums. 	<p>planning between the Ministry of Health and other key sectors for early detection and response to climate-related human health risks.</p>
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DEVELOPMENT CONTEXT

The Timor-Leste Health sector Strategic Plan (2008-2012) states that maternal and child mortality and morbidity indices remain unacceptably high, that around half of all children are malnourished, and that the burden of communicable and vector-borne diseases, especially respiratory infections, tuberculosis, diarrheal diseases and malaria, remains heavy. Community health services, which are managed at district level, are a critical element in implementing the HSSP given that three quarters of the population live in rural areas. A key element in the provision of community health is the Servisu Integrado Saúde Comunitária (CISCa), which aims to provide integrated health services at the community level organized around six key elements consisting of: 1) population registration, 2) nutrition assistance, 3) maternal and child health, 4) personal hygiene and sanitation, 5) health care services, and 6) health education. This project will add to the existing base-line and address specific vulnerabilities arising as a result of climate change.

IMPLEMENTATION

Lead Agency: The Ministry of Health

Other Key Stakeholders: Ministry of Infrastructure, Ministry of Agriculture and Fisheries, WHO, UNICEF, UNFPA, Red Cross (TL).

The Ministry of Health is the appropriate lead agency for implementation of this priority, specifically the Department of Environmental Health and Department of Community Health. The proposed implementation modality would be closely aligned to the provision of community health services based on the CISCa model. Access to safe water supply and nutrition are both critical elements in maintaining a functioning system and require close coordination between the health ministry and relevant directorates within the Ministry of Agriculture & Fisheries, and the Ministry of Infrastructure.

Risks and Barriers: The complexity of identifying a clear and causal relationship between climate hazards, nutrition and disease incidence. The tendency for community health programmes to focus on immediate concerns when faced with overwhelming need, leading to a response-based approach rather than preventative measures.

FINANCIAL RESOURCES

Indicative Budget: Proposed budget (TA only): 1.7 million

Component	Cost (USD)
Policy reform	0.2 million
Institutional and capacity development	0.2 million
Awareness raising and demonstration	1.2 million
Project Management	0.1 million
Total	1.7 million

4.4 Project Profile 4 – Improving Institutional, Human Resource Capacity & Information Management in the Disaster Sector in Relation to Climate Change Induced Risks at National, District and Community levels.

RATIONALE

The NAPA process has highlighted concerns that natural disasters (in particular flooding and landslides) already constitute a significant development risk that become more frequent, widespread and intense across the country, with the potential to cause significant further destruction of property and livelihoods as well as loss of life. Specific issues raised during national- and district-level consultations included the potential for increases in injury and death as a result of high-intensity rainfall events, impacts on physical infrastructure from landslides reducing access to key services (power, health, water and transportation), and increases in forest fires leading to loss of assets and life. While the Government’s focus is primarily on recovery and response measures, a climate risk management approach now needs to be put in place with a greater focus on prevention through improved management of natural resources such as water, forests and land. Such measures are outside of the standard remit of national disaster management authorities, requiring improved cross-ministerial knowledge sharing, coordination, and joint planning. Specific measures are also required to strengthen early-warning systems, particularly in relation to food security, and to put in place a combination of planning, engineering and design measures to reduce risk.

DESCRIPTION

Components	Short-term Outputs	Potential Long-term Outcomes
Policy Reform	<ul style="list-style-type: none"> Integrate the National Disaster Risk Management Policy principles into key GoTL sectoral-policies with a specific focus on climate risks Awareness raising for senior officials and policy makers in key sectors on linkages between disaster risk management and climate-related risks. Develop government strategies in responding to drought. 	<ul style="list-style-type: none"> Improved disaster prevention through expanded DRM within key sector policies, plans and budgets that incorporate climate change risks and provide incentives for lower-risk development.
Climate Risk Planning and Management	<ul style="list-style-type: none"> Data collection and analysis on incidence of key climate-related disaster events (floods, landslides, storms, droughts and forest fires). Institutional review and strengthening of national early-warning systems with a focus on climate-related risks in areas of high vulnerability. Community level mapping of high vulnerability areas to risks of floods, storms and fire and integration into local disaster risk management plans and responses. 	<ul style="list-style-type: none"> Early warning systems for floods, droughts, landslides and fires strengthened by incorporating and communicating climate risk information.

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<p>Investment and Demonstration Activities</p>	<ul style="list-style-type: none"> • Identification, field demonstration and appraisal of targeted climate risk reduction measures: <ul style="list-style-type: none"> - Improved settlement construction, - Livelihoods protection, - Physical infrastructure, - Improved land and water management practices. • Training programme for district and community level professionals to support strengthened planning competencies for climate risk reduction. 	<ul style="list-style-type: none"> • District planners and communities aware of and putting into practice improved and cost effective climate-related disaster prevention measures through local-level demonstration.
<p>Institutional Development</p>	<ul style="list-style-type: none"> • Promote NDMD-led coordination and information sharing for disaster risk management and climate risk reduction with key ministries and at district level, including early warning and response. • Improve capacity at district level to build community-level awareness, disaster preparedness and response capacity. • Establish relations with regional institutions to promote information exchange and joint action at national and district levels in Timor-Leste. 	<ul style="list-style-type: none"> • National and district institutions are better able to provide a coordinated response in disaster risk reduction through the integration of climate risk information.

DEVELOPMENT CONTEXT

Timor-Leste published its National Disaster Risk Management Policy in 2008. The Policy recognizes hydro-meteorological and climate-related hazards in its overall framework as well the potential impacts that these hazards entail on social, economic, physical and environmental spheres. The National Disaster Management Directorate (NDMD) within the Ministry of Social Solidarity is responsible for the coordination of related activities across all key sectors of government. However, capacity constraints mean that its main focus at present is on the delivery of post-disaster response rather than prevention and preparedness. With support from the IOM/AusAID Disaster Risk Reduction (DRR) project, the Directorate is implementing a programme focused on strengthening coordination of sub-national disaster risk reduction, including linkages between district and national levels. The approach includes community training and awareness at sub-district (Suco) level including elements of community-based vulnerability mapping. This exercise is coordinated by District Disaster Management Committees and has been completed in 14 out of 65 sub-districts to date. The Directorate is now seeking to strengthen its capacities in information management, vulnerability mapping and in the establishment of early warning systems for vulnerable communities.

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Additional planned interventions include a UNDP-supported disaster risk management programme to strengthen capacities at community, district and national levels in prevention, preparedness and response. This also includes a regional initiative to strengthen the links with regional centers such as RIMES⁶ in order to provide up-to-date information on hydro meteorological hazards, as well as capacity development and technical support in analyzing weather and extreme event-related risks.

These initiatives, collectively, provide an important baseline against which additional and specific measures to address increased climate-related risks can be designed and implemented, so as to induce a shift towards a comprehensive climate risk management approach over the immediate to medium term.

IMPLEMENTATION

Project Duration: 4 years

Lead Ministry: The Ministry of Social Solidarity

Other Key Stakeholders: Ministry of Agriculture and Fisheries, Ministry of Economy and Development, Ministry of Infrastructure, Red Cross (TL), IOM, UNDP, FAO, UNICEF, UNPAZ (Faculty of Agriculture), Lao Hamutuk, Oxfam, Plan International, Care International.

The Ministry of Social Solidarity is the appropriate lead agency for this priority area, specifically the National Directorate for Disaster Management. The National Directorate's approach and general policy is to integrate disaster management principles into the plans and programmes of key service delivery ministries, with a focus on district and sub districts. Therefore, this priority project will necessarily require a high level of cross-sectoral coordination, particularly in the natural resource sectors of forest, water and land.

Risks and Barriers: The institutional mandate of the Ministry of Social Solidarity in relation to disaster risk management needs further clarification. The current focus of disaster risk management in Timor-Leste is on recovery rather than preparedness, and on disaster events rather than longer-term environmental change. There is an over-reliance on traditional coping strategies for dealing with disaster events and limited innovative thinking in the development of new approaches. There is limited capacity to absorb new roles and responsibilities at different levels within government, as well as capacity development 'fatigue' in many sectors.

FINANCIAL RESOURCES:

Indicative Budget: Proposed budget (TA and Investment): USD 2.6 million

Component	Cost (USD)
Policy reform	0.3 million
Disaster prevention planning	0.4 million
Investment and demonstration activities	1.4 million
Institutional development	0.3 million
Project management	0.2 million
Total	2.6 million

⁶ Regional Integrated Multi-Hazard Early Warning System, based in Thailand.

4.5 Project Profile 5 – Restoration and Conservation of Mangrove Ecosystems and Awareness Raising to Protect Coastal Ecosystems Exposed to Sea Level Rise.

RATIONALE

Timor-Leste occupies the eastern half of Timor Island and is located within the Coral Triangle, a region of globally significant marine biodiversity with the greatest diversity of coral and reef fish in the world. Due to a small landmass dominated by steep, central mountain ranges the majority of the population lives on or near the coastal zone and are highly dependent on coastal and marine resources for life and livelihoods. With a coastline of narrow but diverse, high-quality marine and coastal zone environments extending for over 700km (including significant and diverse mangrove ecosystems), a potential marine exclusive economic zone (EEZ) of approximately 75,000km², extensive deep sea fisheries and offshore oil and gas reserves, the coast and marine zone is of high economic and environmental importance nationally as well as at the local level. Widely accepted as being one of the Nation's most valuable assets, coastal zone resources are expected to contribute significantly to economic development. The Government, with international donor and investment support, is committed to developing this zone, including artisanal and commercial-scale fisheries, tourism and recreation, and in particular, expansion of urban centers, free-trade zones, petroleum processing centers and on-shore petroleum exploration.

Although considered to be in excellent health, the narrow extent of these productive inshore marine/coastal ecosystems in Timor-Leste imposes strong limits on available marine resources and makes them highly vulnerable to the impacts of human resource use, and climate-related impacts. Already the extent of mangroves has reduced substantially, increasingly so in recent years, mainly via deforestation for timber and fuel wood, destructive fishing, inappropriate harvesting technologies, some limited clearing for aquaculture and salt production, and significantly from land-sourced impacts such as siltation from land and water degradation in adjoining catchments. Pressures on coastal ecosystems are expected to increase with the hoped-for economic development and all of these threats are exacerbated by climate-related events.

The expected impacts of climate change on coastal and inshore marine ecosystems include reduced health, diversity and productivity, loss or destruction of coastal habitats and species, destruction of freshwater and shallow marine habitats, physical destruction of coral reefs and mangroves, beach erosion, loss of breeding and nesting habitats, smothering of seabed habitats and vegetation through increased erosion, soil and water salinity, physical destruction by increased river flows and run-off, flooding and sedimentation.

The NAPA consultations emphasized the integrated nature of natural systems from catchment to sea and the requirement for integrated and collaborative management approaches to rehabilitate and protect catchments and coastal ecosystems and create resilience against the impacts of climate change. Consequently, the need to rehabilitate and strengthen mangrove ecosystems to protect coastal habitats was highly prioritized by stakeholders and experts during the NAPA consultations in recognition of the vital role and function that they play in coastal zone ecosystems and functioning and protection.

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DESCRIPTION

Component	Short-term Outputs	Potential Long-term Outcomes
Policy Development	<ul style="list-style-type: none"> • Policy makers and planners at national and district level are better informed of the value of coastal ecosystems as a buffer against climate risks. • Establish a platform for policy dialogue on critical coastal zone management and climate risk linkages. • Emerging coastal zone management policies address increasing climate-related risks through appropriate regulatory and market-based measures and incentives. • Develop national management plan and implementation framework for integrated coastal zone protection and management. Include identification and mapping of critical coastal ecosystems for maintaining climate resilience; economic valuation of coastal ecosystems in reducing climate risks; incorporation of whole-of-catchment principles to ensure reduction in upstream impacts on coastal zone. 	<ul style="list-style-type: none"> • Policies covering coastal zone development promote reduced vulnerability of coastal populations and critical ecosystem resources to climate risks. (Including appropriate state budget allocations to coastal zone protection, urban planning and zoning).
Capacity Development and Planning	<ul style="list-style-type: none"> • Awareness raising and capacity development for planning and operational level stakeholders (government and community representatives) on ecology, benefits, vulnerabilities and management of mangrove ecosystems, technical aspects of rehabilitation and sustainable management, etc. • Review existing and traditional knowledge-based coastal protection systems and consider how to link this with scientific expertise. • Establish a vulnerability-based prioritization system for identification of investments that promote ecosystem based coastal protection. 	<ul style="list-style-type: none"> • Improved management and local-level planning processes in coastal districts that integrate and prioritize investments in ecosystem-based coastal zone protection measures including incorporation of climate change vulnerabilities.
Physical Investment and Demonstration	<ul style="list-style-type: none"> • Develop a national programme of protection and rehabilitation of mangrove ecosystems in priority areas to protect economic, social and environmental assets against climate risks (involving all stakeholders including local communities, private sector and government). • Promote measures to diversify household 	<ul style="list-style-type: none"> • Healthy mangrove ecosystems functioning to protect coastal zone resources in areas of high risk to impacts of climate change with local communities able to

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	<p>incomes in coastal areas to reduce pressure on vital and protected ecosystems. High priority given to the development of fuel wood lots; incentives-based approach to include development of alternative livelihood activities including small business approach such as nature-based tourism.</p>	<p>identify and implement appropriate and cost effective coastal protection measures that also promote income diversification.</p>
<p>Awareness and Information Sharing</p>	<ul style="list-style-type: none"> • Awareness raising at community level to understand the benefits of functioning coastal/mangrove ecosystems for sustainable livelihoods and in alleviating climate-related risks and the impacts of destructive and unsustainable methodologies. • Targeted technical scientific, socio economic and socio-cultural research to support strategic planning and management planning. Participatory research process using appropriate methodologies as a good starting point for other research. Higher scientific knowledge whilst valuing local knowledge. 	<ul style="list-style-type: none"> • Improved coastal zone management by local communities who are aware of climate-related risks of human livelihood activities and have adopted appropriate alternative methods with the support of policy officers, planners and implementers who are aware of and incorporate local data into climate risk adaptation planning and coastal zone planning and management.
<p>Institutional Development</p>	<ul style="list-style-type: none"> • Organic laws – clarify and institutionalize mandates, policy, operational roles and responsibilities between ministries and develop an inter-ministerial operational mechanism for coastal zone policy development and management policy. Also review the use of local/traditional laws. 	<ul style="list-style-type: none"> • Institutions strengthened for effective, climate-resilient, cross-sectoral strategic planning, implementation and management of coastal zone.

DEVELOPMENT CONTEX

Policy, legislative and regulatory frameworks governing coastal zone management are absent or incomplete. Policies that do exist are primarily being developed for other purposes but also have the potential to impact on the coastal zone, for example, a number of fisheries-related laws, the national forestry policy and strategy, legislation and regulations on protected areas and on the prohibition of commercial logging. Historically, conservation and management support for the coastal ecosystems has been limited. However, this has increased with the establishment of the Coral Triangle Initiative, in addition to existing research-related support programmes and various support of the fisheries sector over recent years.

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IMPLEMENTATION

Project Duration: 5 years

Lead Agency: The Ministry of Agriculture and Fisheries

Other Key Stakeholders: The Government (Ministries of Economy and Development (Secretary of State for Environment), State Administration, Infrastructure, Tourism, Trade & Industry, Secretariats of State for Energy Policy and for Natural Resources), national civil society and institutions (Fundacao Haburas, CINAF, PERMATIL, HASATIL, National University), international support, Coral Triangle Initiative Support Programme, FAO, ADB, ATSEF, PEMSEA/ATSEA, and various international research institutions.

The Ministry of Agriculture and Fisheries (MAF) is the best placed government agency to lead this project, specifically with joint management between the National Directorate of Forestry and National Directorate of Fisheries and Aquaculture. Other key stakeholders are those already operational in the coastal sector.

Risks and Barriers: Currently institutional mandates, roles and responsibilities are unclear to the extent that there are no clear lines of authority leading to *ad hoc* and ineffective coastal zone management. There is a lack of budget commitment in favor of perceived poverty-related economic imperatives caused by a lack of technical awareness at leadership levels of the ecological functioning of coastal ecosystems, and the longer-term impacts of unsustainable management. Insufficient data and technical information on socio-economic, scientific and site-level conditions also reduces capacity to effectively design, plan and manage coastal ecosystems in response to the local situations. Integrated 'catchment-to-sea' policy and management approaches are also critical to minimize land-sourced climate impacts on coastal ecosystems.

FINANCIAL RESOURCES

Indicative Budget: (TA and Investment): USD 3.0 million

Component	Cost (USD)
Policy development	0.5 million
Capacity development and planning	0.3million
Physical investment and demonstration	1.5 million
Awareness and information sharing	0.5 million
Project Management	0.2 million
Total	3.0 million

4.6 Project Profile 6 – Improved Strategic Planning, Institutional Frameworks and Methodologies to Promote Sustainable, Integrated Livestock pProduction under Climate Change Conditions.

RATIONALE

Subsistence agriculture and food production are the primary economic activities in Timor-Leste, engaging around 80% of the active workforce, though the steep topography and extensive soil degradation represent clear limits on productivity. The livestock sub-sector is of particular importance to rural communities whereby the majority of rural households own livestock under small-scale, backyard, subsistence mixed farming systems. Livestock are the most important currency of wealth for rural people, as livestock (not including poultry) are considered household assets to be traded, sold or exchanged only where necessary for cash or in cultural or ceremonial exchange.

In Timor-Leste, almost all livestock are kept under traditional management systems where animals roam freely, grazing on natural fodder, and there are few modern inputs or production methods. Productivity levels are low for the prevailing conditions and limited value is added to the sector as derived products or beyond the farm or household. Limited opportunities for profitable sale, difficult market access, diseases, lack of husbandry, animal hygiene health and nutrition knowledge remain major challenges. Veterinary services are limited, mostly provided by a declining system of partly-contracted village livestock workers (VLW) with limited resources and capacity. Some larger-scale cattle production occurs in higher rainfall areas in districts bordering Indonesia to service a live-export cattle trade. Although the scale of this trade is very small (2-3,000 head per year), there is potential for growth, in response to increasing demand in Indonesia's major cities, via intensive, integrated farming systems.

In line with existing development challenges facing livestock, the experts in the Sector Working Groups during the NAPA consultations recognized and highlighted the extreme vulnerability of this sub sector to climate hazards that will further threaten an already fragile system. Possible impacts include: the weakening of immune systems increasing vulnerability to disease, the emergence of new pathogens increasing incidence of disease, trans-boundary quarantine and bio-security risks, reduced fertility, reduced availability and nutritional value of fodder, and increased shortages of water. Post-production risks will also arise with increases in temperature and humidity impacting on slaughter, hygiene, processing, and storage and transport systems. The negative impacts that freely roaming livestock (primarily small and large ruminants and pigs) have on the natural environment and the role they play in exacerbating the land and water degradation impacts of climate change was also recognized.

This priority was acknowledged to have linkages to priority areas 1 and 2 (food security and land rehabilitation and water, respectively) but it was agreed that the importance of the livestock sub-sector and the particular threats to it are critical and specific enough to warrant urgent and targeted interventions for climate change adaptation, specifically in relation to animal health, food and nutrition. Accordingly, it is listed it as a priority to be addressed under the NAPA.

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DESCRIPTION

Component	Short-term Outputs	Potential-long Term Outcomes
Policy and Planning	<ul style="list-style-type: none"> • Vulnerability assessment of the traditional livestock sector to climate-related risks completed. • Institutional and policy review of existing and draft frameworks for livestock and related sectors (agriculture, water, forestry) to integrated climate risk and impact factors affecting traditional livestock farming systems. • Strengthen capacity of policy makers, planners and operational staff to understand and incorporate climate-related risks into planning and design of integrated livestock management and production. 	<ul style="list-style-type: none"> • Current policies and planning instruments governing the management of livestock clearly recognize climate risk factors and provide a clear framework for adaptation planning.
Physical Investment and Demonstration	<ul style="list-style-type: none"> • Develop, demonstrate and implement small-scale ,integrated, intensive animal agribusiness management systems (with links to agroforestry, sustainable energy, waste management, health and disease control) to reduce climate risks and improve productivity, breeding, health and disease control; improved marketing and development of secondary processing and marketing). • Improved biosecurity measures at the farm/household level through improved veterinary services and establishment of a self-monitoring early warning system with livestock owners at the farm and neighborhood level. 	<ul style="list-style-type: none"> • Resilience of livestock management systems to climate risks strengthened through applied and field tested measures supporting households in at least seven districts.
Capacity & Institutional Development	<ul style="list-style-type: none"> • Programme at central and district level to increase capacity of livestock and quarantine staff to understand, detect and respond to exacerbating climate-related risks in all aspects of disease control; monitoring, response, health management programmes, etc. • Establish institutional and household mechanisms for disease and quarantine communication and early-warning systems. • Clear framework for coordination between related sectors and for consultation and communication between government operational staff and communities to improve access and service delivery to local 	<ul style="list-style-type: none"> • The Secretariat of State for Livestock and National Directorate for Quarantine Services actively participating in cross-ministerial initiatives on climate risk management and able to actively engage farmers in related research and policy oriented discussion.

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	communities and emergency response.	
Research & knowledge	<ul style="list-style-type: none"> • Targeted research to identify likely impacts of climate change on the livestock sector to enable effective targeted management and responses. • Develop networks to link veterinary staff to targeted knowledge sources (individuals, organizations and institutions) for support. 	<ul style="list-style-type: none"> • Staff and stakeholders understand climate-risks and exacerbating factors and respond appropriately to reduce the vulnerability of the livestock sector.

DEVELOPMENT CONTEXT

Policy, legislative and regulatory frameworks are absent or incomplete, and several remain as 'final drafts'. Development support in the sector has been small as compared with the irrigated farming sector. Café Cooperativa Timor (CCT) with funding from USAID implements a cattle fattening project via intensive, integrated farming techniques to support growth into the Indonesian market. FAO, via AusAID funding, is supporting a three-year Bio-security Strengthening Project, originally in response to the global HPAI epidemic but with wider impacts. FAO have recently commenced the seven-year *Strategic Programme for Promoting Agricultural Growth and Sustainable Food Security in Timor-Leste*, which will strengthen farmer support services through continued support of the Bio-security Strengthening Programme, and support improvement of farm capacity, household economies, and sustainable livelihoods via improved community-based animal health systems and animal feed production technologies.

IMPLEMENTATION

Project Duration: 4-5years

Lead Agency: The Ministry of Agriculture and Fisheries, Secretariat of State for Livestock, National Directorate for Livestock

Other Key Stakeholders: FAO, NCBA/USAID, Fuiloro Agricultural College, UNTIL, other MAF Directorates (Quarantine Service, Forestry), Ministry of Health.

The Ministry of Agriculture and Fisheries, National Directorate for Livestock and Veterinary Science will be the lead agency for this project in collaboration with National Directorate for Quarantine (transboundary biosecurity, the National Directorate for Forestry (agroforestry, fuel wood and integrated catchment management) and the Secretary of State for Energy Policy (biogas, etc). Other key organizations will be FAO (Bio Security Project) and CCT (cattle fattening programme). The Ministry for Economy and Development is the lead Ministry on climate change and has overarching responsibility for the implementing, monitoring and evaluating NAPA.

Risks and Barriers: The predominance of traditional systems of open-range livestock management, which are suboptimal for productivity and vulnerable to the risk of disease and climate-related impacts, and which are in addition to exacerbating land and water degradation impacts of unsustainable land and water management that are already exacerbated by climate-related hazards. Low government and donor investment in the in the livestock sector due to competing priorities has resulted in an inadequate livestock farmer support system that is reliant on partly-trained and partly-supported Village Livestock Workers (VLWs) in a fee-for-service system to fulfill all on-farm animal health services. This system is itself now in decline due to a lack of resources and support, and the inability of many farmers to be able to afford these services. There are also limitations in cross-ministerial coordination and planning mechanisms to ensure climate risks will be built into rural development.

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FINANCIAL RESOURCES

Indicative Budget: (TA and Investment): USD 2.3 million

Component	Cost (USD)
Policy and Planning	0.2 million
Physical investment and demonstration	1.5 million
Capacity and institutional development	0.4 million
Project Management	0.2 million
Total	2.3 million

4.7 Project Profile 7 – Review and Revise Legislation, Regulations and Standards to Enhance Climate Change Resilient Infrastructure.

RATIONALE

In 2008 extreme monsoonal storms led to high winds, flooding and landslides that impacted heavily on agriculture and destroyed schools, roads, bridges, markets, water pipelines, springs, and health clinics. The human and security impacts were felt in all 13 districts. The Government, through the Ministry of Social Solidarity, responded and provided some measure of support, although this was not sufficient given the scale of the damage. A number of lives were lost and the Government Timor-Leste is now more aware of the importance of reducing the risk of such climate induced losses in the future.

Most importantly, there is now greater understanding within government of the need for a more integrated response including a programme of reconstruction founded on improved construction standards and stronger application of relevant standards. Furthermore, there is recognition that reconstruction in the infrastructure sector should include a number of other related principles, such as environmental sustainability, human health, and the need to conserve human life and critical assets. For example, a high quality and appropriate system of irrigation can support high rice production, but should be combined with early-warning systems that can help the Ministry of Health prevent the spread of airborne and vector diseases.

In order to support this idea, the Government is aware of the need for improved technical standards for materials and equipment, as well as adequate planning, monitoring and evaluation in order to build climate-resilient infrastructure. Existing infrastructure regulations and standards are Indonesian and do not address the impacts of climate change. A number of draft infrastructure regulations have been prepared with support from the UN and other donors.

DESCRIPTION

Activities	Short-term Outputs	Potential Long-term Outcomes
Policy Reform and Legislation Development	<ul style="list-style-type: none">Review and gap analyze existing and draft laws and regulations and standards for infrastructure development.Prepare detailed technical advisories on the reform of key legal instruments governing	<ul style="list-style-type: none">National legislation and standards covering infrastructure development integrate climate proofing approaches in selected

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	<p>the design and construction of infrastructure in key vulnerable sectors (roads, bridges, water supply schemes, schools, health centers and housing).</p> <ul style="list-style-type: none"> • Research climate resilient building materials and standards, for example cement, asphalt and metal. 	<p>critical sectors (roads, bridges, water supply, waste management, coastal protection).</p>
Institutional Development	<ul style="list-style-type: none"> • Establish an urbanization research centre to identify vulnerable areas (especially coastal) to formulate climate resilient urban & rural planning and seasonal early-warning system. • Establish a research or study centre to formulate climate resilient construction methods, standards and materials, and to learn international standards and building materials tests. • Train national authorities and staff on climate resilient infrastructure development both in urban and rural context. • Establish cross-ministerial technical committee on infrastructure standards and codes to provide advice to key decision makers on legal reform. 	<ul style="list-style-type: none"> • Institutional structures and mechanisms in place to technically review, assess, and advise on the integration of cost effective climate resilient methods and standards into key sectoral legislation.
Pilot Testing and Demonstration	<ul style="list-style-type: none"> • Review existing practices based on field investigation and document current standards and failure rates in the existing infrastructure stock. • Implement pilot projects in at least six districts to field test and develop new resilient building methods and standards (cyclone proofing, slope stabilization, flood risk construction standards). • Document best practices for national review, consultations and adjustment of existing infrastructure codes and standards, and identify entry point for the review of other key sectoral legislation (water and agriculture). 	<ul style="list-style-type: none"> • Improved understanding of cost effective methods to climate proof critical infrastructure based on physical demonstration in key sectors (roads, bridges, housing, water supply schemes).
Awareness and Information Sharing	<ul style="list-style-type: none"> • Information campaign on climate resilient urban management. • Promote the use of climate resilient building material including local plantations etc. 	<ul style="list-style-type: none"> • Effective engagement and cooperation among key ministries (infrastructure, agriculture and water), other development actors

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- National and regional awareness measures on climate risks, laws and legislations.

and community on the development of climate resilient standards for infrastructure.

DEVELOPMENT CONTEXT

The Ministry of Infrastructure is composed of four divisions, namely transportation and telecommunication, water and electricity, reconstruction, road and flood control, and laboratory and research. Infrastructure investment is a key priority for Timor-Leste; with the Government declaring both 2009 and 2010 to be the 'Year of Infrastructure'. USD\$70million was spent in 2009 for hundreds of small-scale projects, most of which were implemented over a three-five month period. These projects involved the Ministries of Health, Education, and Infrastructure, as well as the Secretariat of State for Security and Culture, Youth and Sport. During 2010, the Government supported a local development programme focusing on infrastructure in all 13 districts.

In addition, the Ministry of Health, the Ministry of Infrastructure and the Ministry of Finance have all taken the initiative to develop national legislation to improve regulations on infrastructure that include addressing climate risks in the long term. However, there has been limited follow up to this work and the existing Indonesian regulations do not address climate-related risks. There is an immediate need for Timor-Leste to review the existing infrastructure-related laws, regulations and standards and to enhance climate change resilience as a basis for improving the overall legal foundation for national development. This proposed work also relates closely to Project Profile 2 on water resource management and protection, and Project Profile 3 on strengthening capacity and resilience of the community health sector.

IMPLEMENTATION

Project Duration: 3 years

Lead Agency: The Ministry of Infrastructure

Other Key Stakeholders: Ministry of Infrastructure, Ministry of Agriculture, Fisheries and Forestry, Ministry of Health, Ministry of Social Solidarity, FAO, WHO, ADB, The World Bank, Oxfam International, Care International, HASATIL, Permatil, and Haburas Foundation.

Risks and Barriers: The lack of legal experts on international standards and business ethics in order to support the Ministry of Infrastructure, other relevant ministries and the Council of Ministers to review existing Indonesian laws and to produce new legislation that will enhance climate change resilient infrastructure. Limited integrated inter-ministerial coordination to ensure effective development planning, strategies and implementation, which should be based on climate vulnerability assessments and the application of new building standards and codes.

FINANCIAL RESOURCES

Indicative Budget: USD2.0 million

Component	Cost (USD)
Policy Reform & Legislation Development	0.3 million
Institutional development	0.2 million
Pilot testing resilient materials	0.9 million
Awareness and information sharing	0.4 million
Project management	0.2 million
Total	2.0 million

4.8 Project Profile 8 – Support to the Ambitious National Poverty Reduction Target (cf. Draft Timor-Leste Strategic Development Plan 2011-2030) in Relation to the Expected Increased Storm Intensity at Sea by Improving Capacity to Forecast and Adapt Offshore Oil and Gas Infrastructure to Withstand Strong Storms and Waves.

RATIONALE

During the NAPA process, many of the working groups and those consulted in district consultations, voiced their concern at impacts they were experiencing due to the increasing intensity of storms. Concern was voiced across the Sector Working Groups as to the significant impact that intense storms can have in terms of damage caused to both the natural environment and man-made infrastructure. The water sector for example was concerned about damage to water distribution, the food security sector were concerned about damage to crops and on-farm infrastructure, and the biodiversity sector noted how more intense storms could have severe negative impacts mangroves and forests.

The one impact that caused most concern was raised by the infrastructure working group and this related to the potential impacts on the offshore oil and gas industry. Although this was not raised as an issue of concern at the district-level consultations, during the prioritization workshop there was much discussion about what specific infrastructure areas should be prioritized. Ultimately, it was felt that the offshore oil and gas infrastructure should be a priority area. The background to this concern relates to the central role that is foreseen for the Oil and Gas Industry in driving Timor-Leste’s Strategic Development Plan 2011-2030. Indeed the draft SDP 2011-2030 identifies the Petroleum sector as one of the key sectors from which further economic growth will be stimulated. The potential for the sector to contribute in building the foundations of a viable, sustainable and vibrant economy, which will provide substantial revenues to be invested in the people and infrastructure of the country, is clearly set out in the draft SDP.

Concern has been raised throughout the NAPA process at the potential impact that an increase in storm intensity could have in derailing such investment in the population. It is felt that due to the ambitious poverty reduction targets that have been set by the Government, based on the projected output of oil and gas production, the responsibility for ensuring the protection of the infrastructure supporting the delivery of these targets lies with the Government. In addition, revenue projections and subsequent investment plans are dependent on attracting sufficient private sector investment for the development of the oil and gas industry. By offering a more secure operating environment, such investment will be further encouraged.

DESCRIPTION

Component	Short-term Outputs	Potential-long Term Outcomes
Policy and Regulatory Reform	<ul style="list-style-type: none"> • Review of current national and relevant international regulations and standards governing the construction, operation and maintenance of offshore and onshore oil and gas installations. • Review existing risk assessment, risk management and contingency measures in relation to additional risks from storms, high winds and wave action. 	<ul style="list-style-type: none"> • Policies, regulations and standards governing the oil and gas sector (both onshore and offshore) fully integrate climate risk factors.

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	<ul style="list-style-type: none"> • Identify planning, management and technical measures to strengthen the resilience of key policies and regulations 	
Awareness and Information Sharing	<ul style="list-style-type: none"> • A method of collecting, storing and making use of data for effective and timely decision making developed. • Data collected used as an input for sectoral planning. • Establish emergency plans and teams to respond in a timely manner. • Information dissemination of early-warning system from NDMD in place to ensure oil and gas infrastructure is adequately protected. 	<ul style="list-style-type: none"> • Improved climate risk information relevant for the oil and gas sector developed and disseminated. Adequate plans and team are set in place to address potential issues.

DEVELOPMENT CONTEXT

As noted above, the oil and gas sector is viewed as a main driver for Timor-Leste's future development and poverty reduction strategy. Oil and gas earnings of Timor-Leste jumped from around \$141 million in 2004 to around \$2,280 million in 2008. As of 2010, Timor-Leste's non-oil GNP is approximately \$700 per capita and the oil GNP is approximately \$1,800. Oil GNP rose roughly tenfold, and non-oil GNP rose by approximately 1.7-fold since 2004. The result is a country that has a middle-income GNP, of approximately \$2,100 per capita, yet with living standards still of a low-income country, roughly at \$600 per capita. The main reason is that Timor-Leste's oil wealth has not yet been significantly invested in the non-oil economy, and consumption of oil earnings have remained limited (roughly one quarter of the annual oil revenues). A major aspect of the draft Strategic Development Plan 2011-2030 which is expected to be approved shortly, is to invest oil revenues in the economy, in order to boost living standards, non-oil GNP per capita, and productivity.

IMPLEMENTATION

Project Duration: 2 years

Lead Agency: The Ministry of Infrastructure and State Secretariat for Natural Resource Management under the Office of the Prime-Minister

Other Key Stakeholders: Ministry of Social Solidarity, Private Sector, Ministry of Economy and Development.

The Ministry of Infrastructure is the best suited lead government agency for implementation of this project profile given its daily work on infrastructure. The State Secretariat of Natural Resource Management will however also need to be closely involved.

Risks and Barriers: Low public support for this activity that might be perceived as being of limited direct consequence to vulnerable communities. Only insufficient climate-related data may be available to make a clear risk-based case for establishing additional contingencies for the oil and gas sector.

FINANCIAL RESOURCES

Indicative budget: (TA and Investment): USD 1.1 million

Component	Cost (USD)
Policy and Regulations demonstration	0.5 million
Awareness and information sharing	0.5 million
Project Management	0.1 million
Total	1.1 million

4.9 Project Profile 9 – National Institutional Capacity Development to Build and Enhance Timor-Leste’s Capacity to Coordinate/Integrate Climate Change into Strategic Planning in Moving Towards Sustainable Development and Poverty Reduction.

RATIONALE

Throughout the Timor-Leste NAPA process, stakeholders from across the Government, civil society, private sector, bilateral and international organizations identified capacity within the country as a major constraint in terms of adequately addressing urgent and immediate needs relating to climate change adaptation. This was evident during the first round of sectoral workshops in May/June 2010 as set out in Chapter 5 of the NAPA but was strongly emphasized during the second round of workshops in August 2010. Some of the concerns raised were as follows:

- Sector Working Groups were concerned at the unavailability of data and analysis upon which adaptation decisions could be effectively made, for example, the water group pointed to the absence of reliable meteorological data as posing a challenge in their sector.
- All working groups identified the need for ministries and departments to receive ongoing and targeted support in adapting work plans to take account of climate change. The Food Security working group spoke of the need of building institutional capacity to embrace changes required to manage climate change.
- A lack of knowledge amongst key ministry staff on climate change impacts and the inability to integrate new information into work-plans was stressed as a constraint. All sectors recognized the potential for each and every sector to learn from other countries in the region.
- A number of working groups voiced a concern regarding the lack of capacity amongst communities to adapt current systems and practices to likely changes. The working group on Forestry, Coastal Ecosystems and Biodiversity for example identified a gap in terms of the capacity of forest managers and farmers in identifying areas of concern to target. The Health Working Group emphasized local leadership and children as an important target audience as a gateway to the wider public.
- All working groups pointed to the absence of coordination between line ministries in order to adequately tackle the issue. For example, the Water Group identified the need for national coordination on water management drawing on cooperation between those responsible for water and sanitation, power, health, agriculture and flood control. The working group on Forestry, Coastal Ecosystems and Biodiversity recommended a role for a national cross-sectoral climate change taskforce in coordinating such cooperation. Research was pointed to on several occasions as an important area for joint collaboration – the health sector in particular placed considerable emphasis on this point.

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During the prioritization workshop in September 2010, participants and representatives from across all sectors agreed that the need to develop capacity was common to all sectors and that it should be tackled in a comprehensive way in parallel to the priority thematic areas identified during the process. In particular, they felt that solid coordination and backstopping among the various lead agencies would be essential for the effective implementation of the NAPA.

The abovementioned concerns raised by the Sector Working Groups are closely linked to the capacity constraints identified by GoTL and UNDP in the development of the National Capacity Self Assessment, finalized 2007. In the analysis, focusing specifically on the capacity constraints associated to the implementation of the UNFCCC, a number of systemic, individual and institutional issues were further detailed.

DESCRIPTION

Component	Short-term Outputs	Potential Long-term Outcomes
Policy and Planning	<ul style="list-style-type: none"> Completed assessment of current country capacity (state and non-state institutions) to address key climate vulnerabilities and the translation of this assessment into action via a national plan to be integrated into the various department action plans. Strengthen the mandate of the cross-sectoral national climate change team to improve coordination and engagement. Put in place a legal base for the establishment of a national institution. Develop district and sectoral action plans for low carbon climate resilience that build on the NAPA priorities and TL Strategic Development Plan, with a focus on food security and water resources management. 	<ul style="list-style-type: none"> National strategy and action plan for low emissions climate resilient development developed and approved.
Institutional Development and Capacity Building	<ul style="list-style-type: none"> Establish a Climate Change Unit with necessary staffing and budget to engage in and support national policy development and programming activities. Assessment of staff numbers and skills including a training needs assessment and training plan based on current and expected future work responsibilities. Promote sub-national capacity development for improved adaptation planning and implementation. Capacity development support for key non-state actors in climate resilient development planning (national NGOs and Research / educational 	<ul style="list-style-type: none"> National Climate Change Institution effectively coordinating both state and non-state actors in addressing climate risks to human development requirements in a coherent and organised manner.

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	institutions).	
Awareness and Information Sharing	<ul style="list-style-type: none"> • Establish a section within the Climate Change Unit for resource collection and consultation. • Create a countrywide accessible electronic information database on climate change information (creation of a website) to be managed by the Climate Change Unit • Distribute information on climate change impacts to local communities 	<ul style="list-style-type: none"> • Effective climate risk information supplied and adopted by end users at the appropriate scale to improve national capacity to address climate change.

DEVELOPMENT CONTEXT

Climate change is a cross-cutting issue that affects all sectors of society and requires diverse forms of expertise to address. Several individual government institutions and NGOs have begun to think about how to mainstream the climate change issue into their projects, plans and strategies. However, no specific national institution exists to assist in decision making, project identification and management, coordination, and capacity building.

Timor-Leste will shortly unveil its long-term Strategic Development Plan which will be augmented by strategic plans from each Government Ministry. The State Secretariat for Environment has developed a draft strategy which takes a comprehensive look at what it wishes to achieve over the corresponding time-frame. Climate change features prominently in this plan and there is recognition of the need to set up a coordination mechanism. It is envisaged that this coordination mechanism would be housed within the State Secretariat for Environment but would coordinate broadly across government and beyond. Whilst this plan looks at climate change in its broad sense, the NAPA process has provided sufficient opportunity to consider how this mechanism may be formed in order to adequately respond to adaptation requirements.

IMPLEMENTATION

Project Duration: 4 years

Lead Agency: The Ministry of Economy and Development

Other Key Stakeholders: Ministry of Agriculture and Fisheries, Ministry of Education, Ministry of Health, Ministry of Social Solidarity, Ministry of Infrastructure, Universities, Media, NGOs including but not limited to , CARE, Caritas, CVTL (Red Cross Timor-Leste), Mercy Corps Timor-Leste, Hasatil, Oxfam, Halarae, World Vision, Haburas, Trocaire, and the private sector.

The Ministry of Economy and Development could be the lead government agency for implementation of this project profile as it is where the State Secretariat for Environment is currently housed. However, given the cross-cutting nature of this activity, there will be numerous key stakeholders taking part across the government, non-government, media, international, bilateral and private sectors.

Risks and Barriers: Several attempts have been made in the past to promote more cross-sectoral and joined-up approaches – such as the Inter Ministerial Working Group on Environment and Natural Resources. To date, success has been limited because of a tendency for all sectors to view cross-cutting issues to be the responsibility of one lead ministry. The public sector in Timor-Leste suffers from insufficient systems and coordination mechanisms to be able to handle the many agendas of the modern nation state. The work on climate change and sustainable development is

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currently reliant on a very small core of highly skilled staff which, though commendable, will increasingly present a bottle neck in light of the absence of systems being put in place to help build capacity more broadly across all key sectors. Most of the dialogue on climate change and building climate resilience remains at the national level, despite the fact that most of the impacts are being felt at district and suco levels. Recent work on disaster risk reduction and the NAPA are providing a momentum that will need to be sustained and strengthened in the future.

FINANCIAL RESOURCES

Indicative Budget: (TA and Investment): USD 1.3 million

Component	Cost (USD)
Policy and Planning	0.5 million
Capacity development and institution building	0.5 million
Awareness and information sharing	0.2 million
Project Management	0.1 million
Total	1.3 million