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www.gu.edu.au/centre/gccm/</td><td>Document: Griffith Centre for Coastal Management Research Report No. 86</td></tr>
<tr><td>Project:
Assessing Management Challenges and Options in the Coastal Zone of Timor-Leste</td></tr>
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<tr><td colspan="2">Synopsis: This report presents the results of a study that looked at how human activities are impacting on the coastal zone in Timor-Leste, what type of management challenges arise from these impacts, and what kind of management approach can help to address current and future problems in the coastal zone.</td></tr>
<tr><td colspan="2">Keywords: Timor, Timor-Leste, coastal zone, management, human activities, impacts.</td></tr>
</table>

REVISION/CHECKING HISTORY

REVISION NUMBER	REPORT DATE	CHECKED BY		ISSUED BY	
0	May 08		Rodger Tomlinson		
1					

DISTRIBUTION

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	0	1	2	3	4	5	6	7	8
GCCM File GCCM Library	1 1								

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ACKNOWLEDGMENTS

The information for this report was collected during a visit to Timor-Leste in December 2007 to March 2008. I was impressed by the friendliness with which I was received and the willingness with which people from government, from the international community, and from civil society would share information with me and help me out in which ever way they could. I would like to thank in particular Narciso Almeida, Raimundo Mau, Mario Nunes, Carlos Ximenes and Justino dos Santos for helping me understand the roles and responsibilities of different layers of government and line agencies in Timor-Leste. I would also like to thank Demetrio Amaral and Marcelo Belo Soares for sharing with me their experiences from local-scale community-based coastal management initiatives. The staff of the German Development Cooperation (GTZ) in Timor-Leste was invaluable to my research in that they allowed me to use their facilities and access information. I especially thank Brigitte Podborny, Klaus Hütten, and Georg Büttner for their support and advice.

Back in Australia I would like to thank my supervisor Prof. Rodger Tomlinson for his advice and continuous support. The more I got into my study, the more I realised how many people here in Australia and elsewhere were engaged in activities closely related to my research, and it was a great opportunity to exchange ideas, experiences, and contacts. My thanks especially go to Karen Edyvane, Jennifer Drysdale, Leo Dutra, Danielle Pedi, Juno Rouwenhorst, and Simon Albert.

Finally, I could not have embarked on this project without the invaluable and loving support of my husband, Diego Curvo.

EXECUTIVE SUMMARY

The overall aim of this study was to look at how human activities are impacting on the coastal zone in Timor-Leste, what type of management challenges arise from these impacts, and what kind of management approach can help to address current and future problems in the coastal zone.

The FIRST PART of the assessment explores the environmental, economic, social and institutional characteristics of the coastal zone. The first chapter looks at ecological characteristics such as types and condition of coastal (terrestrial and marine) ecosystems and wildlife. The natural environment of the coast to date is in a relatively healthy and pristine condition. The coastal environment consists of a variety of coastal and marine ecosystems that are home to a great number of plant and animal species, many of which are listed as endangered species. The coastal zone is also rich in natural resources such as minerals, especially petroleum, and fisheries. The land and marine parts of the coast are of great natural beauty; the pristine sandy beaches, stunning coral reefs, and unique opportunities for whale watching are main tourist attractions in the country.

The second chapter discusses social characteristics within the coastal zone such as distribution of urban and rural communities, traditional indigenous coastal management regimes and marine tenures, and cultural and heritage values of the coast. The population living in coastal areas is highly dependent on environmental goods and services derived from the coastal environment. Rural communities sustain their livelihoods through subsistence and semi-subsistence agriculture and fisheries, and they need firewood as a primary energy source. In many areas, coastal communities have developed close relationships with the land and sea, which are reflected in local customs and beliefs and traditional natural resource management mechanisms (tara bandu) that are still practiced today. On the other hand, many have been forced to abandon their homelands and re-settle in areas to which they have no ancestral claims and no historical relationship. Many people are still displaced in their own country and live in IDP (Internally Displaced People) camps scattered throughout the country. These relatively recently established coastal communities lack traditional knowledge how to harvest at sustainable levels and protect ecosystems and environmental goods and services that their livelihoods depend on.

Chapters 3-5 discuss the main human impacts on the coastal zone. Impacts are currently at a relatively small scale and confined mostly to urban areas. The most pressing current urban problems include untreated sewage and solid waste disposal, and unregulated coastal development and land occupation. Due to the unsettled issue of land ownership, many properties are illegally occupied, and many IDP camps are located on coastal lands. In rural areas, current problems in coastal communities relate to their high dependence on natural resources and their vulnerability to food shortages. Many of the rural communities along the coast are impoverished and isolated. They are poorly connected to urban centres and thus have very limited access to markets, so that they depend on subsistence farming and fishing. Unsustainable agricultural practices not only result in low agricultural productivity but also cause soil degradation, deforestation, and downstream sedimentation. While many rural households rely on external food supplies, the bountiful fishery resources are far from being harvested to their potential level, mainly due to limited equipment and know-how for commercial-scale deep sea fishing.

The human impacts can be expected to grow significantly with population growth and increase in economic activities. Industrial development, tourism, and urbanization

can exacerbate the pollution of coastal waters from untreated domestic and industrial waste. The need to increase agricultural productivity in order to improve food security and feed a growing nation will require additional land conversion and increase in fertilizer use. An expansion of port operations and the construction of a new international port would necessitate land reclamation and cause pollution of the sea from increased shipping. Destruction of habitat by unregulated coastal development can cause loss of valuable coastal ecosystems that have important ecological functions such as protecting the shoreline from erosion and serving as nursery for fishes and as habitat for the country's rich biodiversity. Increasing demand for natural resources from a growing population could also stimulate overexploitation of fisheries and accelerate soil degradation and deforestation. Another set of potential threats arise from climate change. Timor-Leste has been classified as extremely vulnerable to climate change impacts such as increased climate variability and increased frequency of climate-related natural hazards such as flooding and droughts.

The SECOND PART of this study gives an overview of institutional roles and responsibilities in the coastal zone. It summarizes the main institutional players in the area of coastal management, and it highlights the key components of national and international law that are of relevance in the coastal zone. The analysis of the legal and institutional framework reveals a number of weaknesses, including lack of key laws and regulations (relating to land ownership, coastal development, environmental protection) and lack of enforcement, ill-defined and overlapping jurisdictions, and insufficient mechanisms for cooperation between ministries and between different layers of government.

The THIRD PART is dedicated towards highlighting some of the current governmental and non-governmental partnerships, projects, and initiatives related to coastal zone management. Recent initiatives include the signing of a number of regional and international environmental protection agreement, and local-scale efforts such as the establishment of Marine Protected Areas (MPAs) and the country's first national park.

Finally, the FOURTH PART builds upon the assessment of the previous chapters and develops management options and recommendations for Timor-Leste. The Integrated Coastal Management (ICM) concept is discussed as a management approach that can help to integrate different sectoral policies, stakeholders, and decision-making levels. The ICM approach is gaining momentum in the country and the government is in the process of planning its first local-scale pilot projects. It is recommended that the process of developing and implementing ICM in the country be flexible and adaptive to the changing institutional and regulatory landscape and the dynamics of population growth and economic development. Taking into consideration human capacity constraints and financial limitations, the ICM strategy should work within the existing institutional and legal framework and strengthen cooperation between stakeholders rather than creating new bureaucracies. The limited availability of baseline data calls for close cooperation and exchange of information and know-how from a variety of knowledge sources, including traditional local knowledge. A combination of local and national level approaches is likely to be most appropriate in dealing with the range of different management challenges that were discussed throughout this report. Decision-making should be delegated to the local level where possible, while the role of government focuses on enabling and facilitating the building or strengthening of local capacity through training and education. The main current obstacles include lack of information exchange and coordination, lack of human and financial resources and baseline data, loss of traditional knowledge, and conflict and political instability.

1 INTRODUCTION

Timor-Leste is a very young country that only became independent in 2002. During the 24 years of Indonesian occupation and the post-referendum violence in 1999, vast numbers of Timorese had fled the country, been displaced or killed, and much of the country's infrastructure had been destroyed. The economy came close to a complete standstill as roads, schools, hospitals, government offices, residential buildings, ports, and almost the entire fishing fleet and equipment as well as any other industrial infrastructure were devastated.

Six years after independence, the country is still struggling to recover. Timor-Leste is considered among the 20 poorest countries in the world (Government RDTL 2005). The foreign aid that was pouring into the country after independence is gradually receding. Economic development is still in its infancy and many economic activities are limited to subsistence or semi-subsistence levels. But the prospects for economic development seem promising. Abundance of natural resources such as petroleum and other mineral resources, unexploited fish stocks and healthy marine ecosystems, and stunning natural beauty are some of the great assets that the country is endowed with. The government, with technical and financial support from the international community, is committed to developing commercial-scale agriculture and fishery industries, and it is investigating the possibilities of developing and expanding new economic sectors such as tourism, onshore petroleum exploration, and in-country oil refineries. Foreign investment and trade, and tourism are likely to take off as soon as the country succeeds in building and sustaining peace and political stability.

The yet largely unexploited potential for economic growth in combination with an extraordinarily high population growth rate put the country in a delicate and possibly vulnerable situation. It has to balance development needs of the growing population with the need to protect and conserve the natural environment and resources for current and future generations. Experiences from other parts of the world have shown that such sustainable development is extremely difficult to achieve and is often sacrificed to short-term economic gains. Coastal development and conversion of coastal land have caused heavy and often irreversible degradation of coastal and marine ecosystems throughout the Asia-Pacific. While the coastal environment in Timor-Leste is still in a relatively pristine and healthy condition, this situation can dramatically change if the economy continues to grow and population growth continues at current rates. In some areas unregulated urban development and uncontrolled exploitation of resources is already impacting on coastal ecosystems. The impacts from environmentally harmful activities such as destructive fishing methods and untreated disposal of solid waste and wastewater are currently disguised by a still relatively small population and very limited economic activities. The population is generally very poorly educated and unaware of environmental problems associated with human activities.

All of these factors represent a real danger that the impacts from economic development and population growth on the coastal environment are underestimated or neglected. The current institutional and legal framework does not yet provide sufficient mechanisms for sustainable coastal management. In the Asia-Pacific region, as well as in many other parts of the world, the concept of integrated coastal management (ICM) has emerged in the last decades as a concept to address current and future management issues and threats to the coastal zone. Timor-Leste is one of the few countries in the Asia-Pacific region without any such programs in place (Harvey 2006). But the ICM concept is starting to gain momentum within the country. A number of recent research studies and government reports (Sandlund et al. 2001;

Planning Commission 2002; NDFA 2005; RDTL 2007a) have identified the need to address the most pressing environmental problems and have proposed the development of a more coherent and holistic approach towards coastal management. Success stories from ICM projects in the Asia-Pacific region have encouraged the government to initiate pilot projects to test the ICM approach in Timor-Leste. The country is starting to collaborate with governments within the region and has joined regional networks and programmes in the area of environmental protection.

In view of this background, the aim of this study is to assess the management challenges and options in the coastal zone of Timor-Leste so as to provide a basis on which an ICM strategy could be developed. The understanding of land-marine interactions and human impacts on the coastal zone in Timor-Leste is still very limited and reliable data is fragmented and often difficult to access. This study will attempt to address this knowledge gap by compiling available data and thus provide an overview of the current state of the coastal zone.

The first part of this assessment will explore the environmental, economic, social and institutional characteristics of the coastal zone. The first chapter examines the ecological characteristics of the coast such as types and condition of coastal (terrestrial and marine) ecosystems and wildlife. The second chapter looks at social characteristics within the coastal zone such as distribution of urban and rural communities, traditional indigenous coastal management regimes and marine tenures, and cultural and heritage values of the coast. This information is important in order to understand the role that the coastal zone plays in society and the cultural and historic links that coastal communities have established with the coastal environment. The main economic activities in the coastal zone are discussed in the third chapter. For all key economic sectors, the current state of the sector, the institutional and regulatory framework, potential impacts and conflicts, and strategies and a future outlook are briefly outlined. The chapter specifically addresses agriculture, fisheries, tourism, petroleum exploration, and transport. Chapter four and five discuss other human impacts on the coastal zone such as pollution, deforestation, and spatial planning, and the potential impacts from climate change.

The second part of this study gives an overview of institutional roles and responsibilities in the coastal zone. It summarizes the main institutional players in the area of coastal management, and it highlights the key components of national and international law that are of relevance in the coastal zone.

The third Section is dedicated towards highlighting some of the current governmental and non-governmental partnerships, projects, and initiatives related to coastal zone management.

Finally, the fourth Section builds upon the assessment of the previous chapters and from this knowledge base develops management options and recommendations for Timor-Leste. In this part the ICM concept, its underlying philosophy and guiding principles and examples of its application in the Asia-Pacific region will be introduced. By drawing on research findings from previous chapters and combining those results with lessons learnt from other countries in the region, this final part of the study will apply the ICM concept to the specific case of Timor-Leste and discuss key aspects that need to be taken into consideration when applying this concept in the country.

This report presents the result of an analysis of a broad range of data sources such as government documents, scientific reports, conference proceedings, journal articles, books on the theory of coastal management, and case studies that are used for comparative analysis. It also contains anecdotal information from personal communication with key stakeholders from government, NGOs, and the international

community, and from own observations. The analysis of the data was done primarily as a desktop study and in consultation with stakeholders and experts in Timor-Leste and Australia. The study had to put up with limited and fragmented availability of reliable data and with a constantly changing institutional landscape. While the interpretation of data and observations has been subjected to the greatest scrutiny and peer review that was possible within the short given time frame, it nevertheless reflects personal interpretation and is no more than a snapshot of the dynamic conditions in the coastal zone of Timor-Leste.

What is the *Coastal Zone*?

The coastal zone consists of coastal waters, the coastline, and a coastlands area (Sorensen 1997). In scientific terms the coastal zone can be understood as 'that part of the land affected by its proximity to the sea and that part of the ocean affected by its proximity to the land' (Harvey and Mimura 2006: 10). It is an area of intense biophysical processes and interaction between land and sea. The main focus of attention lies on the area where human activities have an impact on, and are impacted by, the terrestrial and marine environments (Thia-Eng 1993).

For policy purposes it is more useful to have a practical definition that can either be based on fixed or variable distances. Many countries such as Australia have adopted a rather flexible interpretation where 'the boundaries of the coastal zone extend as far inland and as far seaward as necessary to achieve the policy objectives' (Harvey and Mimura 2006: 10). Fixed distance definitions on the contrary set the boundary at a specified distance from the coastline that could range from a few hundred meters to a few kilometers inland and offshore, or could extend from the inland boundaries of coastal watershed to the limits of national jurisdiction in offshore waters (Kay and Alder 2005).

Timor-Leste has not yet adopted any official definition of its coastal zone.

Box 1: What is the *Coastal Zone*?

2 THE CHARACTER OF THE COAST

This first section looks at environmental, social, and economic characteristics in the coastal zone of Timor-Leste.

2.1 Environmental characteristics of the coastal zone

The country of Timor-Leste stretches over approximately 14,874 km^2 that include the eastern part of the island of Timor, the Oecusse enclave (2500 km^2), and the islands of Atauro (144 km^2) and Jaco (8 km^2) (Sandlund et al. 2001). Total length of the main island is 265 km, and maximum width is 97 km. The country has a coastline of 706 km (CIA 2007). To its north lies the Banda Sea and to its south the Timor Sea. The distance to Australia is roughly 500 km (Sandlund et al. 2001).

Figure 1: Map of Timor-Leste

Source: Barnett et al. (2005)

Most of the country consists of relatively steep terrain. The landscape is dominated by the central Ramelau mountain range that has several peaks over 2000m. Around 44% of the country has a slope of 40% or greater (UNDP and RDTL 2006). Productive soil cover is thin and is often washed away in flash floods that are characteristic for the monsoonal climate of the country. Geologically, Timor-Leste is part of the Australian continental plate. In contrast to most Indonesian islands it is not of volcanic origin. The country is rich in mineral deposits, mainly mineral oil on land and in the Timor Sea. The climate is hot and humid and varies greatly within the country. Hard torrential rains frequently cause flash floods that increase the risk of soil erosion and landslides (Sandlund et al. 2001).

Figure 2: Elevations in Timor-Leste

Source: GERTiL (2001: 10)

The northern coast is rocky and steep along most of the shoreline. Arid woodlands are the dominant vegetation type along most of the coast, except east of Lautem where there is dense forest cover. Some areas such as around Dili are characterized by denuded hills with only grass and bushes. There are only very narrow or no coastal plains, except in some regions such as around Manatuto and Dili. Numerous white sandy beaches with interspersed rocky outcrops are scattered along the coast. The waters off the northern coast are deeper, calmer, and more transparent than those off the south coast. Sitting on the edge of a marine trench that runs 3 km deep through the Wetar Strait, the nearshore littoral zone is very narrow, and the sea floor sharply drops off to the deep sea (RDTL and CDU 2006).

The southern coast is shallower and has relatively wide coastal plains that are extensively cultivated or covered by plantations. River deltas, lagoons, floodplains and swamps are characteristic for this part of the coast (RDTL and CDU 2006). There are long stretches of sandy beach with heavy waves and surf. The continental shelf along the south coast is wide and gently sloping. Nearshore waters are more turbid (Sandlund et al. 2001).

Left picture: Girl in Beaçu, south coast. Right picture: Mangroves in Metinaro, north coast.

According to Sandlund et al. (2001), the following biotopes can be found in the coastal zone of Timor-Leste:

- Oceanic and sub-tidal marine environment: includes pelagic water columns, deep-seabottoms, shallower rocky bottoms, sandy-muddy bottoms, seagrass beds and coral reefs.
- Intertidal zone: includes rocky intertidal shelves, sandy-muddy tidal flats and mangrove forests.
- Shorelines: include sandy beaches, dunes, rocky outcrops, limestone cliffs, river estuaries, and brackish lagoons.
- Near-shore zone: includes coastal drylands, natural forests and wetlands.

Mangroves, seagrass beds, and corals reefs are mainly found along the north coast. Total mangrove cover is relatively small and is confined mainly to the region between Tibar and Manatuto (Stockwell 2002). Figure 3 shows the range of land types that can be found throughout the country.

The north and south coast also differ greatly with respect to climate. According to a classification of land types based on agroclimatic zones (refer to Figure 4), the coastal zone includes coastal land and valley floors up to an elevation of 100m above sea level. The north coast (Zone A) is characterized by monomodal rainfall patterns (i.e. only one wet season of 4-5 months per year) and an average annual rainfall of below 1000mm. This zone represents 7.16% of total land area. The southern coast on the contrary is exposed to two wet seasons (Nov-Apr, May-Jul) and around 1500mm of rain annually. This zone stretches over roughly 400.000 ha which make up 10.51% of the country.

There are over 100 rivers that discharge into the coastal zone. All rivers originate in the central mountain range and are relatively short and fast-flowing. Out of the 29 main river systems, 12 are in the northern and 17 in the southern part of the country. Very few of them flow throughout the year (Australian Water Research Facility 2006). The largest catchment is the Loes River followed by Laclo River (Arafura and Timor Seas Experts Forum 2006).

2.1.1 Biodiversity

Timor-Leste has an astounding wildlife. Located within the so-called Coral Triangle (WWF 2007), it belongs to the region with the world's richest and most diverse marine life. The Coral Triangle covers an area of 5.7 million km2 and is home to 75% of all known coral species, more than 3000 species of reef fish, six of seven turtle species, whale sharks, manta rays, and a diversity of marine mammals such as 22 species of dolphin, a variety of whale species, and the endangered dugong (WWF 2007; ABC News 2007). The Savu Sea to the northwest is one of the world's largest whale nurseries for six whale species including humpback whales, pilot whales and the highly endangered blue whales (Bock 2006). Whales frequently pass through the deep ocean trenches in the Savu and Alor Seas and come up to the reefs to feed. In contrast to some of the neighbouring islands of the Alor archipelago, Timor-Leste has no history of whaling, and whales therefore are confident to come close to the shore (Bock 2006). Table 1 shows a list of all endangered marine species found in throughout the country. Fish species suitable for economic exploitation include tuna, skipjack, mackerel and snapper (Nunes 2001).

Figure 3: Land types and uses in Timor-Leste

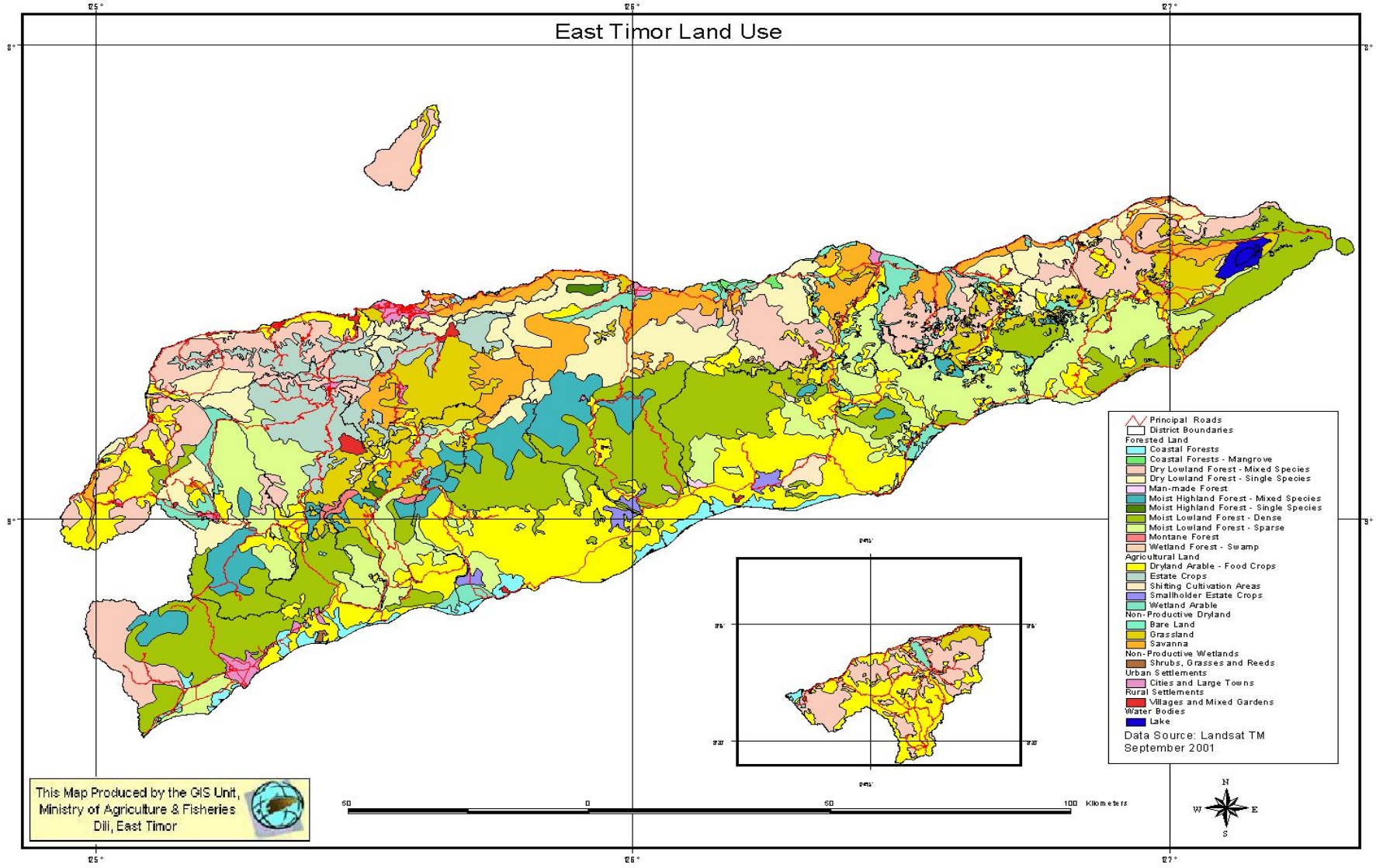

Figure 4: Agroclimatic zones in Timor-Leste

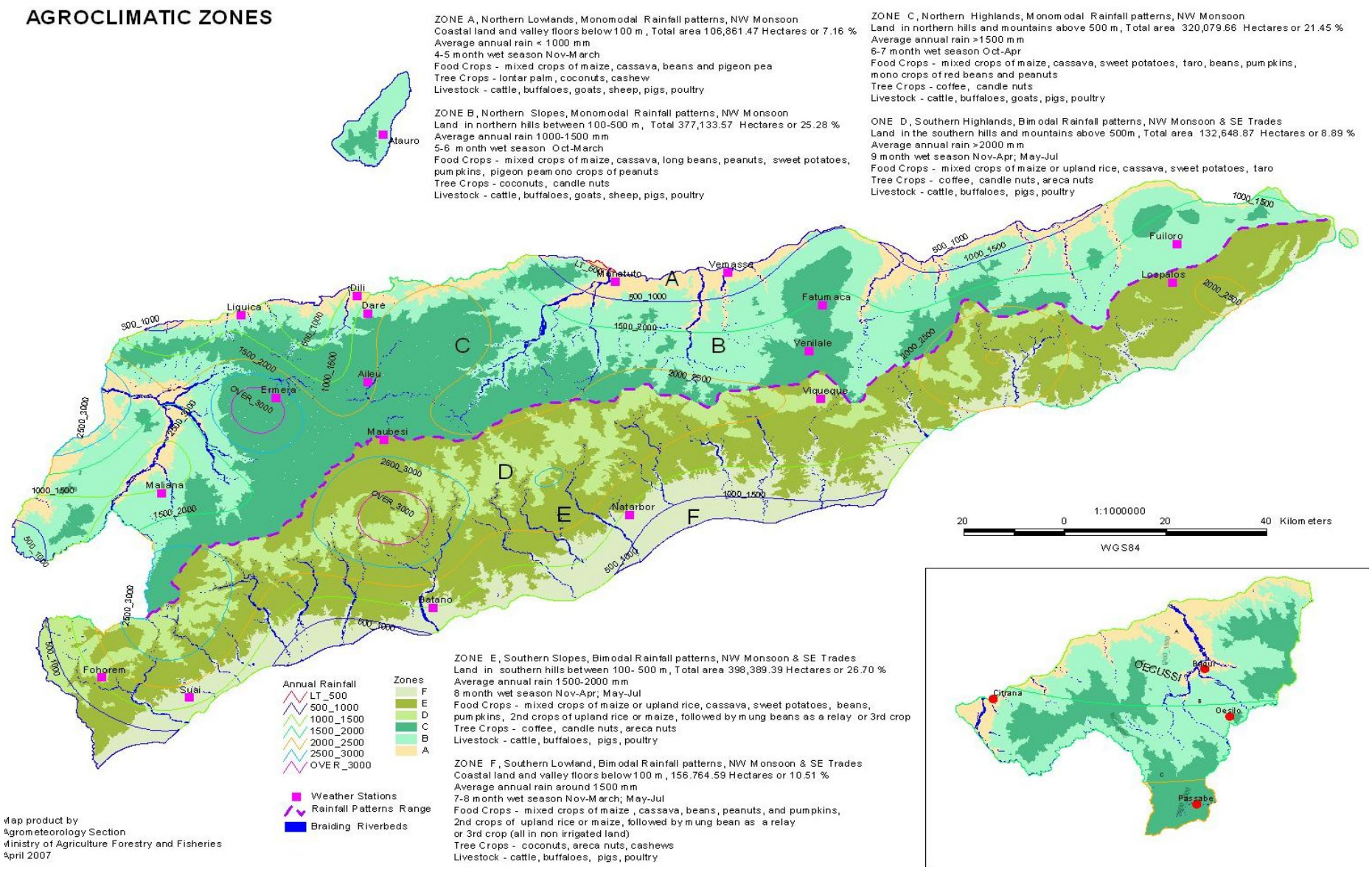

Table 1: Endangered Marine Species

Taxonomic Name	Name English	Category
Chelonia mydas	Green turtle	EN
Eretmochelys Imbricata	Hawksbill turtle	CR
Dermochelys Coriacea	Leatherback turtle	CR
Caretta caretta	Loggerhead turtle	EN
Lepidochelys Olivacea	Olive turtle	EN
Dugong dugon	Dugong	VU
Physeter catodon	Sperm whale	VU
Tursiops truncates	Bottlenose dolphin	DD
Rhincodon typus	Basking shark	VU
Tridacna derasa	Southern Giant Clam	VU

Red List categories for endangered species: CR – critically endangered, EN – endangered, VU – vulnerable, LR - lower risk, DD-data deficiency. Source: Sandlund et al. (2001)

The mangroves, sea-grasses, estuaries, rocky shores and other marine and coastal ecosystems are also habitat of a variety of animal and plant species, many of which are endemic and/or endangered (see Table 1). The estuarine saltwater crocodile (Crocodylus porosus) is found mainly along the south coast.

Shorelines, small islands, coastal wetlands and mangrove areas also provide important habitat to birds, including migratory species. BirdLife International identified sixteen Important Bird Areas (IBAs) across the country, the majority of which are located in coastal areas (BirdLife International 2007).

A detailed description of endangered terrestrial and marine species is found in Sandlund et al. (2001).

2.1.2 Condition of coastal ecosystems and catchments

Coastal and marine ecosystems appear to be in a generally pristine and healthy condition (Sandlund et al. 2001; Stockwell 2002; Alves 2007). The coral reef systems along the northern coast are in a remarkably good condition except for some areas that suffered from bombing/dynamite fishing during Indonesian occupation (ABC News 2007). Coral reefs have also been affected by an unusually strong El Nino event in 1998 that caused coral bleaching in many parts of the central Indian Ocean (Sandlund et al. 2001). The condition of the corals could be potentially threatened by rises in sea temperatures associated with global warming (Barnett et al. 2007). Beaches along urban settlements are often dirty and neglected (de Carvalho et al. 2007b). Although precise stock assessments are unavailable, fish stocks are believed to be in a relatively healthy, unexploited condition (NDFA 2005). Overfishing might be a problem in Dili where there is a strong demand for fresh fish (Stockwell 2002).

The condition of mangroves is becoming a cause of concern in some areas along the north coast where forests are being exploited for fuelwood (Alongi and de Carvalho 2008). Total mangrove cover has decreased significantly over the last decades from approximately 9000 ha in 1940 to 3035 ha in 2000 (FAO 2003). The mangroves in Metinaro, stretching over 24 km2 and representing the biggest patch of mangroves in the country (Arafura and Timor Seas Experts Forum 2006), are currently under threat

from uncontrolled exploitation from a camp of Internally Displaced Persons (IDPs) that is a temporary home to over 6000 people (MTRC Information Centre 2006). Mangroves are exploited for firewood and food stuffs such as bivalves, snails and fish species (Arafura and Timor Seas Experts Forum 2006). This trend is particularly worrisome as mangroves play an important function in protecting and stabilizing the shoreline and are considered as 'keystone species' in tropical coastal ecosystems (Wasson 2001).

The condition of rivers is characterized by high sediment loads caused by soil erosion from deforestation and unsustainable agricultural practices in the upper catchments. Bouma and Kobryn (2002) studied vegetation change between 1989-99 with the use of satellite images. The results indicate a substantial decline and degradation of total dense forest, forest and woodland areas ranging between 19-31%, while there were significant increases in human modified plantation areas and coffee areas. Deforestation appeared to be most acute in areas that had been completely converted to agricultural uses. The most important contributors to deforestation where found to be fire (especially in Bobonaro and Manatuto where fires are used for land clearing and hunting), and intensification of shifting cultivation.

Impacts from degraded catchments on the coastal zone are relatively unstudied in Timor-Leste. Results from the few available studies suggest that high sediment loads are currently the main cause of concern, while pollution with nutrients and other human inputs is less apparent (Arafura and Timor Seas Experts Forum 2006). A pilot study was conducted in the Laclo catchment (Arafura and Timor Seas Experts Forum 2006). High sediment loads from gully erosion, landslides and river bank erosion accrete in the river mouth and cause the river channel to widen and become shallower. During the wet season, large plumes from the river mouth intrude into the sea. The impact on marine productivity was found to be negligible in the Laclo catchment, but the situation may be different in other parts of the country (see chapter 4.2).

2.1.3 Natural hazards

Natural disasters that (potentially) affect the territory of Timor-Leste include earthquakes, tsunamis, cyclones, flooding, and landslides (GERTIL 2001). Due to its geographic location in one of the seismologically most active zones in the world, earthquakes and tsunamis pose an immediate threat to livelihoods. The probability of a major tsunami or earthquake affecting the country has heightened dramatically since the massive ocean floor uplift in December 2004 in the Indian Ocean which substantially increased the seismicity of the region[1] (RDTL 2006). Flooding and landslides occur frequently during the wet season. Increased climate variability as a result from climate change might increase the country's susceptibility and vulnerability to climate-related natural disasters[2].

2.2 Social characteristics of the coastal zone

The current population of Timor-Leste is estimated to be around 1 million (CIA 2007). The country has one of the highest population growth rates in the world, with estimates ranging between 3-4% (UNDP 2006; WB and ADB 2007). In the period from 2000-2003 Timorese women were having on average 7.8 children (National Statistics Directorate 2004). The country is among the poorest countries in the world,

[1] According to estimates the risk of a major tsunami hitting the northern coast of Timor-Leste has increased from a one-in-hundred to a one-in-ten year event (RDTL 2006).
[2] For further information on climate change see chapter 5.

and it ranks lowest among south-east Asian countries in terms of human development (UNDP 2006). The population is highly dependent on natural resources to sustain their livelihoods. According to a household survey conducted in 2001, agriculture including fisheries is the main source of income for 94% of villages (Drysdale 2007: 58). A large portion of the population regularly suffers from food shortages. Firewood is the primary source of energy for 98% of the population (WB and ADB 2007). Table 2 summarizes some of the main social characteristics of Timor-Leste's population.

Table 2: Selected human development indices in Timor-Leste

Human development indices	
life expectancy	58 yrs
adult literacy rate	50%
per capita GDP	370$
Percentage living below poverty line (<0.55$/day)	40%
Percentage suffering from food insecurity	64%
Malnutrition rate	26% (women) 46% (children)
Access to safe drinking water	75% (urban) 51% (rural)
Population growth rate	3-4%/year
Unemployment rate	30% (urban)
Percentage of population under 15	>50%

Source: Compiled from Drysdale (2007), UNDP (2006), RDTL (2005), (WB and ADB 2007)

2.2.1 Human settlement

Historically, the Timorese are a more landward-oriented people that preferably settled in the mountains rather than along the coast (Durand 2006). During Indonesian occupation, however, large numbers of people were forced to leave the mountains where the guerilla was hiding, and had to settle in lowland areas and along the coast. According to some estimates, up to 80% of the population was displaced during Indonesian occupation (Myat Thu 2008). Approximately two thirds of the population (almost 560,000 people) nowadays live in coastal and lowland areas with an elevation up to 500 meters above sea level (National Statistics Directorate 2006: 16). Low-lying areas in Timor-Leste are generally more arable and also better connected to transportation and communications networks. Figure 5 shows population densities throughout the country.

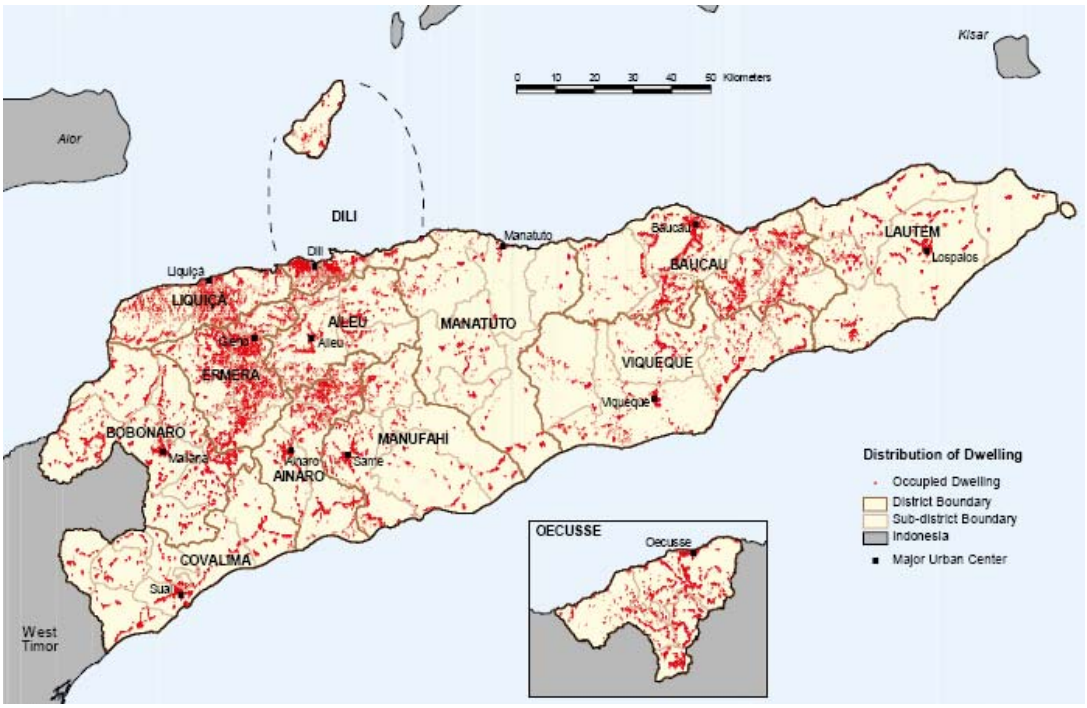

Figure 5: Distribution of occupied dwellings in Timor-Leste

Source: National Statistics Directorate (2006: 23)

The map shows that there are only a very few urban settlements located directly along the coast, with Dili being by far the biggest holding 19% of the country's population (over 26,000 residents) (National Statistics Directorate 2006: 22). In fact, according to GERTiL (2001), Dili is the only area that can be considered as urban space. Other smaller towns along the coast include Manatuto, Liquiça and Oecusse. Most of the population is concentrated along the north coast. Urban population has grown steadily and is projected to continue increasing over the coming decades (National Statistics Directorate 2004). There is also a trend towards people moving back into the mountains for protection, and returning to their original, traditional homeland (GERTIL 2001).

The country is estimated to have around 150,000 Internally Displaced Persons (IDPs) scattered in camps throughout the country (CIA 2007). While initially set up for temporary purposes, many of these camps have turned into permanent settlements. Some of them are sitting directly on the shoreline such as on Dili's main beach. These camps are a major threat to the immediate environment that is littered and polluted with untreated waste and wastewater. In Metinaro along the north coast, one of the biggest IDP camps in the country was erected in a previously untouched, pristine area within proximity of the country's largest remnants of mangrove forest. The mangroves are reported to being cut for firewood and exploited for food stuffs (Nunes, M., pers. comm.).[3]

[3] Mario Nunes is the director of the General Directorate of Forestry, Ministry of Agriculture & Fisheries.

Internally Displaced Persons (IDP) camp in Dili

2.2.2 The coastal population

Most of the coastline in Timor-Leste is inhabited by rural communities whose livelihoods depend on semi-subsistence fishing and farming. It is estimated that 75% of the population lives in rural areas (Drysdale 2007: 62). While rural poverty is generally higher than urban poverty, 46% compared to 26%, rural poverty in lowlands is relatively lower than in highlands (UNDP 2006: 13). Most people rely on a combination of agricultural activities (including fishing). While most of the tourism infrastructure is confined to urban areas, some rural communities operate small-scale tourism enterprises such as on Ataúro Island and Jaco. They derive some income from selling handicrafts, turtle shell and other ornamental shells and corals, renting fisher boats to recreational fishers, island day trippers and dive groups, and low-budget accommodation. Many coastal communities along the southern coast and the far eastern and western parts of the country are badly connected to urban centers and therefore have limited capacity to attract tourists as well as sell products to urban markets. These coastal communities heavily rely on environmental goods and services such as fertility of land and productivity of coastal waters, and they are more vulnerable to food shortages (in urban centers people can purchase food more easily) (Talaue-McManus 2006; Barnett et al. 2007). Uncontrolled coastal development and degradation of coastal resources would put many of these livelihoods at risk and further marginalize the poor segment of the population.

The urban population in the coastal zone faces a different set of challenges. The trend towards urbanization is most obvious in Dili where the population grew by 39% between 2001 and 2004 (Barnett et al. 2007). This population increase is putting enormous pressure on public services that fail to provide sufficient access to safe water, sanitation, electricity, wastewater treatment and solid waste collection. Increased demand for firewood and reduction of woodlands in the Dili area are causing fuelwood shortages in the capital (Bouma and Kobryn 2002). Located on a coastal plain, the growing population is also vulnerable to sea level rise and increased frequency of flooding associated with climate change (Barnett et al. 2007). All of these problems pose an enormous challenge for urban planning and management. Although the National Development Plan 2002-2007 proposed to develop urban Zoning Plans and Urban Land Use Plans for Dili and other urban centers, none of these plans have materialized so far. Nevertheless, the new government is planning to develop and implement an urbanization plan for Dili based on some preliminary work done by GERTiL, a group of architecture students from Portugal (RDTL 2007b).

2.2.3 Cultural & heritage values

Coastal communities throughout Southeast Asia and the Pacific have since long developed strong cultural traditions towards management of natural resources (Torell and Salamanca 2002). Many of them have a long tradition in sea-faring and have developed a strong relationship with the sea. The Timorese have been described as historically being a more landward-oriented people whose interactions with the sea are limited (McWilliam 2002). Nevertheless, coastal communities have developed their specialized relationships with the coastal and marine environment. A recent coastal community survey in the Eastern part of the country revealed that traditional rituals and prayers for good harvest and safe return from the sea are still practiced by a majority of communities (de Carvalho et al. 2007b). In many parts of the country a system of customary law, known as *tara bandu*, regulates the use of natural resources. Tara bandu is a form of customary law related to natural resources management within an area collectively owned by a community (Haburas Foundation 2007). It aims to protect the environment from harmful activities by imposing ritual prohibition under threat of spiritual sanctions such as non-appearance of fish and food resources, damage to and sinking of boats, drowning or illness of transgressors (McWilliam 2002). In some regions such as Bobonaro and Oecusse, estuaries and lagoons are seasonally closed for fishing and only reopened after a ceremony, while in other parts of the country such as in Doloc Oan (Dili district) mangroves are protected under tara bandu (Sandlund et al. 2001; McWilliam 2002). In Tutuala ceremonial harvesting of sea worms marks the beginning of a new agricultural calendar (McWilliam 2002). Restrictions also apply to sacred places such as Jaco island, where no fishing, swimming, diving or going ashore is allowed under customary law (Sandlund et al. 2001). Jono Beach and Hilapuna Beach in the Jaco region are protected under tara bandu. The area of Tutuala and Jaco is also home to some antique rock paintings of around 20.000 years of age (Bock 2006).

Even though many of the traditional cultural practices have proven to be highly adaptive and dynamic systems, they have been weakened by a long history of colonization and occupation (McWilliam 2002; Haburas Foundation 2007). The Constitution does not clearly acknowledge the role of customary law, but recently passed government resolutions and policies address the issue of traditional customs and the role of local communities in natural resource management[4]. Palmer and Carvalho (2007: 2) claim that within the 'bureaucratic vacuum' created by an incomplete regulatory framework as well as weak law enforcement and outreach to local communities, customary laws and practices have experience a resurgence in many communities. The local NGO Haburas Foundation works with coastal communities to revive local knowledge and customs to protect natural resources (Palmer and de Carvalho 2007)[5]. In order to avoid further loss of traditional knowledge, the government could support the collection and recording of information on customary practices in collaboration with communities and NGOs.

The coastal zone is also characterized by numerous language groups that have developed throughout the country and that still practice their local languages today (Durand 2006).

[4] For example the Resolution 8/2007 on the creation of the Nino Konis Santana National Park, and the National Forestry Sector Policy (Resolution 9/2007).
[5] Also see chapter 9.

2.2.4 Customary land and marine tenure

Customary tenures are of great significance with respect to coastal management in Timor-Leste. In a country where only a small fraction of land parcels are given legal status, customary law is a central element that regulates land ownership. According to customary law, land ownership can be obtained through continuous cultivation and through heritage of preferential rights. Marine tenure is mostly derived from coastal land tenure and is commonly less clearly defined (Xavier 2001). Access to land and water, and utilization of its natural resources, are regulated and based upon permission by the clan that holds ownership. On Ataúro Island, for example, the inshore waters are split up between four senior landholding clans, Biloi, Makili, Bikili and Makadadi. Boundaries are demarcated by marker points, and all fishing activities are subjected to approval by local traditional authorities (McWilliam 2002).

The role of customary tenures is not explicitly addressed in the Constitution. While a new land law is still pending, the current legal regime of private and public property does not accommodate for customary claims (McWilliam 2002). Potential conflict might arise from the difficulty to balance traditional local claims with overall national development goals. Equitable distribution of land/sea and its resources however, is not only a question of balancing local versus national needs. It also relates to ensuring fair and equitable access to resources of people that are marginalized by traditionally privileged elites under customary tenure systems (McWilliam 2002).

2.3 Economic activities in the coastal zone

The following section describes the main economic sectors that impact on the coastal zone in Timor-Leste. Each sector is discussed with respect to its current state, institutional and legal framework, strategies and outlook for the future, and potential impacts and conflicts arising from these activities.

2.3.1 Agriculture

2.3.1.1 Status Quo

Agriculture is the main economic activity in Timor-Leste. Around 75% of the population depends on subsistence agriculture (UNDP and RDTL 2006). Shifting cultivation and slash and burn practices are common[6]. Due to the topography of the country, relatively steep hillsides with up to 40% of slope are being cultivated (Sandlund et al. 2001). Agricultural productivity is low and there is currently very limited export potential. The major commodities are food crops (maize, rice, peanut, cassava and sweet potato), tree crops (candlenut, coconut, coffee, cinnamon and cloves) and livestock (WB and ADB 2007). Coffee is the main non-petroleum export. The country is currently dependent on food imports (Barnett et al. 2003). Figure 6 shows that agriculture is a dominant land use in low lying arable dryland along the south coast. This area is mainly used for cultivation of food crops. Rice production in this area is a heritage of Indonesian transmigration programs (Durand 2006). In the western highlands the main agricultural use is coffee cultivation. Areas used for shifting cultivation are not included in this map. To date, approximately 30% of arable land is used for agriculture (Government RDTL 2005).

[6] Under this system field cultivation rotates and follows a cycle of cropping and fallowing (Sandlund et al. 2001: 32)

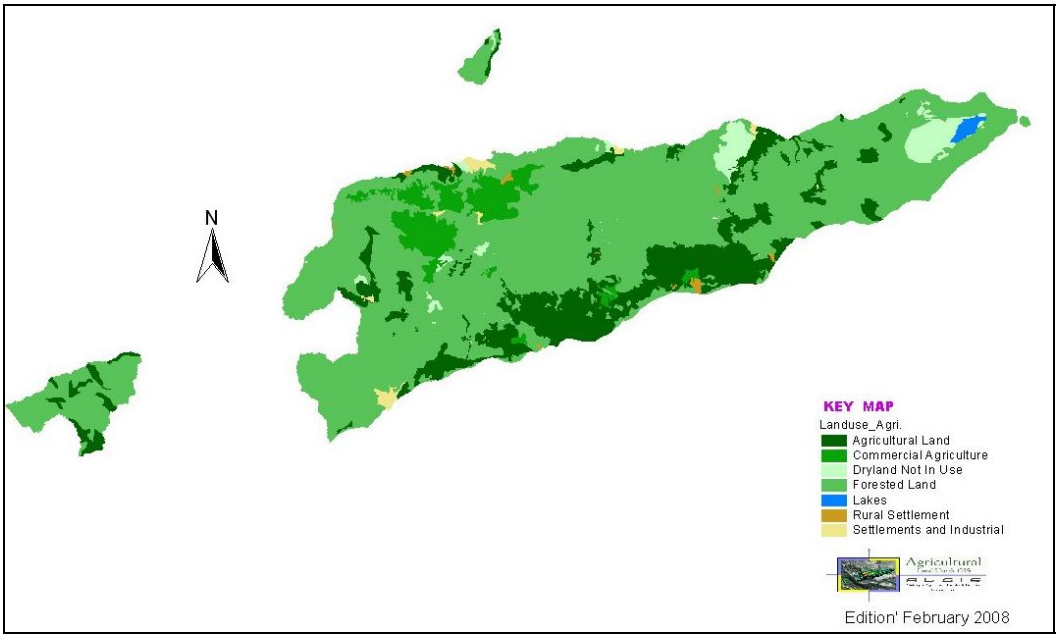

Figure 6: Agricultural Land Use in Timor- Leste

2.3.1.2 Institutional and Regulatory Framework

The main governmental bodies involved in agricultural and rural development are the General Directorate of Food Crops & Horticulture and the General Directorate of Industrial Crops, both under the Ministry of Agriculture & Fisheries. The Agricultural Land-use Geographic Information System (ALGIS) Unit supports the Ministry with GIS-based data. The Ministry is working closely with international development agencies such as the German Technical Cooperation (GTZ) and the Portuguese Aid Agency (IPAD) that are running rural development programmes (Nogueira 2008). There is currently no legislation regulating disposal of agricultural waste. Draft laws on Environmental Impact Assessments, and Pollution Control and Hazardous Waste are currently awaiting the government's approval. For the time being, environmental pollution regulations under Indonesian law still apply (refer to chapters 4.1 and 7.1)

2.3.1.3 Strategies and Outlook

In the short-term, the focus of the government is to improve food security. In the medium- and long term, the government envisions promoting production of crops with higher margins (cashew nuts, mangos, spices, vanilla, restoration of sandalwood, pineapples, passion fruit, guavas, cut flowers) and food processing (roasting of nuts, mango pulp, guava jam, passion fruit concentrate) (Fontes 2004). Due to very limited use of agrochemicals there is a potential to develop an export market for organically grown products. Because of limited availability of fertile land and increasing population growth, there is a need to improve agricultural productivity as well as expand into formerly uncultivated areas. The Portuguese Agronomic Mission works with the government to stimulate rice cultivation in coastal plains (Fontes 2004). The IV Constitutional Government Program (RDTL 2007b) also envisions extending agricultural zones to flood plains in abandoned areas. Other strategies include improved irrigation and water storage infrastructure, and subsidy of fertilizers. The Japan International Cooperation Agency (JICA) completed an Irrigation and Rice Cultivation Project in the Laclo catchment. The project evaluation revealed an increase in chemical fertilizer use from 5% in 2003 to 52,7% in 2007 and pesticide use from 4% to 18.2% of farmers connected to the irrigation scheme (Ministry of Agriculture and Fisheries Timor-Leste 2007: 8).

Rice fields around Tekinomata, Baucau

2.3.1.4 Potential Impacts and Conflicts

Development of the sector will improve food security of the nation and is an important source of income and employment. The use of unsustainable agricultural practices however, can be harmful to the environment. The traditional slash and burn agriculture and cultivation of steep upland hillsides contribute to deforestation and increase the risk of erosion, landslides, and flooding downstream[7]. Increased use of scarce water resources might also give rise to water use conflicts. Of some concern is also the trend towards increased fertilizer use. Excessive nutrient input into waterways causes eutrophication[8] and Harmful Algal Blooms (HABs) in the coastal zone (Koshy et al. 2006). A potential risk also lies in the expansion of agricultural land through conversion of natural habitat that might conflict with environmental protection goals.

2.3.2 Fisheries

2.3.2.1 Status Quo

Despite its long coastline and abundant fishery resources, the sector is currently under-developed (RDTL 2007b). While fisheries were relatively well developed prior to independence, the Indonesian militia destroyed most of the infrastructure and fishing boats and equipment in 1999 (Fonseca 2001; McWilliam 2002). There are currently no large-scale, commercial activities in this sector; fishing is done at subsistence and semi-subsistence levels and is commonly supplemented by other livelihood activities such as agriculture (de Carvalho et al. 2007b). Recent figures (de Carvalho et al. 2007b, NDFA 2005) estimate a total of almost 5000 fishermen in the country, over 1500 of which are on Atauro island, the only place where fishing is the dominant occupation and where it has reached the highest level of sophistication in the country. Most fishing activities are limited to low-technology inshore fishing. Targeted species include demersal species such as snapper, croaker and bream, pelagics like tuna, mackerel, scad and sardines, and a variety of prawns, crabs, lobsters, bivalves and cephalopods (McWilliam 2002). Mainly women and children collect fishes, crabs and mollusks in the intertidal zone at low tide (Sandlund et al.

[7] The effects of deforestation and catchment degradation on the coastal zone are discussed in chapter 4.2.

[8] Eutrophication refers to the process of a nutrient-poor condition turning into a nutrient-rich condition.

2001). Destructive fishing practices such as the use of dynamite and cyanide were common during the Indonesian occupation and are still used in some places (de Carvalho et al. 2007b).

Collecting seafood at low tide at Wataboo beach, Baucau

The country is currently giving fishing licenses to joint venture operations in offshore waters. The fishing operations are closely monitored by two local observers permanently installed on each fishing vessel (NDFA 2005).

2.3.2.2 Institutional and Regulatory Framework

The National Directorate of Fisheries & Aquaculture (NDFA) under the Ministry of Agriculture and Fisheries (MAF) is responsible for the development of the industry. The Inspectorate of Fisheries is in charge of monitoring and control of the industry and enforcement and prosecution.

MAF is collaborating with a number of donor agencies and research institutes to survey and record fish stocks and coastal and marine habitat, strengthen the human capacity for fisheries development, and rebuild the industry infrastructure (refer to Table 3).

Table 3: Selected fisheries development projects in Timor-Leste

Main donor and implementing agencies	Description
AusAID, MAF	Fisheries capacity building
ADB	Hera Port Rehabilitation Project
FAO, MAF	Strengthening the capacity in fisheries information gathering, establishment of two MPAs in Batugade and Atauro
MAF, Northern Territory government (Australia), and a number of Australian research institutes[9]	Coastal/marine mapping
World Bank, MAF/ALGIS	Coastal Fisheries Baseline Study and Community Management, as part of the Second Agricultural Rehabilitation Project. The project included basic habitat mapping and establishment of a limited number of monitoring stations (Stockwell 2002).
Haburas Foundation in cooperation with the Spanish NGO Paz y Desarrollo	Study to identify potentials and development options of the fishery sector in the eastern provinces of the country (de Carvalho et al. 2007b)

The Decree-Law 6/2004 on Management and Regulation of Fisheries and Aquaculture, and Decree 5/2004 of General Regulation on Fishing provide the regulatory basis of the industry. A regulation for the protection of marine resources is expected to be drafted in 2008 (RDTL 2007f).

2.3.2.3 Strategies and Outlook

The NDFA has explicitly committed itself to sustainable development of fisheries (NDFA 2005). In the long term, most prospects for the industry lie in offshore and deepwater fishing where the annual catch value is expected to be 5 to 10 times higher than from inshore activities (Mounsey 2001). The country has a potential fishing area of 16,000 km^2 with largely unexploited resources (Guterres 2003). The government aims to develop an off-shore commercial-scale industry and promote export (RDTL 2007b; 2007f). Potential offshore resources include tuna, deep sea snapper and deep sea shrimp (WB and ADB 2007). The government is also looking into the possibilities of issuing fishing licenses to foreign companies that would allow Timor-Leste to gain economic profit from its resources while the industry is not at a sufficient stage to exploit the resources itself. The proposed development focuses on the north coast where the infrastructure is better and where the strong demand in Dili needs to be catered for (Guterres 2003).

The NDFA is also planning to encourage and facilitate community-based fisheries management initiatives and aims at establishing a network of local, community-supported MPAs and encourage involvement of NGOs (NDFA 2005). MAF is also planning to work with the Department of the Environment and other agencies within MAF to develop an Integrated Coastal Zone Management policy and site-specific management plans (NDFA 2005). The main national fisheries objectives are outlined in Table 4.

[9] Refer to Box 2

Table 4: National Fisheries Objectives 2006-2011

National Fisheries Objectives 2006-2011	
Optimal utilization of living aquatic resources	Estimation of sustainable yields and incomes and development of management plans; Re-establishment of aquaculture industry; Balancing subsistence fishing, commercial fishing, recreational fishing, and fish-based marine tourism such as SCUBA diving and snorkeling; Inshore fishing only by Timor-Leste nationals Licenses for offshore fishing only within sustainable yields and monitored by local observers, Promote export of high value species if resource productivity and compliance with regulations permit
Conservation and enhancement of coastal aquatic habitats	Conservation and restoration of key aquatic habitats such as coral reefs, mangroves, and sea grass beds, monitoring of proposals for development of coastal infrastructure and potentially polluting activities; Integrated coastal planning
An efficient, sustainable and profitable local fishing industry	Encourage private sector development, capacity building
Effective joint management of living aquatic resources through the support of local communities and other stakeholders co-operating with government authorities	Develop fisheries legislation, effective vessel licensing system, and surveillance and enforcement system; Adoption of precautionary approach to resource development and management; Engage local communities and other stakeholders in coastal fisheries management and surveillance and educate them on rights, responsibilities, and legal framework; Develop and implement a strategic plan for collaborative community management and establishment of MPAs.
Efficient & transparent fisheries administration	Training of NDFA staff Seek technical assistance from international advisors

Source: NDFA (2005: 17)

The main limitations of the industry include lack of infrastructure and public transport which limits access to markets, lack of storage and cooling facilities, and limited equipment as well as knowledge to handle modern and more efficient equipment (McWilliam 2002; de Carvalho et al. 2007b). The sector is also in urgent need of reliable baseline data on size and status of fish stocks, critical habitat types (nursery and spawning areas) and on socio-economic conditions of fishing communities (NDFA 2005; WB and ADB 2007).

2.3.2.4 Potential Impacts and Conflicts

Expansion of the industry can have positive impacts on income and employment of coastal communities, and it can contribute to economic development of the country. It may increase food security and potentially generate export earnings. However, the resources might quickly become overexploited if large-scale operations in particular from highly modern foreign fishing fleets are not duly monitored and controlled. Selling licenses can generate income to the government, but such a development might be to the detriment of coastal communities that suffer from depleting stocks. This might give rise to social and equity problems where local livelihoods get eroded in favor of national economic development. Of particular worry is also the fishing activity by unlicensed vessels observed offshore the south coast of Timor-Leste.

MAF needs to co-ordinate its activities with the Department of the Environment. The protection of critical habitats that are of importance to fish stocks as nursery and spawning grounds are in the interest of both the fishery sector and environmental protection and biodiversity conservation efforts. Overfishing and untargeted by-catches disrupt marine ecosystems and may have repercussions for the entire marine food web. Particularly vulnerable species such as endangered species might be put under additional pressure. The use of destructive fishing methods is harmful to marine habitat and destroys coral reefs.

The protection of coastal and marine resources and ecosystems on the other hand might stand in conflict with coastal developments such as reclamations, road building, and land clearing (NDFA 2005). The fishery sector therefore also needs to collaborate with the Ministry of Infrastructure and the Ministry of Tourism, Trade & Industry to integrate efforts in those areas.

2.3.3 Tourism

2.3.3.1 Status Quo

The tourism industry in Timor-Leste is in its early stages of development. In 2004 there were only 35 registered tourism businesses which accounted for 0.37% of all licensed businesses in the country, total lodging capacity is estimated to be 1329 rooms of which over 90% are located in Dili, and there are an estimated 1638 people directly employed in the industry (Pedi 2007: 34). The main attractions the country has to offer are one national park, white sandy beaches and plenty of diving and snorkeling opportunities along the north coast (the south coast is crocodile-infested), a couple of low-budget eco-lodges at Jaco and Ataúro Island, and some middle-class colonial style hotels in major towns (Bock 2006).

The vast majority of international arrivals are related to work and not to leisure. Out of 36,000 international arrivals in 2005 only 3000 were estimated to be tourists (mainly from Australia, Portugal, Japan and China) (Pedi 2007: 34). The large number of international workers represents a market for week-end tourism.

Political instability, low price competitiveness, poor infrastructure and low capacity and skills represent the main hurdles of the industry (Pedi 2007).


Left picture: children selling handicrafts at Com beach. Right picture: Eco-lodge on Atauro

2.3.3.2 Institutional and Regulatory Framework

The Ministry of Tourism, Trade & Industry is in charge of developing the industry. There is currently no legislation in force that regulates the industry, but the IV Constitutional Government Program 2007-2012 (RDTL 2007b) envisions the creation of specific legislation for the sector and the official adoption of a National Tourism Strategic Plan. In Ataúro Island, the local communities in collaboration with the NGO Roman Luan developed a set of tourism regulations that promote ecologically sustainable tourism (see Appendix I).

The government receives support from the WTO and UNDP with tourism policy development (Basiuk 2006), and the Northern Territory government, Australia, is helping the country to identify suitable locations for tourism development and a marine park (ABC News 2007).

2.3.3.3 Strategies and Outlook

According to the IV Constitutional Government Program 2007-2012 (RDTL 2007b: 8), the government is 'committed to develop a structured tourism which will act towards a sustainable and responsible development of tourism, through the planning, coordination and harmonization of transversal policies, taking into account the need to render compatible the environment preservation, natural resources management and the land use planning'. It envisions an industry that is based on the country's natural beauty. Sea life, especially corals, is seen as the future center of tourism attraction. The country has superb coral reefs, underwater caves, and offshore surf, and the Savu Sea offers one of the world's largest whale nurseries that make the country an ideal location for cetacean watching (Bock 2006). The government aims at promoting eco-tourism, which represents an ideal opportunity to develop a niche market for nature-based tourism that minimizes ecological impacts while promoting economic development. The north coast is more suitable for developing the '3-S' (Sun, Sand, Sea) beach tourism due to its better infrastructure and accessibility, and more suitable climate (shorter wet season) (GERTIL 2001).

2.3.3.4 Potential Impacts and Conflicts

The nature of social, economic and ecologic impacts from tourism development will depend on the strategy that the government of Timor-Leste pursues. Tourism is a labour-intensive industry that can generate income and employment to coastal communities. Community-run eco-lodges such as on Ataúro Island and Jaco represent examples of pro-poor tourism development from which coastal communities can profit. In terms of environmental impacts, an increase in the number of tourists will increase needs for infrastructure, food provision and public services,

and it will also increase the amount of waste and consequently the risk of environmental pollution. Depending on whether the sector is developed in an ecologically sustainable way or not, the expansion of the industry may alter coastal landscapes and impact on coastal ecosystems such as damage to reefs.

Possible conflicts might arise over land tenure and access to beaches and fish-landing sites (Sandlund et al. 2001). Cultural conflicts might occur with respect to traditional local customs and values. For example, Jaco island is considered sacred by local people and it is prohibited by customary law to fish, swim, dive or go ashore the island. These prohibitions are frequently violated by domestic as well as international tourists that either disrespect, or are not aware of those restrictions, and by local fishermen that offer transport to the island in pursuit of economic profit. This example shows that tourism development can contribute towards erosion of cultural values (Sandlund et al. 2001).

2.3.4 Petroleum

2.3.4.1 Status Quo

The Timor Sea is rich of petroleum resources. Most of the currently explored oil and gas fields lie approximately 200km offshore within the Joint Petroleum Development Area (JPDA) from which the revenues are shared between Timor-Leste and Australia (see Figure 7).

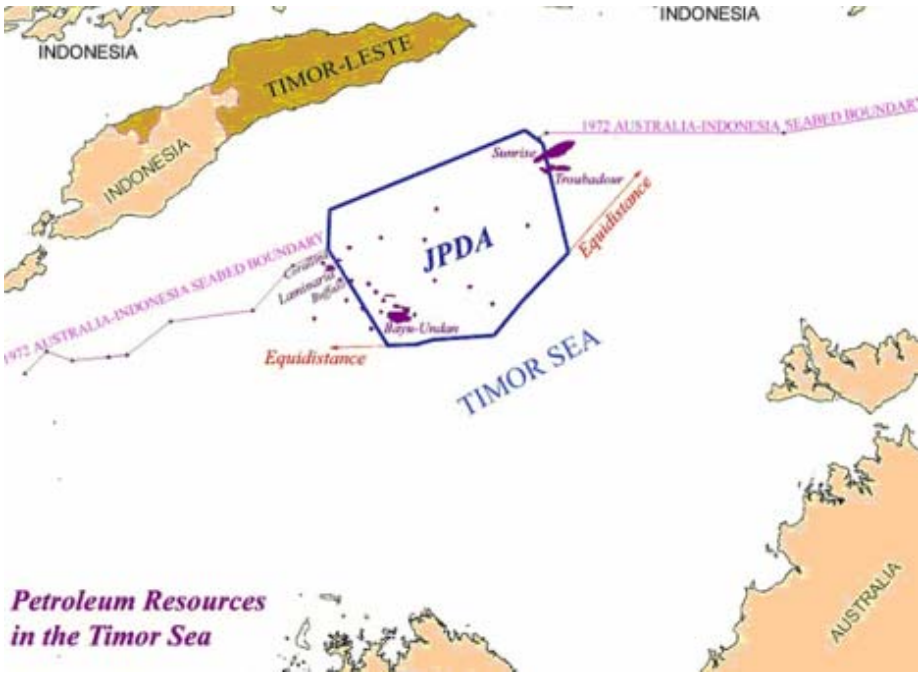

Figure 7: Joint Petroleum Development Area

Source: Timor Sea Office (2007)

The exploration is operated by a consortium of oil companies and the petroleum is transported to Australian onshore facilities for further processing and storage. Onshore reserves are currently not exploited at commercial scales, but an experimental gas-to-power project on onshore gas seeps was conducted in the Aliambata region (RDTL 2006).

2.3.4.2 Institutional and Regulatory Framework

A range of institutions are involved in the offshore exploration of petroleum. The Timor Sea Designated Authority (TSDA) manages the resources of the JPDA on

behalf of Australia and Timor-Leste (Drysdale 2007). The Timor-Leste share of revenues is managed through a Petroleum Fund where revenues are deposited in the Fund, and only the interest income is passed on to the government budget (WB and ADB 2007). The management of revenues involves many government bodies such as the Oil and Gas Directorate within the Ministry of Natural Resources, Minerals and Energy Policy and the Ministry of Planning and Finance. The country is planning to set up a National Petroleum Regulatory Authority (Drysdale 2007).

The joint exploration of offshore petroleum reserves is governed by a set of agreements between the governments of Timor-Leste and Australia, the most important of which are the 2002 Timor Sea Treaty (TST) and the Treaty on Certain Maritime Arrangements in the Timor Sea (CMATS). Main pieces of legislation are the Law 7/2002 on Maritime Boundaries of the Territory of RDTL, the Law 13/2005 on Petroleum Activities, and the UN Convention on the Law Of the Sea (UNCLOS) 1982. A comprehensive list of laws, treaties and regulations relevant to the JPDA can be found on the TSDA website (www.timorseada.org/laws_regulations.html).

2.3.4.3 Strategies and Outlook

The currently exploited petroleum fields are expected to provide total revenues of US$ 12 billion (Drysdale 2007: 72). The industry is still in its infancy and is expected to grow over the next decades when currently unexplored fields will be tapped. There is ongoing discussion between the governments of Timor-Leste and Australia with respect to revenue sharing of currently unexploited fields. If Timor-Leste and Australia were to decide on a permanent maritime boundary, the share of revenues for Timor-Leste could increase substantially (Timor Sea Office 2008). The future value of revenues is unknown due to oil price fluctuations and potentially undiscovered fields. The government is considering in the long term to set up onshore infrastructure for refining, processing and gas liquefaction and construct an undersea pipeline to the shores of Timor-Leste (Neves et al. 2008).

There are also efforts by the government to initiate onshore and nearshore seismic exploration of oil and gas reserves (RDTL 2006).

2.3.4.4 Potential Impacts and Conflicts

In terms of financial revenue, petroleum exploration is the most important economic activity in the country. In 2007 the total petroleum savings were estimated at US$1.4 billion with US$ 100 million new revenues each month (WB and ADB 2007: 1). However, the petroleum exploration currently provides almost no employment to the Timorese population (WB and ADB 2007). Due to lack of qualified Timorese workers the staff involved in the exploration is mostly provided by Australia. This might change under the commitment of Australia to train and gradually employ workers from Timor-Leste (TSDA 2007). While gas and oil revenues, if managed wisely, certainly provide an opportunity for economic growth and investments in infrastructure, health and education, they also hold a risk of what is termed ‘resource curse’. This common phenomenon in resource-rich countries describes the risk of an ‘inability to convert resource wealth into sustainable development’ (Drysdale 2007: 1). Experience from other countries has shown that resource wealth often leads to revenue waste, corruption, conflict, and social inequity.

Potential environmental risks exist in particular in the form of oil spills from shipping accidents and leakages that pollute the environment and are harmful to wildlife in particular when they reach the coast. The clean-up costs of such accidents would be a major burden to the local economy. Oil platforms, underwater pipes and large-scale infrastructure on shore such as terminals and handling facilities can destroy habitat,

but platforms may also serve as large artificial reefs and fish sanctuaries (Mounsey 2001; Sandlund et al. 2001).

2.3.5 Transport

2.3.5.1 Status Quo

Much of Timor-Leste's infrastructure was destroyed in the post-referendum violence. The country has a reasonable 6000 km road network, but roads are generally in a bad condition, especially during the rainy season that often brings extensive damage to roads and bridges (RDTL 2006; UNDP 2006). The north coast is generally better connected to the transportation network than the south coast.

Currently there is one international airport at Dili (the runway is directly on the shoreline), and seven sea ports in operation: Dili (the only international port), Oecusse and Atauro (passenger ferries), Dili-Pertamina and Tibar (oil), Com (fisheries) and Hera (fisheries and coast guards). Other ports and slipways currently not in operation include Carabela (Baucau), Betano, Beaço, and Suai (Böttner, G., pers. comm.)[10]. As to date the amount of maritime traffic in Timorese waters is limited. The only passenger ferry route runs weekly between Dili-Oecusse-Ataúro-Dili. There is currently no international ferry connection. In terms of international maritime trade, the country harbors approximately 20-23 ships per month, most of which are container vessels, some bulk commodity ships with rice from Vietnam and cement from Indonesia, two Pertamina oil tankers, and supply vessels for oil rigs in the Timor Sea. The main trading routes for container ships are between Surabaya, Kupang and Dili, and between Singapore, Dili and Darwin. At the moment, international trade mostly consists of imports. Timor-Leste is still highly dependent on imports of oil, food stuffs, construction materials and other processed goods that it lacks the capacity to produce in-country. Coffee is the primary non-petroleum export product (WB and ADB 2007). All international maritime traffic runs through the international port in Dili, Dili-Pertamina and Tibar harbors.

The country is lacking the capacity to operate a Search and Rescue (SAR) service which is currently provided by Indonesia (north coast) and Australia (south coast). Two boats of the Timorese navy are currently operating as coast guards at Hera port (Hütten, K., pers. comm.)[11].

2.3.5.2 Institutional and Regulatory Framework

The Ministry of Infrastructure is the main government body in charge of maritime and land transport. The Port Authority of Timor-Leste is a financially independent public institute under supervision of this ministry (RDTL 2003). According to Decree Law 2003-03 on the the establishment of the port authority, it has jurisdiction over:

- areas of interest to a port, including the ports and slipways Oecusse, Tíbar, Dili, Dili-Pertamina, Hera, Ataúro, Carabela (Baucau), Com (Lospalos), Betano, Beaço, and Suai.
- All the coastline of Dili, externally demarcated by the coastal road stretching from the Becora brook, to the east, to Pertamina terminal inclusive, to the west.

The execution of this wide ranging responsibility however is still limited.

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[10] Georg Böttner is Legal Advisor to the Port Authority of Timor-Leste.
[11] Klaus Hütten is the Team Leader of the Maritime Transportation Services Development Program of the German Development Cooperation (GTZ).

The port authority receives legal and administrative support from the German development cooperation GTZ. The Japanese government is providing funds for the construction of port facilities (extension of pier) in Dili (JICA 2007), and the ADB financed the rehabilitation of the Hera Port (ADB 2004).

The main pieces of national legislation relevant to the coastal zone are Decree-Law 3/2003 on the establishment of Port Authority and Law 7/2002 on Maritime Boundaries of the Territory of Timor-Leste. The currently drafted laws on Environmental Impact Assessment and Pollution Control and Hazardous Waste will also impact on infrastructure development and port operation.

In terms of international agreements, Timor-Leste is signatory to the UN Convention on the Law of the Sea (UNCLOS), the International Convention of the Prevention of Pollution from ships (MARPOL), the Basel Convention on the Transboundary Movement of Hazardous Wastes and their Disposal 1989 and the International Convention for the Safety of Life at Sea (SOLAS), and it is member of the International Maritime Organisation (IMO)[12].

2.3.5.3 Strategies and Outlook

The government has plans to improve efficiency of ports and airports and extend the current maritime transport network by creating additional domestic and international passenger routes to Indonesia and Australia (RDTL 2007b). With continuing population growth, the current size of the Dili international port will not be sufficient after 2010-2012 (Böttner, G., pers. comm.). Its current location in the middle of the city also cannot be sustained in the long run (GERTIL 2001). The government is currently investigating the possibility to build a new international port at Tibar bay, 15km west of Dili. The location offers supportive bay conditions, and the wide, open hinterland would accommodate for the construction of the port city. Negotiations between the government and potential construction companies are underway and a feasibility study is being conducted with support from the German government (RDTL 2007b). Further hydrographic and topographical surveys are needed, and funding arrangements are yet to be decided on. The proposed port would be substantially larger than the Dili international port and could possibly serve as a regional hub for eastern and western trade due to its strategic location between the Pacific and Indian Ocean. In the long run it might also be necessary to revive or construct ports along the southern coasts thus facilitating maritime transport between Australia and Timor-Leste, and to oil platforms in the Timor Gap (GERTIL 2001).

The government is also considering putting into service the International Baucau airport and construction of domestic airports (RDTL 2007b).

2.3.5.4 Potential Impacts and Conflicts

Seaports can play a major role in supporting the local economy. They can support the growth of port-related industrial activities and promote urban and industrial development. With rapid population growth and urbanization, ports can become important sources of income and employment. On the other hand they might affect traditional methods of earning livelihoods and potentially cause displacement and disruption of coastal communities. Social conflicts and equity issues might arise with respect to the distribution of benefits that favors industry and urban development over rural livelihoods.

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[12] Most international conventions were signed by Indonesia during the time of occupation. They remain valid in Timor-Leste unless replaced by other laws and agreements.

With respect to environmental impacts, the construction and operation of a port inevitably impacts on the coastal landscape. Coastal habitat such as coral reefs and fringing mangroves might have to be removed to accommodate for the new port and its facilities, and construction activities might disrupt marine life and pollute the environment. The proposed construction of the Tibar international port would require removal of coral reefs and other habitat. Marine pollution from shipping and port-related activities includes accidental and deliberate discharges of waste products, dirty oils, and ballast water, and hazardous materials such as bulk oil, chemicals, LPT and ore concentrates that are transported via ships (Morrison and Delaney 1996). Particularly mangroves are susceptible to oil pollution that may block their breathing roots (pneumatophores) and cause asphyxiation of trees (Mitsch and Gosselink 2000).

Big infrastructure projects such as the construction of a new international port require close collaboration between different government agencies that hold a stake in such development. There might be clashes of interest between different stakeholders such as the Port Authority, the Directorate of Land and Property, TradeInvest (under the prime minister's office and responsible for attracting investors), and environmental protection efforts.

2.3.6 Other coastal resources uses

The following table summarizes other uses of coastal resources compiled from Sandlund et al. (2001), Pires (2001), and own observations.

Table 5: Coastal resource uses in Timor-Leste

	Extent	**Potential impacts**
Salt extraction	Practiced in barren salt flats that naturally occur behind some mangrove fringes. Some salt evaporation ponds have been constructed e.g. around Manatuto	So far there seems to be no severe damage to mangroves, but further development/expansion needs to be monitored.
Sand & gravel extraction	Common practice in river-mouths and beach-crests along the northern coast.	If excessive, this could lead to shoreline erosion, instability of river bank or seabed, and destruction of habitat and fish spawning grounds. At the moment sediment input from rivers appears to exceed extraction.
Aquaculture	Some small-scale ponds (mainly prawn and mullet farming) exist along the north coast behind fringes of mangroves. The extent is limited so far, but plans for expansion exist and need to be monitored.	Aquaculture development can lead to destruction of mangrove forests, salinisation of adjacent groundwater, eutrophication, pollution with chemicals and drugs, and spreading of prawn diseases.
Mining	Timor-Leste is rich in natural resources such as onshore and offshore oil and gas reserves, gold, silver, chromite, bentonite, clay, sandstone, marble, limestone, basalt, silica and a few other resources. To date there are no mining activities	Mining could cause environmental pollution from slurries and wastes that are transported to coasts by rivers and seepage.

	except petroleum extraction.	
Sea turtle eggs, meat and shell	Turtle shell is used for handicrafts/jewelry or decoration and sold to locals & tourists throughout the country, e.g. along the road between Manatuto and Dili, and in Tutuala. Eggs and meat are consumed locally.	Sea turtles are listed as endangered species. Over-harvesting could remove these species from Timorese waters.
Collection of ornamental shells, corals, and live fish & reef invertebrates	Collection and sale of ornamental shells and corals is common. The capture of live marine ornamental fish and reef invertebrates (including corals) for export to the aquarium trade is currently not practiced in Timor-Leste but is common in neighboring Indonesia.	This poses a risk in particular for slow-reproducing and rare/endangered species that might be threatened by extinction. For some species the limited collection might be sustainable, but this practice has to be carefully monitored, especially if tourism increases.

2.4 Other human impacts on the coastal zone

While the uses and impacts described above can be directly related to certain economic activities, there are many other ways through which humans modify and impact on, the coastal environment (many of them being indirect impacts from economic activities). The most important such impacts are described below.

2.4.1 Pollution and waste management

2.4.1.1 Status Quo

The extent of pollution of coastal habitats and waters in Timor-Leste is not being monitored and therefore remains unknown (Sandlund et al. 2001). From own observations and from a limited number of studies (Sandlund et al. 2001; Arafura and Timor Seas Experts Forum 2006) it appears that the scale of environmental pollution is still relatively low and confined to some (mainly urban) areas.

Left picture: waste disposed on main beach in Dili. Right picture: Dili international port – a potential source of marine pollution.

The main sources of pollution currently are waste (household food scraps, paper, plastic, cardboard, bottles, domestic waste water), construction (metal shavings, used tins, asbestos), agriculture (non-organic fertilizers, pesticides), motor vehicles (smoke, used oil), and tourism (liquid and solid waste) (Conceicao 2001). Solid waste from imported goods is said to have increased significantly since arrival of the UN

(Sandlund et al. 2001). Most of the rubbish is burnt, and wastewater goes untreated into creeks, beaches and groundwater (Conceicao 2001). Solid waste collection and disposal is currently estimated to be provided for 60% of households in Dili and 0% in other towns, sewage collection and disposal ranges between 60-76% for major urban settlements, urban drainage collection and disposal between 45-55%, and rural sanitation covers only 13% of all households (Australian Water Research Facility 2006: 11). Water quality seems to be a problem in some areas especially during the dry season. In Viqueque and Manatuto districts the water was found to be of extremely low quality (Abrantes 2001). The Timor Sea is a busy shipping route and a commercial fishing area. Although little accurate and reliable data is available on the present state of the marine environment, the Timor Sea is believed to be moderately affected by shipping and commercial fishing as well as oil and gas exploration (Morrison and Delaney 1996).

2.4.1.2 Institutional and Regulatory Framework

Draft laws on Environmental Impact Assessments, and Pollution Control and Hazardous Waste, and a Sanitation Management Decree including the establishment of a wastewater treatment system are currently awaiting the government's approval. The following regulations from Indonesian law are applied as subsidiary law (Conceicao 2001):

- The Indonesian Environmental Management Act (1997) is the primary piece of legislation governing environmental pollution.
- Indonesian Government Regulation No 20, 1990, regarding water pollution
- Indonesian Government Regulation No 27, 1999, regarding environmental impact assessment
- Indonesian Government Regulation No 41, 1999 regarding the control of air pollution
- Indonesian Government Regulation No 85, 1999 regarding the management of dangerous or toxic waste

2.4.1.3 Strategies and Outlook

The IV Constitutional Government Program 2007-2012 (RDTL 2007b) has set the target to substantially improve the quality of life of the Timorese with respect to drinking water and power supply, and provision of proper sewerage systems. There are plans to put in place legislation on sewerage and extend the existing sewerage network. It is suggested to set up a National Surveillance Network that would monitor the quality of water, soil and air. Other activities on the government agenda include a system of pollution control including and Environmental Licensing System, and the development of a National Policy of Waste Management.

2.4.1.4 Potential Impacts and Conflicts

Environmental pollution includes biological, chemical and physical pollution that can impact on the coastal zone in multiple ways. In urban areas, surface runoff, untreated wastewater, and septic tank leakage/overflows can contaminate coastal and marine habitat and pollute groundwater. In rural areas, river-borne pollution from agricultural practices such as use of fertilizers and pesticides, and increased sediment loads from deforestation can impact on coral reefs and fisheries. While pollution to date appears to be at a relatively low scale, this situation could change rapidly when economic development takes off. Future pollution sources may include harbour wastes, oil spillage, agricultural inputs, industrial chemicals, mining drainage, and waste from tourism (Conceicao 2001; Sandlund et al. 2001). Particular attention

needs to be placed on effluent from hospitals that may contain drugs and chemicals and pose a potential health hazard (Sandlund et al. 2001). A study in the Laclo catchment has shown an increase in chemical fertilizer use from 5% in 2003 to 52,7% in 2007 and pesticide use from 4% to 18.2% of farmers connected to the irrigation scheme (Ministry of Agriculture and Fisheries Timor-Leste 2007: 8). Chemical fertilizer use has dropped dramatically after independence but is increasingly needed to compensate for declining soil fertility (Arafura and Timor Seas Experts Forum 2006).

2.4.2 Deforestation and catchment degradation

2.4.2.1 Status Quo

Timor-Leste has a total forest area of 1.4 million ha, which is equivalent to approximately 53.7% of forested land cover (Nunes 2003: 20; WB and ADB 2007: 23). From this total cover, 350,000 ha might be under threat of degradation and deforestation (Nunes 2003). Forests in Timor-Leste have a long history of exploitation: local timber species such as teak, ebony, redwood and especially sandalwood were heavily exploited during Portuguese colonization and also during Indonesian occupation, most of which was exported. Even though commercial logging is nowadays prohibited by law, illegal logging is occurring in some areas. Another cause of deforestation is uncontrolled fire wood collection. Every household requires on average 24kg of firewood per day; with high rates of population growth and increasing urbanization this is posing a big challenge in particular for urban areas such as Dili where fire wood is already becoming scarce (RDTL 2007e). In coastal areas mangroves are being exploited for fire wood and other products (Nunes 2003). Mangroves are also reported to be cut at the IDP camp in Metinaro (Nunes, M., pers. comm.). This practice stands in contrast to reports from other parts of the country where mangroves are traditionally protected by customary law (Sandlund et al. 2001). Other causes of deforestation are fires (especially in Bobonaro and Manatuto), conversion for agricultural use, and livestock grazing (Bouma and Kobryn 2002). The deforestation rate is estimated to be approximately 1.2% per year, which is one of the highest rates in the region (WB and ADB 2007: 23).

Deforestation in combination with unsustainable agricultural practices has impacted on the condition of catchments. Erosion, soil loss, siltation of riverbeds, increased water turbidity, rapid water runoff, landslides and flood damage to land and property downstream are the main results of degraded catchments (Australian Water Research Facility 2006).

Left picture: Women collecting firewood on Atauro. Right picture: Muddy waters discharging into the sea, south coast.

2.4.2.2 Institutional and Regulatory Framework

The government of Timor-Leste is currently developing new forest legislation with support of the FAO (RDTL 2007e). In 2000 UNTAET put in place two emergency regulations for environmental protection: Regulation 19/2000 on protected places, and Regulation 17/2000 on the prohibition of logging operations and export of wood from East Timor. Under Regulation 19/2000, 15 protected areas were defined. Forest commissions were set up in three of these protected areas (Jaco, Tutuala, Natarbora) (Nunes 2003). Although these regulations still remain in place, they have been of limited success on the ground due to lack of enforcement. There is a need to either revise the existing or develop new legislation that takes into account the specific conditions of Timor-Leste (RDTL 2007b). There is also a need to strengthen the role of forest guards that are currently under-equipped and unable to avoid illegal logging.

The General Directorate of Forestry under the Ministry of Agriculture and Fisheries is the main government body in charge of protecting and regulating the use of forest resources. Besides Rehabilitation and Reforestation, the Directorate also has divisions working on Protected Areas & National Parks, and Watershed Management (see Table 6). A number of bilateral (Portuguese Aid Agency, Japan International Cooperation Agency JICA) as well as local and international non-governmental agencies (Haburas Foundation, CARE International, BirdLife International, Australian Water Research Facility) are engaged in projects related to reforestation, agro-forestry, and watershed management.

2.4.2.3 Potential Impacts and Conflicts

Deforestation and degradation of watersheds have led to increased amounts of sediments being carried to estuaries and reefs. Increased material input (sediment, nutrient, pollutant) can impact on the productivity and health of coastal ecosystems. It can change species composition and abundance, and it can threaten the ecological integrity of wetlands and coastal reefs (Gao 2006). In Timor-Leste the impacts of increased sedimentation are relatively unknown. A study conducted in 2007 in the Laclo catchment (Ministry of Agriculture and Fisheries Timor-Leste 2007) revealed that most of the sediments and nutrients from the river were carried over the narrow continental shelf and down into the deep ocean and therefore had little impact on coastal ecosystems. Along the south coast the situation might be different, because the continental shelf is wider and has a gentler slope, and there are more river deltas and floodplains in which materials can accumulate (Arafura and Timor Seas Experts Forum 2006). A pilot study in the Caraulun catchment started off in 2006 and is expected to be concluded this year (RDTL and CDU 2006). The condition of the watersheds might deteriorate if the trend towards increasing numbers of people moving uplands continues (Arafura and Timor Seas Experts Forum 2006).

Another impact from increased runoff due to deforestation is downstream flooding. Flash floods and landslides are common in particular during the wet season (IWC).

2.4.2.4 Strategies and Outlook

The General Directorate of Forestry is pursuing multiple strategies to halt deforestation and reduce the impacts from catchment degradation. The department of forest protection and rehabilitation has initiated a reforestation program (using especially local timber species such as sandalwood) that has already started off in a limited number of places such as Oecusse. Mangrove rehabilitation is a priority action and is planned for 2008 in Metinaro region and the area around Hera (Nunes, M., pers. comm.). The government aims at protecting at least 70% of forest by 2020 (RDTL 2007e). Agroforestry is promoted as an alterative to traditional slash and burn cultivation in the uplands. An expansion of forest commissions with active community

participation is needed to control illegal logging operations and increase public awareness (Nunes 2003). The Government Forestry Policy and Strategy (RDTL 2007e) sets out plans to actively involve local communities in the sustainable management of forest resources, for example through the establishment of communal wood plantations and through the utilization and recognition of traditional resource management and conflict resolution mechanisms. Local and international NGOs such as CARE International and Haburas Foundation, and the Portuguese Aid Agency (IPAD), take part in reforestation and agro-forestry initiatives.

The Japan International Cooperation Agency (JICA) and the Australian Water Research Facility (AWRF) run projects on Community-Based Integrated Watershed Management / Integrated Water Resource Management in the Laclo and Comoro Rivers (Ross et al. 2006; JICA 2007).

2.4.3 Spatial Planning

The use of urban and rural space currently is not regulated in a systematic way. Although the National Development Plan (Planning Commission 2002) did suggest the development of Urban Land Use Plans and Strategic Zoning Plans, these ideas never materialized. There are no restrictions for development along the shoreline. In Dili numerous foreign and local entrepreneurs are taking advantage of this lack of regulation by setting up restaurants and hotels on, or adjacent to, the main beach. In other urban areas such as Manatuto, housing construction projects are rehabilitating residential areas along the shoreline. Many abandoned properties are occupied by families without any legal ownership.

Government mandates for spatial planning are not very well defined. Under the Ministry of Infrastructure, the Secretary of State for Electricity, Water and Urbanization is responsible for urban planning. The government's approval of the Urban Master Plans for Dili and Baucau produced by GERTiL, a group of architects from the Technical University of Lisbon, is still pending. Agricultural land use planning and mapping is done through MAF and with support from ALGIS, the Agricultural Land Use GIS Unit under MAF. MAF in cooperation with UNDP has recently embarked on a Sustainable Land Management Project that includes land use assessment (UNDP and RDTL 2007). The National Directorate for Land and Property (NDLP) handles cadastral matters related to land use and develops the legal framework for land and property.

Unplanned land use and occupation potentially undermines efforts to develop the country in a sustainable way. Strategic urban and regional planning needs to tackle the issue of illegal occupation and use of coastal land and resources, and it would need to find solutions for the numerous IDP camps that were set up on an adhoc basis and whose future is uncertain. Strategic spatial planning should also address the question how the coastal zone should be developed and whether and to which extent coastal development should be specifically regulated.


Left photo: construction of beach cafés in Dili. Right photo: construction of residential buildings in Manatuto.

2.5 Climate change

Coastal zones are more vulnerable to the impacts of climate change than other land types. This is not only to their naturally lower degree of resilience to environmental change, but also due to the high value that humans place on them as locations for settlement, economic activities and food production (Nunn and Kumar 2006). Climate change may pose a risk to human security particularly in societies where livelihoods largely depend on the provision of environmental goods and services, and where these goods and services are closely linked to climate (Barnett et al. 2003). Timor-Leste is among the countries classified as being 'extremely vulnerable' to climate change (Wasson 2001; Christoff 2008).

In Timor-Leste the discussion on climate change was initiated through two key events: a conference on Sustainable Development in East Timor in 2001 (Anderson and Deutsch 2001) and the 1st National Workshop on Climate Change in 2003 (Silva et al. 2003). The following issues have been identified by Barnett et al (2003; 2007) and Wasson (2001), as the key potential impacts from climate change on Timor-Leste.

The climate in Timor-Leste is expected to become hotter, drier, and more variable. This means that there will be less but more intense rainfall, and there will likely be more El Nino events and associated droughts. Reduced rainfall negatively impacts on agricultural productivity and food security and may become a problem in particular in some regions along the north coast that already suffer from water shortages during the dry season. Along the south coast the increased intensity of rainfall may result in increased soil erosion, flooding and landslides.

Recent estimates anticipate a global mean sea level rise of 9-88 cm over 100 years. Depending on the extent of sea level rise, associated effects might include shifting coastline and shoreline erosion, partial loss of tidal ecosystems such as mangroves and seagrasses, saltwater intrusion into freshwater aquifers (which is already a problem in Manatuto region), and increased flooding. Due to the generally steep terrain of the coastline, human settlements are only expected to experience damage in low lying areas such as Dili, the Manatuto region, and Oecusse. At first glance, Dili appears to be relatively vulnerable to sea level rise: it is located on a coastal plain, it is home to over 260,000 residents (19% of the country's total population), and many of the residential houses, government and commercial buildings and infrastructure are in very close proximity to the shoreline (National Statistics Directorate 2006). The risk of flooding from the three main rivers in Dili (Comoro, Bemorl, and Benmauc

rivers) is currently relatively low, but this may possibly change as a result from climate change.

The currently good condition of coastal and marine ecosystems may avoid or weaken some of the impacts on the coastal zone. Intact reef systems are more resilient to coral bleaching associated with sea temperature rise. Coastal wetlands such as mangrove forests can reduce the impact from sea level rise by protecting the coast from shoreline erosion and storm surge.

By becoming a member of the United Nations Convention on Climate Change (UNCCC) in 2006, Timor-Leste has the opportunity to receive financial and technical assistance to adapt to climate change. The National Capacity Self Assessment (RDTL 2007a) funded by the Global Environment Facility (GEF) was the first step towards implementation of the UNFCCC. The next step is a National Adaptation Plan of Action (NAPA) that will define priority areas of action that might be eligible for further funding. The government could also receive funding from the Clean Development Mechanism (CDM) and Adaptation and Mitigation Fund under the Kyoto Protocol (Wasson 2001). Activities such as mangrove reforestation represent an ideal opportunity for a CDM investment for carbon sequestration.

3 INSTITUTIONAL ROLES & RESPONSIBILITIES IN THE COASTAL ZONE

This section analyses which key institutions and laws influence the management of the coastal zone and gives an overview of the roles and responsibilities of the most important government agencies.

3.1 Institutional framework

The Democratic Republic of Timor-Leste (RDTL) is administratively divided into 13 districts (*distritu*), 65 sub-districts (*sub-distritu*), and 442 villages (*suco*) (National Statistics Directorate 2006). Eleven out of thirteen districts have a coastline.

Within the four-tier governance structure (central-district-subdistrict-village), most of the power and financial authority lies with the central government (McWilliam, A., pers. comm.). The local governments only account for less than 1% of total government spending (RDTL 2006). Despite recent commitments towards decentralization and strengthening of local governments, the central government to date remains the most powerful institution within the coastal zone. All natural resources are owned by the State (Palmer and de Carvalho 2007). The entire coastline and national maritime waters lie within the jurisdiction of the central government, with exception of the coastline of Dili that specifically falls under the jurisdiction of the Port Authority of Timor-Leste[13].

The government structure has undergone several transformations since its formation in 2002, and roles and responsibilities of the different government bodies are not well defined and often overlapping. The most important ministries and government agencies with respect to the coastal zone are depicted in Table 6. The roles and responsibilities of these institutions are discussed in further detail in chapter 3 on economic activities in the coastal zone.

There are very few mechanisms for integration between government agencies. An inter-ministerial natural resources working group at Vice-Minister level has been established but is currently not operational (Australian Water Research Facility 2006). One of the objectives of this group is to assess feasibility of integrated management at national and local levels, covering land, water and coastal zones. The implementation of the three UN Conventions on climate change, land degradation and biodiversity also require the establishment of inter-ministerial working groups that is currently still pending. A multi-sectoral National Disaster Risk Management Committee (NDRMC) is to be set up as part of the National Disaster Risk Management Plan drafted in 2005 (RDTL 2005). This Plan addresses potential risks such as tsunamis, earthquakes, floods, landslides, El Nino events and other climatic hazards. The establishment of a joint National Disaster Operations Centre, development of integrated early warning systems, and a comprehensive risk communications program are considered high priorities by the government (RDTL 2006).

Although there is no institution explicitly in charge of integrated coastal management (ICM), the NDFA under MAF has taken the lead in initiating ICM pilot projects. The NDFA will collaborate with the Secretariat for the Environment and other agencies

[13] According to the Decree Law 2003-03, the coastline under jurisdiction of the Port Authority of Timor-Leste is 'externally demarcated by the coastal road stretching from the Becora brook, to the east, to Pertamina terminal inclusive, to the west'.

within MAF in developing a policy framework for ICM and site-specific management plans (NDFA 2005) (see chapter 8).

Table 6: Government roles and responsibilities in the coastal zone of Timor-Leste

Government agency		**Roles & Responsibilities**
Office of Prime Minister		
	Office of Secretary of State for Natural Resources	design, execution, coordination and assessment of policies in the areas of mineral and natural resources, including oil and gas, activities such as mining, petroleum and chemical industries; urban waste management
	TradeInvest	national investment agency that aims at promoting & facilitating foreign investment
Ministry of Economy and Development		
		draft environmental policies and evaluate & monitor implementation; conduct strategic environmental assessments of plans & programs, coordinate EIA of national-level projects; promote strategies for integrating environmental issues in sectoral policies; ensure adoption of pollution prevention & control measures when issueing environmental licences to production facilities
	Secretariat of the Environment	Coordination of implementation of climate change and biodiversity conventions; environmental education; National Parks and protected areas
Ministry of Infrastructure		
	Transport & communication	land transportation, sea transportation, civil aviation
	Public Works	Flood control, erosion prevention
	Secretary of State for Electricity, Water & Urbanization	urban planning: oversee all urban constructions, develop national urbanization plans
Ministry of Agriculture and Fisheries		
	General Directorate of Forestry	Rehabilitation & reforestation; Production & Utilization of Forest Products; Protection & Management of Forest Resources; Protected Areas & National Parks; Watershed Management
	National Directorate of Fisheries & Aquaculture	Fisheries industry; Marine resources; Aquaculture & Salineculture; Implementation of ICM pilot projects and MPAs
	Inspectorate of Fisheries	Monitoring, Control & Management; Enforcement & Prosecution; Vessel Monitoring Systems
	General Directorate of Food Crops & Horticulture	Food production; Horticulture; Irrigation & Water User Management
	General Directorate of Industrial Crops	Coffee; Perennial Plants & Herbs
	Agricultural Landuse Geographic Information System (ALGIS) Unit	Provides Ministry with maps, spatial data, remotely sensed images, tables, agro-climate data and analysis to support activities.

Ministry of Tourism, Trade & Industry		
		design, implement and evaluate national tourism policy
Ministry of Defense & Security		
		oversee military & civil maritime navigation; look after safety of people & goods in case of fires, floods, landslides, earthquakes and other hazardous situations
	National Police Marine Unit	coast surveillance, ensure compliance of fishing in EEZ with law, monitor compliance with tax & customs laws, control of maritime border
Port Authority of Timor-Leste		
		port rehabilitation and development; provision of services relating to the functioning of ports within and outside jurisdiction, namely in assisting ships and ensuring safe navigation
Ministry of Justice		
	National Directorate of Land and Property	development of land law; establishment of land registry; land surveys and cadastral matters; valuation and land/property taxation; administration of State land, Government land, and Abandoned land

3.2 Legal framework

The statutory framework for coastal management in Timor-Leste constitutes elements of national as well as international law as depicted in Figure 8. There is no overarching legislation that covers (integrated) coastal management in Timor-Leste, instead, the approach is currently sectoral. While it is beyond the scope of this report to individually discuss all laws and regulations that impact on the coastal zone, the following sections discusses the main pieces of legislation and highlights the key problems of the current legal framework with respect to coastal management.

3.2.1 National Law

The regulatory framework in Timor-Leste is still incomplete and administration and law enforcement are weak. The legal system in Timor-Leste is a complex mosaic of Indonesian, UNTAET (United Nations Transitional Administration of East Timor), and RDTL (Democratic Republic of Timor-Leste) law. Indonesian law is used as subsidiary law that is successively replaced as new laws (largely based on Portuguese law) are passed by the government. There is currently no overall Environmental Protection Act, but the Constitution of Timor-Leste Article 61 on the environment establishes the fundamental right to a human, healthy, and ecologically balanced environment, and emphasizes the role of the State to protect the environment and safeguard the sustainable development of the country. Land and resource management laws are as yet unformed and contested, and there is no piece of legislation explicitly mentioning coastal management. Figure 8 shows the main pieces of legislation relevant to coastal zone management.

A main problem of the current legal system is the lack of enforcement. One reason for this is limited financial and human resources. For example, there are currently only 26 forest guards in charge of controlling illegal logging throughout the entire country (Nunes, M., pers. comm.), and there are only two coast guard boats in charge of patrolling the entire coastline. Secondly, the Indonesian law is not entirely compatible with the judicial system and therefore cannot be implemented consistently (Silva et al. 2003).

The UNTAET Regulations, most importantly Regulation 2000/19 on protected places and Regulation 2000/17 on the prohibition of logging operations and export of wood from East Timor, were emergency steps taken to protect the environment from imminent destruction. Because of their explicit relevance to environmental protection in the coastal zone, it is worth discussing them in some detail. Under Regulation 2000/19 (UNTAET 2000a), 15 protected areas were designated, seven of them including coastal areas[14]. The regulation specifically aims at protecting endangered species, coral reefs, wetlands, mangrove areas, and historic, cultural and artistic places. Any potentially harmful activities such as hunting, agricultural cultivation, construction activities and pollution are prohibited, with exception of some specified traditional local practices. Regulation 2000/17 (UNTAET 2000b) prohibits 1) cutting, removal and logging of wood from land in East Timor, 2) export from East Timor of wood in any form, including logs, planks, plywood or furniture, and 3) the burning or any other destruction of forests. The prohibitions do not apply to producing wood for traditional farming and other domestic, traditional or cultural uses, construction of traditional houses, construction of religious buildings on land below 1500 meters elevation and which has slope of less than 25%.

These regulations are ambitious but have been of limited success so far. Besides the problem of weak enforcement, they have been criticized for not adequately reflecting the local conditions of the country, in particular with respect to the penalty system (Nunes, M., pers. comm.). There is a need to draft a policy on the implementation of these regulations.

The unsettled issue of land ownership has implications for land-use and spatial planning, including in the coastal zone. At present, land claims consist of a complex layering of customary tenures, holders of titles issued in the Portuguese era, holders of titles issued in the Indonesian era, and current occupiers (Fitzpatrick 2002). Many real estates have been illegitimately occupied or appropriated (East Timor Land Law Program 2005). The Directorate of Land and Property under the Ministry of Justice is devising a legal framework for land ownership based on preliminary work done by the East Timor Land Law Program, an initiative between the Directorate of Land and Property under the Ministry of Justice, the UNTL (National University) and ARD Inc. (Nixon and Urresta 2004). It is not clear to which extent traditional indigenous governance structures will be recognized within this system. While there is no explicit recognition of customary tenure within the Constitution, all natural resources are clearly stated as being State property (Langton et al. 2005). There is an urgent need to approve the pending land law, establish a registry for real estate, and develop Strategic Zoning Plans and Urban Land Use Plans as proposed in the National Development Program 2002-2007.

At present, draft laws on Environmental Impact Assessment (EIA) and pollution control are discussed in parliament. In the future it will be necessary to develop additional laws such as on biodiversity and a general environmental protection law (Ximenes, C., pers. comm.)[15].

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[14] Jaco Island together with surrounding rocks, reefs, and other surface and sub-surface features, Tutuala Beach and adjacent forest, Cristo Rei Beach and hinterland, Manucoco Reserve on Atauro Island, Riverlet Clere Sanctuary, Tilomar Reserve, and Lore Reserve.

[15] Carlos Ximenes is the Director of the Secretariat of the Environment, Ministry of Economy & Development.

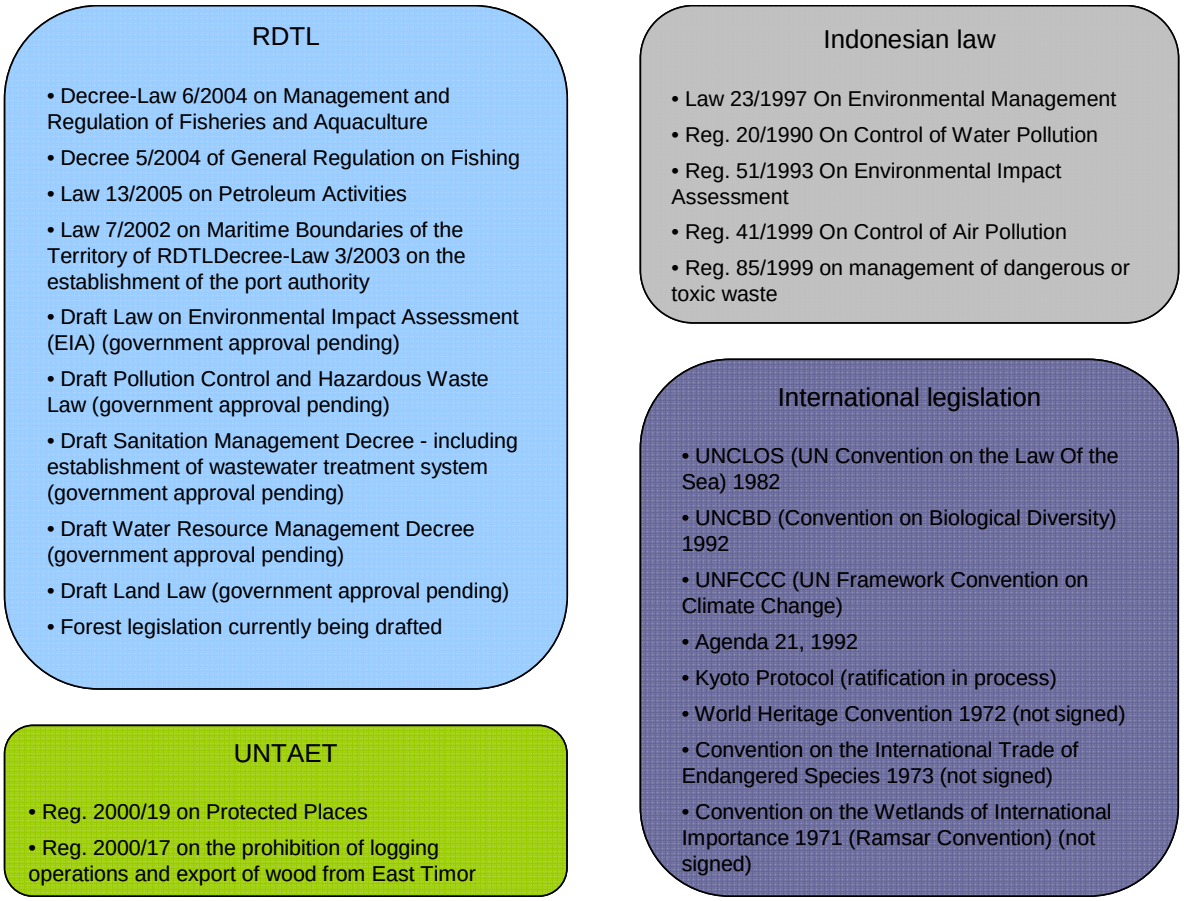


Figure 8: Key national and international legislation influencing coastal management in Timor-Leste

3.2.2 International Environmental Law

International Environmental Law refers to international agreements such as treaties, conventions, covenants and declarations of principles (Ogle 2001). Below are the most important agreements that Timor-Leste has committed to and that are relevant to coastal management.

The United Nations Conference on Environment and Development (UNCED) in 1992 passed a major resolution on protecting the environment called Agenda 21. Chapter 17 explicitly deals with the protection of the marine and coastal areas (UN 2004). The principles for Sustainable Development on which Agenda 21 is based have been enshrined in the constitution of Timor-Leste.

In April 2006, Timor-Leste ratified three UN Conventions, namely the UN Convention on Biological Diversity (UNCBD), the UN Framework Convention on Climate Change (UNFCCC), and the UN Convention to Combat Desertification and Land Degradation (UNCCD). As a first step towards implementation, the government has gone through a National Capacity Self Assessment (NCSA) which has resulted in the formulation of priority issues (RDTL 2007a).
The UNCBD addresses various issues of biodiversity including protection and equitable use of biological resources in the coastal zone. The national priority for the Thematic Area Coastal and Marine Biodiversity as formulated by the NCSA (RDTL 2007a: 13) is the need for an 'integrated ecosystem approach to sustainable use of coastal and marine biodiversity, improved marine protected areas and community involvement in fisheries management, and data on the taxonomy, status and biological characteristics of fish species and habitats'. Furthermore, it is suggested to

develop national guidelines for an 'ecosystem approach in marine and coastal biodiversity for integrated coastal management', and draft a policy on coastal zone management (RDTL 2007a: 15).

The UNFCCC is an intergovernmental agreement to combat climate change. For Least Developed Countries such as Timor-Leste, the Convention poses no restrictions on development and calls for no specific GHG reduction targets, but it offers financial and technical assistance to countries to adapt to climate change (Barnett et al. 2003). Article 4 paragraph 1(e) calls on parties to cooperate in adapting to climate change, and develop appropriate and integrated plans for coastal zone management (Barbosa 2007). The priority issues for Timor-Leste include vulnerability assessment on drought, flood and coastal area management, and improved coordination between agencies that deal with climate related issues, including information exchange on vulnerability and coastal zone management (Barbosa 2007).

Priority issues for the UNCCD include improved watershed management to reduce deforestation and catchment degradation, and mitigation strategies to cope with drought (RDTL et al. 2007).

UNCLOS (UN Convention on the Law of the Sea) 1982 defines a coastal state's jurisdictional rights for internationally recognized maritime zones, including inland waters, the territorial sea, the contiguous zone, and the Economic Exclusion Zone (EEZ) (UN 2007). In 2002 Timor-Leste enacted Law 7/2002 on Maritime Boundaries which is based on international law, in particular UNCLOS. Under this law, the country's territorial sea, continuous zone, and EEZ have been set at 12 nm, 24 nm, and 200 nm, respectively. However, the definition of precise maritime boundaries with Australia and Indonesia is still pending (Timor Sea Office 2007).

The country is also member to the International Maritime Organisation (IMO) and signatory of MARPOL, Other international treaties that Timor-Leste might consider signing in the future are the World Heritage Convention 1972, the Convention on the Wetlands of International Importance 1971 (Ramsar Convention), the Convention on the International Trade of Endangered Species 1973, and the Kyoto Protocol[16].

[16] The ratification of the Kyoto Protocol has already been approved by the Council of Ministers (Carlos Ximenes, pers com).

4 PARTNERSHIPS, PROJECTS AND INITIATIVES IN THE COASTAL ZONE

During the first years of independence, most government initiatives and international engagement in Timor-Leste have been devoted to securing political stability, improving health conditions, and fostering economic development. Nevertheless, environmental issues and issues of sustainable development are finding increasing the attention of political decision-makers, the international research community, and the Timorese society at large. There are a number of ongoing activities in Timor-Leste that are in one way or the other related to coastal zone management. These include governmental as well as non-governmental projects and partnerships, and research activities. The people and networks behind these activities are important stakeholders and valuable sources of knowledge with respect to coastal zone management in the region. The following sections will discuss activities of the Timorese government, civil society organizations, and international cooperation and research initiatives. The distinction however is somewhat arbitrary; many of the activities are partnerships engaging multiple governmental and non-governmental stakeholders and could therefore fit into any of the categories. The activities are therefore placed in the category of the key actor that holds a dominant role in the described activity.

4.1 Governmental initiatives

Timor-Leste is a member country of the Regional Programme on *Partnerships in Environmental Management for the Seas of East Asia* (PEMSEA). In December 2006 it signed the Haikou Partnership Agreement for the implementation of the *Sustainable Development Strategy for the Seas of East Asia* (SDS-SEA) (Ministerial Forum 2006). PEMSEA is a joint initiative between the Global Environment Facility (GEF), United Nations Development Programme (UNEP), and the International Maritime Organisation (IMO). It aims at building interagency, intersectoral, and intergovernmental partnerships for achieving sustainable development of the Seas of East Asia (PEMSEA 2008). It has developed a range of methodologies, techniques, working models and standards that help to improve coastal management, such as the Integrated Coastal Management (ICM) framework that has been successfully applied at numerous project sites.

One of the first steps under this agreement was the formulation of an SDS-SEA Work Program for the country. The government has agreed with PEMSEA to jointly implement the *Integrated Coastal Resource Management Project 2007-2010* (RDTL and UNDP 2007). The main components of this project will be (a) the development and adoption of an integrated coastal and marine policy and a State of Coast (SOC) reporting system; (b) the development and implementation of a community-based alternative livelihood program through seaweed farming and coastal resource conservation; and (c) the development and implementation of site-specific strategies and management plans for coral conservation and marine protected areas within an Integrated Coastal Management (ICM) framework (MAFF 2007; PEMSEA 2008). NDFA is the main implementing agency of behalf of the government of Timor-Leste.
The official establishment of the Nino Konis Santana National Park in August 2007 (RDTL 2007d) has been a major achievement of the government of Timor-Leste in terms of protection of coastal habitat. The National Park stretches over an area of approximately 123,590 hectares, including 67,930 ha of terrestrial and 55,660 ha of marine area (de Carvalho et al. 2007a). It includes the island of Jaco and the coastline of Lautem district. A detailed map of the National Park is provided in Appendix III.

The marine area of the Natural Park is entirely located within the so-called 'Coral Triangle' discussed below, and it links together three Important Bird Areas (IBAs) designated by BirdLife International: Lore; Monte Paitchau and Lake Iralalara; and Jaco Island (BirdLife International 2007).

The National Park will be managed cooperatively with local communities. In accordance with the management principles of the *IUCN Management Category V Guidelines for Protected Area Management* (Phillips 2002), a collaborative joint management approach is envisaged to protect the rights of use for local communities for sustainable traditional, spiritual and cultural needs, and respect customary ownership. To date, multiple stakeholder surveys and community consultation have been conducted, and a legal and regulatory framework for management and enforcement has been drafted (de Carvalho et al. 2007a). An Interim Committee including representatives from government as well as from villages within the designated area is yet to be set up. Next steps include formal declaration to establish the National Park as an internationally recognized Protected Area (such as inclusion in World Heritage listing), establishment of the management structure, and completion of the legal and regulatory framework.

Several activities are currently underway relating to the establishment of Marine Protected Areas (MPAs) in Timor-Leste. The NDFA is undertaking surveys to identify potential sites for MPAs in collaboration with FAO and PEMSEA (dos Santos Silva et al. 2007; RDTL and UNDP 2007). The Northern Territory government, Australia, is working with the Timorese government to help establish the first marine park in Timor-Leste (ABC News 2007).

The *Coral Triangle Initiative (CTI) on Coral Reefs, Fisheries, and Food Security* is an initiative that brings together six governments including Timor-Leste, Indonesia, Malaysia, the Philippines, Papua New Guinea, and the Solomon Islands, and aims at protecting marine life, promoting sustainable fishing, and ensuring food security in the region (Aglionby 2007). It was initiated by the Indonesian government and was endorsed by participating governments during the APEC Summit in September 2007.

4.2 Civil society organizations

Civil society organizations are organizations that were formed in society and in separation from government and the private sector (Bano 2001). In Timor-Leste, civil society has strong roots in resistance organizations working underground during Indonesian occupation and fighting for independence. Many of these organizations are now gradually evolving into organizations that help rebuilding the country (Bano 2001). The sector is developing rapidly with numerous organizations cropping up, and many of them disappearing again as funding dries up. East Timor NGO Forum is functioning as an umbrella for many of these organizations.

The most famous and most active environmental NGO (Non-governmental organization) operating at the national scale is Haburas Foundation. Based in Dili, it runs various projects throughout the country related to protection and management of coastal resources. Most activities are based in the Lautem district (Tutuala, LosPalos, Jaco island) where the organization has its roots and where the newly established National Park is situated. Projects include mangrove replanting, ecotourism development, catchment rehabilitation and reforestation, environmental education and the strengthening and other traditional natural resource management regimes (Haburas Foundation 2007). Haburas works closely with local community groups and aims at utilizing traditional Timorese culture to promote sustainable environmental practices and at the same time addressing developmental needs of communities. For example, Haburas worked with elders in seven communities to

revive tara bandu (ritual prohibition, discussed in chapter 2.3). In one of the communities the focus was on coastal resources management. Haburas is engaging in capacity building and community education and helps communities to shift from environmentally harmful practices such as destructive fishing methods and harvesting of turtle eggs, meat and shells to environmentally sound practices. For example, it educates local people to substitute turtle shell with other materials such as wood and bamboo to produce handicrafts.

Demetrio Amaral de Carvalho, director of Haburas, won the Goldman Prize in 2004 for bringing sustainable development and environmental protection into the constitution of Timor-Leste.

Left picture: Selling turtle-shell jewelry in Tutuala. Right picture: Environmental education at eco-lodge, Jaco.

Another locally active NGO is Roman Luan on Ataúro Island. One of the activities is the Bikeli Marine Management Project that helped to establish two community-based Marine Protected Areas (MPAs) in the Bikeli region of Ataúro Island (Pedi 2007). Subsistence fishing and agriculture are the main sources of livelihood on the island (NDFA 2005). In response to declining fish catches, the fishing communities in cooperation with Roman Luan established the two MPAs for which a set of regulations have been drafted (Belo Soares, M., pers. comm.). The NGO is also running an eco-lodge on Vila beach and has developed a set of guidelines for sustainable eco-tourism (see Appendix I). All regulations and guidelines were developed through a consultation process that brought together key stakeholders such as village heads, Fishermen's cooperatives, and Dili-based dive tour operators. Other activities are concerned with sustainable fisheries and include a survey of fisheries operations and community workshops on safe fishing practices, and coastal revegetation (Pedi 2007). A partnership project between Roman Luan, the Australian Conservation Foundation, and the Marine and Coastal Community Network in Darwin engaged in capacity building in community-based marine management.

There are a number of international NGOs active in Timor-Leste and in the Coral Triangle region. The World Wide Fund for Nature (WWF) and The Nature Conservancy (TNC) have multiple project sites in Indonesia and other parts of the Coral Triangle region, and they are major drivers behind the Coral Triangle Initiative that was signed by Timor-Leste in 2006. In the Alor-Solor region of Eastern Indonesia, just off the coast of Timor-Leste, WWF/TNC have worked with the local government and communities to help establish a number of Marine Protected Areas (MPAs) (WWF 2007). Ataúro Island, which is located just approximately 20km from Wetar and 45km from Alor, and whose inhabitants are connected to the Indonesian islands through trade and family bonds, has been influenced by the experience of MPAs in Indonesia. According to Marcelo Belo Soares, secretary and program manager of Roman Luan, learning from the Indonesian example has been a major impetus for Bikeli fishermen to initiate the MPA on Ataúro Island (pers. comm.).

BirdLife International, a global partnership of non-governmental conservation organizations, has been working with the Timor-Leste government (Ministry of Agriculture, Forestry and Fisheries, MAFF) since shortly after the country's formal independence and has conducted a number of biological surveys in the region that helped to identify key bird habitat areas. Currently the group is working on developing a community-based consultative process for conservation and a national protected areas network, and helping to draft national protected area legislation and policy frameworks (BirdLife International 2007).

4.3 International cooperation and research

International development aid agencies have directed substantial funding towards improving environmental management in Timor-Leste. UNEP has projects related to environmental governance and access to Multilateral Environmental Agreements (MEAs), sustainable rural energy development, biodiversity conservation and land degradation management (UNDP and RDTL 2006). UNDP in cooperation with Norwegian Institute for Nature Research also conducted an assessment of environmental needs and priorities in Timor-Leste. The widely-quoted final report (Sandlund et al. 2001) is the only national-scale study on the state of the environment after independence. The World Bank has funded coastal baseline and fisheries studies as part of the Second Agricultural Rehabilitation Project (Stockwell 2002). The Asian Development Bank (ADB) has put funding into the Hera Port Rehabilitation Project, and integrated water resource management (ADB 2004). AusAID has conducted projects on fisheries management planning, fish stocks assessment in Dili harbor, and agricultural and forestry landuse mapping (AusAID 2007). The FAO is currently cooperating with the NDFA to assess the prospects for establishing MPAs in a number of locations in Timor-Leste, including Ataúro island, Manatuto and Liquiçá (dos Santos Silva et al. 2007). The project included some limited coastal community surveys and a coastal baseline survey, and the development of a coastal mapping system. After conclusion of the final report there was no follow-up on the proposed community-based coastal resource management scheme. These are just a number of selected activities that are of relevance to coastal zone management.

The international research community is becoming increasingly interested in Timor-Leste as a study site. Throughout Australia, there are multiple research groups working in particular on Timor-Leste and/or the Asia-Pacific region. It is beyond the scope of this report to list all studies relevant to the coastal zone in Timor-Leste. The following studies include those that were identified as most relevant for this research topic and were used as references throughout the report.

A number of research activities were initiated under the umbrella of the Arafura Timor Research Facility[17]. The 'Timor-Leste Coastal/Marine Habitat Mapping for Tourism and Fisheries Development Project' is a joint initiative between the government of Timor-Leste, the Northern Territory government, Australia, and a group of Australian research institutes (refer to Box 2).

Australian universities such as Charles Darwin University, Australian National University, James Cook University, University of Western Australia and Murdoch

[17] The ATRF is a joint venture between the Australian Institute of Marine Science (AIMS) and the Australian National University (ANU). It collaborates with the Charles Darwin University (CDU), the Northern Territory government and the James Cook University in a number of research studies in Timor-Leste.

University all have research groups dedicated to research in Timor-Leste. Some relevant studies include an assessment of vegetation change and land use patterns in Timor-Leste between 1989-1999 conducted by Bouma and Kobryn (2002) from Murdoch University, and an ongoing study of the Australian Water Research Facility (2006) on biophysical, economic, social and cultural aspects of water resources in Timor-Leste.

The University of Timor-Leste (UNTL) currently does not offer any education in coastal or marine sciences or natural resources management. The CDU works closely with the UNTL to provide professional development programs and graduate courses (Bock 2006).

Timor-Leste Coastal/Marine Habitat Mapping for Tourism and Fisheries Development Project

The government of Timor-Leste in cooperation with the Northern Territory government, Australia, and a consortium of research institutes including Charles Darwin University, Australian National University, Australian Institute of Marine Science and the Arafura Timor Research Facility, has recently embarked on a Tourism & Marine Mapping project that aims at identifying potential sites for national and marine parks, tourism infrastructure, and small scale fishing and aquaculture industries.

The program embraces six individual research projects related to

1) Coastal/Marine Habitat Mapping

2) Coastal & Marine Ecotourism on the North Coast of Timor-Leste

3) Megafauna Surveys for Ecotourism Potential

4) Jaco Marine Park – Timor-Leste's first Marine Protected Area

5) Fisheries Development in the Com-Tutuala-Jaco Island area

6) River Catchments and Marine Productivity in Timor-Leste –Caraulun Catchment to Coast.

Under the Coastal/Marine Habitat Mapping project, scientists from Australia and Timor-Leste will systematically map five nautical miles of the marine environment along the entire coastline of Timor-Leste. The marine survey information will be put into a geographical database that links to marine habitat maps. After conclusion of the study, the equipment for marine species identification will be left in Timor-Leste as to encourage continuation of mapping and monitoring after the project ends.

Project 2 includes the creation of an inventory of coastal and marine natural, cultural and heritage values, an assessment of current and potential ecotourism infrastructure, and the development of a coastal and marine ecotourism strategy for the north coast.

Project 3 aims at identifying marine megafauna such as cetaceans, sharks and other fishes by means of aerial surveys of coastal waters and ground truthing field trips.

The Jaco Marine Park project explores the possibility of creating the country's first official Marine Protected Area. Besides in-depth coastal and marine field surveys, it also includes stakeholder consultation as well as capacity building in MPA planning, consultation and implementation, and the development of a Marine Park Management Plan.

Project 5 aims at evaluating the potential especially of offshore deep water fisheries along the north coast.

The Caraulun Catchment study is a follow-up study of the pilot project in the Laclo catchment that was conducted in 2006 (Arafura and Timor Seas Experts Forum). These two studies investigate the impacts from upland land-use in two major river catchments (the Laclo River along the north coast and the Caraulun River along the south coast) on erosion and downstream sedimentation and coastal sediment deposition.

Sources: ABC News (2007), Bock (2006) and Ministry of Agriculture, Forestry and Fisheries and Charles Darwin University (2006).

Box 2: Timor-Leste Coastal/Marine Habitat Mapping for Tourism and Fisheries Development Project

5 TOWARDS INTEGRATED COASTAL MANAGEMENT (ICM)

While the previous chapters have assessed the environmental, social, economic, and institutional characteristics of the coastal zone, this chapter will introduce the concept of Integrated Coastal Management (ICM) and analyze its applicability to the context of Timor-Leste.

Integrated policies towards the management of the coastal zone currently do not exist in Timor-Leste. In fact, coastal management is a term rarely ever encountered in East Timorese policy-making. The coast and its resources are managed in a sectoral, non-integrated way. Nevertheless, the interest in ICM has been growing in the country. The need for a more integrated approach towards coastal management has been explicitly mentioned in a number of reports and government documents, such as:

- The National Development Plan 2002-2007 (Planning Commission 2002: 220) lists as one of the proposed project activities under the Division of Environment the development of a draft policy on catchments and coastal zone management. This activity was never realized.
- Timor-Leste's recent commitment to the regional PEMSEA network includes the development of an ICM framework and the implementation of site-specific ICM pilot projects (RDTL and UNDP 2007).
- 'Fish for Sustainability', the Strategic Plan for Fisheries produced by NDFA (2005: 13), states the need for NDFA to collaborate with the Department of Environment to promote an ICM policy and develop site-specific plans.
- The National Capacity Self Assessment (NCSA), a process identifying potential action points for the implementation of the three UN Conventions on biodiversity, land degradation, and climate change, identified uncontrolled and unregulated coastal zone management as one of the urgent environmental problems and suggests the drafting of a policy on coastal zone management (RDTL 2007a).
- In 2002, a marine environment/coastal management specialist working with MAF as part of the Second Agriculture Rehabilitation Project (ARPII) identified the need for improved coastal resource management. He suggested a co-management or community-based coastal management scheme and did some groundwork on developing a coastal resource management framework (Stockwell 2001) (see Appendix III). He also developed a detailed prototype ordinance for community resource management.
- In 2001, an assessment of environmental needs and priorities in Timor-Leste identified the need to develop integrated coastal zone management as one priority issue.

While these references clearly suggest the development of an ICM policy, this process is only just starting to gain momentum. These following sections have been produced in order to facilitate the development and implementation of an ICM strategy in Timor-Leste.

5.1 Principles of ICM

The term Integrated Coastal Management (ICM) – or Integrated Coastal Zone Management (ICZM) – emerged in the late 1960s as a new concept to better

integrate and co-ordinate human activities in the coastal zone[18]. With the emergence of the sustainable development paradigm in the early 1990s grew the understanding that conventional sector-based, short-term management approaches were not effective in dealing with the complex nature of coastal issues and with increasing local, regional, and global pressures on the coastal zone (Thia-Eng 1993). ICM is a broad concept that has been defined and interpreted in many ways in different parts of the world. Sorensen (1997: 9) defines ICZM as 'the integrated planning and management of coastal resources and environments in a manner that is based on the physical, socioeconomic, and political interconnections both within and among the dynamic coastal systems, which when aggregated together, define the coastal zone'. It can be broadly understood as a process of managing and balancing the various and often conflicting resource uses and demands within a geographically defined coastal zone. In short, the main principles and characteristics of ICM are that it (Sorensen 1993; Kay and Alder 2005):

- applies a holistic*, systems perspective* that looks at variable impacts on the coastal zone and their interconnections;
- is based on the *sustainable development* principle that aims at balancing conservation needs with socioeconomic development
- takes a *long-term perspective* which takes into account the *precautionary principle* and the needs of present and future generations
- is an iterative, *adaptive management* process that needs to respond to local specificities and adapt to changing conditions, for example caused by climate change, population growth, or economic development
- promotes stakeholder involvement through *participatory planning*

According to Cicin-Sain (1993) the notion of 'integration' can be understood as:

- Integration among sectors (e.g. fisheries, tourism, maritime transport)
- Integration between the land and water sides of the coastal zone
- Integration among levels of government (local, regional, national)
- Integration between nations
- Integration among disciplines (e.g. natural sciences, social sciences, engineering)

Depending on whether the purpose of initiating an ICM process is to address current management problems, or to provide future directions for coastal development and management, an ICM program can focus on strategic or on operational management aspects.

Strategic plans aim at providing a framework for future coastal development and management and could target issues such as future coastal urban development, siting of ports, and development of tourism infrastructure (Kay and Alder 2005). A national-scale ICM strategy would typically be such a strategic document that defines broad, long-term objectives and sets the context in which more detailed site-specific plans operate.

[18] A range of terms are used in literature to describe this concept, including Integrated Coastal Management (ICM), Integrated Coastal Zone Management (ICZM), and Coastal Zone Management (CZM). For simplicity this paper uses the term ICM unless when quoting from original sources.

Operational ICM plans are more directed towards the day-to-day management of a particular site or issue. They set specific objectives and may include issues such as allocation of financial and human resources and establishment of working groups and management bodies (Kay and Alder 2005).

ICM is nowadays seen as a fundamental tool in achieving sustainable development and it has become a dominant paradigm in coastal management (Sorensen 1993, 45). It has been widely adopted by governments throughout the world. Especially in developing countries the number of ICM efforts is growing. Developing countries are particularly dependent on scarce coastal resources for economic growth and therefore benefit most from protecting the coastal environment and ensuring sustainable use of coastal resources (Thia-Eng 1993). The following section discusses the role of ICM in the Asia-Pacific region.

5.2 Coastal management in the Asia-Pacific region

The countries in the region share many similarities in the coastal zone. They often have similar biophysical characteristics, and many of the countries share social and cultural values and practices relating to coastal resource use and access. Many of the Pacific island states also have a common colonial history and often experience social conflict between different ethnic groups (Torell and Salamanca 2002). Past mistakes and best practices from other postcolonial and post-conflict states in the region can provide valuable lessons for Timor-Leste.

Sustainable development and ICM have been widely adopted in the Asia-Pacific region. Increasing pressures on the coast and deteriorating environmental quality was the trigger in many countries to adopt new management approaches for the coastal environment (refer to Box 3).

Coastal Zones in the Asia-Pacific

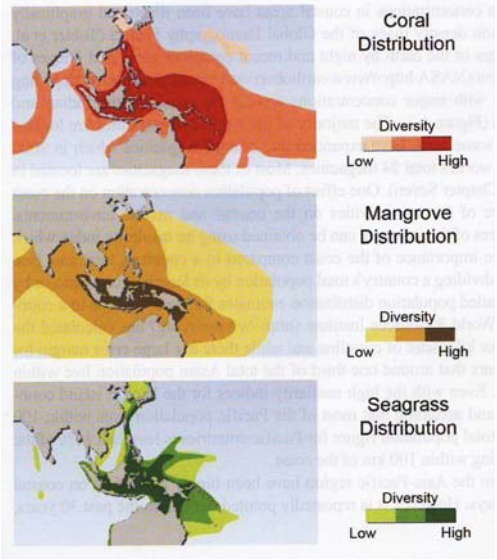
The Asia-Pacific coastal region has distinguished characteristics that make it particularly vulnerable to global environmental change and that require wise management of the coastal environment.

The most common problems in the Asia-Pacific coastal region include:

Rapidly growing coastal settlements: The Asia-Pacific is the region with the highest economic growth rate in the world, and populations are growing rapidly with increasing densities along the coast.

Deteriorating environmental quality: In some parts the coastal environment is heavily degraded and coastal resources such as mangroves, coral reefs and fisheries have been depleted at large scale.

Loss of critical habitats (in particular coral reefs, estuaries and mangroves): More than 60% of Asia's mangroves have been converted to aquaculture ponds, and coral reefs are under threat from rising sea temperatures and pollution. In Southeast Asia 88% of coral reefs are considered as facing medium to very high threat from anthropogenic pressures.



Distribution and density of coral, mangrove and seagrass in the Asia-Pacific region. Source: Harvey and Mimura (2006)

Reduced biodiversity: Southeast Asia is considered an epicenter of global marine diversity. It holds over 600 out of almost 800 coral reef species in the world, 75% of the world's mangrove species, and 45% of the world's seagrass species. Increasing pressure on their habitat puts many of these species at risk of extinction.

Depletion of fisheries: A number of factors have caused collapses of fish stocks in the region, including use of destructive fishing methods (bottom trawling, fishing with explosives and poisons), destruction of nursery habitat such as mangroves, over-capitalization of industry, illegal fishing, and insufficient regulations and their enforcement, and land-based pollution (NDFA 2005).

Global warming: Asia-Pacific countries, in particular island states, are increasingly vulnerable to natural hazards, and susceptible to the impacts of global warming. Timor-Leste is among the countries classified as being 'extremely vulnerable' to climate change (Wasson 2001; Christoff 2008).

Small island states in the Pacific suffer most from environmental problems which they have a very limited capacity to cope with and recover from. Small populations, a narrow range of available resources, high dependence on trade, tourism, and often financial assistance, and limited area of land and technologies available for waste treatment and disposal render small islands particularly vulnerable to the effects of environmental change (Kerr 2005; Calado et al. 2007).

Sources (except if stated otherwise): Harvey and Mimura (2006) and Ponzi et al. (2004)

Box 3: Coastal Zones in the Asia-Pacific

Coastal management as such is not a new management approach. In the Asia Pacific it has undergone several transformations over time from pre-colonial to centralized, to community-based and co-management schemes. In pre-colonial times, traditional indigenous management systems based on customs and taboos regulated the use of coastal resources in many Pacific Island states. Such customary

local management approaches were mostly suppressed and weakened by colonial powers that favored centralized over decentralized governance structures to exert their power. Customary communal ownership of land and natural resources was replaced by open access regimes that tended to stimulate overexploitation and resource depletion. Recently, many coastal states such as the Philippines, Solomon Islands, Indonesia, and Sri Lanka, have moved back towards decentralized, community-based and co-management schemes. Table 7 shows the extent to which countries in the Asia-Pacific have adopted ICM strategies. According to the assessment by Harvey and Hilton (2006: 57), Timor-Leste and Cambodia are the only countries with no such initiatives in place[19].

There is a broad range of literature that documents examples of Integrated Coastal Management in the Asia-Pacific region. Kay and Alder (2005) and Harvey (2006) discuss numerous case studies throughout the region. While the implementation of such programs is not always successful, there are numerous examples of local-scale initiatives that have helped to protect the coastal environment, sustain livelihoods, and provide opportunities for participation of local communities and indigenous peoples.

Besides local initiatives, the past decades have also experience a growth in regional networks that join forces to protect coastal and marine systems in the region and foster dissemination and exchange of knowledge in coastal management. Box 4 describes some examples of such collaborative efforts.

[19] More recent developments and government initiatives in the field of ICM as discussed in chapters 8-10 have not been included in this assessment.

Table 7: Comparative assessment of ICM practices in Asia-Pacific

	Traditional practices based on customs & cultural norms	Community based approaches with modest institutional support	Formal special area plans for regions	Special area management plans on a sector by sector basis	Inter-ministerial and inter-agency co-ordination on a national or sub-national basis	Special coastal agencies at the national or sub-national level
American Samoa						
Bangladesh						
Brunei						
Burma						
Cambodia						
China						
Cook Islands						
Fiji						
French Polynesia						
FS Micronesia						
India						
Indonesia						
Japan						
Kiribati						
Malaysia						
Maldives						
Mariana Islands						
Marshall Islands						
Nauru						
New Caledonia						
Niue						
North Korea						
Northern Mariana						
Pakistan						
Palau						
Papua New Guinea						
Philippines						
Republic of Korea						
Russian Federation						
Singapore						
Solomon Islands						
Sri Lanka						
Taiwan						
Thailand						
Timor-Leste						
Tonga						
Tuvalu						
Vanuatu						
Vietnam						
Wallis and Fortuna						
Western Samoa						

Key

No governmental recognition or provision made for this approach

Some governmental recognition or provision made for the approach (and/or data lacking)

Explicit government support and implementation of the approach

Regional networks and initiatives in the Asia-Pacific region

The *United Nations Environment Programme (UNEP) Regional Seas Initiative* was launched in 1974 and embraces 13 Regional Seas Programmes in more than 140 countries (UNEP 2005). Regional Seas programmes function through Action Plans and regional Conventions and Protocols. Issues that are addressed range from chemical wastes and coastal development to the protection of marine and coastal ecosystems and biodiversity. Timor-Leste is currently not a member to this initiative.

The *Programme of Partnerships in Environmental Management for the Seas of East Asia* (PEMSEA) was established in 1994 to address national and transboundary environmental issues of the Seas of East Asia. It is a joint initiative between the Global Environment Facility (GEF), United Nations Development Programme (UNEP), and the International Maritime Organisation (IMO) that aims to build intergovernmental, interagency, and intersectoral partnerships in environmental management. It has produced methodologies, techniques, working models and standards for the sustainable development of the Seas of East Asia. One such product is an Integrated Coastal Management framework (PEMSEA 2008). Timor-Leste is a PEMSEA member since 2006. It has signed the Haikou Partnership Agreement for the implementation of the 'Sustainable Development Strategy for the Seas of East Asia (SDS-SEA) (Ministerial Forum 2006).

The *Asia-Pacific Network for Global Change Research* (APN) is an inter-governmental network supporting global change research in the Asia-Pacific region. A number of APN-funded projects were devoted to global change coastal zone research (Harvey et al. 2004). Timor-Leste is currently not a member of the APN.

The *Locally-Managed Marine Area Network* (LMMA) is a network of conservation projects mainly in the Asia-Pacific region that are applying the LMMA approach. LMMA promotes community-based marine/nearshore management and supports the role of traditional coastal management practices. The website (www.lmmanetwork.org) provides a broad range of case studies from Indonesia, Fiji and elsewhere.

The *World Conservation Union (IUCN)* is the world's largest conservation network that was founded in 1948 and brings together 82 States, 111 government agencies, over 800 non-governmental organizations (NGOs), and some 10,000 scientists and experts from 181 countries. The *IUCN Programme on Protected Areas* is one of the focus areas that established the World Commission on Protected Areas (WCPA), a network of protected area expertise. The Marine Working Group of the IUCN-WCPA in Southeast Asia produced a Regional Action Plan for Marine Protected Areas covering the period 2002-2012 (WCPA 2007).

Other regional networks and initiatives include the South Pacific Regional Environment Programme (SPREP), the ASEAN Working Group on Marine and Coastal Environment, and the Pacific Island Regional Ocean Policy. The *Coastal Zone Asia Pacific (CZAP) Conferences* were initiated in 2002 and are held biannually. Coastal management is one of the conference topics (Harvey and Hilton 2006).

Box 4: Regional networks and initiatives in the Asia-Pacific region

5.3 Applying the ICM framework to the context of Timor-Leste

As can be seen from examples around the world, ICM programs have taken many different forms in different places. The ICM concept by itself can only provide a framework and a set of guiding principles within which the implementation strategy needs to be adapted to different climatic, political, cultural and socioeconomic conditions (Thia-Eng 1993). The following sections attempt to apply the ICM framework to the context of Timor-Leste and highlight some key considerations related to ICM implementation in the country.

5.3.1 Integrating Local and National Scale Management

ICM is a flexible management concept that can be implemented at national, regional, or local scale. Many industrialized countries such as Germany, United Kingdom, and Australia, as well as developing countries and Island states such as Indonesia and Sri Lanka have recently developed or are already applying national-scale ICM (or ICZM) strategies and legislation. In the Asia-Pacific, local and regional ICM schemes are becoming popular. Both types of management have their advantages and disadvantages (refer to Table 8).

Table 8: Advantages and disadvantages of centralism versus localism in coastal management

Advantages of centralism	**Advantages of localism**
General perspective of management issues	Intimate knowledge of the problems
More effective in tackling national-scale management issues, e.g. commercial fishing, regional planning	More effective in tackling localized issues, e.g. MPAs
More experts and funding available	Decisions directly affect people's lives, creating an incentive to be successful, and increasing a sense of stewardship and responsibility by the community which in turn increases compliance
	Can integrate local knowledge and traditional natural resource management and conflict resolution mechanisms
	Capacity building through involvement of communities in development of ICM plan and day-to-day management
Disadvantages of centralism	Disadvantages of localism
Highly bureaucratic, centralized management is expensive to operate and more challenging to enforce because of the broad scope	Community-based and participatory approaches are time-consuming and require long-term commitment. MAF only has a limited capacity to deliver extension service at local level.
Cannot take into consideration specific local issues and might be inefficient when dealing with small-scale activities such as subsistence fishing	Decisions at local level might conflict with broader national development or conservation goals
When developed without consultation at local level, centralized systems often lack commitment and support of local communities and are difficult to enforce.	Difficult to achieve when central government is reluctant to devolve power to community level

Source: Compiled from Kay and Alder (2005: 108); Stockwell (2001); and MAFF and Oxfam (2004)

In the case of Timor-Leste, both local and national level approaches can provide solutions for a more sustainable development of the coastal zone.

Traditional customs and management structures are still strong in many coastal communities throughout the country. Experience from other countries has shown that where customary tenures and traditional governance systems are strong, national-level ICM approaches were often difficult to implement and local level approaches

proved to be more successful (examples from the Asia-Pacific region can be found at www.Immanetwork.org and in Kay and Alder (2005)). Community-based coastal management schemes can be effective in areas where existing customary regulations such as tara bandu are already in place, or where communities wish to revitalize such traditions. Coastal communities can be given responsibility to control their resources and develop and implement local management plans, for example for a community-managed MPA. In Ataúro and Tutuala, strong traditional management structures and support from local NGOs have contributed to the success of community-based coastal management regimes. Local management plans might also be useful for regions that are exposed to urgent pressures from development and competing land uses (especially Dili), in potential tourism areas (Dili, Baucau, Lautem), protected areas, and areas that face specific management issues such as potential sites for land-based oil exploration (Suai, Viqueque) (Sandlund et al. 2001).

Some management issues, however, are more effectively dealt with at the national scale. These include providing an effective institutional and regulatory framework for the sustainable management of coastal resources, regulation of industries and other economic activities operating at regional or national scales, and regional/national spatial planning. Local approaches can also fail to be effective in areas where (customary or legal) property rights over coastal land and resources are ill-defined and open access problems lead to overexploitation of resources and environmental degradation (WB and ADB 2007). Many people were forced to re-settle during the Indonesian occupation and during post-independence violence and have no ownership over the land they occupy. These newly established communities have no historically rooted relationships to the land they occupy and therefore have no traditional governance systems in place. During Indonesian occupation, many people were forced to leave the mountains and settle along the coast. These communities understandably lack traditional ecological knowledge and experience on how to manage resources in a sustainable way. In these areas, reliance only on community-based approaches might not be sufficient.

In principle, ICM should be based on the scale of the management unit that is most effective in dealing with the targeted issue, whether it is the village, district, or the whole country (Harvey and Hilton 2006). Deciding between local and national scale approaches is not necessarily a question of either-or. Both approaches can be applied in a complimentary manner, following the principle of subsidiarity where decisions are only devised to the national level when the issue cannot be handled at local level (Hanson 2001). A national ICM plan covering the entire coastline would serve as the framework in which individual local management plans operate.

5.3.2 Public Participation & Pooling of Knowledge

The long history of violence has caused vast numbers of Timorese to flee the country. While many of them have returned to their homeland since independence, great numbers of Timorese have permanently settled in Australia, Indonesia and elsewhere. The migration especially of educated people represents a huge loss of human capital to the country. Large-scale destruction of physical infrastructure and valuable data further diminished the resources and the capacity that the country has today. Because of this limited availability of human, physical, and informational resources, it is extremely important to utilize all available sources of expertise from within government and across line agencies, from NGOs, local communities, and international research groups and development agencies. Based on the institutional analysis in chapter 6, the following table represents a preliminary list of key stakeholders that can provide valuable input into the process of formulating and implementing ICM in Timor-Leste.

Table 9: Key stakeholders in the coastal zone of Timor-Leste

Key stakeholders	Potential role
Government: MAF, Secretariat of the Environment	Identification of management issues and implementation of ICM strategy e.g. through an inter-ministerial working group
Local communities	Identification of management issues and implementation of ICM strategy
Local NGOs: Haburas Foundation, Roman Luan	Identification of management issues, support in implementation e.g. through capacity building and public awareness campaigns
International NGOs: BirdLife International	Identification of management issues, support in implementation e.g. through capacity building and public awareness campaigns
International aid & research community:	Identification of management issues and support/advice in drafting of ICM strategy
Regional Networks: PEMSEA, LMMA	Support/advice in drafting of ICM strategy

Pooling of knowledge, experience, and data provides benefits to the ICM process in many ways:

- Utilization of various sources of knowledge and data sharing will produce more accurate and reliable information on management issues and solutions;
- Integration of the key stakeholders in the ICM process increases the acceptance of such a program in the wider community and thus facilitates implementation and enforcement;
- Community consultation raises awareness of the community towards management issues/problems;
- Participating in regional networks allows learning from best practices and gaining access to valuable sources of management information and tools such as climate data and coastal models (Harvey and Hilton 2006);
- Participatory planning should be a two-way process that capitalizes on local knowledge on the environment while providing opportunities to the communities to increase their capacity to manage coastal resources in a sustainable way.

How to involve local communities in decision-making is a key consideration that should be addressed early in the process. There are many forms of community involvement ranging from consultation to collaborative and community-based management schemes. The extent of involvement depends on factors such as the type of issues being addressed, planning approach, availability of resources, and the geographic scale of the program (Kay and Alder 2005). When developing a national level ICM policy it is logistically and practically impossible to directly include all stakeholders in the process. Here their role might be restricted to representatives attending meetings of the planning team or public meetings (Kay and Alder 2005). At the local level however, communities can be directly involved in the development of a local ICM plan (e.g. through community surveys, workshops etc.) and its implementation, for example through environmental education programs, site monitoring, enforcement of management regulations, and program evaluation. In the Philippines, for example, there are over 100 community-based coastal resource management projects and more than 400 locally management MPAs where communities are taking on great responsibility for management and enforcement (Kay and Alder 2005: 152, 166).

The actual roles and responsibilities of government and local communities in the ICM process will depend on the type of collaboration chosen by the decision-makers and therefore cannot be described in detail here. Under a co-management scheme, responsibilities could be allocated as depicted in Table 10. Here the government has a lead role in developing national-scale policies and regulations, but only takes a facilitating role at local level where it supports local communities to build and reinforce the capacity to manage its resources in a sustainable way. Stockwell (2001) has developed a co-management or community-based coastal management scheme for Timor-Leste that could be used as a basis for developing a joint ICM framework.

Table 10: Example of division of responsibilities between government and local communities under a collaborative or community-based management approach

Roles of government
▪ Initiating and taking the lead in the formulation of a national-scale ICM strategy; ▪ Overseeing the implementation of national and local ICM plans; ▪ Raising public awareness through provision of information to the general public, development of environmental programs for primary and secondary school curricula, higher education, e.g. introducing natural resources management studies at university; ▪ Providing training to extension officers and local communities, e.g. in MPA management (collecting user fees, setting up buoys and signs, site monitoring); ▪ Providing extension services and assisting with development activities as requested by local communities; ▪ Management and regulation of larger scale industries such as commercial fishing, tourism, maritime transport, and petroleum exploration.
Roles of local communities
▪ Provide knowledge about local resources, biophysical information, customary rules and decision-making hierarchies, religious and spiritual beliefs, and socioeconomic information; ▪ Participate in decision making; ▪ Identify actions; ▪ Program evaluation.

Adapted from Stockwell (2001), compiled from Stockwell (2001; Kay and Alder 2005; and Sandlund et al. 2001)

5.3.3 Towards Implementation

This section highlights the key aspects of consideration for initiating the development of an ICM framework in the country. The suggested recommendations are based on the author's personal interpretation of the above situational analysis of the coastal zone in Timor-Leste.

One of the first considerations is in which institutional setting ICM is going to operate. Chapter 6 has broadly described responsibilities of government agencies in the coastal zone. Based on such an institutional analysis, it would have to be determined which agency takes the lead in the drafting of an ICM policy, and which other agencies and stakeholders would have to be involved in the formulation and implementation of such a policy. The NDFA has so far been the most active ministry with respect to ICM and would be a candidate as a lead agency. The institutional setting should be as simple as possible as to avoid adding new layers of bureaucracy

and diverting valuable staff time to meet requirements. It is suggested that the policy should work with existing legislation and institutions and improve networking and cooperation between the key players, for example through an inter-ministerial working group including all relevant government agencies.

Once the institutional arrangement has been clarified, next steps include the formulation of the overarching goal and strategic directions, and definition of the scope and desired output of the process. Here again, a simple and flexible approach is suggested. While the current institutional and legal framework is undergoing continuous transformations, the produced policy needs to be flexible and adaptive. Rather than defining fixed goals, the process should be oriented towards 'action learning' where continuous monitoring and evaluation provide feedback on the applied approach and enable re-adjustments. In a dynamic and developing country such as Timor-Leste, potential threats from development and population growth can quickly emerge, and priority setting will need to be adjusted. Other current issues might not be relevant in the future as a result from increased community awareness and behavioral changes. The above analysis of the environmental, social, economic and institutional situation in the coastal zone is a snapshot that will undoubtedly change as the country develops. The ICM framework needs to be open and adaptive towards these changes[20].

In the short-term, current capacity constraints will allow the government only to focus on high-priority issues. The government could initially draft a basic national ICM strategy, possibly based on the framework developed by PEMSEA, and focus on a limited number of site-specific pilot projects. In an incremental process, the government could then identify best practices and gradually increase the scope of application. The following table summarizes the main environmental issues in the coastal zone and could serve as a starting point to define priority actions. The coastal resource management framework suggested by Stockwell (2001) and developed by the Philippine Department of Environment and Natural Resources (DENR 2001)(see Appendix III) could be used as a framework to define phases and steps in the ICM process.

[20] The European Union has developed so-called ‚sustainability indicators' that aim at evaluating the effectiveness of ICM programs (see http://ec.europa.eu/environment/iczm/home.htm). Monitoring and evaluation indicators from a Philippine case study are described in Kay and Alder (2005). Such indicators, if adapted to the needs of the country, could be used for guidance on how to monitor and evaluate ICM programs.

Table 11: Key environmental issues in the coastal zone of Timor-Leste

ISSUE	EXTENT	PRIORITY
Resource utilisation		
Overfishing inshore by artisanal fishers	low	low
Overfishing by industrial / commercial vessels offshore	unknown	investigate
Destructive fishing (dynamite, cyanide)	low ???	potential
Non-local fishers disrespecting traditional management	low now	potential
Unsustainable collection of shells and corals	occasional	moderate
Unsustainable collection of marine aquarium animals	not yet	potential
Mangrove clearance for rice paddies, salt or shrimp ponds	low now	potential
Mangrove felling for wood	localized	serious
Capture of sea turtles for meat or shell and taking eggs	occasional	serious
Capture of dugongs for meat	low	investigate
Mining of sand and gravel (beaches and river mouths)	localized	moderate
Socio-economic and cultural issues		
Unregulated construction (restaurants, hotels, residential buildings) on beachfront	localized (Dili)	serious
Disrespect by foreigners and tourists for sacred places	localized	serious
Unregulated tourism development causing land conflicts	potential	potential
Unregulated tourism causing habitat destruction	potential	moderate
Internally Displaced People (IDPs) causing destruction and degradation of environment, esp. cutting of mangroves and disposal of untreated sewage, organic and solid wastes to sea	localized	serious
Pollution and waste issues		
Oil and gas exploration and extraction - spillage	not yet	potential
Mineral extraction and mining entrails	not yet	potential
Deforestation and catchment degradation causing excessive sediment loads transported into the coastal zone	regional/national	urgent
Disposal of untreated sewage, organic wastes to sea	urban	serious
Disposal of industrial pollutants and chemicals into sea	urban	investigate
Pollution by pesticides via rivers to sea	unknown	investigate
Dumping of solid wastes by ship in harbor	localized	moderate
Littering of beaches and shores with solid wastes	localized	moderate
Institutional concerns		
Lack of integrated coastal zone management policy	national	urgent

Lack of institutional capacity for coastal management	national	urgent
Conflicting and incomplete legislation	national	urgent
Weak law enforcement	national	urgent
Lack of multisectoral integration/coordination	national	urgent
Il-defined and overlapping government mandates	national	urgent
Other issues		
Global warming of sea, sea level rise, coral bleaching	global	monitor
Low level of public awareness/education on environmental issues	national	urgent

Source: Adapted from Sandlund et al. (2001)

The diagram below illustrates the steps within the general process of an ICM project, adapted from Kay and Alder (2005: 309). This study has attempted to address the first step in the process: the diagnosis of the physical, socio-economic, institutional and legal environment of the coastal zone in Timor-Leste.

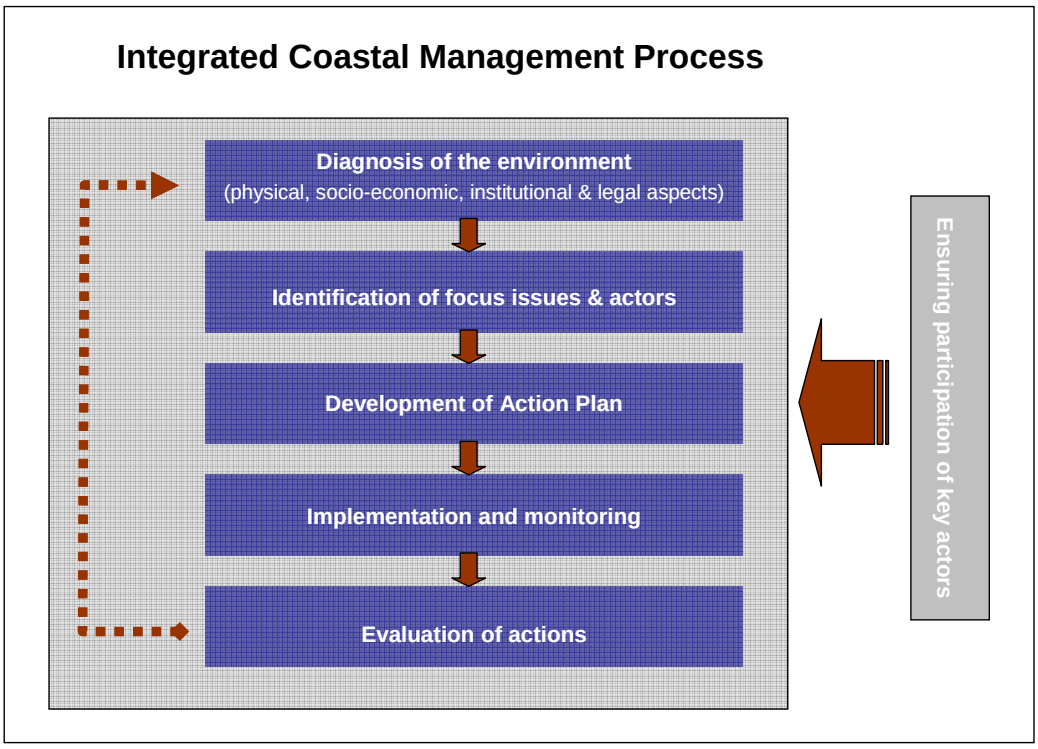


Figure 9: The ICM Implementation Process

5.3.4 Obstacles to ICM in Timor Leste

The following conditions could obstruct the implementation of ICM in Timor-Leste:

Lack of information exchange and coordination: ICM requires people from government, private sector, NGOs, and local communities to work together and coordinate their activities. Within government there are currently very few mechanisms that facilitate coordination between line agencies. There are also a huge number of international development agencies, NGOs, and research projects in the country that each pursue their own agenda. Some of the activities are long-term engagements that run in close cooperation with the government or local NGOs, while others work independently and only on a short-term basis. In this continuously changing institutional landscape it is important to improve networking and information sharing as to avoid duplication of efforts and share knowledge and experience.

Lack of resources: The country to date only has limited financial and human resources available for the development of the country. It also still lacks the physical infrastructure that is needed to develop sectors such as tourism and commercial industries. Many of the economic activities in the country are dependent on international funding. Likewise, most initiatives related to ICM in the country (except projects from the Haburas Foundation) are done through partnerships with international donor or research agencies. While such support is undoubtedly of great value to the country, it is important to build up programs that continue to run even when the international community pulls out. There have been many ICM programs in the Asia-Pacific region that died/collapsed when donor funding dried up. An ICM program is much more likely to be successful in the long run if it is financially independent from donors, and if it is designed and implemented by a local institution with a strong sense of ownership for the program. Many ICM programs in the past have also failed because they were driven by external players and often applied Western-style management approaches that were not compatible with the local conditions (Harvey and Mimura 2006b).

Lack of data: Lack of data is a common problem in all sectors of the country. Much of the existing data was destroyed or taken when Indonesia left the country. There is only very limited baseline data available for example on fish stocks, water quality, and land use in the coastal zone. Consequently, there is limited understanding of land-marine interactions in the coastal zone. Due to the increasing number of research activities in the country, this situation is likely to change for the better in the future.

Loss of traditional knowledge: Traditional natural resource management schemes have been weakened by centuries of suppression by Portuguese colonization and Indonesian occupation. While the elders in the communities may still possess valuable local knowledge on the natural environment and on customary rules, the younger generation is losing such traditional knowledge. Development, modernization, and education are influencing coastal communities and may further weaken traditional coastal resource management schemes. There is an urgent need to collect and record information on traditions and customs in the country as to avoid loss of indigenous culture that is not only of cultural heritage value but that can also serve as model for sustainable use of natural resources.

Continued conflict and political instability: Continued violence is a serious drawback to sustainable development in the country. Destruction and burning of offices, warehouses, schools, and other public and private buildings, stealing of equipment such as computers, destroys much of the progress that the country and the

international community has achieved in the first years of independence. Political instability is also an obstacle to tourism development and foreign investment. Ethnic conflicts also cause problems such as internal migration. Such an unstable environment will be a challenge and potential threat for the implementation of ICM in the country.

Changing institutional landscape: Timor-Leste is a young country that is still undergoing institutional transformations. While this situation on the one hand is a 'window of political opportunity' to bring in new ideas, concepts, and best practices from other parts of the world (see example South Africa, Kay and Alder 2005: 311), this is also a major challenge for an ICM program that has to work in a dynamic institutional framework where the roles and responsibilities of government agencies are ill-defined and sometimes overlapping.

6 CONCLUSION

The overall aim of this study was to look at how human activities are impacting on the coastal zone in Timor-Leste, what type of management challenges arise from these impacts, and what kind of management approach can help to address current and future problems in the coastal zone.

The natural environment of the coast to date is in a relatively healthy and pristine condition. The coastal environment consists of a variety of coastal and marine ecosystems that are home to a great number of plant and animal species, many of which are listed as endangered species. The coastal zone is also rich in natural resources such as minerals, especially petroleum, and fisheries. The land and marine parts of the coast are of great natural beauty; the pristine sandy beaches, stunning coral reefs, and unique opportunities for whale watching are main tourist attractions in the country.

The population living in coastal areas is highly dependent on environmental goods and services derived from the coastal environment. Rural communities sustain their livelihoods through subsistence and semi-subsistence agriculture and fisheries, and they need firewood as a primary energy source. In many areas, coastal communities have developed close relationships with the land and sea, which are reflected in local customs and beliefs and traditional natural resource management mechanisms (tara bandu) that are still practiced today.

On the other hand, there also exist a large number of people that have been forced to abandon their homelands and re-settle in areas to which they have no ancestral claims and no historical relationship. During Indonesian occupation, many people had to leave the highlands and re-settle in low lying coastal areas. As violence continues even after independence, many people are still displaced in their own country and live in IDP camps scattered throughout the country. These relatively recently established coastal communities understandably lack traditional knowledge how to harvest at sustainable levels and protect ecosystems and environmental goods and services that their livelihoods depend on. Especially in these communities it is important to provide training and education on environmental issues to ensure sustainable use of coastal resources.

Human impacts on the coastal environment are currently at a relatively small scale and are mostly localized issues that are confined particularly to urban areas. In Dili, one of the most urgent problems is the untreated sewage and solid waste that are disposed into creeks and dumped on the beach and pollute the coastal environment. The population of Dili is growing constantly not only from internal urban migration, but also from the large international community that is putting additional pressure on public services and is raising the demand for housing and recreational and tourism facilities such as restaurants and hotels. While the city is expanding and houses, restaurants, and hotels are built at prime locations on the beachfront, there are no urban planning or coastal development policies or regulations in place that could regulate such development. Due to the unsettled issue of land ownership, many properties are illegally occupied, and many IDP camps are located on coastal lands.

In rural areas, the most pressing problems in coastal communities relate to their high dependence on natural resources and their vulnerability to food shortages. Many of the rural communities along the coast are impoverished and isolated. They are poorly connected to urban centers and thus have very limited access to markets, so that they depend on subsistence farming and fishing. Unsustainable agricultural practices not only result in low agricultural productivity but also cause soil degradation,

deforestation, and downstream sedimentation. While many rural households rely on external food supplies, the bountiful fishery resources are far from being harvested to the potential level, mainly due to limited equipment and know-how for commercial-scale deep sea fishing.

The human impacts can be expected to grow significantly with population growth and increase in economic activities. Many developing countries have made the experience that the country's development has come at high environmental costs. Industrial development, tourism, and urbanization can exacerbate the pollution of coastal waters from untreated domestic and industrial waste. The need to heighten agricultural productivity in order to improve food security and feed a growing nation will require additional land conversion and increase in fertilizer use. An expansion of port operations and the construction of a new international port would necessitate land reclamation and cause pollution of the sea from increased shipping. Destruction of habitat by unregulated coastal development can cause loss of valuable coastal ecosystems that play important ecological functions such as protecting the shoreline from erosion and serving as nursery for fishes and as habitat for the country's rich biodiversity. Increasing demand for natural resources from a growing population could also stimulate overexploitation of fisheries and accelerate soil degradation and deforestation. Another set of potential threats arise from climate change. Timor-Leste has been classified as extremely vulnerable to climate change impacts such as increased climate variability and increased frequency of climate-related natural hazards such as flooding and droughts.

When considering not only the current but also the future management issues in the coastal zone, it becomes clear that the country will need to find a balance between the various and often conflicting demands on, and uses of, the coastal environment and its resources. The country has an obligation to feed its people and meet the basic needs of society. The government is committed to economic development including expansion of agricultural production, utilization of its abundant resources such as fisheries and petroleum, and development of the tourist industry. These immediate development needs have to be balanced against the long-term need to conserve and protect the coastal environment and its biodiversity so as to maintain agricultural productivity of land and healthy fish stocks for future use.

An analysis of the institutional and legal framework in the country has revealed a number of weaknesses with respect to dealing with coastal management issues. The legal framework is still incomplete and lacks proper enforcement. Jurisdictions of the central and local government in the coastal zone are not clearly defined, and roles and responsibilities of government departments are ill-defined and sometimes overlapping. There are no mechanisms for cooperation between ministries and between different layers of government with respect to coastal management issues.

The have been a number of recent projects and partnerships initiated by the governmental and non-governmental sector, and with involvement of the international research and development aid community, aimed at improving coastal management in the country. The government has joined regional networks such as PEMSEA and has become signatory to a couple of inter-governmental environmental protection agreements. Several local-scale efforts such as the establishment of MPAs and the country's first national park have also been important steps in this direction.

Integrated Coastal Management (ICM) has been discussed in the last section as a management approach that can help to integrate different sectoral policies, stakeholders, and decision-making levels. The ICM approach is gaining momentum in the country. Although there is currently no national-scale ICM policy in place, the government is in the process of planning its first local-scale pilot projects. The

government can make use of the numerous experiences with ICM in the Asia-Pacific region and learn from their past failures and from best practices. Nevertheless, a country- or site-specific ICM plan will need to be adapted to the environmental, political, and socioeconomic conditions of the particular part of the coast that the ICM plan covers. It is recommended that the process of developing and implementing ICM in the country be flexible and adaptive to the changing institutional and regulatory landscape and the dynamics of population growth and economic development. Taking into consideration human capacity constraints and financial limitations, the ICM strategy should work within the existing institutional and legal framework and strengthen cooperation between stakeholders rather than creating new bureaucracies. The limited availability of baseline data calls for close cooperation and exchange of information and know-how from a variety of knowledge sources, including traditional local knowledge. Traditional governance mechanisms can play a strong role in supporting ICM schemes and should be supported and integrated into the development of site-specific management plans. The decision-makers will need to define the scale of the management unit (village/district/country) which is considered most effective in achieving the objectives. A combination of local and national level approaches is likely to be most appropriate in dealing with the range of different management challenges that were discussed throughout this report. Decision-making should be delegated to the local level where possible, while the role of government focuses on enabling and facilitating the building or strengthening of local capacity through training and education.

The main obstacles to ICM that were identified during the assessment include lack of information exchange and coordination, lack of human and financial resources and baseline data, loss of traditional knowledge, and conflict and political instability.

LIST OF REFERENCES

ABC News. (2007). "NT helping E Timor establish first marine park." Retrieved 01.01.2008, from http://www.abc.net.au/news/stories/2007/12/18/2121409.htm?section=australia.

Abrantes, A. (2001). Fresh Water Resources and Integrated Watershed Management. Haq, Bilal U. R. Anderson and C. Deutsch. Dili, Timor Aid.

ADB (2004). Timor-Leste Eighth Progress Report. Dili, Asian Development Bank**:** 52-60.

Aglionby, J. (2007). "Ecological zone created in Pacific." *FT.com. London: Sep 10, 2007. pg. 1* Retrieved 14 September 2007, from http://proquest.umi.com/pqdweb?did=1334055311&sid=2&Fmt=3&clientId=13713&RQT=309&VName=PQD

Alongi, D. M. and N. A. de Carvalho (2008). "The effect of small-scale logging on stand characteristics and soil biogeochemistry in mangrove forests in Timor Leste." *Forest Ecology and Management* **255**: 1359-1366.

Alves, G. (2007). Thematic Assessment Report: The United Nations Convention on Biological Diversity (UNCBD). National Capacity Self Assessment (NCSA) Project Timor Leste. Dili, RDTL, UNDP, GEF**:** 31.

Anderson, R. and C. Deutsch (2001). "Conference Proceedings." *Conference on Sustainable Development.*

Arafura and Timor Seas Experts Forum (2006). River Catchments and Marine Productivity in Timor Leste. Final Report., Government RDTL, Charles Darwin University, Australian Institute of Marine Science, The Australian National University, United Nations Development Programme,.AusAID. (2007, June 2007). "Aid activities in East Timor." Retrieved 12 April 2008, from http://www.ausaid.gov.au/country/cbrief.cfm?DCon=5901_3683_7838_3843_6784&CountryID=911&Region=EastAsia.

Australian Water Research Facility (2006). Situational Analysis Report for East Timor - January 2006 Brisbane, International WaterCentre.

Bano, A. (2001). The Role of Civil Society Organisations in Sustainable Development in East Timor. *Conference Proceedings, Conference on Sustainable Development.* R. Anderson and C. Deutsch. Dili, Timor Aid.

Barbosa, A. S. (2007). Thematic Assessment Report on The United Nations Convention on Climate Change (UNFCCC). *The National Capacity Self Assessment of the Democractic Republic of Timor -Leste.* Dili, Government of Timor-Leste. Global Environment Facility, United Nations Development Programme**:** 50.

Barnett, J., et al. (2003). Climate Change in Timor Leste: Science, Impacts, Policy and Planning. Briefing to Government, civil society, and donors, República Democrática de Timor-Leste, University of Melbourne, CSIRO**:** 44.

Barnett, J., et al. (2007). "Vulnerability to Climate Variability and Change in East Timor." *Ambio* **36**(5): 372-278.

Basiuk, R. (2006). Sustainable Tourism Sector Development and Institutional Strengthening, Republic of Timor-Leste. Environmental Planning Inputs. Dili, UNWTO/UNDP Project for the Government of Timor-Leste**:** 53.

BirdLife International. (2007, 2008). "Timor-Leste (formerly East Timor) declares first national park." Retrieved 20 March, 2008, from http://www.birdlife.org/news/pr/2007/08/timor-leste_np.html.

Bock, A. (2006). Beauty and struggle: mapping tourism in Timor-Leste. *Origins.* **2:** 18-20.

Bouma, G. and H. Kobryn (2002). Assessing Vegetation Change in East Timor Using Landsat Thematic Mapper Data. Perth, Murdoch University**:** 47.

Calado, H., et al. (2007). "Integrated Coastal Zone Management Strategies on Small Islands." *Journal of Coastal Research* **Special Issue 50**: 125-129.

Christoff, P. (2008). Pacific Ark. *The Diplomat.* **6:** 40-42.

CIA. (2007, 15 March 2007). "The World Factbook: East Timor." Retrieved 29 March 2007.

Cicin-Sain, B. (1993). "Sustainable Development and Integrated Coastal Zone Management." *Ocean & Coastal Management* **21**: 11-44.

Conceicao, C. (2001). Environmental Pollution and Waste Management in East Timor. *Conference Proceedings, Conference on Sustainable Development.* R. Anderson and C. Deutsch. Dili, Timor Aid.

de Carvalho, D. d. A., et al. (2007b). Potensi Perikanan dan Potret Perempuan Zona Litoral Kawasan Timur (potential of fishery resources and a portrait of women in the coastal zone of eastern districts). Dili, Haburas Foundation.

de Carvalho, D. d. A., et al. (2007a). Monografia Sub-Distrito Tutuala. Dili, Haburas Foundation.

DENR (2001). *Philippine Coastal Management Guidebook No. 1: Coastal Management Orientation and Overview.* Cebu City, Philippines, Coastal Resource Management Project of the Department of Environment and Natural Resources, Bureau of Fisheries and Aquatic Resources of the Department of Agriculture, and Department of the Interior and Local Government.

dos Santos Silva, C., et al. (2007). Project Progress Report. Dili, Food and Agriculture Organisation (FAO) - Trust Fund Programme.

Drysdale, J. (2007). Sustainable Development or Resource Cursed? An Exploration of Timor-Leste's Institutional Choices. Fenner School of the Environment. Canberra, Australian National University. **Doctor of Philosophy:** 301.

Durand, F. (2006). EAST TIMOR: A Country at the Crossroads of Asia and the Pacific A Geo-historical Atlas. Chiang Mai, Thailand, Silkworm Books.

East Timor Land Law Program (2005). Land Administration in East Timor. Dili, Ministério Justica, Direccao de Terras e Propriedades, RDTL, Centro Nacional de Investigacao Científica, Universidade Nacional Timor Lorosae, ARD Inc.**:** 21.

FAO (2003). Status and trends in mangrove area extent worldwide. Forest Resources Assessment Working Paper No. 63. Rome, Forest Resources Division, FAO.

Fitzpatrick, D. (2002). *Land claims in East Timor*. Canberra, Asia Pacific Press.
Fonseca, A. d. (2001). Economic & Environmental Effects of Small Scale Fishers and Fish Farmers. *Conference Proceedings, Conference on Sustainable Development.* R. Anderson and C. Deutsch. Dili, Timor Aid.

Fontes, L. (2004). "Ministry of Agriculture, Forestry and Fisheries - Home." Retrieved 1 April 2008, from http://www.maf.gov.tl/English/index.htm.

Gao, S. (2006). Catchment-Coast Interactions in the Asia-Pacific Region. *Global Change and Integrated Coastal Management: The Asia-Pacific Region.* N. Harvey. Dordrecht, The Netherlands, Springer. **10:** 67-92.

GERTIL (2001). Plano Estratégico de Reconstrução e Desenvolvimento de Timor Leste (PETIL). Lisbon, GERTIL - Grupo de Reconstrução de Timor Lorosae, Universidade Técnica de Lisboa**:** 119.

Government RDTL (2005). Timor Leste 2005: Millennium Development Goals. Dili.

Guterres, A. (2003). Planning for fisheries development in East Timor. *Agriculture: New Directions for a New Nation - East Timor (Timor-Leste)*. H. da Costa, C. Piggin, C. J. da Cruz and J. J. Fox. Dili, ACIAR. **ACIAR Proceedings No. 113:** 22-23.

Haburas Foundation (2007). Haburas Foundation Overview. Dili.

Haburas Foundation (2007). Tara Bandu. Dili.

Hanson, A. J. (2001). Governance and Sustainability Development. *Conference Proceedings, Conference on Sustainable Development.* R. Anderson and C. Deutsch. Dili, Timor Aid.

Harvey, N., Ed. (2006). *Global Change and Integrated Coastal Management: The Asia-Pacific Region*. Coastal Systems and Continental Margins. Dordrecht, Springer.

Harvey, N. and M. Hilton (2006). Coastal Management in the Asia-Pacific Region. *Global Change and Integrated Coastal Management: The Asia-Pacific Region*. N. Harvey. Dordrecht, Springer. **10**.

Harvey, N. and N. Mimura (2006). Importance of global change for coastal management in the Asia-Pacific region. *Global Change and Integrated Coastal Management: The Asia-Pacific Region.* N. Harvey. Dordrecht, The Netherlands, Springer. **10:** 1-15.

Harvey, N. and N. Mimura (2006b). New Directions for Global Change Research. Global Change and Integrated Coastal Management: The Asia-Pacific Region. N. Harvey. Dordrecht, Springer. **10:** 315-334.

Harvey, N., et al. (2004). Global Change Coastal Zone Management Synthesis Report. Kobe, Asia-Pacific Network for Global Change Research**:** 37.

JICA (2007). *JICA Timor-Leste Information Sheet.* Dili, Japan International Cooperation Agency.

Kay, R. and J. Alder (2005). *Coastal Planning and Management.* London; New York, Taylor & Francis.

Kerr, S. A. (2005). "What is small island sustainable development about?" *Ocean & Coastal Management* **48**: 503-524.

Koshy, K., et al. (2006). Impacts of Pollutants in the Asia-Pacific Region. *Global Change and Integrated Coastal Management: The Asia-Pacific Region.* N. Harvey. Dordrecht, The Netherlands, Springer. **10:** 231-276.

Langton, M., et al. (2005). "Community-Oriented Protected Areas for Indigenous Peoples and Local Communities." *Journal of Political Ecology* **12**.

MAFF (2007). The Implementation of the SDS-SEA in Timor Leste: Integrated Coastal Resource Management Project, 2007-2009. Draft Project Work Plan and Budget, MAFF.

MAFF and Oxfam (2004). Study on Lessons Learned in Implementing Community Level Agriculture and Natural Resource Management Projects in Timor-Leste. Dili, Ministry of Agriculture, Forestry and Fisheries, Oxfam**:** 50.

McWilliam, A. (2002). "Timorese seascapes." *The Asia Pacific Journal of Anthropology* **3**(2): 6-32.

Ministerial Forum (2006). Haikou Partnership Agreement on the Implementation of Sustainable Development Strategy for the Seas of East Asia. Ministerial Forum, East Asian Seas Congress, Haikou.

Ministry of Agriculture and Fisheries Timor-Leste (2007). Results of Social Impact Survey. Laclo Irrigation Scheme. Manatuto, Timor-Leste, Japan International Cooperation Agency**:** 12.

Mitsch, W. J. and J. G. Gosselink (2000). *Wetlands*. New York, John Wiley & Sons.
Morrison, R. J. and J. R. Delaney (1996). "Marine Pollution in the Arafura and Timor Seas." *Marine Pollution Bulletin* **32**(4): 327-334.

Mounsey, R. (2001). Economic & Environmental Effects of Offshore Fishing Activities. *Conference Proceedings, Conference on Sustainable Development.* R. Anderson and C. Deutsch. Dili, Timor Aid.

MTRC Information Centre (2006). Dili IDP Camp Size Based on Number of Food Recipients. Dili, RDTL**:** Map Number: MTRC-117-v02.

Myat Thu, P. (2008). Rural Re-settlement and Land Access in East Timor. *Democratic Governance in Timor-Leste.* Darwin.

National Statistics Directorate (2004). Population Projections 2004-2050. Analysis of Census Results. General Population Census of Timor-Leste 2004, RDTL.

National Statistics Directorate (2006). Timor-Leste Census of Population and Housing 2004 Atlas. Dili.

NDFA (2005). Fish for Sustainability: Our Strategic Plan for Fisheries, 2006-2011. Working draft 21 December 2005. Dili, National Directorate of Fisheries & Aquaculture**:** 28.

Neves, G., et al. (2008). Sunrise LNG in Timor-Leste: Dreams, Realities and Challenges. Dili, La'o Hamutuk - Timor-Leste Institute for Reconstruction Monitoring and Analysis.

Nixon, R. and E. Urresta (2004). Report on Research Findings, Policy Options and Recommendations for a Law on Land Rights and Title Restitution, Directorate of Land and Property, Ministry of Justice, UNTL. ARD**:** 91.

Nogueira, M. R. (2008). Programa de Apoio ao Desenvolvimento Rural de Timor Leste (PADRTL), Instituto Portugues de Apoio ao Desenvolvimento (IPAD).

Nunes, M. (2001). The Natural Resources of East Timor: A physical, geographical and ecological review. *Conference Proceedings, Conference on Sustainable Development.* R. Anderson and C. Deutsch. Dili, Timor Aid.

Nunes, M. (2003). Forest conservation and fauna protection in East Timor. *Agriculture: New Directions for a New Nation - East Timor (Timor-Leste)*. H. da Costa, C. Piggin, C. J. da Cruz and J. J. Fox. Dili, ACIAR. **ACIAR Proceedings No. 113:** 20-21.

Nunn, P. D. and R. Kumar (2006). Coastal Evolution in the Asia-Pacific Region. *Global Change and Integrated Coastal Management: The Asia-Pacific Region.* N. Harvey. Dordrecht, The Netherlands, Springer. **10:** 93-116.

Ogle, L. A. (2001). How can international environmental law assist East Timor? *Conference Proceedings, Conference on Sustainable Development.* R. Anderson and C. Deutsch. Dili, Timor Aid.

Palmer, L. and D. d. A. de Carvalho (2007). "Nation building and resource management: The politics of 'nature' in Timor Leste." *Geoforum* **2007**: 12.

Pedi, D. (2007). Community-based ecotourism as a pro-poor development option: A case study of Tua Ko'in Eco-village, Atauro Island, Timor-Leste. School of Global Studies, Social Science and Planning. Melbourne, RMIT University. **Master of Social Science:** 134.

PEMSEA. (2008, 23 January 2008). "Stakeholder Consultation and Formulation of SDS-SEA Work Program for Timor-Leste." Retrieved 15 Feb 2008, from http://www.pemsea.org/about-pemsea/pemsea-news/stakeholder-consultation-and-formulation-of-sds-sea-work-program-for-timor-leste.

Phillips, A. (2002). Management Guidelines for IUCN Category V Protected Areas Protected Landscapes/Seascapes. Gland, Switzerland

Cambridge, UK, International Union for Conservation of Nature and Natural Resources (IUCN).

Pires, A. (2001). East Timor: Mining, Resource Extractive Industries. *Conference Proceedings, Conference on Sustainable Development.* R. Anderson and C. Deutsch. Dili, Timor Aid.

Planning Commission (2002). East Timor National Development Plan.
Ponzi, D., et al., Eds. (2004). Pacific Region Environmental Strategy 2005-2009. Volume II: Case Studies. Manila, Asian Development Bank.

RDTL (2003). Decree-Law No.3/2003 of 10 March on the Establishment of the Port Authority and on the Approval of the Bylaws Thereof. **3/2003:** 15.

RDTL (2005). National Disaster Risk Management Plan. Dili, National Disaster Management Office, Civil Protection Directorate, Minister of Interior.

RDTL (2006). Overview of Sector Investment Programs: Sectoral Priorities, Programs and Expenditures.

RDTL (2007a). National Capacity Self Assessment (NCSA) Final Report. Dili, Directorate for Environmental Services, State Secretariat for Environmental Coordination, Territorial Ordinance and Physical Development, Global Environment Facility, United Nations Development Programme**:** 86.

RDTL (2007b). IV Constitutional Government Program. P. o. t. M. s. Office**:** 79.
RDTL (2007d). "Resolucao do Governo No. 8/2007: Cria o Parque Nacional Nino Konis Santana." *Jornal da Republica* **1**(21): 1805-1807.

RDTL (2007e). "Resolucao do governo no. 9/2007: Política Nacional e Estratégias para o Sector Florestal." *Jornal da Republica* **1**(21): 1808-1818.

RDTL (2007f). Annual Action Plan Civil Year 2008, National Directorate of Fisheries and Aquaculture.

RDTL and CDU (2006). The Timor-Leste Coastal/Marine Habitat Mapping for Tourism and Fisheries Development Project, RDTL, Ministry of Agriculture, Forestry and Fisheries (MAFF), Charles Darwin University (CDU)**:** 22.

RDTL, et al. (2007). Thematic Assessment Report for the Implementation of the United Nations Convention to Combat Desertification (UNCCD). Dili**:** 37.

RDTL and UNDP (2007). Draft Memorandum of Agreement on the Implementation of the Sustainable Development Strategy for the Seas of East Asia in Timor Leste: Integrated Coastal Resource Management Project, 2007-2010. MAFF and U. t. P. R. Facility.

Ross, H., et al. (2006). Conceptual Framework for Catchment-Scale Integrated Water Resource Management. International River Symposium, Brisbane.

Sandlund, O. T., et al. (2001). Assessing Environmental Needs and Priorities in East Timor. Final Report. NINANIKU, UNDP, Dili. Norwegian Institute for Nature Research, Trondheim**:** 73.

Silva, H. d., et al. (2003). *Conference Proceedings*. 1st National Workshop on Climate Change, Dili, Government of RDTL, UNDP, CARE International.

Sorensen, J. (1993). "The international proliferation of integrated coastal zone management efforts." *Ocean & Coastal Management* **21**(1-3): 45-80.

Sorensen, J. (1997). "National and International Efforts at Integrated Coastal Management: Definitions, Achievements, and Lessons." *Coastal Management* **25**: 3-41.

Stockwell, A. (2001). Introduction to Co-Management or Community-Based Management of Coastal Resources. Dili, Second Agricultural Rehabilitation Programme, World Bank.

Stockwell, A. (2002). Coastal Habitat Assessment and Monitoring Procedures. Dili, Second Agricultural Rehabilitation Project, World Bank, Department of Fisheries and the Marine Environment**:** 46.

Talaue-McManus, L. (2006). Pressures on rural coasts in the Asia-Pacific region. *Global Change and Integrated Coastal Management: The Asia-Pacific Region*. N. Harvey. Dordrecht, The Netherlands, Springer. **10:** 197-229.

Thia-Eng, C. (1993). "Essential elements of integrated coastal zone management." *Ocean & Coastal Management* **21**(1-3): 81-108.

Timor Sea Office. (2007). Retrieved 15 Feb 2008, from http://www.timorseaoffice.gov.tp/.
Torell, M. and A. M. Salamanca (2002). Institutional Issues and Perspectives in the Management of Fisheries and Coastal Resources in Southeast Asia. *ICLARM Technical Report 60.* Stockholm, ICLARM - The World Fish Center**:** 212.

TSDA. (2007). "JPDA Employment Information." Retrieved 1 April 2008, from http://www.timorseada.org/employment_info.html.

UN. (2004, 15 December 2004). "Agenda 21: Chapter 17." Retrieved 7 April 2008, from www.un.org/esa/sustdev/documents/agenda21/english/agenda21chapter17.htm.

UN. (2007, 23 October 2007). "Oceans and Law of the Sea: United Nations Convention on the Law of the Sea of 10 December 1982." Retrieved 1 April 2008, from http://www.un.org/Depts/los/convention_agreements/convention_overview_convention.htm

UNDP. (2006). "Human Development Report 2006: Timor-Leste." Retrieved 12 September 2007, from http://hdr.undp.org/hdr2006/statistics/countries/data_sheets/cty_ds_TMP.html.

UNDP and RDTL (2006). Environment & Natural Resource Management. Dili, Environment and Natural Resource Management Unit, UNDP Timor-Leste**:** 2.

UNDP and RDTL (2007). Capacity Building in and Mainstreaming of Sustainable Land Management - SLM Project Factsheet. Dili, United Nations Development Programme, RDTL.

UNEP. (2005). "UNEP Regional Seas Programme East Asian Seas." Retrieved 3 April 2008, from http://www.unep.org/regionalseas/Programmes/UNEP_Administered_Programmes/East_Asian_Seas/default.asp.

UNTAET (2000a). Regulation No. 2000/19 on Protected Places. U. N. T. A. i. E. T. (UNTAET), United Nations Transitional Administration in East Timor (UNTAET). **UNTAET/REG/2000/19**.

UNTAET (2000b). Regulation No. 2000/17 on the prohibition of logging operations and the export of wood from East Timor, United Nations Transitional Administration in East Timor (UNTAET). **UNTAET/REG/2000/17**.

Wasson, M. (2001). East Timor and Climate Change: Security and Sustainable Development. *Conference Proceedings, Conference on Sustainable Development.* R. Anderson and C. Deutsch. Dili, Timor Aid.

WB and ADB (2007). Economic and Social Development Brief, World Bank Group, Asian Development Bank,**:** 79.

WCPA (2007). "World Commission on Protected Areas - South East Asia." Retrieved 1 May 2008, from http://www.wcpasea.org.

WWF (2007). The Coral Triangle - The centre of marine biodiversity. Kerobokan, Bali, World Wide Fund for Nature.

Xavier, P. d. S. (2001). Land Rights and Sustainable Development in East Timor. *Conference Proceedings, Conference on Sustainable Development.* R. Anderson and C. Deutsch. Dili, Timor Aid.

APPENDICES

Appendix I: Atauro Island Tourism Regulations

A. Socio-cultural

1. Tua Ko'in is the centre for tourism promotion

2. Places that already have tourism facilities or intend to develop tourism facilities should work with and consult the Kuteleki Mahahanak Association for Pro-poor Ecotourism

3. Tourists who come to Atauro must have proper identification

4. Tourists must respect and adapt to local culture

5. Tourists visiting villages or sub-villages should use local resources and facilities

6. Roman Luan will prepare a centre at Tua Ko'in to promote Atauro culture

7. The Association will support the villages and sub-villages in developing/revitalizing Atauro culture e.g. traditional dances, songs and instruments

8. The Association will assist local craftspeople to develop and market their crafts (e.g. basket weaving, traditional statues etc)

B. Environment

1. Water
   - Water systems used for tourist accommodation must be approved by the Association
   - Water systems must be managed in ways that are not detrimental to the environment
   - Consumers have the responsibility to care for and maintain water systems

2. Waste
   - Waste management systems that do not impact negatively on the environment must be in place. Waste management system must be approved of by the Association
   - Non-organic waste such as bottles, plastic, cans must be properly managed

3. Vegetation
   - Trees and other vegetation should be cultivated/cared for
   - It is forbidden to cut down trees or burn off indiscriminately

4. Land
   - Tourism facilities should fit in with natural surroundings

5. Beach
   - Beaches are public places (accessible to ALL)
   - Beaches used by tourists should have rubbish bins/waste disposal facilities
   - Beaches should be kept clean
   - Beach plants (dune plants) should be cultivated / should not be disturbed

6. Sea /Boats
   - Permanent anchorages must be used in frequently used places

- Forbidden to allow spill petrol or oil spillages into the sea
- Forbidden to take or harm/destroy reefs and other marine life
- Tourists must follow regulations for fishing activities – e.g. in protected areas
- Jet-skis are forbidden
- Use of substances/equipment that destroys smaller fish is forbidden (e.g. small nets, poisons etc)

7. Tourists
   - Should respect both the sea and land environments
   - Tourism facilitators should prepare guides for tourists
   - Information (about environment and culture) should be prepared for tourists

C. Economy

1. Land

   Remembering that Atauro is a small island and the population continues to grow we must think of future generations –
   - Lease land (do not sell) through a contract after consultation with the Association

2. Development
   - The Association will work with the Department of Investment and Tourism
   - Tourism Development on Atauro Island will be decided by the Association
   - The Association's principles are based on Ethical Eco-tourism – e.g. facilities/buildings use local materials (as much as possible) and local builders. Only things not available on Atauro e.g. cement, reinforcing iron etc can be brought in.
   - The Association gives opportunities for local people to develop tourist facilities

3. Management

The Association expects/trusts the investor to:
- Provide management training for Atauro people
- Management training should lead to work for Atauro people, Atauro people should also prepare themselves for this work in the future
- 75% of Staff at tourist facilities should be Atauro people
- Training in English and other languages should be provided

4. Staff

The Association expects/trusts the investor to:
- Salaries paid to staff should be consistent with national regulations
- Work place and conditions must be of good standard and safe

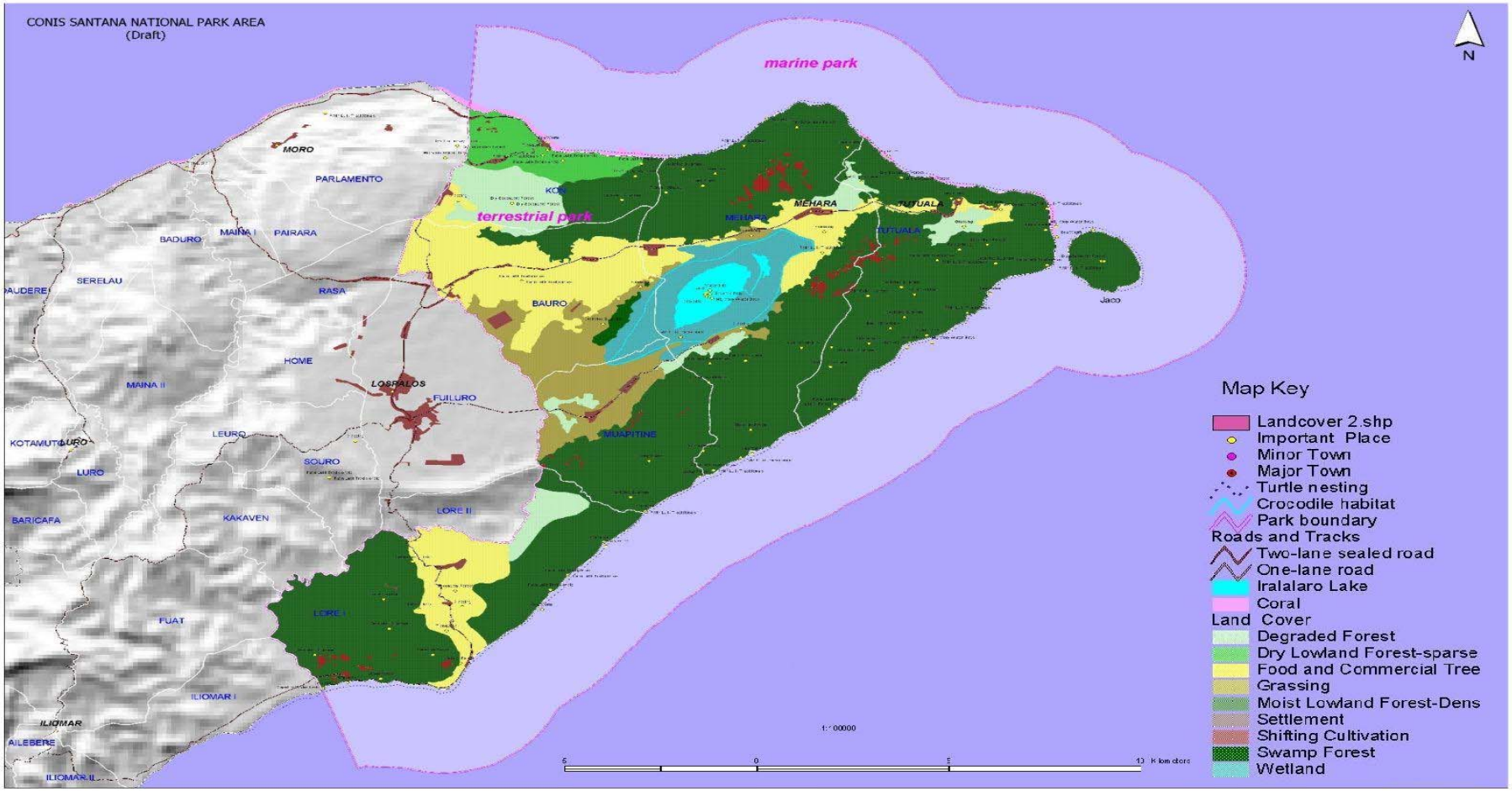
5. Food Produce

- To raise the level of local economy purchase of local produce should be a priority – only when unavailable should produce be brought in from outside
- Local products should also be given priority

6. Transport

- Priority should be given to local vehicle/boat owners for tourist transport around Atauro

Appendix II: Nino Conis Santana National Park



Appendix III: Coastal management phases and steps and roles of various sectors

(Source: DENR 2001a)

Phases and Steps	Activities and Outputs	Roles of Local Government, Community and Stakeholders	Technical Assistance Roles of Government, NGOs and Donors
PHASE 1 Issue identification and baseline assessment			
a. Program preparation	• Allocate budget • Determine boundaries and scope • Make work plans/budgets • Assign personnel • Secure consensus on overall approach	• Source funding for CRM planning activities • Annual investment plan for CRM • Enter into memoranda of agreement • Participate in discussion • Communicate needs and potential roles • Agree on design	• Prepare work plans • Formulate working agreements • Contract and train staff • Facilitate consensus on design
b. Secondary information gathering	• Compile existing maps, reports, data • Interview information sources • Compile existing laws, plans • Review other sources of information	• Provide information • Assist to compile information • Begin to develop information storage and retrieval system	• Locate sources of information • Compile information in useful form • Coordinate activities
c. Field assessment] Participatory Coastal Resource Assessment (PCRA) and other research	• Train practitioners • Conduct PCRA mapping and data collection • Contract special research studies on fish stock assessment, habitat condition, water quality, enterprise, and others	• Conduct PCRA with technical assistance • Participate in special research and data collection • Assist to analyze data • Provide inputs to mapping	• Train practitioners • Facilitate PCRA • Conduct specialized research • Analyze research data • Make results available
d. Database and profile development	• Maps completed • Set up data storage and retrieval system • Compile coastal environmental profile	• Provide information • Assist with profile analysis • Data validation	• Determine data storage site, personnel • Write profile • Distribute

Phases and Steps	Activities and Outputs	Roles of Local Government, Community and Stakeholders	Technical Assistance Roles of Government, NGOs and Donors
	• Use profile as planning base • Refine boundaries and further research needs	• Use profile for planning • Decide on boundary demarcation • Present profile to legislative bodies	profile • Facilitate discussions on boundaries and research needs
e. Prioritization of issues and analysis of causes	• Conduct community-based planning sessions • Develop issue tree • Prioritize issues for management	• Participate in process and provide major input • Participate in conflict resolution • Set priorities in real terms	• Facilitate process • Interject outside perspectives, research findings, policies, etc. • Help translate issues into causes
PHASE 2 CRM plan preparation and adoption			
a. Establish management bodies	• Fisheries and Aquatic Resource Management Committees (FARMCs) established and active • Multisectoral Technical Working Group established	• Advisory body to local government • Provide basic policies • Provide major inputs to plan	• Build consensus among community • Facilitate planning process • Conduct planning workshops • Provide technical guidance • Assist to set up management bodies
b. Define goals and objectives	• Conduct CRM planning workshop • Identify and evaluate management options • Management strategies and actions identified	• Build consensus among community • Local government support to planning process	

Phases and Steps	Activities and Outputs	Roles of Local Government, Community and Stakeholders	Technical Assistance Roles of Government, NGOs and Donors
c. Develop CRM strategies and action plan	• Proposed water use zones delineated and mapped • Multi-year management plan drafted • Community consultations on draft management plan conducted • Proposed CRM plan presented in multisectoral forum • Multi-year CRM plan finalized and adopted	• Local government and community participation in planning process • Plan presented to concerned legislative bodies for adoption and support	• Facilitate inter-agency coordination
PHASE 3 Action plan and project implementation			
a. CRM plan implementation	• Establish and staff municipal CRM office • Action plans developed for CRM plan implementation • Secure support as required • Increase implementation effort • Marine sanctuaries established and functional • Environment-friendly enterprises established • Mangrove areas rehabilitated and managed under community-based plan • Registry of municipal fishers established	• Take full responsibility • Participate in implementation • Provide local personnel • Organize community groups to assist with implementation • Enter stakeholder agreements • Source funding	• Facilitate initial implementation • Provide seed funding • Provide technical guidance • Conduct training course as required
b. Legislation and regulation	• Ordinances enacted for CRM plan and implementation • Permits and licenses issued for municipal water uses consistent with CRM plan	• Participate in decision process • Endorse and implement	• Assist to draft • Provide information with examples
c. Law enforcement	• Coastal law enforcement units trained and operational	• Participate and support • Deputize and	• Technical training • Assist in

Phases and Steps	Activities and Outputs	Roles of Local Government, Community and Stakeholders	Technical Assistance Roles of Government, NGOs and Donors
	• Ordinances enforced	organize fish wardens	coordination
d. Revenue generation	• Taxes, fines, and fees collected from enterprise development, coastal law enforcement, and local water use	• Establish regular collection system • Use revenue for CRM	• Provide examples and technical assistance
e. Annual program preparation and budgeting	• Review implementation progress of CRM plan • Annual Investment Plan prepared and budget allocated for CRM • Staffing requirements identified • Operation and maintenance needs identified • Capital outlay requirements identified • Special projects identified • Training, technical assistance, and outreach needs identified	• Conduct public review • Develop Annual Investment Plan for CRM • Allocate budget • Commit staff	• Technical assistance as appropriate • Policy guidance • Source funds
PHASE 4 Monitoring and evaluation			
a. Monitoring and evaluation report prepared	• Train monitoring and evaluation team • Monitor environment and CRM process and feedback to database and plan • Performance evaluations conducted • Management capacity assessments conducted • Outcome evaluations conducted • Annual monitoring and evaluation	• Collect data • Participate in process • Take responsibility	• Assist to train local government personnel • Assist to analyze data • Assist to set up sustainable system
b. Refine management plan	• Annual CRM plan review and revision	• Use data to refine plan and update database	• Provide input on plan refinement

Phases and Steps	Activities and Outputs	Roles of Local Government, Community and Stakeholders	Technical Assistance Roles of Government, NGOs and Donors
PHASE 5 Information management, education and outreach			
a. Information management	• Establish and update Coastal Database • Produce and update local water use and coastal habitat maps • Annual CRM status reports and maps produced • Information management system functions and institutionalized	• Process data into useful information	• Design information system • Maintain national coastal databases • Provide training
b. Information, education, and communication	• Information disseminated for education and planning • Technical assistance and outreach program established • Conduct education campaigns for local CRM programs • Hold public hearings for proposed CRM plans and ordinances	• Disseminate and use information • Feedback to plan • Disseminate report on status of coastal resource management	• Assist with information and education materials development • Prepare and disseminate district and national reports on the status of coastal resource management