Title: CARBON CATCHMENTS:
Integrating climate change adaptation and mitigation in Timor-Leste

Ingvar Anda

Degrees: PhD: Sustainability and Technology Policy (Murdoch University)
Bachelor of Arts, Honours, Politics, Philosophy and Sociology (Murdoch University)

Faculty: Engineering, Health, Science and the Environment
University: Charles Darwin University
Master of Tropical Environmental Management (MTEM)
Date of Submission: 06/11/2013

“I declare that this thesis my own work and has not been submitted in any form for any other degree or diploma at any university or other institute of tertiary education. Information derived from the published and unpublished work of others has been acknowledged in the text and list of references”.

Signed: .................................................................  Date: 07/11/2013
Acknowledgements

I would like to thank those at CDU who have provided guidance in the writing of this thesis - Bronwyn Myers, Penny Wurm and Garry Cook. I would also like to thank my partner Bu Wilson for putting up with me writing yet another thesis and my son Oscar who missed out on valuable playtime. And to the people of the back blocks of Oecusse, Timor Leste, who provided the original inspiration when we worked together trying to come up with sustainable livelihood opportunities in a harsh and isolated environment.
Contents

Acknowledgements ................................................................. i
List of Figures ........................................................................ iii
List of Tables .......................................................................... iii
Acronyms ............................................................................... iv
Abstract ................................................................................ 1
1. Introduction ....................................................................... 2
  1.1 A Changing Climate ...................................................... 2
  1.2 Defining Climate Change Adaptation and Mitigation ....... 3
  1.3 Development in a Changing Climate – Timor-Leste .......... 6
2. Timor-Leste Policy Context - Climate Change Mitigation and Adaptation .... 10
  2.1 Forestry Policy ............................................................... 10
  2.2 Adaptation: National Adaptation Programme of Action (NAPA) .... 16
  2.3 Mitigation .................................................................... 17
3. Community Level Adaptation Priorities ................................ 20
  3.1 Introduction – context of adaptation ............................... 20
  3.2 Adaptation Priorities ..................................................... 21
  3.3 Reforestation and Agroforestry: No Regrets Adaptation ...... 26
4. Mitigation potential of community based activities in Timor-Leste ........ 28
  4.1 Introduction .................................................................. 28
  4.2 Community-based Natural Resource Management for Carbon Sequestration project in East Timor (CBNRM-ET) ............. 29
  4.3 Community based fire management to reduce emissions .... 32
  4.4 Mangroves (‘Blue Carbon’) ............................................ 37
  4.5 Summary of mitigation benefits ...................................... 38
5. Carbon farming potential of the Laclo River catchment in Timor-Leste .... 39
  5.1 Introduction ............................................................... 39
  5.2 The Laclo River Catchment Study .................................. 39
  5.3 Integrated carbon catchment management ....................... 40
6. Conclusion ......................................................................... 48
7. References ........................................................................ 51
List of Figures
FIGURE 1: The Laclo River catchment area in Timor-Leste .........................14

List of Tables
TABLE 1: Summary of emission reductions and carbon credits
in three land use sectors.............................................................................43
TABLE 2: Comparative forest cover in Timor-Leste 1972-99...............................46
TABLE 3: Summary of CO2 emissions reductions and carbon
credits in the Laclo catchment.................................................................48
<table>
<thead>
<tr>
<th>Acronyms</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACIAR</td>
<td>Australian Centre for International Agricultural Research</td>
</tr>
<tr>
<td>ACCRA</td>
<td>Africa Climate Change Resilience Alliance</td>
</tr>
<tr>
<td>AGB</td>
<td>Above Ground Biomass</td>
</tr>
<tr>
<td>ATSEF</td>
<td>Arafura &amp; Timor Seas Expert Forum</td>
</tr>
<tr>
<td>AusAID</td>
<td>Australian Agency for International Development</td>
</tr>
<tr>
<td>CBA</td>
<td>Community Based Adaptation</td>
</tr>
<tr>
<td>CBNRM</td>
<td>Community Based Natural Resource Management</td>
</tr>
<tr>
<td>CDM</td>
<td>Clean Development Mechanism</td>
</tr>
<tr>
<td>CDU</td>
<td>Charles Darwin University</td>
</tr>
<tr>
<td>CSIRO</td>
<td>Commonwealth Scientific, Industrial Research Organisation</td>
</tr>
<tr>
<td>DCCEE</td>
<td>Department of Climate Change and Energy Efficiency</td>
</tr>
<tr>
<td>DSAPF</td>
<td>Directorate of Agriculture, Fisheries and Forestry</td>
</tr>
<tr>
<td>ENSO</td>
<td>El Nino Southern Oscillation</td>
</tr>
<tr>
<td>FAO</td>
<td>Food and Agriculture Organisation</td>
</tr>
<tr>
<td>GEF</td>
<td>Global Environment Facility</td>
</tr>
<tr>
<td>ICCAI</td>
<td>International Climate Change Adaptation Initiative</td>
</tr>
<tr>
<td>IOD</td>
<td>Indian Ocean Dipole</td>
</tr>
<tr>
<td>IPCC</td>
<td>Intergovernmental Panel on Climate Change</td>
</tr>
<tr>
<td>LAC</td>
<td>Local Adaptive Capacity</td>
</tr>
<tr>
<td>LDC</td>
<td>Least Developed Country</td>
</tr>
<tr>
<td>LULUCF</td>
<td>Land Use, Land Use Change and Forestry</td>
</tr>
<tr>
<td>MAFF</td>
<td>Ministry of Agriculture, Forestry and Fisheries</td>
</tr>
<tr>
<td>NAILSMA</td>
<td>Northern Australia Indigenous Land and Sea Management Alliance</td>
</tr>
<tr>
<td>NAPA</td>
<td>National Adaptation Programme of Action</td>
</tr>
<tr>
<td>NGO</td>
<td>Non Government Organisation</td>
</tr>
<tr>
<td>PAR</td>
<td>Participatory Action Research</td>
</tr>
<tr>
<td>PCCSP</td>
<td>Pacific Climate Change Science Program</td>
</tr>
<tr>
<td>REDD</td>
<td>Reduced Emissions from Deforestation and Degradation</td>
</tr>
<tr>
<td>RDTL</td>
<td>Republica Democratica de Timor-Leste</td>
</tr>
<tr>
<td>SALT</td>
<td>Sloping Agricultural Land Technology</td>
</tr>
<tr>
<td>SOC</td>
<td>Soil Organic Carbon</td>
</tr>
<tr>
<td>SIDS</td>
<td>Small Island Developing States</td>
</tr>
<tr>
<td>UNDP</td>
<td>United Nations Development Programme</td>
</tr>
<tr>
<td>Acronym</td>
<td>Full Name</td>
</tr>
<tr>
<td>-----------</td>
<td>--------------------------------------------------------------------</td>
</tr>
<tr>
<td>UNEP</td>
<td>United Nations Environment Programme</td>
</tr>
<tr>
<td>UNFCCC</td>
<td>United Nations Framework Convention on Climate Change</td>
</tr>
<tr>
<td>UNTAET</td>
<td>United Nations Transitional Administration in East Timor</td>
</tr>
<tr>
<td>WAFMA</td>
<td>West Arnhem Land Fire Management Agreement</td>
</tr>
<tr>
<td>WALFA</td>
<td>West Arnhem Land Fire Abatement Project</td>
</tr>
</tbody>
</table>
Abstract
Climate change is a global problem that particularly impacts the poorest people in developing countries. As efforts to mitigate the effects of climate change increasingly flounder, the need to adapt to the impacts of climate change become more pressing and urgent. This thesis presents a case for a closer integration of climate change adaptation and mitigation policy and programming in the Timor-Leste context as a more effective approach to achieving both adaptation and mitigation objectives as well as enhancing rural livelihoods and natural resources management.

In the Timor-Leste context, policies and programs around sustainable land management and climate change adaptation are shown to be largely complementary. Communities are acknowledged as playing a key role in local level resource management and adaptation. Climate change mitigation policy and programming is largely undeveloped in Timor-Leste and a conceptual separation of adaptation and mitigation should be avoided. An effective integration of climate change mitigation and adaptation is presented through the examination of community level case studies.

Income generation from carbon credits is examined using WAFMA in the Northern Territory as a reference. Reforestation and agroforestry are shown to have the greatest potential for mitigation outcomes as well as being consistent with policies and programs for sustainable land management and climate change adaptation. How this would look in practice is demonstrated in a catchment management approach that achieves livelihood, adaptation and mitigation outcomes – a carbon catchment.
1. Introduction

1.1 A Changing Climate

The global climate is changing and this change is being driven by a dramatic increase in greenhouse gases from human activity. There are a number of greenhouse gases but the most abundant one is carbon dioxide (CO$_2$). According to the fourth assessment report of the Intergovernmental Panel on Climate Change (IPCC), the concentration of carbon dioxide has increased from around 280 ppm in the pre-industrial period (around 1750) to 379 in 2005 (IPCC 2007). This increase is due almost entirely to increases in emissions from industrial activity (combustion of fossil fuels) and changes in land use (deforestation, agriculture) (IPCC 2007). Although some countries in Europe have initiated programs to reduce greenhouse gas emissions since the early 1990's, CO$_2$ emissions globally have continued to increase from an annual average of 6.4 GtC per year in the 1990s to 7.2 GtC per year in the period 2000-2005 (IPCC 2007). This recent increase has largely been driven by the massive growth in fossil fueled industrial activity in the developing world, particularly China which is now the world's largest emitter of greenhouse gases. Average global temperatures have increased by 0.74°C in a century (1906-2005) with the rate of temperature increase almost doubling in the second half of that period (IPCC 2007). Future rises in temperature are projected to range from 1.1°C (low emission scenario) to 6.4°C (high emission scenario) by 2090 (IPCC 2007). Change is increasingly certain, although the degree of change is hard to predict with a high degree of accuracy – either spatially or temporally.

The broad range of future climate scenarios reflects both the different emission scenarios that are used to generate the projections and different projections for any given emission scenario. A high emissions scenario leads to a projection of a high degree of climate change whereas a low emissions scenario leads to a climate change projection at the lower end of the scale. Mitigating climate change means reducing emissions of greenhouse gases (e.g. less burning of fossil fuels, less deforestation and burning) and increasing the absorption of CO$_2$ from the atmosphere (e.g. increased reforestation and soil carbon). Any reduction in rates of emissions or
increase in CO\textsubscript{2} absorption contributes to global mitigation due to the fact that climate change is driven by concentrations of greenhouse gases in the atmosphere and these gases diffuse more or less globally. This means that whilst it may be reasonably easy to quantify the emissions reductions required to mitigate climate change impacts, it is much more difficult to predict the impacts of climate change at a particular location due to local variations in climate change (more rain in some areas, less rain in others for instance) and so difficult to tailor adaptation strategies to particular locations. Mitigation efforts always have a global impact, whereas adaptation is predominantly local.

Whilst climate projection models can anticipate global mean temperature increases (within particular emissions trajectories) with only some reasonable precision, it is even more difficult to project scenarios of rainfall patterns and localized weather impacts (Ensor 2011). However, the computer models used are being improved and in the Timor-Leste context, the Australian Government funded Pacific Climate Change Science Program (PCCSP) has conducted a national level analysis using a number of climate projection models and has projected that temperature increases will be between 1.5 and 3°C warmer (relative to 1990 baseline) by 2090\textsuperscript{1}. Overall, rainfall is expected to remain reasonably constant but wet season rainfall is expected to increase and dry season rainfall is expected to decrease (PCCSP 2011). Timor-Leste already suffers from a high degree of inter-annual climate variability due to the influence of the ENSO cycle. During El Niño years there is a marked decrease in rainfall as well as a later onset of the rainy season. Projected climate change impacts could exacerbate the impacts of climate variability with potentially devastating impacts on food security and water availability in Timor-Leste (Barnett et al. 2007; Myers et al. 2011).

1.2 Defining Climate Change Adaptation and Mitigation

Mitigation is about avoiding the devastating anticipated impacts of climate change in a high emission scenario by reducing emissions. Adaptation is about adapting to the unavoidable impacts of an already changing climate. According to the IPCC, climate

\footnote{1 The temperature increase in island contexts is expected to be lower than in large land masses due to the moderating influence of the ocean.}
change adaptation is defined as “adjustment in natural or human systems to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities” (IPCC 2007). Another definition of adaptation is “a process of sustainable and permanent adjustment in response to new and changing environmental circumstances” (Schipper et al. 2008). More recent definitions of adaptation emphasize that uncertainty needs to be central to adaptation planning in order to avoid ‘maladaptation’ or adaptations that increase vulnerability to future changes rather than reduce vulnerability (Ensor 2011). Research on adaptation at the community level has identified three components to adapting in the face of uncertainty – vulnerability reduction (to particular hazards such as floods or droughts); strengthening the capacity to absorb shocks or ride out changes (such as diversifying seed types and developing alternative livelihoods); and building adaptive capacity (such as training and support for experimenting with crop variety selection) (Ensor and Berger 2009).

Vulnerability to climate change is not uniform, poor communities have greater vulnerability to the potential impacts of climate due to the higher exposure of their livelihoods to these impacts (e.g. rain-fed agriculture, limited access to alternative grazing areas, etc) (Ensor and Berger 2009). Vulnerability then, can be defined as the interaction of the potential impacts of climate change and the adaptive capacity of those (countries, communities, households, individuals) exposed to those impacts. Poverty, low education, poor health and lack of social capital, are factors which can reduce adaptive capacity (Adger et al. 2003; Ensor and Berger 2009). In the context of rural development in developing countries, adaptive capacity is a particularly important concept as rural communities often have limited assets and formal training opportunities to understand and prepare for the impacts of climate change. Activities that support a community’s ability to change to current challenges are essential to community based adaptation (CBA) interventions but “community-based adaptation must be defined by a balance between actions that support the ongoing ability to change, and those that respond to current challenges .... current challenges become an entry point for actions that build the capacity to adapt” (Ensor 2011, p. 2). A study of local development interventions within the Africa Climate Change Resilience Alliance (ACCRA) defines adaptive capacity as “the ability of individuals and communities to anticipate, deal with and respond to change – both changing
climate and development pressures – while maintaining (or improving) their wellbeing” (Levine et al. 2011 p. vii). As adaptive capacity refers to a potential to respond to change it is not readily measurable but the ACCRA research focused on five dimensions that it considered contribute to adaptive capacity: the asset base, institutions and entitlements, knowledge and information, innovation and flexible forward-looking decision-making and governance (Levine et al. 2011, p.3).

At present there is a policy and practical separation between climate change adaptation and climate change mitigation in Timor-Leste. This is not unusual and is the case in many countries and possibly reflects a focus on international policy formation under the United Nations Framework Convention on Climate Change (UNFCCC) which maintains a fairly rigid distinction between adaptation and mitigation (Pelling 2011). Pelling argues that mitigation is logically a subset of adaptation as mitigation is “an adaptive act aimed at ameliorating or reversing the root causes of the anthropocentric forcing processes behind climate change (Pelling 2011: 22). Reconceptualising mitigation as a subset of adaptation may be particularly useful in the Timor-Leste context as it is a low emission country with a highly vulnerable population facing urgent adaptation priorities. For instance, agroforestry is a significant adaptation strategy that also has significant mitigation potential (Verchot et al. 2007). Seeing mitigation as a subset of adaptation would also bring to the fore methodologies for capturing carbon data within adaptation programs, and allow potential livelihood opportunities from carbon credits to be more easily evaluated within adaptation programs. In short, community based mitigation activities can be seen as part of a community’s adaptive capacity.

There is an emerging policy agenda to integrate climate change adaptation and mitigation with sustainable development which has been termed “low carbon resilient development” (Fisher 2013). This approach seeks to develop an agenda that simultaneously reduces carbon emissions (mitigation), builds climate resilience (adaptation) and supports development. There is an underlying assumption that addressing these three policy areas simultaneously will be more cost effective and potentially lead to “triple wins” (Fisher 2013). A study looking at the integration of mitigation and adaptation in the tourism sector in Fiji identified reforestation as a
good example of combining climate change adaptation and mitigation. As well as
acting as carbon sinks (mitigation) trees reduce vulnerability to cyclones, improve
micro-climates and increase amenity in tourist areas (Bencken 2005). Agroforestry is
well recognized as having the highest potential for carbon sequestration within the
land use, land use change and forestry (LULUCF) sector in non-Annex 1 countries
as well as being very effective as an adaptation strategy (Verchot et al. 2007).

1.3 Development in a Changing Climate – Timor-Leste

There is a great inequity in climate change causes and impacts. Climate change
impacts affect people differently. The poorest are most vulnerable due to their lack
of assets to use in the event of a shock such as flood or drought. The poor in rural
areas of developing countries are also more dependent on natural resources for their
livelihoods (farming, fishing, livestock rearing) which are in turn more vulnerable to
climate change impacts (Ensor and Berger 2009). Despite being the most vulnerable
to the impacts of climate change, and having the least capacity to adapt to those
impacts, the world’s poor have done the least to contribute to the causes of climate
change. The low cost, emissions intensive development path followed by rich,
industrialized countries has left a legacy of increased greenhouse gases in the
atmosphere that now constrains the ability of developing countries to take the same
path to development (Baer et al. 2008). Future development will need to be low
carbon emission, which is currently more expensive. Adapting to climate change that
is already ‘locked in’ further increases the cost of development for developing
countries. Climate change negotiations have failed to address how these costs will be
covered despite the strong expectation that adaptation funding would have been
agreed at the UNFCCC Copenhagen conference in 2009 (Ensor and Berger 2009).

Timor-Leste is a developing country that is particularly vulnerable to the impacts of
climate change (Barnett et al. 2007; PCCSP 2011). Despite the uncertainty, Timor-
Leste is beginning to engage with the significant challenge to adapt. Policies are
being developed and refined and programs are being designed and implemented.
These policies and programs are focused on adaptation. Where mitigation is
considered it is largely considered in isolation from adaptation. This thesis presents a
case for a closer integration of climate change adaptation and mitigation policy and
programming in the Timor-Leste context as a more effective approach to achieving both adaptation and mitigation objectives as well as enhancing rural livelihoods and natural resources management.

This paper firstly examines the policy context of climate change. In chapter two I will look at the policy context and how forestry policy and traditional natural resource management practices, or *tara bandu*, are central not just to sustainable forest management but to both climate change adaptation and mitigation. In chapter three and four I examine adaptation and mitigation through the lens of rural development project case studies in both areas. The two adaptation case studies reviewed are both located in Timor-Leste. Climate change mitigation has received less attention than adaptation in Timor-Leste so we will examine the one mitigation case study in Timor-Leste that this author is aware of but also look at case studies of climate change mitigation through fire management in the neighbouring Indonesian province of Nusa Tengarra Timor (NTT) and in the Northern Territory of Australia, as well as the mitigation potential from mangrove rehabilitation or "blue carbon". These mitigation activities are compared for their carbon sequestration potential.

In seeking to present a case for the integration of adaptation and mitigation one of the more complex issues that comes up is how is mitigation funded? Pricing greenhouse gas (GHG) emissions to drive reductions is a cornerstone of the global effort to avoid dangerous climate change. The EU introduced an emissions trading scheme (ETS) in 2005. Polluters in Europe are able to offset some of their GHG emissions through the purchase of certified emission reductions (CERs) from mitigation projects in developing countries. This process is administered by the UNFCCC through the clean development mechanism (CDM). CDM mitigation projects can include afforestation/reforestation projects similar to projects discussed in this paper but the requirements for designing and monitoring projects are challenging and more suited to large scale commercial projects (Boyd et al. 2007). A perhaps greater challenge to long term project viability is the extreme volatility of the carbon price. Since the start of the EU ETS in 2005, the price of one ton of CO₂ has varied from €32 in April 2006, collapsed to near zero in 2007, recovered and traded above €30 in 2008 before collapsing again to €2.80 in early 2013 (Carrington 2013). Similar ETS schemes are being put in place or planned in Australia, New Zealand, Korea and at the sub-national level in China and the USA, but it is unclear
how a reasonably stable carbon price will be maintained to allow an ETS to deliver the emissions reductions in industrialized countries it is designed to achieve (Carrington 2013) as well as supply a reliable funding stream to mitigation projects in developing countries.

This thesis does not seek to evaluate the merits or otherwise of carbon offset schemes, as it is focused on looking at the practical aspects of integrating community level climate change adaptation and mitigation. In order to look at the potential financial aspects of a mitigation project in Timor-Leste this paper will take as its reference point a carbon offset payment scheme developed in the Northern Territory of Australia between the operator of the Darwin Gas Plant (Conoco-Philips), the Northern Territory Government, the Northern Land Council and the Indigenous traditional owners of West Arnhem Land. Under this project, the Darwin Gas Plant supports traditional owners to manage fires in accordance with their traditional responsibilities in West Arnhem Land to offset the CO₂ emissions associated with emissions from the plant. Under this agreement, carbon payments are calculated at AUD 10 a ton with an annual payment of AUD 1,000,000 for 17 years (indexed to 2006) (NAILSMA, 2012). This scheme gives long term certainty to the community level mitigation activities it funds and is a useful benchmark for similar projects elsewhere including that discussed in this paper.

Another issue that comes up in looking at carbon offset credits is that of ‘additionality’. In Clean Development Mechanism (CDM) projects the key question in this regard is ‘without the revenue of carbon credits made possible by CDM, would the investment occur anyway’ (Gillenwater 2012). In the WAFMA case above, the reduction in emissions from savanna burning would not have occurred without the payment of carbon credits from the Darwin Gas Plant therefore the emissions reductions qualify as ‘additional’. I will not go into the question of additionality in relation to theoretical projects in Timor-Leste discussed here, as it would depend on a number of contextual issues and examining them would detract from the main focus of looking at how adaptation and mitigation outcomes could be more effectively integrated.

Through examining forestry and climate change policy and programming context in Timor-Leste we will see that there is a significant degree of overlap in the types of
approach and activities that would be applied in programs that would have the objective of addressing climate change adaptation needs or implementing programs that contribute to the mitigation of climate change. That being the case, the fifth and final chapter looks at how an integrated approach to climate change adaptation and mitigation at the community level in Timor-Leste might look. A study of the Laclo river catchment is drawn on to examine how climate change adaptation and mitigation may be integrated into a catchment management approach that addresses broader sustainable rural development objectives, a ‘triple win’ (Smith and Wollenberg 2012; Fisher 2013) of sustainable livelihood, climate change mitigation and climate change adaptation outcomes – a carbon catchment.

Fig 1: The Laclo River catchment area in Timor-Leste
2. Timor-Leste Policy Context - Climate Change Mitigation and Adaptation

This chapter outlines the policy framework within Timor-Leste around climate change (adaptation and mitigation) and related areas, particularly forestry. Forestry policy is particularly important in this context as the majority of Timor-Leste’s population are rural people living a largely subsistence agrarian existence. Rural communities are dependent on forests for fuel, building materials, medicine, fodder and food, particularly in times of drought and flood. Effective management and sustainable use of forest resources is essential to the wellbeing of rural communities, therefore, this chapter also looks at traditional forest and land management practices and their recognition and adoption within state policy.

Due to its tumultuous past Timor-Leste did not become a party to the UNFCCC until 2007. It submitted its National Adaptation Programme of Action (NAPA) in December 2010 and initiated the process of producing its Initial National Communication in August 2010 with an expected completion date of Sept 2013. National communications usually contain information on national circumstances, vulnerability assessment, financial resources and transfer of technology, and education, training and public awareness, as well as an inventory of emissions.

2.1 Forestry Policy

The development of a forestry policy for Timor-Leste is a crucial component in the process of shifting to a sustainable land use framework and viable livelihood options for the majority rural population in Timor-Leste who depend heavily on forest resources. Protection of remaining forest, and reforestation of degraded areas, is also crucial in adapting to, and mitigating, the impacts of climate change. Forests on the island of Timor are heavily degraded and under continuing pressure from unsustainable farming practices, extraction of fuel wood and timber, over grazing, and destructive burning practices (McWilliam 2001a, 2003; Meitzner-Yoder 2005; FAO 2005). Forest cover is estimated to have declined by 30% during the 24 years
of Indonesian occupation (McWilliam 2003). A detailed analysis of Landsat data revealed that just in the ten year period between 1989 and 1999 there was an 18% decline in forest cover (Bouma and Kobryn 2004). Increases in population, lack of capacity in adopting more sustainable approaches, and a history of poor policy approaches mitigate against effectively addressing forest and watershed management. With 70% of Timor-Leste’s land having a slope of greater than 26% (RDTL 2011) the land is highly vulnerable to erosion from deforestation and poor farming practices. The increased erosion potential associated with more extreme rainfall events under a changing climate (Myers et al. 2011) increase the imperative to find effective and sustainable forest and watershed management strategies.

The 2005 National Forest Policy identifies deforestation and degradation as a serious national problem with an adverse effect on watershed condition and therefore on food security. Fuel wood for household use contributes significantly to forest degradation and this has increased since the removal of Indonesian era kerosene subsidies in 1999. The average Timorese household is estimated to use 24 kg of wood per day for cooking (FAO 2005). Overgrazing by cattle and current burning regimes also contribute significantly to forest degradation (McWilliam 2003, 2000). The draft Timor Leste National Action Programme to Combat Land Degradation also has sustainable management of forest as a key component through minimizing further encroachments on remaining forests (shifting cultivation, illegal logging and uncontrolled grazing) and promoting community forest management and integrated agroforestry (FAO 2008b)

Timor scholar Andrew McWilliam argues that in order to avoid the failures of colonial era (Indonesian and Portuguese) forest management, national forestry policy “will only succeed with the full cooperation and involvement of the majority of rural communities who derive their subsistence and domestic needs from local resources” (McWilliam 2003, p. 319). McWilliam identifies three principal strategies for optimizing forest resource development²:

² McWilliam’s identification of these three strategies deliberately avoids including opportunities from mechanisms for carbon credits from forest carbon sequestration but sees these three policy strategies as prerequisites for developing carbon credit schemes from forestry in Timor-Leste (McWilliam 2003).
1. The promotion of more sustainable agriculture through agro-forestry and the integration of timber resources within the Timorese seasonal dryland farming systems;

2. The creation of co-management systems between the national government and local custodial communities for the control and management of designated forest blocks and protected areas;

3. The promotion of forest plantation systems which combine technical and commercial cooperative arrangements between government or private commercial agencies and local farmers.

This is broadly the goal of the reformulated national forest policy whose goal, objectives and strategy were formulated by Food and Agriculture Organisation of the United Nations (FAO) in 2005. The principal policy objective of the forest policy is “effective protection of the ecological integrity and biological composition of not less than 70% of the area of forests by 2020” (FAO 2005). This is a very ambitious objective and assumes a central role for communities in forest management whose customary land and forest usage rights within suco boundaries “will be determined and legally recognized under Land Law 01-2003” (FAO 2005). Although this is a worthy objective, and the proposed central role of rural communities in forest management is consistent with McWilliam’s (2003) criteria for successful forest policy, it is not so straightforward in terms of the current state of land law in Timor-Leste. Land Law 01-2003 is repealed under the draft Land Law of June 2009, however, this new draft Land Law is still not passed and as such there is no legal basis for customary land and forest usage rights that the forest policy assumes (Wright 2010a). Even if the draft land law is passed the current draft confers no legal rights on customary land tenure systems but merely imposes an obligation for the government to ‘consult’ with local communities when making decisions around land use (Wright 2010b). The legal impasse around land law has gone on since the

---

1 It is not clear if this 70% refers to all existing forests or only forested areas that come under the authority of the Forests Dept.
United Nations Transitional Administration in East Timor (UNTAET) period and still has not been resolved. This leaves the area of community land ownership and use in a legal grey area and one that needs to be resolved if effective community level land management practices are to be implemented and maintained within a clear and secure legal framework. A central role for communities is essential if the state law is to have legitimacy in the eyes of the community who see local (Suco) level authorities as the most important authority when it comes to regulating land use, in particular land disputes (Nixon, 2008).

Agro-forestry is central to sustainable land management in upland farming systems but has been neglected in colonial forestry policy in Timor-Leste due to a focus on plantation agriculture and irrigated rice cultivation (McWilliam 2003). The Indonesian State in particular was suspicious of the ‘potentially seditious spaces’ that characterized upland farming practices and communities. Upland subsistence farming communities constitute the bulk of the Timor-Leste population, and forestry and land policy needs to place them at the centre of land management practices if it is to be successful. This requires an ‘integrated or multi-use landscape approach” that takes into account the basic needs of farming communities (McWilliam 2003 p.322). It also needs to take into account traditional processes of natural resource management.

2.1.1 Tara Bandu

In traditional Timorese culture large areas of forest were protected as lulic (sacred) with strict prohibitions on damaging activities (cutting, grazing, burning) (McWilliam 2001a, Meitzer Yoder 2005). Various historical accounts of forest extent indicate that these once covered a very significant part of the island of Timor but have since been reduced to a fraction of their former coverage. Those areas of forest that remain are believed to owe their preservation largely to their lulic status (McWilliam 2001a). Under traditional Timorese forest classification hilltops were left forested in order that they would remain ‘cool’ and contribute to the fertility of

---

surrounding agricultural lands (McWilliam 2001a). A central element in customary forest management practices is that of tara bandu, a traditional practice for regulating human interactions with their immediate environment (Soares 2004). Tara (hanging) bandu (prohibition) refers literally to the inverted branch or cluster of leaves hanging from a tree to inform those in the area of a prohibition in force (Meitzner Yoder 2005:249). Under the Indonesian occupation, traditional systems of forest management (including tara bandu) were ignored or banned, and a system of forestry planning imposed that alienated local communities or even led to their forced removal (de Carvalho 2011).

Pinto (2011) argues that tara bandu is implicitly recognized under the Republica Democratica de Timor Leste (RDTL) constitution as a cultural practice and in the post-independence period, tara bandu has been reinstated as a central aspect of community life and government forest policy. However, as noted above there are considerable legal uncertainties remaining around land ownership and management. Nonetheless, communities, non-government organizations (NGO) and the forestry directorate have embraced tara bandu as a means of revitalizing traditional culture and enforcing sustainable land management practices. The leading Timorese environment NGO, Haburas, was an early advocate of supporting tara bandu for community level governance of natural resources for sustainability (de Carvalho 2011). This approach corresponds to Gibson et al. (2005) observation that local level rule enforcement is a prerequisite for successful resource management at the local level.

In one of the first tara bandu conducted in post-independence Timor-Leste, community leaders in the enclave district of Oecusse imposed restrictions and a localised ban on the harvesting of palm leaves due to over harvesting for roofing material (Meitzner Yoder 2005: 253-4). In the district of Liquiça, adjacent to Dili, also in 2001, Haburas began working with the local community to revitalize the tara bandu tradition as it is seen as reinforcing the ecological objectives of the NGO (de Carvalho 2011). Concurrent with this revitalization of tara bandu at the local level, the newly independent Timor-Leste state began integrating tara bandu into state policy.
In the post independence period *tara bandu* was widely promoted as a ‘traditional’ activity that is compatible with modern natural resource practices and was officially sanctioned in the first draft forest policy of 2003 (Meitzner-Yoder 2005:250). Ministry of Agriculture and Fisheries (MAFF) staff often participate in *tara bandu* as they see it as a means to advance contemporary sustainable forest management practices as did some NGOs (Meitzner-Yoder 2005).

The author of this paper, whilst working for an international NGO in Oecusse District, participated in a *tara bandu* in the village of Nefomtasa in 2004, along with the District Head of MAFF, Jose Oki. Both Jose and myself gave addresses along the lines of sustainable land management. At the conclusion of the ceremony, community members signed agreements that regulated land clearing for crops, cattle grazing, and firewood extraction in areas considered sacred. Although in many ways *tara bandu* initiatives can appear to advance the objectives of development NGOs, government policy and community empowerment, it is not necessarily so straightforward. For example, Haburas is wary of government appropriation of what is a community level cultural-spiritual practice (Meitzner-Yoder 2005:251). Given the inconclusive status of land law, the department of Land and Property also has misgivings about state involvement in *tara bandu* due to what may be seen as tacit endorsement of land claims (Meitzner-Yoder 2005:251).

Notwithstanding the legal uncertainty of authority over land in Timorese law, as well as civil society misgivings around State appropriation of what is a cultural-spiritual tradition, *tara bandu* should be a central component of local level approaches to sustainable land management. As the principal traditional local governance tool for natural resource management its use is essential for an effective land co-management partnership between local communities and government (McWilliam 2003). *Tara bandu* offers effective, culturally appropriate, methods of rule enforcement that are a prerequisite for effective local level forest management (Gibson et al. 2005) and that are also largely consistent with ecological sustainability principles (de Carvalho 2011; Pintu 2011). *Tara bandu* has also been identified as an appropriate regulatory framework for community level climate change adaptation programs, particularly in relation to the protection of water resources (RDTL 2010). However, *tara bandu* follows a ritual process that does not readily fit into a modern ‘project management
cycle' and care should be taken in designing and implementing projects that assume a critical role for *tara bandu* (this issue will be examined more in chapter four).

### 2.2 Adaptation: National Adaptation Programme of Action (NAPA)

As a least developed country (LDC), Timor-Leste has been assisted by UNDP to develop a national adaptation programme of action (NAPA – RDTL 2010). The NAPA was created by a process under the UNFCCC whereby LDCs can identify and respond to the most urgent and pressing needs to adapt to the impacts of climate change. East Timor's NAPA was finalized in December 2010 and involved a participatory approach that included all key government departments, UN agencies, donors, local and international NGOs, and the Red Cross (RDTL 2010). The NAPA drew on the most current climate data at the time of publication and available projections of climate change impacts and then assessed vulnerability across the country.

The NAPA identified nine priority adaptation measures of which the top three were food security, water resources and human health (RDTL 2010). The priority placed on food security is warranted due to the extremely high existing levels of chronic food insecurity. The United Nations development Programme (UNDP) records a high proportion of underweight children (45% of children) across Timor-Leste and this is a strong indicator of food insecurity (Barnett et al. 2007). The 2009-10 Timor-Leste demographic and health survey found that the proportion of underweight children had increased from 46% to 52% between 2003 and 2009-10 indicating that little headway is being made in addressing malnutrition (NDS 2010). Oxfam recorded up to 80% of households in some districts with moderate or severe food insecurity (Oxfam 2007). Most rural households live off subsistence agriculture and approximately 41% live below the poverty line (Barnett et al. 2007). Chronic food

---

5 Food security is defined as existing "when all people, at all times, have physical and economic access to sufficient safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life". (FAO 2008).


7 However, the NDS cautions against comparisons on figures for child nutrition due to differences in data analysis methodology with previous surveys.
insecurity is exacerbated by regular drought events brought on by the El Nino Southern Oscillation (ENSO) (Fox 2002; Barnett et al. 2007).

Climate change is expected to exacerbate the effects of existing climate variability and there is a reasonable likelihood that there will be more hot dry days and less rainfall but with more intense rainfall events (PCCSP 2011). This may lead to a greater incidence of landslides and soil erosion unless there is greater effort placed on preventing clearing vegetation on steep slopes (Barnett et al. 2007). The integration of trees into sloping land farming systems (agro-forestry) and reforestation of denuded hilltops is therefore a priority for both food and water security.

Within the NAPA, a number of priority projects are proposed. The first of these is focused on food security through building resilience of rural livelihoods. Key activities include reforestation of degraded lands and promotion of sustainable land management (RDTL 2010). Another priority adaptation measure is restoration and conservation of mangrove ecosystems to protect coastal ecosystems (RDTL 2010). Both of these measures would also have potentially substantial mitigation benefits. Reforestation and sustainable land management present significant carbon sequestration opportunities through increased biomass and soil carbon and reduced emissions from burning (Lasco and Cardinoza 2007; Godinho et al. 2003; Nair et al. 2009; Myers et al. unpublished). Mangrove ecosystems are believed to store more carbon per hectare than any other forest ecosystem (Murdiyarso et al. 2009).

2.3 Mitigation

Given that over 70% of Timor-Leste’s population relies principally on agriculture for their livelihood (RDTL 2011) and there is little industry⁸, it is reasonable to assume that the majority of Timor-Leste’s GHG emissions arise from land use, land use change and forestry (LULCF). Opportunities for mitigation, and associated carbon

⁸ Although the Government of Timor Leste derives the bulk of its revenue from its share of the natural gas deposits in the Timor Sea, these resources are processed in Darwin and exported, with no gas related industrial processes currently carried out in Timor-Leste.
credits from avoided emissions and carbon sequestration, would therefore be in the agriculture and forestry sectors. Current agricultural practices in Timor-Leste are largely based around shifting cultivation with substantial burning of native vegetation in the dry season prior to cropping in the wet season. Studies in the adjacent Indonesian province of Nusa Tenggara Timur (NTT) indicated that annual emissions from savanna burning are around 10kg CO$_2$e/ha whereas in the Northern Territory of Australia they are estimated at 50 kg CO$_2$e/ha (Myers et al. forthcoming). It can be assumed that emission rates from savanna fires in Timor-Leste are similar to those of NTT.

Under the UNFCCC, all signatory countries are required to submit an initial national communication (INC) reporting on the steps they are taking, or envisage taking, to implement the Convention. The INC also contains a detailed greenhouse gas inventory outlining estimated emissions by category (energy, industry, agriculture, land use, forestry etc.). Timor-Leste is currently compiling its INC, with assistance from UNDP, and this is not expected to be completed until late 2013. As such, Timor-Leste does not yet have a comprehensive baseline of GHG emissions. As a small LDC with a predominantly subsistence population, Timor-Leste can be assumed to have a very low emission footprint. Due to other pressing developmental needs, low carbon development is not a particularly high priority\(^9\) as compared to adaptation.

Mitigation of climate change through carbon sequestration in forests is an important part of global mitigation strategies. Although forests in Timor-Leste do not have as high biomass volumes as found in mature rainforests in high rainfall areas (such as western Indonesia), there is still potential in Timor-Leste’s forests. Above ground biomass (AGB) carbon sequestration rates for a stand of *Paraserianthes falcatoria* in Aileu district of Timor-Leste have been recorded at 4.3 – 9.9 MgC/ha/yr (Godinho et al. 2003). This indicates there is significant potential for storing carbon in protected

---

\(^9\) According to Timor-Leste’s Strategic Development Plan 2011-2030, Timor-Leste is committed to meeting at least half of its energy needs from renewable sources by 2020 (RDTL 2011). This commitment is inconsistent with the TL Government’s earlier (2008) decision to go ahead with a carbon intensive heavy oil power plant that will generate practically all of Timor-Leste’s required electricity for many years to come. See http://www.laohamutuk.org/Oil/Power/2011/11PowerPlant2011.htm
forests as well as through reforestation. The integration of agroforestry into Timorese agricultural practices also has significant potential for carbon sequestration with AGB carbon sequestration rates in agroforestry systems elsewhere recording rates of up to 15 MgC/ha/yr (Nair et al. 2009). These rates do not include soil carbon which is also significant. Planting and conservation of mangroves also offer a significant opportunity for carbon sequestration (Murdiyarso et al. 2009).

As discussed previously, there is a consistent policy and practical separation between adaptation and mitigation in UNFCCC and most national processes. Following Pelling (2011) this paper argues for an integrated approach to climate change adaptation and mitigation with adaptation at the fore and mitigation outcomes clearly defined and quantified. The following two chapters examine adaptation and mitigation case studies to draw out the limitations of addressing adaptation and mitigation separately before looking at how an integrated approach might work in the final chapter.
3. Community Level Adaptation Priorities

3.1 Introduction – context of adaptation

Due to its tumultuous history of conflict and occupation, Timor-Leste has a particularly poor historical meteorological data. Although there are reasonably reliable rainfall records from Dili airport from 1950 onwards there are little or no comprehensive or reliable long term temperature records (PCCSP, 2011). This paucity of national climate data hinders the ability to make accurate observations of historical changes to climate and therefore provide baselines to assess risk (Barnett et al. 2007). In order to assess climate change in the Timor-Leste context for the preparation of the NAPA, the Government of Australia’s Department of Climate Change and Energy Efficiency (DCCEE) prepared an overview of future climate projections based on regional and global climate models. 10 This report also made use of historical meteorological data from Indonesia (including West Timor) and Australia (Kirono 2010).

The NAPA identifies projected climate changes including increases in temperature, increase in overall rainfall and extreme rainfall events and increases in sea level by up to 1 metre by 2100 (RDTL 2010). The PCCSP climate study generally confirms these overall projections although it notes a degree of uncertainty in rainfall projections which generally indicate a decrease in dry season rainfall and an increase in wet season rainfall (PCCSP, 2011). Predicting climate change in Timor-Leste is particularly difficult not just due to the limited historical data but also due to the high degree of existing climate variability. The ENSO cycle has a strong effect on Timor-Leste’s climate which greatly increases variability and rainfall can be up to 50% less than average in El Nino years followed by higher than average rainfall causing flooding in La Nina years (Barnett et al. 2007). This cycle of drought years and flood years has a strong impact on food security (Fox 2003). It is unclear if climate change

10 The Government of Australia is providing ongoing technical and financial support to a number of neighbouring countries (including Timor-Leste) to establish reliable climate change information as part of the Pacific Climate Change Science Program (PCCSP).
will affect the ENSO cycle one way or the other (strengthen or dampen) as projection models are inconclusive (RDTL 2010). A further complication is the Indian Ocean Dipole (IOD) which appears to correlate with lower than average dry season rainfall during the positive phase of the IOD (PCCSP, 2011).

Compounding the effects of climate variability and climate change are the existing poor land management practices employed by the great majority of Timor-Leste’s farmers. Extensive clearing of vegetation on steep slopes causes significant erosion and loss of top soil throughout Timor-Leste (Barnett et al. 2007; RDTL 2010; Oxfam et al. 2012). Climate change will also exacerbate the existing poor availability of water which is already identified by farmers as the principal constraint on agricultural production (Barnett et al. 2007). With the population expected to almost triple by 2050 (from 1 million to 2.5 – 3 million) (Molyneux et al. 2012), it is particularly imperative that adaptation strategies are developed that sustainably improve food security and enhance environmental outcomes. This is the objective of the National Adaptation Programme of Action (NAPA).

3.2 Adaptation Priorities

Following an extensive consultation and analysis process, the NAPA was finalised in 2010 and identifies 9 priority adaptation measures for Timor-Leste:

1. **Food Security:** Reduce the vulnerability of farmers and pastoralists to increased drought and flood events.
2. **Water Resources:** Promote Integrated Water Resource Management (IWRM) to guarantee water access in a climate change context.
3. **Human Health:** Enhance the capacity of the health sector and communities to anticipate and respond to changes in distribution of endemic and epidemic climate-sensitive diseases, and reduce the vulnerability to infection of populations in areas at risk from expansion of climate-related diseases.
4. **Natural Disasters:** Improve institutional and community (including vulnerable groups such as women and children) capacity to prepare for and respond to climate change induced natural disasters.
5. Forests, Biodiversity and Coastal Ecosystems: Maintain and restore mangrove and forests and promote awareness raising to protect coastal ecosystems and forests from climate change impacts.

6. Livestock Production: Improve planning and legal framework for the promotion of sustainable and balanced food for livestock production.


8. Supporting the ambitious national poverty reduction target in relation to the expected increased storm intensity at sea by improving the capacity to forecast and adapt offshore oil and gas infrastructure to withstand strong storms and waves.

9. A ninth priority area, underpinning all others, focuses on developing National Institutional Capacity for Climate Change through which overarching programme level coherence will be ensured.

Food security and water resources top the list of priority sectors and this is consistent with analysis of existing climatic and environmental conditions as well as climate prediction models. There is also an emphasis on elements that build the ‘adaptive capacity’ (Ensor and Berger 2009) at national, local government and community level. As Timor-Leste only became a signatory to the UNFCCC in 2007 and the NAPA was only finalised in late 2010, adaptation planning and implementation activities are only in the early stages. Rural infrastructure, food security and water resources (as well as disaster risk reduction) are the focus of the initial adaptation projects that are currently being implemented or in the planning stage. In order to provide a picture of how adaptation is being approached on the ground in Timor-Leste, a brief overview of two of these projects follows:

3.2.1 Adaptation Project Case Study 1

UNDP/ Ministry of Economy and Development; Ministry of State Administration and Territorial Management; Ministry of Infrastructure: Strengthening the Resilience of Small Scale Rural Infrastructure and Local Government Systems to Climatic Variability and Risk.

22
This is a large project that was approved in late 2011 and is in the final stages of proposal development (all references to the Project Identification Form – PIF). The total funding for the project is expected to be around USD 25 million although this includes separately budgeted rural development projects that this project would link in with to ensure existing climate risk and long term climate change considerations are incorporated into small scale infrastructure projects (GEF 2011). Essentially, this project aims to integrate four of the 9 adaptation priorities identified in the NAPA (water resources (2); physical infrastructure (7); Forests, biodiversity and coastal ecosystems (5); and national institutional capacity (9) (GEF 2011; RDTL 2010) into local level planning and implementation of rural infrastructure. Its emphasis on flood mitigation infrastructure would also contribute towards addressing adaptation priorities 1 (food security) and 4 (natural disasters).

The first two components of the project deal with the integration of the systematic use of climate risk information in local level planning and budgeting to reduce climate risk. The third component is the physical investments to reduce climate risks. The PIF identifies that much local level infrastructure has been of poor quality and has often not lasted more than a few seasons in the harsh conditions of Timor-Leste (GEF 2011). Although there has been a marked improvement in the quality of rural infrastructure since the introduction of a more organized and systematic approach under the governments Local Development Programme and Fund (LDP – established in 2004), the PIF identifies that the LDP does not take into account anticipated increases in climate variability as a result of climate change.

Crucially, the PIF identifies that if infrastructure is to be climate resilient, it needs to be complemented by broader soil and land management measures that reduce the risk of damage from additional climate risks such as increased silt loads in flood events (GEF 2011). The PIF also highlighted the link between improved land management and increased water storage capacity and aquifer recharge to cope with longer dry periods. Damage to rural infrastructure from intense rainfall events was an issue raised by communities in Oxfam’s participatory action research (PAR), as was reduced availability of water in dry seasons (Oxfam et al. 2012; RDTL 2010).
Some of the land management measures intended include: “natural regeneration of vegetation, terracing, check dams, and gulley plugs, as further detailed in the Government’s sustainable land management guidelines” (GEF 2011:15). The project aims to carry out these activities in at least 10 sub-districts covering at least 50,000 hectares. The integration of climate risk considerations, and broader land management considerations, in the implementation of rural infrastructure projects through this project should have a broader national impact through its influence over district development planning and implementation. The focus in this project on land management is designed to significantly reduce erosion through reforestation and terracing. These activities will almost certainly reduce emissions and sequester carbon (in biomass and soil) but these mitigation outcomes are not identified or data intended to be captured.

3.2.2 Adaptation Project Case Study 2
Oxfam led consortium - Community Based Adaptation

As part of its international climate change adaptation initiative (ICCAI), the Australian Agency for International Development (AusAID\(^\text{11}\)) are funding community based adaptation projects in the Pacific and Timor-Leste. The funding application guidelines advised applicants to “scale up current successful community-based adaptation activities or to build an adaptation component onto existing community-based activities” (AusAID 2009b). The four members of the Oxfam led consortium, Oxfam Australia, Caritas Australia, Trocaire and Catholic Relief Services, had each been active in Timor-Leste for 10 years or more and have well established activities in sustainable livelihoods, disaster risk reduction, water and sanitation, and other community based rural development activities. A major component of the Oxfam led NGO consortia project was to establish an evidence base for climate change and associated impacts at the community level through participatory action research (PAR). This research was carried out in 6 of the 13 districts of Timor-Leste and included communities in the six agro-ecological zones

\(^{11}\) On November 1\(^{\text{th}}\) 2013, AusAID officially ceased to be an independent Australian Government agency and began to be absorbed as a subsidiary unit within the Department of Foreign Affairs and Trade (DFAT). The process of aligning the Australian aid program more consistently with Australia’s foreign policy and trade objectives is expected to take till at least July 2014. As the outcome of this process is unclear at the time of submitting this thesis (06/11/2013) all references remain as AusAID.
of the country (lowlands, slopes and highlands on both north and south side of the island) (Oxfam 2012). The aim of the PAR was to facilitate the drawing out and sharing of local climate knowledge, as well as the available scientific knowledge, to understand the impact of climate change on existing livelihoods and to develop strategies that reduces vulnerability to existing climate hazards and potential climate change impacts. Some of the key findings of the PAR were:

- An increase in rainfall over the last 30 years, but also an increase in intense rainfall events as well as increased climate variability. This is reducing the abilities communities to effectively follow traditional planting calendars.
- Decrease in water availability (with deforestation identified as a contributing factor)
- Increased erosion and loss of topsoil due to intense rainfall events (with deforestation identified as a contributing factor)
- Although farmers recognize that their own poor land use practices are a significant contributing factor to deforestation - and loss of topsoil many farmers complain they have no knowledge of or access to more sustainable land use practices.
- Some farmers were implementing activities that were characterized as adaptation measures (reforestation, agro-forestry, tara-bandu etc) but felt they needed more specialist knowledge to implement more effectively and comprehensively.

Oxfam et al. 2012

A number of recommendations for adaptation measures came out of the PAR including: reforestation and agroforestry; terracing; soil conservation; erosion control; tara bandu (Oxfam et al. 2012). These are activities that have already been included in previous programs implemented by consortia members (disaster risk reduction (DRR), sustainable livelihoods, etc) but have greater urgency in the context of climate change. A key recommendation for government is to integrate climate change adaptation into policy and planning and utilize the structures already in place for DRR programming. Integrating climate change adaptation (CCA) in
disaster risk reduction is increasingly common internationally. A good example is AusAID’s disaster risk reduction policy which aims for a comprehensive integration of CCA and DRR in development policy and programming (AusAID 2009a).

One of the strengths of this project is that it builds on existing long term programs that are already focused on various elements of sustainable rural development (natural resource management, disaster risk reduction, sustainable livelihoods, etc.). This ensures that adaptation elements are already building on a strong foundation. The adaptation funding merely complements existing work developed from a good understanding of community vulnerability, a good entry point for adaptation (Ensor and Berger 2009; Ensor 2011). A major weakness is that the explicit adaptation activities are funded by AusAID in a 15 month project timeline that is a very short period to ensure objectives are sustainably implemented. A 30 month extension and new funding to the project was awarded, as part of the next round of community based action grants under ICCAI in 2012. However, this piecemeal approach to adaptation funding increases the risk that adaptation initiatives will fail. To some extent this reflects the development of adaptation funding initiatives ‘on the run’ by donors keen to demonstrate goodwill to developing countries in the face of ongoing failures at UNFCCC climate negotiations.

3.3 Reforestation and Agroforestry: No Regrets Adaptation

A common theme across the NAPA and the adaptation projects summarized here is the central importance of reforestation and agro-forestry which were also priorities in forestry policy and the NAPA as summarized in an earlier chapter. The use of agroforestry in sloping agricultural land to mitigate against climate hazards (drought, flood) has been a crucial element of disaster risk reduction programming in many countries (Chaudhury et al. 2011; Kafle 2006). Targeted reforestation and agroforestry activities are therefore crucial elements in any broader program tackling sustainable land management, food security or disaster risk reduction. Their inclusion in any climate change adaptation program would be an example of ‘no regrets’ adaptation (Heltberg et al. 2009) in that reforestation and agroforestry would help address an urgent current need for improved land management practices in
Timor-Leste as well as being an effective adaptation measure for anticipated climate change impacts.

The UNDP adaptation project examined here identifies reforestation of upland areas as crucial to not only increased agricultural production and more resilient agricultural systems, but also to ensure lower catchment infrastructure (roads, bridges, irrigation channels, etc) are protected from flood events. This is also identified as crucial to effective catchment management in a study of the Laclio river catchment (Alongi et al. 2012). The Oxfam consortia also has a strong emphasis on reforestation and agroforestry as important for both adaptation and improved livelihoods.

Good adaptation measures therefore should lead to improved livelihood outcomes, and furthermore, can contribute to effective mitigation efforts yielding to ‘triple-win’ outcomes (Smith and Wollenberg 2012). Reforestation and agroforestry can be important mitigation measures in that they can absorb large quantities of CO₂ in biomass and soils. Mitigation outcomes (through reforestation and agroforestry) are already embedded in the two adaptation projects examined here. They are just not explicitly identified and quantified as mitigation. In the next chapter we will look at projects that do identify and quantify mitigation benefits before examining a potential integrated adaptation/mitigation project in the final chapter.
4. Mitigation potential of community based activities in Timor-Leste

4.1 Introduction

Chapter two outlined the policy context in Timor-Leste and how this is working towards reduced destruction of forests through promotion of sustainable land use practices (agroforestry, changed burning regimes, etc.) and reforestation. These forest policy measures were also shown to be consistent with identified adaptation priorities. These measures (forest protection, reforestation, agroforestry, changed burning regimes, etc.) also have significant potential to reduce current emission levels (changed burning regimes, forest protection) and to sequester additional carbon (agroforestry, reforestation). This chapter will look in more detail at the mitigation potential of these various activities.

As noted in chapter 2, there is limited data available on both current CO₂ emissions and the potential mitigation benefits specific to the Timor-Leste context. One of the few initiatives involving collecting baseline data on carbon sequestration rates in the land use sector in Timor-Leste specifically is a community based natural resource management project implemented by the NGO CARE (Lasco and Cardinoza 2007). Other studies have been carried out on the carbon mitigation benefits of changed fire management regimes in the neighbouring Indonesian province of Nusa Tenggara Timor (NTT) and the nearby Northern Territory of Australia. A third area to be examined in this chapter is the potential mitigation benefit of rehabilitating degraded mangrove forests.

\[12\text{ The UNFCCC has a comprehensive list of approved methodologies for use in CDM mitigation projects that attract CERs (see }\text{http://cdm.unfccc.int/methodologies/index.html}). \text{ Some methodologies are well established (afforestation and reforestation) and some are only recently developed and approved (agroforestry) and others still are under various stages of development (e.g. soil carbon, mangrove reforestation). This study will not go into the intricacies of carbon accounting methodologies and eligible activities, however, all activities discussed have either approved methodologies or are under development.}\]
4.2 Community-based Natural Resource Management for Carbon Sequestration project in East Timor (CBNRM-ET)

In 2001 CARE International in Timor-Leste received funding from the Canadian Climate Change Fund to implement a community-based natural resource management (CBNRM) for carbon sequestration project. The goal of the project was to enhance carbon sequestration in 12 villages in upland communities of Laclubar sub-district in Manatuto district and Remexio sub-district in Aileu district, through CBNRM whilst also improving livelihood security (Cardinoza, 2005). The project did not receive carbon credits as agroforestry was not yet included under CDM activities (this was included from 2008). Also, Timor-Leste was only a signatory party to the UNFCCC from 2007. However, it was an early attempt to integrate objectives of improved NRM, carbon sequestration and improved livelihoods within a single development assistance project.

The project identified deforestation as the major problem that the project aimed to address with an estimated loss of 200,000 ha of forest nationally between 1972 and 1999 which is estimated to be a loss of carbon stocks of around 11.4 M tC (Cardinoza 2005). The main local causes of forest loss identified in the project area are: forest fire, shifting cultivation, fuelwood gathering, logging, and extensive grazing (Cardinoza 2005) which is much the same as that identified in other local and national level studies (McWilliam 2000, 2001a, 2003; Meitzner-Yoder 2005; FAO 2005; Alongi et al. 2012). The key focus in implementing the project was through the revival of *tara bandu* in the project areas (Cardinoza 2005).

Although the use of CBNRM based in traditional practices was laudable it may have been premature to rely almost entirely on *tara bandu* as an implementing framework, particularly so early after the reinstatement of this tradition and so early after the emergency period. The project managers identified a number of weaknesses in the *tara bandu* approach including: elaborate (and expensive) ceremony sometimes requiring long lead times to provide the necessary ceremonial materials (feast); no monitoring system; small and specific areas with the authority of the *tara bandu* confined to the village boundaries; little or no participation by women; educated people, particularly youth, may not support the *tara bandu*, seeing it as a cultural...
anachronism; only works where local government recognises and supports enforcement (Cardinoza 2005).

A lack of fit between unrealistic donor timeframes and local culture made it highly unlikely that this project would have achieved its objectives. The elaborate *tara bandu* ceremonies required a long lead time and although the project began in late 2001 and was to be completed by early 2005 but the ceremonies themselves were not completed till Sept 2004 (Cardinoza 2005). Not mentioned in this project report is the obvious lack of fit between donor imposed timeframes and cultural realities on the ground. In this case the cultural reality of CBNRM is that it can take two years for a community to be at a point where they can enact a *tara bandu* ceremony with the CBNRM framework agreed and management responsibilities and sanctions in place following the ceremony. Unfortunately this is more than half way into the project timeframe and results on the ground were no doubt needed to be demonstrated in mid-term reporting with CARE therefore required to embark on planting before the CBNRM framework (*tara bandu*) was in place. Given the crucial role assigned to *tara bandu* in the project it is not surprising that the first year (April 2002 – Mar 2003) of agroforestry and reforestation plantings were unsuccessful with most seedlings (over 55%) destroyed by animal grazing and uncontrolled fire (Cardinoza 2005).

Another problem faced by the project identified by Cardinoza (but not specifically related to *tara bandu*) was that of the persistence of a hand out mentality as a result of emergency relief activities from late 1999 until 2001. Indeed not only was this hand out mentality still present whilst the CBNRM project was being implemented, the hand outs themselves were still present. A large UN managed project (AMCAP) that ran concurrently with the CBNRM project (in one of the same districts, Manatutu) was assessed by independent evaluators to have failed in its objective relating to upland reforestation due largely to lack of maintenance of reforested areas and expectation of payment for seedlings by community members. In fact, AMCAP had been paying villagers to produce seedlings for forestry activities but once payment ceased the villagers ceased producing seedlings (Klap and Foo 2007).

The expectation of payment by villagers participating in activities intended for their benefit (such as CBNRM and AMCAP) was a common problem in Timor-Leste
after the emergency phase and hindered the transition to a more sustainable development approach. The author of this dissertation was managing a rural development program in the district of Oecusse from 2002 to 2005 and saw firsthand the difficulty of trying to shift this handout mentality to one of long term sustainability and self reliance. Agroforestry programs were included in the Oecusse district program and it was extremely difficult to get sufficient community input to ensure that plantings were well managed. It was decided to focus on small pilot plots (1 to 5 ha) and to demonstrate success and scale up slowly rather than try to plant large plots that were more likely to fail. We had the luxury of secure recurrent funding so could take this longer term approach. An evaluation conducted in 2009 reported that farmers in the Caritas project had largely shifted from environmentally destructive swidden agriculture and employing a suite of SALT approaches including agroforestry (Peachy 2009). This demonstrates that a longer term approach at sustainable land management/NRM is possible but needs time to get methods established in pilot projects which can then be scaled up.

A published baseline study of the CBNRM project established representative baseline carbon stocks in the project sites of Laclubar and Remexio. The reforestation baseline sites were originally forest but had been converted to grassland for some decades through regular fires that prevented plant succession. The agroforestry baseline sites were upland farms which were mainly planted with annual crops such as maize. Sample plots of intact mature forests containing the dominant tree species of *Paraserianthes falcataria* and *Casuarina equisetofolia* were used to calculate projected carbon accumulation after 25 years of successful reforestation and agroforestry in the project area (Lasco and Cardinoza 2007).

The total carbon density in above ground biomass (AGB) in the grassland and cropping areas was very low ranging from 5.6 to 13.8 Mg ha$^{-1}$. Although baseline

---

13 Swidden, or slash and burn agriculture, involves the cutting and burning of forest with crops planted in the cleared area. In a low population setting, rotation cycles are long and forests can recover. In the Timor context, population increases have led to rotation cycles being shortened and there is increasing pressure on forests which cannot recover (McWilliam 2001b; Alongi et al. 2012). An increasing population and climate change impacts will further exacerbate this situation (Molyneux et al. 2012)

14 using methods for carbon measurement as set out in manuals produced by World Agroforestry Centre and IPCC good practice guidance for LULUCF greenhouse gas inventory as well as being consistent with approved modalities and guidelines for aorestation/reforestation CDM projects under the UNFCCC (Lasco and Cardinoza 2007).
soil carbon measurements were carried out, the authors of the report did not include projected soil carbon increases as it was felt that although reforestation and agroforestry would tend to increase soil carbon over time there was little basis for predicting the magnitude of the increase\(^{15}\) (Lasco and Cardinoza, 2007). Drawing on the results of the sample plots from mature forests, biomass accumulation in reforestation areas was estimated at 14.3 Mg ha\(^{-1}\) in Laclubar and 5.6 Mg ha\(^{-1}\) in Remexio (differential attributed to higher average rainfall in Laclubar) in years 1-15 with a decline of 10% in years 16-25 (approach consistent with IPCC national greenhouse inventory). For agroforestry the same baseline growth figures were used but with lower AGB accumulation assumed due to initially lower tree cover (20% of reforestation in years 1-5; 40% at years 6-10; 70% at 11-15; and 100% thereafter) (Lasco and Cardinoza 2007).

Using this baseline for AGB, the authors estimated a total amount of carbon sequestered by the project over a 25 year period would be between 84,621 MgC (low scenario) and 137,671 MgC (high scenario). This equates to between 3385 and 5506 tonnes of carbon sequestered per annum in an area of 1645 ha (825 reforestation, 820 agroforestry) or around 2.05 to 3.35 tonCO\(_2\)/ha/pa. Assuming a price of AUD 10 per tonne of carbon this is between AUD 33,850 and AUD 55,060 per annum. This is between AUD 20.50 and AUD 33.47 per hectare per annum.

4.3 Community based fire management to reduce emissions

Burning is one of the largest contributors to permanent forest loss in Timor-Leste (Cardinoza 2005; McWilliam 2000, 2001a, 2003; Meitzner-Yoder 2005; FAO 2005). Addressing destructive burning practices is a focus of government and civil society through sustainable land management and improved community based forestry management (tara bandu). Although there are no projects specifically looking at carbon abatement from fire management in Timor-Leste, there are projects that can be drawn on for savanna-dominated landscapes in the neighbouring Indonesian province of Nusa Tenggara Timur (NTT) as well as nearby northern Australia.

\(^{15}\) More recently Nair (et al. 2009b) have published a paper broadly estimating the soil carbon sequestration potential in tropical agroforestry systems.
4.3.1 West Arnhem Land Fire Management Agreement (WAFMA)

WAFMA is a ground breaking carbon offset project involving Darwin Liquefied Natural Gas (DLNG, owned by Conoco-Philips), the Northern Territory Government, the Northern Land Council and traditional owners and traditional land managers in West Arnhem Land in the Northern Territory of Australia. Under the agreement, DLNG will provide AUD 1 million per year for 17 years (via the NT Government) to fund the reestablishment and ongoing costs of traditional savanna burning practices of the Indigenous people of the area (NAILSMA, 2012). WAFMA grew out of an existing fire management project (WALFA) that began in 1997 that sought to enhance biodiversity outcomes through improved fire management drawing on Indigenous fire management practices (Whitehead et al. 2009).

Savanna burning contributes 46% of total GHG emissions (based on 2002 figures) in the Northern Territory (Northern Territory Government 2006) and is therefore the most obvious target for reducing emissions. The high GHG emissions from savanna burning is largely attributed to the ‘hot’ fires of late dry season wildfires (Tropical Savannas CRC 2012). These fires have become more prevalent since the traditional burning practices (wurrk) of Indigenous peoples, ‘cool’ patchwork fires carried out earlier in the dry season (Garde et al. 2009), were largely discontinued over the last century resulting in a reduction in plant biomass and increased GHGs (CO₂, methane and nitrous oxide) in the atmosphere (Tropical Savannas CRC).

The Agreement was brokered by the NT Government as part of its commitment to reduce greenhouse gas emissions from savanna fires (Northern Territory Government 2006). Conoco-Philips entered into the agreement as part of the approval process for the construction of the LNG plant in Darwin Harbour whereby emissions associated with the loss of monsoon forest on the LNG plant site, as well as emissions from the plant itself, would be partially offset through funding the restoration of Indigenous fire management over the WALFA project area (Whitehead et al. 2009). The GHG emission reduction target of the project was an annual reduction of 100,000 tonnes of CO₂-equivalent relative to a 10 year (1995-2004) baseline. The actual emissions reduction achieved in the first five years of the project have exceeded this target by around 40% (NAILSMA 2012).
The methodology used to determine emissions reductions from savanna burning has been formally accepted by the DCCEE under the carbon farming initiative\textsuperscript{16}. Only methane and nitrous oxide emissions from savanna fires are officially counted as reductions, as CO\textsubscript{2} from fires is to a varying extent reabsorbed in biomass after the fires and this is difficult to quantify and no globally agreed methodology is in place yet\textsuperscript{17} (Tropical Savannas CRC, 2011). Using the savanna emissions methodologies for estimating methane and nitrous oxide emissions from savanna fires, the 28,000 km\textsuperscript{2} of west Arnhem Land covered under WAFMA was assessed as having emissions of these gases of around 100,000 tonnes (CO\textsubscript{2} equivalent) per annum. With an agreed price of AUD 10 per ton this equated to a payment of AUD 1 million per annum (indexed to 2006) by Conoco-Philips to offset the estimated direct emissions of the Darwin LNG plant (Whitehead et al. 2009).

The funds employ around 30 indigenous fire managers who have reinstated traditional burning practices. Although difficult to quantify due to inadequate baseline studies, the reduction in wildfires is believed to lead to enhanced biodiversity outcomes. The reintroduction of traditional fire management has had additional cultural benefits such as: clan groups returning to country; imparting of traditional knowledge by elders to young people; and increased knowledge exchange between western scientists and Indigenous land managers (NAILSMA 2012). The revitalised cultural connection to land has an added dimension of improved physical and mental health of the indigenous people involved ‘healthy country, healthy people’ (Garnett et al. 2009). The WAFMA project is groundbreaking in its development of carbon accounting methodologies for savanna burning, but also provides a model for a funding mechanism for community level mitigation projects that avoids the complexity, volatility and uncertainty of market based carbon offset credit mechanisms.


\textsuperscript{17} However, studies in Australia show that savanna which is subject to a less intensive fire regime (ie. low incidence of large-scale wildfires and regular controlled fires) can act as a significant carbon sink, that is as net absorbers of CO\textsubscript{2}. (Williams et al. 2004).
4.3.2 NTT fire project

Uncontrolled large late dry season fires are also a problem in the eastern Indonesian province of NTT (which includes the western half of the island of Timor). Savannas cover around one third of the total land area of NTT and a number of Australian organisations\(^\text{18}\) have been involved in a study to understand the drivers of fire in NTT and viable options for improved fire management (Myers et al. unpublished). Although most fires are small (<5ha) some late dry season fires cover extensive areas of hundreds of hectares and cause substantial damage not just to remaining monsoon forests but also to crops and houses (Fisher et al. 2006; Russell-Smith et al. 2006). The drivers of increase in the incidence of unmanaged fire are complex but Russell-Smith et al. (2006) identify three broad issues: societal change impacting on traditional hierarchical social structures and resultant conflicts over land ownership both within and between communities; conflict over access to, and utilisation of, forestry resources between local communities and state authorities, and; National and Provincial policies that proscribe traditional burning practices. More recently (2009) national regulations have been modified to allow for 'local wisdom' in the use of fire at the community level (Myers et al. unpublished).

As part of the ACIAR study, agroforestry plots were established and strategic use of fire implemented. In order for the community agroforestry plots to be managed effectively (including prescribed burning) two elements of success were identified: ownership of assets were clear and equitable; and local leadership was strong and ongoing (Myers, et al.). Although the main driver of the fire management study was to reduce the impact of wildfires on livelihoods and biodiversity, the researchers also looked at the potential emission reductions through fire management. The NTT study utilised emission calculation methodologies developed in northern Australian savannas to calculate emissions and emission reductions in the NTT context. Estimating that between 6 and 26% of NTT savanna burns annually with total emissions in the range of 23-70 Gg CO\(_2\)-e or between 10 and 30kg CO\(_2\)-e/ha (Myers et al..unpublished).

\(^{18}\)CSIRO, ACIAR, CDU
Myers et al. assume a reduction in emissions of around 20% which they calculate would yield annual offsets worth AUD 108,000 using the Australian market price on carbon of AUD 23 per tonne. The Australian carbon price is set at a fixed price with a transition to a floating market based price by July 2014. The price will then be linked with the EU market which has currently fallen to around AUD 6 a tonne due to stagnated markets and over-allocation of permits (Hannam 2013). This would then generate only around AUD 28,000. Even assuming a price like the AUD 10 a tonne locked in for the WAFMA project it would generate only AUD 47,000 or about 5% of what is paid annually in the WAFMA agreement. This amount would probably not cover the cost of monitoring over such a large area so although fire management is crucial in reducing the impact of wildfires on livelihoods and biodiversity, it is probably not a cost effective activity for generating any form of carbon credits/payments.

4.3.3 Potential for carbon abatement from fire management in Timor-Leste

Whilst the cultural and biophysical conditions of West Arnhem Land are substantially different to that of Timor-Leste there are aspects that can be drawn on. Firstly, the methodology for calculating emissions can be utilised in similar savanna landscapes (such as Eastern Indonesia and Timor-Leste); secondly, the funding mechanism, a government facilitated/mandated ‘voluntary’ offset funding mechanism could be replicated in Timor-Leste. The gas Conoco-Philips processes in Darwin is extracted from the Timor Sea under a joint venture between the Governments of Australia and Timor-Leste. Conoco-Philips has no offsetting scheme similar to WAFMA in Timor-Leste but does fund some very small scale corporate social responsibility (CSR) activities including a 5 hectare reforestation project at Tasi Tolu implemented by local NGO Santalum with a grant of USD 25,000. This project aims to plant 5000 trees. The Government of Timor-Leste could look at mandating Conoco-Philips to offset emissions associated with gas extraction through funding larger scale fire management and/or reforestation/agroforestry activities than the current essentially cosmetic activities near Dili.

As noted in the discussion on NTT fire management, the income generation potential from carbon offset payments (either through trading mechanisms or mandated payments) was very low. In the Timor-Leste context, the total land area is about 1/3 of that of the NTT (14,874 km$^2$ compared to 47,876 km$^2$). Assuming a similar savanna coverage in Timor-Leste as that of neighboring NTT of 1/3, the total income generation potential of a similar fire management scheme yielding similar reductions as the NTT pilot studies is only around AUD 15-16,000 annually (at AUD 10 a ton). Expressed in AUD per hectare the figure is less than AUD 0.10 or around 0.5% of that achievable from reforestation and agroforestry. Although carbon offset payments have been used to fund fire management very successfully in the Northern Territory context, it may not be a viable option in the NTT and Timor-Leste context even if the carbon price was to rise significantly.

4.4 Mangroves (‘Blue Carbon’)

Mangrove forests are some of the most carbon intensive ecosystems on earth (Nellemann et al. 2009) and present a significant opportunity for reducing CO$_2$ emissions at a low cost on a global scale (Siikamaki et al. 2012). Mangrove forests sequester carbon at annual sequestration rates estimated at up to 50 Mt CO$_2$e ha$^{-1}$ (with soil carbon making up over half of this) but there is a high degree of variability making development of standardised accounting methodologies difficult (Broadhead 2011). Broadhead provides an overview of projects working on mangrove carbon credit sales which have carbon sequestration rates ranging from 1.33 to 33.2 ton/ha/yr (Broadhead 2011). Assuming somewhere in the middle of this range as a reasonable benchmark we can use of figure of 15 ton/ha/yr. Drawing on the figure of AUD 10 per tonne of CO$_2$ we then have a figure of AUD 150 per hectare per annum.

Timor-Leste’s mangrove forests have been reduced from a total of around 9000 ha in 1940 to an estimated 1800 ha in 2008 with around 75% of this situated on the north coast (National CTI Coordinating Committee of Timor-Leste, 2012). Harvesting of mangroves for firewood in Timor-Leste is small scale but unsustainable and has been the major contributor to the widespread loss and degradation of mangrove forest in Timor-Leste (Alongi and de Carvalho 2008). Although the total area of denuded and
degraded mangrove in Timor-Leste is relatively small (approx 7000 ha) at a rate of AUD 150 per hectare it may be economically feasible to fund mangrove rehabilitation through carbon credits.

4.5 Summary of mitigation benefits

The table below contains a summary of the potential for mitigation of CO₂ emissions from the three areas examined:

<table>
<thead>
<tr>
<th>Type of mitigation activity</th>
<th>Sequestration or avoided emissions rate (kg CO₂-e per hectare/per annum)</th>
<th>Potential for carbon credits (at AUD 10 per tonne) (AUD per hectare/per annum)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reforestation and Agroforestry (50% each)</td>
<td>2005 – 3347</td>
<td>20.05 – 33.47</td>
</tr>
<tr>
<td>Fire Management</td>
<td>2 – 6</td>
<td>0.02 – 0.06</td>
</tr>
<tr>
<td>Mangrove reforestation</td>
<td>15,000</td>
<td>150.00</td>
</tr>
</tbody>
</table>

Table 1: Summary of emission reductions and carbon credits in three land use sectors

The next chapter will look at how these activities would potentially be implemented in a particular catchment area in Timor-Leste that incorporates an approach that integrated adaptation and mitigation within a catchment management framework.
5. Carbon farming potential of the Laclo River catchment in Timor-Leste

5.1 Introduction

Ideally, a carbon farming initiative would not only generate an income (through carbon credits or mitigation payments) but would also be best practice land care in and of itself. In a similar fashion to how we described ‘no-regrets adaptation’ in chapter 3 we are looking for ‘no-regrets mitigation’ in terms of carbon farming initiatives. That is, the activities would provide a positive benefit regardless of their climate change mitigation benefits. Degraded landscapes have impacts not just on the immediate area (decreased agricultural productivity, increased erosion and landslide, potential decline in availability of springwater, etc) but further down the catchment through increased run-off leading to increased erosion and sediment deposit. In order to effectively manage these impacts a whole of catchment approach is one of the more effective approaches.

With a carbon price linked to market mechanisms that fluctuate wildly it is difficult to provide funding certainty to long term mitigation projects. In this analysis we will assume something like the WAFMA agreement where a fixed price (AUD 10 per tonne CO$_2$) is paid over a long period (20+ years) to ensure certainty.

5.2 The Laclo River Catchment Study

The Laclo river catchment (together with the Caraulun catchment) was the subject of a study of catchments and marine productivity carried out by a group of researchers from Australia and Timor-Leste (Alongi et al. 2012). The objective of the Laclo and Carulun studies was to ascertain whether “land use, particularly deforestation of river catchments, impacted on coastal and nearshore resources in Timor-Leste” (Alongi et al. 2012). In the context of this paper, the question is only directly relevant in the context of mangrove forests. However, the broad findings of the study (particularly that of the community consultations) are directly relevant to this study in both contexts of adaptation and mitigation.
Alongi et al. conducted extensive community consultations throughout the catchment area and also carried out scientific studies of catchment processes and change. They observed a particularly strong correlation between local community understanding of the link between deforestation and an increase in upland erosion, and the scientific evidence. They also observed a poor community understanding of the link between upland erosion and increased lowland river sedimentation and river shallowing and widening where the scientific understanding of these links was clear. However these views are not so much in conflict as reflecting an absence of understanding on the part of most community members (Alongi et al. 2012). In the case of the role of shifting (swidden) agriculture there was a disagreement in that the community members generally believed that shifting agriculture contributes to serious erosion and adds to the sediment load of rivers. This was contradicted by the scientific evidence where more than 90% of lowland river sediment is coarse gravel and sand and only around 4-6% of fine river sediment is from topsoils of the kind cultivated by shifting agriculturalists (Alongi et al. 2012). In terms of impact on coastal and nearshore resources addressing the main source of increased river sediment (riverbank erosion, upland riverbed erosion and landslides) is the priority and targeted reforestation (riverbanks and landslides) is the solution (Alongi et al. 2012). Although sheet erosion of hillslopes (from upland agriculture) is not a significant source of river sediment Alongi et al. advocate policies that minimise erosion on these lands with a focus on agricultural sustainability and livelihoods. The community discussions also elicited that due to increased population the area of shifting agriculture is increasing and rotations are getting shorter (Alongi et al. 2012).

Following McWilliam (2001a) Alongi et al. see joint management between local people's institutions and government as key to effective agro-ecological management and that the fact "that there is more agreement than disagreement between local and scientific knowledges is a good basis for catchment and coastal management" (Alongi et al. 2012: 59).

5.3 Integrated carbon catchment management
In order to carry out an assessment of the potential for mitigation through reforestation and agroforestry we first need to ascertain what area of land we are looking at. The Laclo catchment study identified that the principal driver of increased sediment load in the river was deforestation (Alongi et al. 2012). As discussed in chapter two, deforestation has occurred significantly across Timor-Leste, particularly during the Indonesian occupation from 1974 to 1999 (McWilliam 2003). The Laclo catchment study did not have specific deforestation figures for the catchment so we will need to extrapolate from the national figures that are available:

<table>
<thead>
<tr>
<th>Forest type</th>
<th>Area (ha) 1972</th>
<th>Percentage</th>
<th>Area (ha) 1999</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dense forest</td>
<td>321,542</td>
<td>25</td>
<td>207,654</td>
<td>16</td>
</tr>
<tr>
<td>Sparse forest</td>
<td>324,558</td>
<td>26</td>
<td>246,196</td>
<td>19</td>
</tr>
<tr>
<td>No forest</td>
<td>624,546</td>
<td>49</td>
<td>816,796</td>
<td>65</td>
</tr>
<tr>
<td>Total Area</td>
<td>1,270,646</td>
<td>100</td>
<td>1,270,646</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 2: Comparative forest cover in Timor-Leste 1972-99 *Source: O. T. Sandlund et al., ‘Assessing environmental needs and priorities in East Timor: Final report’ (Dili and Trondheim: UNDP and Norwegian Institute for Nature Research, 2001) figures taken from McWilliam 2003*

The above figures show a national forest cover in 1972 of 51% with a decline to 35% by 1999. That is the total area of deforestation during this period covered 16% of the land surface area of Timor-Leste. The Laclo catchment covers an area of approximately 1386 km² (ATSEF 2006). If we assume deforestation rates in the Laclo catchment similar to those occurring nationally, an area of deforestation covering 16% of the catchment represents an area of 22,080 ha. If we then apply to this the rates of potential carbon sequestration that were measured in the CARE project study sites (Laclubar and Remexio, both within the Laclo catchment) of between 2.05 and 3.35 ton/CO₂/ha/pa (Lasco and Cardinoza 2007), with reforestation/agroforestry we have an annual sequestration rate of between 45,264 and 73,968 tonnes. At AUD 10 a tonne, this would generate between AUD 450,264 and AUD 730,968 per annum.

If we look at the potential mitigation outputs from fire management based on the NTT study (Myers et al. unpublished). Assuming a similar area of burning (as NTT savanna) of approximately one third (44,000 ha) of the Laclo catchment is savanna
and between 6% and 26% of this burns each year we then have between 2640 and 11,440 ha of annual burn. The avoided emissions (at 2-6kg ha at AUD 10 t CO₂e) would generate between AUD 5.28 and AUD 68.64 p/a. Fire management would need to be a crucial part of catchment management, to ensure the viability of agroforestry and reforestation plantings, but could not be a viable carbon credit or payment scheme due to the extremely low figures.

Turning now to mangroves, the Lacio catchment study does not give a figure for the area of mangroves found in the mouth of the river apart from noting that mangroves on the north coast are generally sparse and located in small, quiescent embankments (Alongi and De Carvalho 2008; Alongi et al. 2012). As noted previously, Timor-Leste’s mangrove forests have been reduced from a total of around 9000 ha in 1940 to an estimated 1800 ha in 2008 with around 75% of this situated on the north coast (National CTI Coordinating Committee of Timor-Leste, 2012). With a total loss of over 7000 ha there is a potential for generating around AUD 1,050,000 p/a through rehabilitating this total area of mangroves. However, based on the literature reviewed, only a very small proportion of this would be in the vicinity of the Lacio river mouth as most mangroves on the north coast are concentrated around Metinaro, Tibar and Maubare, to the west of Lacio (FAO 2003). For the purposes of this exercise, we will assume that no more than 5% of the 1940 mangrove forests on the north coast, were in the vicinity of the Lacio river mouth. This would equate to an area to be rehabilitated of around 260 ha. At AUD10 tonne for the sequestered carbon, this would equate to a potential carbon credit payment of AUD 39,000.
<table>
<thead>
<tr>
<th>Type of mitigation activity</th>
<th>Sequestration or avoided emissions rate (kg CO₂ per hectare/per annum)</th>
<th>Area suitable within Laclo catchment area</th>
<th>Total potential for carbon credits (at AUD 10 per tonne) per hectare/per annum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reforestation and Agroforestry (50% each)</td>
<td>2005-3347kg (AGB only)</td>
<td>22,080 ha</td>
<td>AUD 450,264. - AUD 730,968.</td>
</tr>
<tr>
<td>Fire Management</td>
<td>2-6kg</td>
<td>44,000 ha (between 6% and 26% burnt each year)</td>
<td>AUD 5.28 - 68.64</td>
</tr>
<tr>
<td>Mangrove reforestation</td>
<td>15,000kg</td>
<td>260 ha</td>
<td>AUD 39,000</td>
</tr>
</tbody>
</table>

Table 3: Summary of CO₂ emissions reductions and carbon credits in the Laclo catchment

Based on the above analysis, the greatest potential for the generation of carbon credits would be through the implementation of reforestation and agroforestry in degraded areas of the catchment, particularly upland areas. The Laclo catchment study particularly identified deforestation in upland areas as the major driver of increased sedimentation of the lower reaches of the river resulting in damage to infrastructure (bridges, roads) and loss of areas suitable for rice cultivation (Alongi et al. 2012). With a projection of higher temperatures and increased rainfall events (Barnett et al. 2007; Myers et al. 2011) we can expect to see even higher rates of sedimentation as a result. Reforestation becomes both a mitigation and an adaptation priority.

Adaptation to climate change has already begun to be integrated into the overall development process in Timor-Leste, principally through the NAPA. Mitigation is still not a major focus due to the relatively low emissions in Timor-Leste (both aggregate and per capita) however an integrated approach to mitigation and adaptation in Timor-Leste can not only develop complementary benefits in terms of adaptation, mitigation and livelihoods – ‘triple win’ (Smith and Wollenberg 2012)
but reduce the overall costs of adaptation. As noted in chapter three, the donor driven ‘project approach’ to adaptation can create challenges of continuity when donor funding timelines are short term and objectives require longer term commitments to ensure success. With more complex programs such as these, longer timeframes are required if project impacts are to be sustainable. Also, program development needs to be iterative, a ‘learning by doing’ approach that monitors success and failures along the way (Douthwaite et al. 2003).

The WAFMA agreement discussed in chapter 4 provided a much longer timeframe (17 years) which provides funding for indigenous fire management activities and allows long term planning. Using a similar funding arrangement in the Lacio catchment, long term adaptation activities (as well as broader sustainable land management goals) could be implemented more effectively than through short term adaptation donor funding mechanisms. Adaptation funding initiatives (such as AusAID 2011) could be used initially to build adaptive capacity in the target communities and implementing partners (local NGOs, local government agencies, etc) as well as set up pilot reforestation/agroforestry plots. Carbon offset funding mechanisms could then kick in once pilot initiatives are well established and scaling up and out towards the larger catchment target can begin. The fact that in the Lacio catchment there is a direct correlation between adaptation priorities (as identified in the NAPA – 1 Food security: Reduce the vulnerability of farmers and pastoralists to increased drought and flood events; 2. Water Resources: Promote Integrated Water Resource Management (IWRM) to guarantee water access in a climate change context, and; 5 Forests, Biodiversity and Coastal Ecosystems: Maintain and restore mangrove and forests and promote awareness raising to protect coastal ecosystems and forests from climate change impacts (RDTL 2010)) and the most effective mitigation options of reforestation and agroforestry makes opportunities for synergy attractive.

One of the practical challenges for this type of project would be the mechanism for channelling carbon payments. In the WAFMA context, the payment for carbon

---

20 A fixed funding agreement like this also provides greater certainty than complex carbon market linked schemes such as CDM which not only are linked to highly volatile carbon market pricing but also have a degree of programmatic complexity that mitigates against community level projects (Boyd et al. 2007).
offsets from the Darwin LNG plant are made to the traditional land owners through the Northern Land Council (NLC), a relatively straight forward process. In the Laclo catchment, the direct implementation could be carried out on a mixture of communal and individually managed land, potentially involving thousands of stakeholders. One way of managing this could be through the involvement of microfinance institutions (MFI). An MFI could be part of the overall catchment management framework with the skills and expertise to disburse carbon-related payments to smallholder farmers (Werneck 2012). Payments could then be linked to performance objectives (total area planted and trees maintained, fire management and grazing management strategies in place and implemented) as well as actual carbon sequestered.

Carbon credits generating an annual amount of between AUD 450,264 and AUD 730,968 (from AGB in 22,000 ha of reforested land and agroforestry) is a significant source of income, even in relatively large area such as the Laclo catchment, and would contribute significantly to fund large scale catchment management. The figures calculated here only include above ground biomass (AGB) and do not include soil organic carbon (SOC) which could potentially add significantly to the total figure (Nair et al. 2009b). Nonetheless, it would take some years before the full target of 22,000 ha was reforested/converted to agroforestry and set up costs would be required. The proposed activities within catchment management would be complementary with the two adaptation projects discussed in chapter three. In fact, all three projects have erosion control (primarily through reforestation) as a central element.

Although the scale of an integrated Laclo catchment management and climate change mitigation/adaptation project (or carbon catchment) is much larger than that of the CARE CBNRM project (which was also largely unsuccessful in meeting its objectives (Cardinosa, 2005)), it is not larger or more complex than recent adaptation projects such as the Oxfam led consortium. This project works with around 100 communities (total pop. around 20,000) across six of the 13 districts in Timor-Leste (Oxfam et al. 2012). One of the strengths of the Oxfam consortium is that all of the agencies involved (Oxfam, CRS, Trocaire and Caritas Australia) have been working with the local NGOs and communities in the project for many years and the adaptation project is not a stand-alone project but one that builds on current and previous activities (food security, DRR, WASH, NRM, etc). Building on an
integrated rural development approach to develop ‘carbon catchments’ offers
opportunities for increasing the resilience of communities to the impacts of climate
change as well as developing carbon livelihoods.

As we saw from the CARE CBNRM project case study in the previous chapter, it is
difficult to ensure that community level projects such as these have sufficient
community ‘buy-in’ to ensure that the trees are not just planted but maintained and
protected from fire and grazing animals (Cardinoza 2005). The failure to ensure that
happened was largely a result of an over ambitious expectation that community level
tara bandu processes would follow a timeframe consistent with the donor set project
timeframe. Tara bandu had only been recently re-established after the trauma and
disruption of the Indonesian occupation and it was premature to place so much
weight on this as the central element of community management of reforestation
activities. Introducing agroforestry and reforestation takes time for a strong sense of
community ownership to develop but once the results are evident to the community
it is possible to scale up from pilot projects to achieve a broader and more
sustainable impact (Peachy 2009; Douthwaite et al. 2003; Douthwaite et al. 2007).

Integration of mitigation outcomes into adaptation programs can provide additional
income generating opportunities for rural communities long after the adaptation
project implementation cycle is complete. AusAID is beginning to look at the
integration of mitigation in community based adaptation projects but still maintains a
fairly rigid distinction between the two (AusAID 2011). In the most recent round of
community based climate change action grants, AusAID had significantly increased
the amount of funding available (up from AUD 2.7 million to AUD 30 million) and
also introduced a mitigation component. Mitigation and adaptation were still treated
and funded separately though and mitigation projects were only eligible in Vietnam
based projects. Where there was a mitigation component in an adaptation project the
mitigation component could not exceed 20% of the total project funding (AusAID
2011).

In the context of reforestation and agroforestry in Timor-Leste, this distinction is
meaningless. The reforestation of degraded upland areas (as well as the promotion of
agroforestry) is the central prerequisite for sustainable land management and rural
development in Timor-Leste. Whether coming at the problem from addressing food
security (Fox 2000; McWilliam 2003); land degradation (FAO 2008b); forest management (FAO 2005; McWilliam 2001); catchment management (Alongi et al. 2012); disaster risk reduction (Oxfam et al. 2012); climate change adaptation (Barnett et al. 2007; Molyneaux et al. 2012; Oxfam et al. 2012); or climate change mitigation (Lasco and Cardinoza 2007), the key element is the focus on reforestation of degraded areas and the introduction of agroforestry into farming systems.

In this context, current demands for food security and the urgent need to adapt to the increasing impacts of climate change should take precedence but not lose sight of the contribution that these activities are making to mitigating climate change through carbon sequestration (Lasco and Cardinoza 2007). Mitigation in this context is very much a subset of adaptation (Pelling 2011). As shown in this section, the potential volume of carbon sequestered can generate significant income streams even based on quite low carbon prices (AUD 10 tonne CO$_2$) and could contribute significantly to a whole of catchment management program for the Laclo River, as well as be a key sustainable livelihood and mitigation outcome.
6. Conclusion

This thesis presented a case for a closer integration of climate change adaptation and mitigation policy and programming in the Timor-Leste context as a more effective approach to achieving both adaptation and mitigation objectives as well as enhancing rural livelihoods and natural resources management.

At both the national policy development level and the rural community level, sustainable land management, particularly in relation to upland forests and agriculture, was shown to be a key issue for the maintenance of forest resources and food security as well as being central to climate change adaptation. How this was being addressed in terms of national policy development was examined in chapter two and chapter three looked at examples of climate change adaptation activities at the community level. A central role for communities at the local level in the sustainable management of forest resources is a key element of Government forestry policy. Adaptation policy also acknowledges that communities need to play a key role in implementing adaptation initiatives at the local level. I conclude that current policy in land and forestry management and climate change adaptation are largely consistent and complementary.

Although policies around mitigation are largely undeveloped in Timor-Leste, this presents an opportunity for avoiding a conceptual separation from adaptation and ensuring mitigation is integrated into adaptation (Pelling 2011) to achieve complementary objectives of low carbon resilient development (Fisher 2013). Although there is currently little data available, it was assumed that the majority of Timor-Leste’s greenhouse gas emissions relate to land use emissions, principally forestry and agriculture related. In chapter four we looked at the potential for contributing to the mitigation of climate change through carbon sequestration in reforestation, agroforestry, and mangrove rehabilitation, as well as through reducing emissions from savanna burning. The potential for these activities to generate carbon credits or payments was examined drawing on the funding agreement developed between Conoco-Philips, the Northern Territory Government and Indigenous landholders in Arnhem Land (WAFMA). Reforestation and agroforestry was shown to have the greatest potential for the generation of credits as well as being consistent
with policies and programs for sustainable land management and climate change adaptation. However, in order for mitigation objectives to be achieved in community level projects there needs to be a more realistic approach to the timeframes required, from both project implementers and donors.

In the fifth and final chapter, a study of the Laclo river catchment was drawn on to examine how climate change adaptation and mitigation may be practically integrated into a catchment management approach that addresses the need for the sustainable upland land management to improve catchment health, as well as improve food security and adapt to the impacts of climate change. A program approach was proposed that allows for long term development grounded in sustainable livelihoods with ‘carbon catchments’ contributing to income generation in rural communities.

As explained in the introduction to this paper, the emissions trading schemes already in place in the EU (and being established elsewhere: Australia, New Zealand, Korea, USA and China) suffer from extreme price volatility which is an impediment to the viability of long term mitigation programs. Although it was not the objective of this paper to evaluate the merits or otherwise of various models of carbon offset scheme, this paper drew on the example of WAFMA as a stable funding mechanism that allows for the ongoing implementation of an effective community based mitigation program with long term viability. Even using the relatively low carbon price set in WAFMA (AUD 10 a ton) it was shown that a significant additional income stream could be generated through the implementation of reforestation and agroforestry within a catchment management framework that also adapts to the impacts of climate change.

This thesis has demonstrated how effective climate change adaptation programs in Timor-Leste, with an emphasis on sustainable land management based around reforestation and agroforestry, are very similar, in terms of approach and activities, to an effective mitigation program in rural Timor-Leste. If done over a realistic timeframe, community based adaptation programs, with a focus on reforestation/agroforestry have the potential to generate significant income in the form of carbon credits. NGOs designing community level adaptation programs should also be considering collecting baseline data on carbon sequestration rates that
demonstrate a clear mitigation evidence base that may assist communities access carbon credit payment schemes.

Donors such as AusAID also need to look at how their separation of adaptation and mitigation helps or hinders the effective implementation of climate change programs. Current guidelines for community based action grants on climate change make a clear distinction between adaptation and mitigation programming. Where there are mitigation objectives within adaptation programs, these should be no more than 20% of the overall project activities (AusAID 2011). At present community level mitigation grants were only available in Vietnam. This thesis has demonstrated that such a distinction would be meaningless in rural adaptation programs in Timor-Leste and should be reviewed in future funding rounds (should they occur).

The Government of Timor Leste should look to carry out integration or alignment between adaptation and mitigation policy for integrated low carbon resilient development (Fisher 2013). It also look at how a carbon offset payment scheme similar to WAFMA could be applied in the Timor-Leste context in future negotiations involving its share of the oil and gas resources in the Timor Sea. These could be used to fund integrated community level adaptation and mitigation programs that offset emissions generated from Conoco-Philips (or other energy companies) activities in Timor-Leste and its maritime economic zone.
7. References


considerations in AusAID programs, AusAID, Canberra,


Broadhead JS (2011) Reality check on the potential to generate income from mangroves through carbon credit sales and payments for environmental services, Regional Fisheries Livelihoods Programme for South and Southeast Asia (GCP/RAS/237/SPA) Field Project Document 2011/REG/2.


Levine S, Ludi E, Jones L (2011) Rethinking support for adaptive capacity to climate change – The role of development interventions, Overseas Development Institute, London.


61


