Integration of the ecosystem sector and climate change mitigation in carbon accounting schemes: Practical and policy approaches

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Abstract

In 1992 the United Nations Conference on Environment and Development (the Rio Earth Summit) addressed two linked global crises: climate change and biodiversity decline. The Convention on Biological Diversity and the United Nations Framework Convention on Climate Change were opened simultaneously for signature. Climate change provides an urgent incentive to develop mechanisms to reduce or prevent further degradation of ecosystems particularly through deforestation. Working together, abatement in this ecosystem sector and in the energy sector could drive most global emissions reductions.

However, negotiations leading to the 1997 Kyoto Protocol, which crystallized the commitment of the UNFCCC, forfeited the inclusion of the ecosystem sector for largely political and ideological reasons. This thesis by prior publications suggests that the result is the decoupling of the ecosystem sector from climate change policy, and that this continues to drive discordant policies at international, national and regional levels.

The European Union, for instance, does not permit credits derived from ecosystems in its emissions trading scheme, the largest in the world, and will not consider them until after 2020. The concept of reducing emissions from deforestation and forest degradation (REDD) emerged to fill the gap left by the forfeiture of the ecosystem sector. But the implementation of REDD is held back by the slow pace of international climate change policy processes, and lacks financial support. Meanwhile deforestation continues at alarming rates. In Australia, the complex design of the Carbon Farming Initiative takes its cue from the Kyoto Protocol, hindering uptake and militating against the role of ecosystems in climate mitigation.

This thesis interrogates the reasons for the lack of funding for REDD and provides a practical financial solution, called iREDD, to project-level private investment. A
framework for integrating the ecosystem sector into landscape-scale climate mitigation approaches using Australia’s Natural Resources Management (NRM) framework is also developed.
Acknowledgements

Various people have been acknowledged in the papers comprising this thesis and they include Mr. Bob Smith for advice relating to the Tiwi Islands. Mike Berwick provided ongoing support and encouragement for the Wet Tropics Project. Bill Laurance and Oscar Venter provided helpful comments on the iREDD concept. My sincere gratitude goes to my supervisors Dr. Don Franklin, Dr. Dan Metcalfe and, particularly, Prof. Mike Lawes who all had faith in me. Mike deserves special mention as my primary supervisor and for standing by me as we steered the process of a thesis by prior publications through university processes. In the end I must thank the innovative Charles Darwin University for taking this on. And finally to my husband Dr. Noel Preece, son Dr. Luke Preece, and granddaughter 21 month-old Milla Mai Preece, for simply being there, even if, in Luke’s case, it was to be cheeky about an elder PhD.
Statement of Original Authorship

This thesis comprises eight chapters including six chapters that are original peer reviewed academic articles published between 2008 and 2012. The contribution of Penny van Oosterzee (the candidate) to each of the articles is presented here. Of the six articles the candidate was sole author for one and lead author for five of the articles. New and original work comprises Chapter One (the Introduction to the Study) and Chapter eight (the Conclusions). Each chapter that is a published paper is preceded by a preface that summarises the context and place of the paper in the overall thesis. The contributions of the co-authors to the incorporated articles are detailed below.
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<td>Four</td>
<td>van Oosterzee, P, N. Preece, A. Dale (2010) Catching the baby: accounting for biodiversity and the ecosystem sector in emissions trading. Conservation Letters 3:83-90</td>
<td>Conceptualized by van Oosterzee. The study represents several years of research by all authors. All authors were involved in the development of a Wet Tropics Pilot Scheme for regional aggregation of sustainable land use activities for climate mitigation and biodiversity conservation.</td>
<td>International review, policy implications and interpretation by van Oosterzee. Data presented in case study of the Wet Tropics Project collected and analysed by Preece.</td>
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Declaration of original authorship

I hereby declare that this work, now submitted as a thesis for the degree of Doctor of Philosophy with Charles Darwin University, is the result of my own investigations, and all references to ideas and work of other researchers have been specifically acknowledged. I certify that the work comprising this thesis has not already been accepted in substance for any degree, and is not being currently submitted in candidature for any other degree.

Penny van Oosterzee
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<tr>
<td>ACCU</td>
<td>Australian Carbon Credit Unit</td>
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<tr>
<td>AFOLU</td>
<td>Agriculture, Forestry and Land-use</td>
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<td>ADP</td>
<td>Ad Hoc working Group on the Durban Platform for Enhanced Action</td>
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<td>AWG-KP</td>
<td>Ad Hoc Working Group on the Kyoto Protocol</td>
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<td>AWG-LCA</td>
<td>Ad Hoc Working Group on Long-term Cooperation</td>
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<tr>
<td>CBD</td>
<td>Convention on Biological Diversity</td>
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<td>CDM</td>
<td>Clean Development Mechanism</td>
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<td>CE</td>
<td>Clean Energy</td>
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<td>CER</td>
<td>Certified Emission Reduction</td>
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<td>CFI</td>
<td>Carbon Farming Initiative</td>
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<td>CO₂-e</td>
<td>Carbon Dioxide Equivalent</td>
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<td>COP</td>
<td>Conference of Parties</td>
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<td>CP2</td>
<td>Second Commitment Period under the Kyoto Protocol</td>
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<td>CPRS</td>
<td>Carbon Pollution Reduction Scheme</td>
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<td>ETS</td>
<td>Emissions Trading Scheme</td>
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<td>EU</td>
<td>European Union</td>
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<td>EUETS</td>
<td>European Union Emissions Trading Scheme</td>
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<tr>
<td>GHG</td>
<td>Greenhouse Gas</td>
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<tr>
<td>GHGE</td>
<td>Greenhouse Gas Emissions</td>
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<td>FCPF</td>
<td>Forest Carbon Partnership Facility</td>
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<tr>
<td>IPCC</td>
<td>Intergovernmental Panel on Climate Change</td>
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<tr>
<td>LULUCF</td>
<td>Land-use land-use change, and forestry</td>
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<tr>
<td>NAMA</td>
<td>Nationally Appropriate Mitigation Actions</td>
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<td>NGRS</td>
<td>National Greenhouse Response Strategy</td>
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<td>NMM</td>
<td>New Market Mechanism</td>
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<td>NRM</td>
<td>Natural Resource Management</td>
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REDD  Reducing Emissions from Deforestation and forest Degradation
REDD+ Reducing Emissions from Deforestation and forest Degradation, and the role of conservation and the enhancement of forest carbon stocks
UNFCCC United Nations Framework Convention on Climate Change
US United States
VCS Verified Carbon Standard
Statement of Ethical Clearance

This dissertation is constructed from prior publications. All data were derived from publically available secondary sources, which did not require ethical clearances.
Chapter One

Introduction
Chapter One

Introduction

The papers comprising this PhD by prior publication were written between 2008 and 2012, during the first commitment period of the Kyoto Protocol of the United Nations Framework Convention on Climate Change. This was a period of rapid policy shifts in Australian climate change policy relating to climate change mitigation, and agriculture, forestry, and land use (AFOLU), essentially the ecosystem sector. In such a policy-quake environment the papers presented here provide both a review of some of the consequences of these policy shifts, and new insights into current international and Australian policy, particularly with respect to natural resource management, biodiversity, and Australia’s Carbon Farming Initiative. These prior publications provide solutions to help evaluate and facilitate the inclusion of the ecosystem sector in climate change mitigation at the international, national and regional level and in the policy, economic, and natural resource governance sectors.

Focus on REDD

Because climate change and the ecosystem sector converge most critically in tropical forests there is a focus in this thesis on reduced emissions from deforestation and forest degradation (REDD). The emergence of the concept of REDD internationally is explained below as part of the United Nations climate change processes, and also in Chapters Two, Three, Four and Five (van Oosterzee 2012, van Oosterzee & Garnett 2008, van Oosterzee et al. 2010, van Oosterzee et al. 2012) including an analysis of a potential missed opportunity in the Northern Territory of Australia (van Oosterzee & Garnett 2008).
While REDD has come to focus on developing countries, deforestation also occurs in industrialized countries. Australia, in particular, has a history of high deforestation. In 1990 – the Kyoto base year – deforestation in Australia accounted for 132Mt CO$_2$-e or 23% of total emissions (Macintosh & Waugh 2012). In 1999 Australia had the fifth highest deforestation rate in the world (Steffen et al. 2009). Australia’s Treasury figures show that clearing of forests and woodland still accounts for 74 Mt CO$_2$-e per annum, equivalent to 13% of Australia’s emissions using 2005 figures. For most of its history, Australia has used regulation for deforestation reform with mixed results (Macintosh 2012). How Australia may now deal with deforestation through the Carbon Farming Initiative is discussed in Chapter Two (van Oosterzee 2012).

For the ease of understanding, key concepts and issues have been identified and described in concise boxes where they are used in this introduction. Each of the chapters has detailed explanations of concepts used in those chapters.

**The integration of the ecosystem sector into climate change considerations**

An important foundation stone of humanity’s attempts to deal with the two major global crises of biodiversity decline and climate change came in 1992 with the United Nations Conference on Environment and Development, commonly known as the Rio Earth Summit. The pivotally integrated Convention on Biological Diversity (CBD) and the United Nations Framework Convention on Climate Change (UNFCCC) were opened simultaneously for signature: one committed to conserving the work of creation and not unraveling it, and one at keeping greenhouse gases in the atmosphere at safe limits (United Nations 1993).

The services provided by ecosystems are the foundation for human well-being (Secretariat of the Convention on Biological Diversity 2006) providing essential services to humanity such as food, shelter, water quality, the diversity of life, and a
climate that nurtures life (Millennium Ecosystem Assessment 2005). It is not possible to avoid dangerous climate change without taking into account ecosystem services. Each year, tropical forests draw down 15% of global emissions (Trumper et al. 2009), while deforestation and agricultural emissions are responsible for over 20% of global emissions (McKinsey & Company 2009). Agriculture could abate from 5 to 14% of global annual carbon dioxide emissions, with costs ranging between US$20 to US$100 per tonne of carbon dioxide equivalent (CO$_2$-e), from improved cropland and grazing land management, and restoration of degraded lands and cultivated organic soils (Smith et al. 2008). The ecosystem sector provides an abatement opportunity second only to the energy sector in its potential to mitigate greenhouse gas (GHG) emissions. At a cost of €60 per tonne it may be possible to abate as much as 54% of global emissions with the ecosystem sector providing about one third of the opportunity through actions such as avoided deforestation, reforestation and grazing land management, and the energy sector providing most of the rest through, for instance, energy efficiency and renewable energy (McKinsey & Company 2009).
Box 1.1. Concepts of abatement, sequestration, mitigation, and adaptation

*Abatement* includes actions that reduce or eliminate greenhouse gas pollution and includes actions that increase carbon sequestration, which is the process of increasing the content of a carbon sink (other than the atmosphere).

*Mitigation* can be described as human intervention that reduces the sources and enhances the sinks of greenhouse gases. Generally mitigation is an action that tackles the causes of climate change, while *adaptation* tackles its effects on society and the environment (Deeb 2011).

While *mitigation* and *adaptation* are often treated separately, in the ecosystem sector they are integrally linked. Mitigation builds the adaptive capacity of a landscape to the impacts of climate change. For instance, rehabilitating tropical watercourses both sequesters new carbon and helps secure flows for human use.

Climate change provides an urgent incentive to develop mechanisms to reduce or prevent further degradation of ecosystems (natural, agricultural, and forest), particularly through deforestation. Working together, the ecosystem sector and energy sector could drive deeper cuts in emissions earlier.

However, negotiations leading to the 1997 Kyoto Protocol, which crystallized the commitment of the UNFCCC, forfeited using the ecosystem sector - what the Protocol terms land-use, land-use change and forestry (LULUCF) - for climate mitigation apart from narrowly defined afforestation and reforestation activities. The reasons for this were largely ideological and political (van Oosterzee & Garnett 2008, van Oosterzee et al. 2010, van Oosterzee 2012). This thesis by prior publication argues that, as a result, biodiversity and the ecosystem sector were
decoupled from climate change mitigation (van Oosterzee et al. 2010) and have since then rarely been considered together (van Oosterzee & Garnett 2008, van Oosterzee et al. 2010, van Oosterzee 2012). The global dimension of this policy discordance has ramifications at the international, national and regional levels (van Oosterzee et al. 2010, van Oosterzee et al. 2011, van Oosterzee 2012, van Oosterzee et al. in review).

**The United Nations climate change processes**

**COPs and the Kyoto Protocol**

A brief summary of the United Nations climate change processes with relevance to the ecosystem sector is provided here. These processes provide the background to, and frame the international, national and regional land-based policy and abatement activities.

The United Nations Framework Convention on Climate Change (UNFCCC), adopted in 1992, has as its main objective to achieve "stabilization of greenhouse gas concentrations in the atmosphere, at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame sufficient to allow ecosystems to adapt naturally to climate change, to ensure that food production is not threatened and to enable economic development to proceed in a sustainable manner" (United Nations, 1992, p.4). At the time the largest share of global emissions originated in developed countries prompting the UNFCCC to call on these countries to take the lead on combating climate change according to the undefined notion of “common but differentiated responsibilities” (United Nations, 1992, p. 5).

All parties to the UNFCCC, as part of a number of general commitments (United Nations, 1992, p.6), committed to develop and submit national inventories of anthropogenic GHG emissions by sources and removals by sinks, and promote
sustainable management, conservation and enhancement of sinks. Countries listed in Annex 1 of the UNFCCC (developed countries) made a non-legally binding aim to returning their GHG emissions to 1990 levels by 2000 - an aim which was not met by most, including Australia - and to communicate detailed policies and measures adopted to mitigate climate change (United Nations 1992). Important elements of the UNFCCC include the ability to create institutional structures, and a system of establishing and amending Protocols and Annexes (Leal-Arcas 2011).

The UNFCCC entered into force in 1994 and has been ratified by 195 Parties. A process that included annual meetings, called Conference of Parties, or COPs, was established and there have been 18 COPs to date. Berlin hosted the first COP (COP 1) in 1995, where parties provided the ground rules for a protocol that would begin a process of legally binding action beyond the year 2000. The phrase “common but differentiated responsibilities”, reflecting the different capabilities of countries to respond to climate change, was narrowly defined in Berlin to focus only on strengthening the commitments of industrialized parties to set emission limits within a specified timeframe. Two years of intense negotiations produced the Kyoto Protocol of the UNFCCC, adopted in 1997 at COP 3 in Kyoto, which committed developed countries to reducing their overall emissions of GHGs by an average of 5.2% below 1990 levels between 2008-2012.

The ecosystem sector and the Kyoto Protocol

Attempts to incorporate the ecosystem sector into the Kyoto Protocol came late in the negotiation process (Depledge 2000), and was hurried, characterized by confusion, manipulated science and poor decision-making (Fry 2002). For instance, the pivotal question of which activities should be included in the Kyoto Protocol, was asked by negotiating parties in October 1997 only weeks before the December COP 3. The resulting frenetic negotiations that went round the clock during COP 3 agreed
that only afforestation and reforestation would be covered by the Protocol in the first commitment period 2008-2012 (Depledge 2000). These activities are inscribed in Article 3(3) of the Protocol. No consensus was reached on other ecosystem-based activities, which became the focus of a confusing Article 3(4). Among other things, Article 3(4) states that subsequent meetings of the COPs would decide on which other ecosystem activities would be included in the Protocol, and that these activities would be counted in subsequent commitment periods. In apparent contradiction, Article 3(4) also states that a party may choose to count these activities in the first commitment period (United Nations 1997). The Protocol, in Article 12, also introduces the Clean Development Mechanism (CDM) that allows developing countries to provide offsets for developed countries, limited in the ecosystem sector to afforestation and reforestation activities.

Subsequent COPs were characterized by each party taking advantage of the confusion of Article 3(4) by vying for textual adjustments to suit their particular circumstances (Fry 2002). Parties became deadlocked, and COP 6 in The Hague collapsed largely because of disagreement on how forests were to be dealt with (Leal-Arcas 2011). Talks resumed in July 2001 but by then the political landscape had fundamentally shifted. Up until then the United States (US) had been an active part of the negotiations, but the newly elected US President, George W. Bush, announced he would not support what he considered a fatally flawed process that would damage the US economy, and exempt developing countries from participating in a legally binding global climate agreement (Carpenter 2012).

Other countries also threatened to abandon the Protocol, unless adjustments to the text were made to suit their circumstances. Fearing an abandonment of the Protocol altogether, politically desperate concessions were offered (Fry 2002). For instance, Russia, who elected to count forest management in its first commitment period, was allowed an arbitrary doubling of estimates of its forest management.
credits. Australia negotiated its emissions from land clearing to be added to the 1990 emissions base year. Since 1990 was a high year of clearing, and hence of emissions, such an inflated estimate would make it comparatively easy for Australia to meet its first commitment obligations, particularly since clearing was shortly to become regulated. Brazil refused the generation of credits for protecting its forests to be part of the Kyoto Protocol, largely because of issues of sovereignty.

The case to use the Kyoto Protocol to correct the failure of not properly valuing biodiversity and ecosystems collapsed.

The Bali Roadmap

The Kyoto Protocol entered into force in 2005 and has been ratified by 192 parties. The Protocol mandates further consideration of future commitments by Annex 1 countries to set emission limits to be considered at least seven years before the end of the first commitment period, 2008-2012. Therefore, the first session of the conference of the meeting of parties to the Kyoto Protocol (CMP 1) held in 2005 in Montreal in tandem with COP 11, established a negotiating group to discuss long-term cooperation under the UNFCCC beyond 2012. The idea of compensating countries for reduced emissions from deforestation and forest degradation, abandoned during the negotiations of the Kyoto Protocol, also resurfaced under the popular banner of REDD.

These discussions of long-term cooperation culminated in 2007 at COP 13 and CMP 3 in Bali in a document that came to be known as the Bali Roadmap (United Nations Framework Convention on Climate Change 2008b). Because of the need to include the US in climate change negotiations, the Bali Roadmap establishes two negotiations tracks: the Convention track and the Kyoto Protocol track. The Convention track known as the Ad Hoc Working Group on Long-term Cooperation
(AWG-LCA) includes the US, and the Ad Hoc Working Group on the Kyoto Protocol (AWG-KP) does not.

Fundamentally, the AWG-LCA is committed to developing a legal instrument that seeks to include all major emitters in some form of binding agreement. This agreement is to be based on four building blocks: mitigation, adaptation, technology and financing. The agreement, which may take several years to negotiate, would result in a gap of some years with no legally binding obligations for developed countries, unless a second commitment period under the Kyoto Protocol was agreed. The latter was the task of the AWG-KP track.

**Copenhagen and Cancun**

At the 2009 Copenhagen joint COP 15 and CMP 5, hopes were high for a legally binding agreement beyond 2012 that would merge the two tracks into one comprehensive framework for enhanced action. This was underscored by the exceptional attendance of 130 heads of states (Carpenter 2012). The Conferences, however, were marred by disputes, and a binding legal instrument for all major emitters was not forthcoming. This failure overshadowed the significant achievement that was made in Copenhagen (Jackson & McGoldrick 2010): that for the first time, the main emerging economies, including large emitters such as China, India and Brazil, agreed to targets to reduce or slow their GHG emissions.

A mechanism called Nationally Appropriate Mitigation Actions (NAMAs) was agreed at Copenhagen to monitor the mitigation pledges of developing countries, dependent on capacity and funding from developed countries. The resulting pledges of the Copenhagen Accord, while not formally adopted by the COP, potentially cover approximately 80% of global emissions, compared to the 14% of emissions covered by industrialized countries under the second commitment period of the Kyoto Protocol (Morel et al. 2012).
At Copenhagen a commitment also was made to establish a Green Climate Fund of $30 billion between 2010 and 2012 in fast-start finance, and to mobilize $100 billion per year by 2020 for developing countries (Morel et al. 2012). This Fund would support a range of activities including REDD, though it was not until the next COP at Cancun that the term REDD and REDD+ (to include reduced emissions from deforestation, forest degradation, conservation and management of forests, and enhancement of forest stocks) was clearly defined. In this thesis REDD includes reduced emissions from deforestation, forest degradation and all its variations.

The Copenhagen Accord also set a goal of avoiding a 2°C increase in mean global temperature above pre-industrial levels to prevent dangerous anthropogenic interference with the climate system, and set finance goals to address transparency, adaptation, technology and forestry. More than 80 countries have subsequently submitted mitigation pledges (Carpenter 2012, United Nations Framework Convention on Climate Change 2009).

The endemic incrementalism (La Viña et al. 2012) that has characterized the international climate negotiations since 1992 continued in 2010 at the Cancun COP 16. While COP 16 and CMP 6 solidified and formalized much of the Copenhagen Accord, the broader legal issues including the fate of the Kyoto Protocol, and how to obtain finance for developing country commitments were skirted.

Cancun nevertheless provided a framework for the Green Climate Fund to achieve and disperse climate funds, and outlined the basic steps for countries to prepare themselves for the provision of finance for REDD programs, which include readiness, implementation, and results-based action (funding related to actual verified emissions reductions). The issue of how REDD should be financed remained divisive with disputes over market versus nonmarket-based approaches. The details were however shelved until the 2011 COP 17 at Durban.
Durban and Doha

COP 17 and CMP 7 held in Durban in 2011 repeated the elements of earlier meetings: “global leaders in a high-stakes game to save the world, the palatable tension over clashing interests, claims of sabotage and backdoor deals juxtaposed with impassioned demonstrations and panicky news blitzes, the climax into near-chaos, the last-ditch effort for compromise now known as the “huddle”, and, of course, the miraculous “save”. Then ominously, though probably anticipated, big questions emerge as the screen fades to black.” (La Viña et al. pg 1).

The main outcome of the Durban Platform was an agreement to have a legally binding deal that would include the main global emitters by 2015: essentially an agreement to have an agreement by 2015, but not enforced until 2020. An Ad Hoc Working Group on the Durban Platform for Enhanced Action (ADP) was established to develop the legally binding deal for all major GHG emitters, using the four building blocks of mitigation, adaptation, technology and financing established at COP 13 in Bali.

Informal discussions on mitigation agreed that developed countries would continue the process of clarifying and reporting their emission reduction targets and aim to strengthen them, while developing countries would develop undefined NAMAs. A web-based NAMA registry would record mitigation actions seeking international support - and match actions with available support - or simply be registered for recognition. This new idea (La Viña et al. 2012) of matching actions with available support allows international, national, public, private and NGOs to submit information on financial and other support available for the preparation and delivery of NAMAs.
An Adaptation Committee was operationalized and all developing countries are eligible to formulate national adaptation plans and hence access funds for their implementation.

The design of the Green Climate Fund was agreed. It was to be a creature of the UNFCCC governed by the COP. The Fund exclusively finances climate change work including for mitigation, adaptation, REDD, technology and capacity building, and its scale is significant with the aim of USD $100 billion per year by 2020. Without funds, however, it remains an empty shell.

Between 2012 and 2020 the only legally binding agreement is the second commitment period of the Kyoto Protocol to run from 2013-2020 (agreed later at COP 18 in Doha). A major change under this second commitment period is that forest management is now included as a mandatory activity to be accounted for.

At Durban, progress on REDD focused on the financing of results-based action. Negotiations agreed that a diverse range of sources, including private and market-based was required to finance REDD.

In 2012, the COP 18 at Doha maintained the glacial pace of negotiations toward the goal of a legally binding deal that would include the main global emitters by 2015 (but that would not be enforced until 2020). The Doha COP did, however, secure the details of the second commitment period of the Kyoto Protocol (Boyle 2012).

Canada, Russia, Japan and New Zealand, however, pulled out of the second commitment period making it even more insignificant as a vehicle to avoid dangerous climate change than before (Leal-Arcas 2011, Boyle 2012). In retaliation, access to Kyoto mechanisms such as the Clean Development Mechanism are to be limited only to those parties taking part in the Kyoto Protocol and countries such as New Zealand with regional trading schemes will not have access to CDM markets.
Doha saw the discussion of a concept called a new market mechanism (NMM) that connects the Kyoto Protocol mechanisms and those under the broader Convention. This mechanism is intended to be broad and may potentially include credits generated from NAMA activities, and from REDD activities (which themselves could be considered a NAMA).

As international negotiations have proceeded, inconsistencies and overlaps have become apparent. At Durban, for instance, parties knowingly breached the 2020 deadline for avoiding irreversible climate change because the only legally binding deal, the Kyoto Protocol commitment period 2 (CP2), covers a mere 14% of global emissions, compared with 38% covered by signatories in 2008 (Morel et al. 2012). The chances of achieving the 2°C objective is unlikely with a political action delayed by two decades. Costs and risks of dangerous climate change associated with political inaction of this magnitude swamp even the combined effects of uncertainties surrounding future energy demands, mitigation technology and geophysical uncertainty (Rogelj et al. 2013). Also apparent are overlaps (and an overzealous use of acronyms) such as that between NAMAs, which may include REDD activities, and forest management of the Kyoto Protocol. LULUCF, REDD, and agriculture also overlap, (LULUCF together with agriculture is also called AFOLU) (Boyle 2012).

The concept of a landscape approach for the ecosystem sector under a future agreement emerged as a potential way to deal with overlapping concepts. Chapters Six and Seven address one such approach developed in Australia (van Oosterzee et al. 2011, van Oosterzee et al. in review).

**Australia’s climate change policies**

Australia originally embraced the conventions adopted at the Rio Earth Summit in 1992 under the Keating Labor Government, then threatened to abandon the Kyoto
Protocol in 1997, under the Howard Liberal Government, unless it could count its 1990 base year deforestation emissions toward the first commitment period. As deforestation has since fallen, Australia will receive a deforestation offset worth up to 100 Mt CO$_2$-e/yr (Macintosh 2012) and is the main reason Australia will achieve its emission target of 108%. Australia finally ratified the Kyoto Protocol in 2007 shortly after the Rudd Labor Government gained power.

In 2009, the Rudd Labor Government introduced a proposed national emissions trading scheme called the Carbon Pollution Reduction Scheme (CPRS). It had two versions. The original CPRS took a narrow view of offsets, essentially following the Clean Development Mechanism (CDM) in only including afforestation and reforestation. After significant public input an amended scheme provided a national framework to include abatement from across the ecosystem sector. The Senate failed to pass the CPRS in late 2009. After a disappointing result in Copenhagen, Prime Minister Rudd effectively scrapped the CPRS, which triggered his ousting in June 2010.

In 2011 the Gillard Labor Government legislated the Clean Energy (CE) Act and accompanying legislative package. The CE Act establishes an emissions trading scheme, which started on 1 July 2012. The Scheme imposes obligations on the nation’s biggest polluters to reduce GHG emissions through the surrender of tradable permits or the use of domestic or international offset projects. Emissions from the ecosystems sector are not covered by the Scheme, but instead the sector is permitted the opportunity to generate tradable carbon credits from across the ecosystem sector called Australian Carbon Credit Units (ACCUs) under the Carbon Farming Initiative (CFI). The CFI is derived essentially from the offsets provisions of the earlier CPRS.
While the CFI allows the generation of credits from across the ecosystem sector - the first national scheme in the world to do so - the design, complexity and cost of project development will likely work against uptake. The design of the CFI takes its cue from the CDM with its potential to proliferate complex and narrow methodologies and approaches to integrity standards such as leakage, permanence and additionality (Box 1.2) (van Oosterzee 2012). Only 37,846 ACCUs have been issued up to mid-2013 (Australian Government 2013b), which is less than 1% of the mitigation potential of the CFI estimated by the Australian Government’s Treasury (2011).

**Box 1.2. Concepts of leakage, permanence and additionality.**

*Leakage* refers to the unanticipated increase in emissions outside an avoided-deforestation project’s accounting boundary (Murray 2008).

*Permanence* is the guarantee that abatement activities involving carbon sequestration, such as avoided deforestation, will sequester carbon for a meaningful amount of time.

*Additionality* means showing that greenhouse gas abatement activities would not otherwise have occurred without the support of a mechanism such as the Carbon Farming Initiative in Australia or the Clean Development Mechanism internationally.

The conservative nature of the CFI filters down to the site level, where for example, a recent study from north-eastern Queensland has shown that a conservative model used for estimating carbon in reforestation, for carbon credits under the CFI, underestimates carbon stocks in reforestation by up to 54.9%, thus depriving landholders of financial incentives to engage in the CFI (Preece et al. 2012).
The Wet Tropics Pilot Project

The Australian Wet Tropics Region Biocarbon Sequestration and Abatement Project provides an example of a landscape-scale framework for integrating the ecosystem sector into climate change mitigation approaches within national policy using existing natural resource management governance frameworks (van Oosterzee et al. 2011, van Oosterzee et al. in review).

The Wet Tropics Project is used as a case study in Chapters Four, Six and Seven to provide insights, borne of applying best practices, to the impacts of the changing policy environments. When it was planned in 2006 and 2007 the only market framework available in Australia for ecosystem sector offsets was the international voluntary carbon market: a market dominated by corporate social responsibility and individuals who voluntarily mitigate their emissions caused by, say air travel, electricity use and other sources.


The Wet Tropics Project was designed to meet all the requirements of the Verified Carbon Standard (VCS), including the use of best-practice international methodologies of the Clean Development Mechanism, and of the Inter-Governmental Panel on Climate Change (Degree Celsius 2009a). The Wet Tropics Project was being audited against Climate Community and Biodiversity Standards, which is a requirement to meet biodiversity and social criteria for the VCS (Degree Celsius 2009a), when Australia’s Carbon Pollution Reduction Scheme (CPRS) was introduced. The ramifications of the application of Kyoto rules, embedded within the
CPRS, on the Wet Tropics Project are analysed in Chapter Four. This analysis was influential in the incorporation of activities from across the ecosystem sector into the November 2009 amendments of the CPRS, which was eventually carried over to the Carbon Farming Initiative (van Oosterzee et al. in review).

**Box 1.3. Governance**

Governance in the context of the environment is the management of natural resources, including the structures and processes that provide the social and institutional matrix in which management takes place (Bodin & Tengo 2012)

**Contribution of this thesis**

This PhD thesis by prior publication addresses a number of themes:

- The history and milestones in the development of international climate change policy.

- The United Nations Framework Convention on Climate Change and its Kyoto Protocol and how these influence climate change mitigation policies at international and national scales.

- The integration of the ecosystem sector into climate change policy development and why sound policy cannot ignore the ecosystem sector.

- Implementing project-level REDD through risk-based approaches.

- The ecosystem sector and carbon markets.

- Australia’s natural resource management framework and the development of landscape approaches to mitigating climate change
• Australia’s climate change policy and the ecosystem sector

This thesis makes an original contribution to the body of knowledge on the role of the ecosystem sector in climate change considerations at international, national and regional levels. Contributions are conceptual, theoretical and applied on a number of levels. Conceptually the thesis interrogates the role of ideology and politics in the formulation of long-lasting policies such as the Kyoto Protocol of the UNFCCC (Chapters Two, Three and Four). Originally intended to draw together international collaboration and action to drive down global GHG emissions, the Kyoto Protocol has had mixed success and a major failing, the abandonment of the ecosystem sector, has undermined the value of, and how global ecosystems are perceived and integrated into climate change policy (Chapter Four). The published papers incorporated in this thesis indicate how international policies influence the design of national ones, such as Australia’s Carbon Farming Initiative (Chapter Two).

Australia’s regional natural resource management (NRM) model is examined for its potential role in the governance and the inclusion of the ecosystem sector in climate change mitigation. A conceptual link with regional NRM and a landscape approach to climate mitigation is made in Chapters Six, Seven and Eight.

This thesis scrutinizes and challenges the underpinning premise of concepts such as additionality, leakage and permanence (Chapter Five) and their application in climate change policy. These three concepts are potentially contrived, or at least over-stated, and they have hindered the integration of ecosystem considerations and climate change mitigation into meaningful policy. In practice, additionality, leakage and permanence have stalled efforts to implement workable financial mechanisms essential to abate greenhouse gas emissions.

An important objective of this thesis is to describe and evaluate potential solutions to difficult policy problems. Chapter Five provides a workable, financial, results-based
mechanism (iREDD) to incorporate private investment in REDD projects, which is based on proven insurance-based hedging principles. Chapters Six and Seven provide a policy model for integrating the ecosystem sector at the landscape scale by embedding it within regional NRM governance frameworks.

Following this introductory chapter this thesis is divided into chapters that, apart from the concluding chapter, are reprints of published and peer-reviewed academic articles (Chapter Seven is in the review process). Chapter Two is an overview paper that (1) introduces the UNFCCC and the politics behind the forfeiture of the use of the ecosystem sector in the Kyoto Protocol; (2) examines the ramifications of international policies on Australia’s CFI; and (3) introduces the concept of REDD.

In Chapter Three the politics and ideology that resulted in the forfeiture of the ecosystem sector, focusing on forests, is more fully elaborated. Chapter Three provides a snapshot of Australia's land-based carbon market as it was in 2007 and examines missed abatement opportunities in the Northern Territory where deforestation is occurring.

Chapter Four demonstrates how the forfeiture of the ecosystem sector from the Kyoto protocol resulted in the decoupling of ecosystems and their biodiversity from climate change policy using the Wet Tropics Project as a case study.

Chapter Five examines the potentially dissembling role of three key concepts – leakage, permanence and additionality - that hinder the integration of the ecosystem sector into climate change policy and stall the development of workable financial mechanisms that underpin the key ecosystem abatement opportunity of REDD.

Based on the Wet Tropics Project, Chapter Six introduces a framework for integrating the ecosystem sector into climate mitigation policy using Australia’s NRM framework. Chapter Seven further develops the latter framework by reviewing the theoretical foundations for integrated NRM, analyzing the last decade of NRM
policies and governance in Australia, and shows how the framework is particularly relevant for emerging landscape approaches.

Chapter Eight summarizes the research and its contribution to practice and policy. First, the chapter provides a synopsis of the contribution of each chapter to the overall thesis. Following this are reflections on the implications of this research to policy and practice, showing where past debates still influence current policy. Examples of solutions are highlighted, such as risk-based approaches, a move toward landscape approaches, and examples of the incorporation of the ecosystem sector in national and sub-regional policies.
Chapter Two

The integration of biodiversity and climate change mitigation: A contextual assessment of the Carbon Farming Initiative
Chapter Two
The integration of biodiversity and climate change mitigation: A contextual assessment of the Carbon Farming Initiative


Context

This overview paper contextualizes Australia’s Carbon Farming Initiative (CFI) within international processes. The paper reminds us that, in 1992 at the United Nations Conference on Environment and Development (Rio Earth Summit) the clear intention was to integrate reducing biodiversity decline with climate change mitigation actions and policy. However, the Kyoto Protocol forfeited the ecosystem sector and did not include it in climate abatement policies, largely for ideological and political reasons, which led to a discordant policy setting.

The chapter examines Australia’s efforts to include the ecosystem sector in climate change policy and how these policies tracked and reacted to global climate change politics. The CFI ultimately takes its cue from the Kyoto Protocol and this paper suggests that the CFI’s complex design and treatment of biodiversity is a reflection of the global policy discordance, hindering uptake and militating against the role of ecosystems in climate mitigation.

The emergence of the concept of reduced emissions from deforestation and forest degradation (REDD) is introduced with a discussion of how deforestation is dealt with by the CFI.
Summary

The Carbon Farming Initiative (CFI) allows the creation of tradable Australian Carbon Credit Units (ACCUs) derived from across the ecosystem sector via project-level baseline and credit activities: it is the first national offset scheme in the world to broadly include farming and forestry projects. Because these activities have the potential to produce both biodiversity and climate change benefits, a crucial outcome is for widespread uptake of the policy. However, the design, complexity and cost of the CFI project development process, and low prices as a result of ACCUs trading in the voluntary market, will all likely militate against this.

This article shows how international politics and policy surrounding the Kyoto Protocol have influenced the design of the CFI, with its potential to proliferate complex and narrow methodologies and counter-productive approaches to integrity standards such as permanence. The article shows that despite the pressing need to integrate biodiversity and climate change considerations as equally important challenges, their global integration remains poorly articulated. Biodiversity considerations are also not integrated into the CFI but, rather, are dealt with indirectly through safeguard measures that avoid perverse incentives and unintended harm, and as an optional co-benefit via the development of an index.

This article suggests that we need to move past the shackles of Kyoto toward streamlined and standardized approaches such as risk-based assessments and the use of regional baselines. Using regionally specific baselines such as for avoided deforestation would allow landholders to opt-in to regional-scale mitigation opportunities. Activities that Australia accounts for, such as reforestation and deforestation, should also be able to opt-in for coverage under the Clean Energy Act (and out of the voluntary carbon market) to obtain a secure price.
Australia’s Carbon Farming Initiative

The Carbon Farming Initiative (CFI) is the first national offset scheme in the world to include carbon credits derived broadly from the ecosystem sector, including farming, landfill and forestry projects. This paper investigates the global context and history of this policy, which informs how biodiversity considerations are dealt with in the CFI, and how this policy could evolve to help restoration and biodiversity outcomes on the land.

The Objectives of the CFI are to help Australia meet its obligations under the Kyoto Protocol; to create incentives for people to undertake land sector abatement; and to do that in a manner consistent with protecting Australia’s environment (Commonwealth of Australia 2011).

It works in conjunction with Australia’s Clean Energy Act and accompanying legislative package, but trades in the voluntary market. The CE Act establishes an emissions trading scheme, starting on 1 July 2012.

The CE Act imposes obligations on the nation’s biggest polluters to reduce greenhouse gas emissions through the surrender of tradable permits or the use of domestic or international offset projects (Carbon Market Institute 2011). Emissions from the land sector are not covered by the Scheme, but instead the land sector is permitted the opportunity to generate tradable carbon credits called Australian Carbon Credit Units (ACCUs) under the CFI.

Carbon Farming Initiative offsets are generated from project-level baseline and credit activities. They are differentiated into sequestration and emissions avoidance projects (Commonwealth of Australia 2012). Those derived from sequestration projects involve the sequestration of carbon dioxide in vegetation and soil, and avoidance of carbon dioxide emissions from the disturbance of soil or vegetation.
Emissions avoidance projects are those that derive from avoidance of methane and nitrous oxide emissions from agriculture and feral animals.

The meanings of the definitions used in the CFI are derived from accounting commitments under the Kyoto Protocol (United Nations 1998). Annex B countries (developed countries) committed, for instance, to accounting for afforestation, reforestation and deforestation during the first commitment period 2008. Accounting for forest management, revegetation, cropland management and grazing land management is voluntary, and Australia elected not to count these toward its Kyoto obligations.

Australian Carbon Credit Units are, accordingly, of two kinds, those that are Kyoto consistent and those that are not. Kyoto-consistent ACCUs include reforestation, reduction in nitrous oxide emissions from fertilizer use, and managing methane emissions from piggeries and dairies. Non-Kyoto consistent ACCUs include soil carbon and improved forest management. Only Kyoto-consistent ACCUs are eligible for trade within compliance schemes such as the CE Act. Non-Kyoto ACCUs can only be used in voluntary markets or in domestic Government programs. Kyoto ACCUs can be exchanged for Kyoto units and sold to foreign buyers. Australia would not be able to count these units toward its Kyoto accounts.

The CFI project development process is complex, and involves a number of steps and processes, each with their own complexity. Before a project can be developed to generate ACCUs, a methodology for the project type must be approved through the statutory Domestic Offset Integrity Committee. Once there is a methodology, the processes to implement a project include: becoming a recognised offset entity; opening a registry account; becoming an eligible offset project; undertaking a project according to approved methodologies; submitting regular audit reports; and applying for ACCUs and having them issued.
Rigorous ‘integrity standards’ are required to guarantee genuine abatement and include proving additionality, leakage considerations and permanence obligations of 100 years for sequestration projects. Additionality means that activities must demonstrate emissions reductions that would not otherwise have happened, for example, avoided deforestation as a direct result of the CFI. Leakage refers to the unanticipated increase in emissions outside a project’s accounting boundary as a result of the projects implementation, for example, forest being cleared elsewhere as a result of a CFI project. Permanence is the guarantee that an emissions reduction, such as avoided deforestation, will remain so for a meaningful amount of time.

Australian Carbon Credit Units are considered financial instruments and this further triggers policy frameworks established under Australia’s Corporations Act and other legislation. For instance, a project proponent must hold an Australian Financial Services Licence to trade them, and general consumer provisions under other legislation are also triggered, incurring additional transaction costs.

Polluters covered under the CE Act can purchase international permits (e.g. from the European Union and Clean Development Mechanism) to meet Scheme obligations after an initial fixed price period to bed the Scheme in. This is aimed to provide access to the lowest cost abatement.

Biodiversity is dealt with as a co-benefit and project developers will be given the opportunity to note biodiversity co-benefits on the Register of Offset Projects. This co-benefit notification will likely be via an index that will be specified in the regulations, and provide proponents with a low cost avenue to obtain a market premium (Commonwealth of Australia 2011).

Biodiversity and the extent to which it is integrated into Australia’s climate change response is strongly influenced by global events past and present.
The integration of biodiversity and climate change: a short history

An important foundation stone of humanity’s attempts to deal with the two major global crises of biodiversity decline and climate change came in 1992 with the United Nations Conference on Environment and Development, commonly known as the Rio Earth Summit. Boutros Boutros-Gali, then Secretary General of the United Nations, opened the Summit with two minutes of silence on behalf of life on Earth. His impassioned speech had a focus on nature, and warned that we had “only a few years or a few decades to act” (United Nations vol 2 pg 33 1993). The pivotally integrated United Nations Framework Convention on Climate Change (UNFCCC) and the Convention on Biological Diversity (CBD) were opened simultaneously for signature: one is committed to conserving the work of creation and not unravelling it, and one aims at keeping greenhouse gases in the atmosphere at safe limits (United Nations 1993).

The Kyoto Protocol, adopted in 1997 in Kyoto Japan, crystallized the commitment of the UNFCCC. The Protocol works through a targets and timetable structure: setting legally binding targets for developed countries to reduce their greenhouse gas emissions starting with a first commitment period of 2008-2012. The Protocol introduces the Clean Development Mechanism that allows developing countries to provide offsets for developed countries.

The need to integrate the two conventions could not have been made clearer. Yet the options for linking biodiversity conservation with climate change mitigation has to this day not been properly articulated (Phelps et al. 2012). In 2003 the inter-linkages between biodiversity and climate change were first enunciated in a report (Secretariat of the Convention on Biological Diversity 2003) that itself was an outcome of the 2002 World Summit on Sustainable Development, commonly called
“Rio + 10”. The report made it clear that we were losing the battle of slowing biodiversity loss. The Summit set a biodiversity target: that the current rate of biodiversity loss at the global, regional and national levels would be significantly reduced by 2010 (Secretariat of the Convention on Biological Diversity 2010). Yet another five years elapsed before a formal decision emerged in 2008 to integrate climate change activities within the programmes of the CBD. Decision IX/16 of the Convention of Parties (COP) to the CBD, led to another technical report Connecting Biodiversity and Climate Change Mitigation and Adaptation (Secretariat of the Convention on Biological Diversity 2009).

A year later, Ban Ki-moon, current Secretary General of the United Nations, prefaced the 2010 Global Biodiversity Outlook by reminding us that the target set at Rio + 10 had not been met (Secretariat of the Convention on Biological Diversity 2010). “The conservation of biodiversity makes a critical contribution to moderating the scale of climate change and reducing its negative impacts by making ecosystems – and therefore human societies – more resilient. It is therefore essential that the challenges related to biodiversity and climate change are tackled in a coordinated manner and given equal priority.” (BAN Ki-moon in Secretariat of the Convention on Biological Diversity 2010).

The 2010 Global Biodiversity Outlook tracks the decline in all three main components of biodiversity – genes, species and ecosystems. We know that ecosystem services themselves are underpinned by biodiversity and are the basis of human wellbeing as summarized below (Table 1).

There is also global consensus on a strategy for the integrated management of land, water and living resources, called the ‘ecosystem approach’ adopted by the Conference of Parties to the CBD in 2000 (http://www.cbd.int/decision/cop/?id=7148) and outlined in the Box below.
Table 1 - Ecosystem Services to humanity

<table>
<thead>
<tr>
<th>Ecosystem Service</th>
<th>Description</th>
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<tbody>
<tr>
<td>Supporting Service</td>
<td>Maintain conditions for life including oxygen production, soil formation, nutrient cycling, primary production, pollination and seed dispersal</td>
</tr>
<tr>
<td>Regulating Services</td>
<td>Regulates ecosystem processes including air and water quality, flood and erosion control, waste treatment, biological control of agriculture and disease</td>
</tr>
<tr>
<td>Provisioning Services</td>
<td>Provide products from ecosystems including food, water, wood, fibre, biochemicals and medicines</td>
</tr>
<tr>
<td>Cultural Services</td>
<td>Non-material benefits including spiritual and religious values, knowledge systems and educational values.</td>
</tr>
</tbody>
</table>

Source: Adapted from Millennium Ecosystem Assessment 2005

Most recently, species loss has been shown to have ecosystem effects rivaling those of ozone, acidification and elevated CO₂ (Hooper et al. 2012).

The first UNFCCC decision on the integration of biodiversity and climate change only appeared in 2011 at the Durban COP. It merely recognizes that policy approaches in the forest sector can promote biodiversity benefits (United Nations Framework Convention on Climate Change 2011a).

Two terms, “safeguards” and “co-benefits”, are recent terms adopted by the UNFCCC in reference to biodiversity (Pistorius et al. 2010). Safeguards are minimum requirements, such as legislation and regulations, for avoiding apparent risks to biodiversity (Phelps et al. 2012). Biodiversity co-benefits refer to benefits above an agreed upon baseline which requires some form of measurement, and is what is implied under the development of a regulated index that can note biodiversity co-benefits for “projects that go the extra mile” (Commonwealth of Australia 2012) under the CFI.
The 12 Principles of the Ecosystem Approach of the Convention on Biological Diversity

1. The objectives of management of land, water and living resources are a matter of societal choice.

2. Management should be decentralized to the lowest appropriate level.

3. Ecosystem managers should consider the effects (actual and potential) of their activities on adjacent and other ecosystems.

4. Recognizing potential gains from management, there is usually a need to understand and manage the ecosystem in an economic context. Any such ecosystem-management programs should:
   - Reduce those market distortions that adversely affect biological diversity (i.e., eliminate perverse subsidies, etc.);
   - Align incentives to promote biodiversity conservation and sustainable use;
   - Internalize costs and benefits in the given ecosystem to the extent feasible (including full accounting for ecosystem goods and services).

5. Conservation of ecosystem structure and functioning, in order to maintain ecosystem services, should be a priority target of the ecosystem approach.

6. Ecosystems must be managed within the limits of their functioning.

7. The ecosystem approach should be undertaken at the appropriate spatial and temporal scales.

8. Recognizing the varying temporal scales and lag-effects that characterize ecosystem processes, objectives for ecosystem management
should be set for the long term.

9. Management must recognize that change is inevitable.

10. The ecosystem approach should seek the appropriate balance between, and integration of, conservation and use of biological diversity.

11. The ecosystem approach should consider all forms of relevant information, including scientific and indigenous and local knowledge, innovations and practices.

12. The ecosystem approach should involve all relevant sectors of society and scientific disciplines.

**Throwing the baby out with the bathwater**

Despite the best intentions, the integration of biodiversity conservation and climate change mitigation seems as distant as ever. Biodiversity is more often than not considered as an ancillary, or co-benefit (Diaz 2009), an after-thought (BAN Ki-moon in Secretariat of the Convention on Biological Diversity 2010), or worse, a burden (Gardner 2012).

Climate Change and biodiversity loss converge most critically in tropical forests (Phelps et al. 2012). Tropical deforestation accounted for most of the ecosystem sectors (agriculture, forestry and other land use) and around a quarter of all anthropogenic carbon emissions in the 1980s and 1990s (Laurance 2007).

In the 14 years since the Kyoto Protocol was signed, about 200 million hectares of mostly rainforest have been cleared (based on figures from Food and Agricultural Organization 2006). Using conservative figures and assuming around 200tC/ha in these forests (Ramankutty et al. 2007) this amounts to about 147 Gt, equating to
245 years of Australia’s CO\textsubscript{2}-e emissions at current rates. The cleared area of 200 million hectares does not include increases in the area of degraded forests, which is about 25% more (derived from figures in Markku et al. 2007). Excluding forests from the Kyoto equations has added to the certain, permanent and massive loss of biodiversity without any influence whatever on United States and Australian consumption patterns.

Within Australia, the on-going deforestation rate in the Wet Tropics, for example, has averaged 1660 ha per year for the past 20 years (unpublished data from the Department of Environment and Resource Management 2009), equivalent to a release of at least 450,000 t CO\textsubscript{2}-e per year. By contrast, historic data show that reforestation using environmental plantings is occurring at only about 40 ha per year: <1% of the potential sequestration benefits of avoided deforestation and degradation.

In the lead up to the Rio Earth Summit, and in the early 1990s, conservationists could be forgiven for thinking that climate change at last provides an effective motivation to finance avoided deforestation (van Oosterzee & Garnett 2008). How did we get from here to the current international climate change policy frameworks that arguably throw the baby out with the bathwater by discarding the link between carbon reduction and biodiversity conservation - the very thing that it was essential to keep (van Oosterzee et al. 2010)?

 Mostly the reason is political (Havemann 2009, Laurance 2007, van Oosterzee & Garnett 2008) and stems from negotiations leading up to the Kyoto Protocol where Europeans - fundamentally reacting to American consumerism - objected to the possibility that the United States and countries like Australia could ‘buy their way out’ of reducing their emission through private enterprise offsetting their emissions through investing in forests.
In global climate change deliberations this logic had the affect of demoting biodiversity to a mere aside or after-thought: an offset for something else implicitly of greater importance. Instead of seeing the ecosystem sector working together with abatement as a way of driving deeper cuts earlier (Schlamadinger et al. 2007) - clearly the original intention - political sides were taken and farcically played out with Europeans broadly “against” forests and Americans “for” them (van Oosterzee et al. 2010).

Technical difficulties in measurement were seen to be insurmountable barriers. Notions of permanency and certainty were considered obstacles. In reality, notions such as these are indicators of real world complexity, not necessarily unique to carbon projects (Rayden et al. 2010), and not applied as strictly to other Kyoto areas. Accounting for problems of leakage, permanence and additionality tend to form an ‘unholy trinity’ against forest-based projects even though these concepts can be overstated or contrived (van Oosterzee et al. 2012, MacIntosh & Waugh 2012). A 100-year permanence rule, such as Australia has, is one of the major obstacles to investment. Investment in the Climate Action Reserve, the only other scheme that seems to use it, has stalled due to caution in committing to 100 years of permanence. Ironically, rather than adding value because of higher integrity, the reverse effect of discounting forest credits is occurring due to their perceived complexity and hence riskiness.

In reality the logic of the 100-year rule is weak. Carbon dioxide has no single atmospheric lifetime and varies from five years for individual carbon atoms to thousands of years depending on different physical and chemical aspects (Macintosh & Waugh 2012). Risk based assessments approaches, now widespread, and emerging insurance approaches can provide viable and rigorous alternatives (van Oosterzee et al. 2012). These approaches estimate the risk that sequestered carbon is eventually released again within the timeframe of the project. The risk
buffer generated can compensate for future losses. Insurance mechanisms can also reduce the risk embedded in uncertain futures.

With the European Union not permitting offsets derived from ecosystems in its emissions trading scheme, the worldwide demand for forestry offsets has been taken up by the voluntary market, which has become a significant player in exploring, piloting and shaping future compliance carbon markets. The fact that innovative solutions have so readily emerged in this market, and that these innovations are now being embraced in compliance markets (for example, California’s forthcoming ETS), underscores the arguably contrived nature of the arguments that kept ecosystems out of the global carbon equations in the first place.

Australia, however, has largely paralleled international sentiment. Here Hamilton (cited in van Oosterzee & Garnett 2010) states that reforestation will let polluters off the hook. Downie (2007) warns against offsets, particularly those associated with forestry projects because ‘sooner or later the forest will be felled, burned or destroyed.’ According to Downie (2007) an Australian scheme should be integrated with the European Union’s scheme, which excludes forestry projects entirely. From a global market perspective this action suggests forests are worth more dead than alive (Mitchell quoted in Tollefson 2008).

A significant problem of not including the full potential of forests in the Kyoto Protocol is that it denied public and political willingness to pay for avoided deforestation and reforestation, and this willingness is now in decline (van Oosterzee et al. 2012). Most importantly it has denied the opportunity to buy time. Maintaining carbon in forests even if uncertain and impermanent, postpones global warming with its droughts, floods and other disasters. This would have represented a prevention of all the damages that would have occurred during even a temporary period of postponement (Fearnside, 2001).
The opportunity was missed to use the Kyoto Protocol to correct the failure of not properly valuing forests and avoiding their loss. Only narrowly defined afforestation (the direct human-induced conversion of land that has not contained a forest for at least 50 years to forested land) and reforestation (the direct human-induced conversion of non-forested land as of 31 December 1989) were permitted with in the Kyoto Protocol’s Clean Development Mechanism (CDM). Today these politically tainted projects make up a tiny proportion of the total projects in the CDM: there are only 30 afforestation/reforestation projects or 0.75% of the total CDM projects totaling 7.8 MtCO$_2$e (Diaz et al. 2012). And there is only one major buyer, the World Bank’s BioCarbon fund.

The CDM, responding to the toxic global politics leading up to the Kyoto Protocol, instigated a reactionary proliferation of complex and narrow methodologies. Currently there are 20 methodologies for afforestation/reforestation of which less than half are actually used by registered projects (Diaz et al. 2012). The process of validation itself takes more than 600 days. Not surprisingly, there are global calls to simplify AR CDM rules to be more pragmatic and better accommodate realities (Platonova-Oquab et al. 2012).

Being a creature guided by the Kyoto Protocol and its Clean Development Mechanism, Australia’s CFI has also adopted a project-level baseline and credit design. While it is early days, an indication of the potential to develop a raft of complex and narrow methodologies can be seen in the approved “Methodology for Quantifying Carbon Sequestration by Permanent Environmental Plantings of Native Species using the CFI Reforestation Modeling Tool” where environmental plantings are narrowly defined as “comprising native species that are native to the local area and which can consist of a mix of tree and understory species or a single species if monocultures naturally occur in the area”. This ignores the significant amount of research being undertaken on the use of monocultures as establishment and
‘framework’ species that allow other local native species to grow up underneath the canopy at considerably reduced cost (Goosem & Tucker 1995, Bristow et al. 2006, Piotto 2008). The Permanent Environmental Plantings methodology, being the first forestry methodology enacted, sets a prescriptive precedent. If a project proponent wished to use a native that would not normally form a monoculture as a framework species, a new methodology would need to be submitted and approved.

The cost for developing a methodology is estimated to be around $125,000 and takes two years to develop from inception to approval (World Bank 2010). Likewise, the CFI will incur high transaction costs. As an example of the sorts of costs likely to be incurred, contracting a surveyor to map and register one stand of forest could cost in the order of $500-$10,000 or more depending on the complexity of the forest stand. At $10/t CO$_2$-e a cumulative return from sales might be in the order of $120 for one hectare of forest in the third year after planting (based on a wet tropics forest). This return would not cover the costs of registering legal rights to the carbon, let alone the cost of survey and plan preparation or the costs of establishing the forest. The real cost of project development and implementation is high to the landholder despite the expectation that forests deliver low cost abatement.

**REDD**

Largely as a result of the continuing loss of forests and of biodiversity, the idea of compensating countries for keeping and managing their forests once again emerged under the banner of REDD (reducing emissions from deforestation and degradation) at the 2005 Conference of Parties to the UNFCCC. Instructions to consider and stimulate action on REDD followed at the Bali COP in 2007. At the 2009 Copenhagen COP, REDD+ (incorporating conservation and management of forests) was recognized as crucial in climate mitigation efforts, though the term ‘REDD+’ itself was only clearly defined a year later at the Cancun COP. However, this 2010
COP faltered on decisions regarding financial structures to actually pay for REDD (used here to include all its variations) and the role of market versus non-market approaches based on the ideological arguments in the lead up to the Kyoto Protocol continued to be divisive.

In reality, the argument against using market approaches is not sound: resources required to reduce deforestation and degradation (i.e. REDD) by 50% range from US$17-28 billion per year (O’Sullivan et al. 2010) - four to seven times higher than the figure of US $4 billion per year currently pledged from 2010-2012 to non-market based REDD efforts. The 2011 Durban COP at least opened a way for both public and private sources of finance, and new market-based solutions are emerging (van Oosterzee et al. 2012).

At the country level, a number of multilateral funds have been established, the most important of which are the World Bank’s Forest Carbon Partnership Facility and Forest Investment Program, and the United Nations REDD program. These struggle to disburse funds; largely because of the complexity of rules, difficulty of coordinating country-level projects, and high transactions costs. As a result, REDD, too, has stalled, and this uncertainty has knock-on effects for essential private sector enthusiasm.

While REDD has come to focus on developing countries, deforestation also occurs in industrialized countries. Australia, in particular, has a history of high deforestation. In 1990 – the Kyoto base year - deforestation accounted for 132 Mt CO$_2$-e, or 23% of Australia’s total emissions (Macintosh & Waugh 2012). During negotiations for the Kyoto Protocol in 1997 Australia threatened to abandon the Protocol unless it could count its 1990 base year deforestation emissions (these had fallen by over 50% between 1990 and 1997, and could be used to offset emissions). As deforestation has since fallen, Australia will receive a deforestation offset worth up to 100 Mt CO$_2$-
e/yr (Macintosh 2012) during the first commitment period. This offset is the main reason Australia will achieve its emission target of 108% on 1990 levels. It will not be in Australia’s best interests, therefore, to allow Kyoto ACCUs to be sold to foreign buyers and lost to Australia’s accounts.

In 1999, Australia was the fifth highest deforester in the world (Steffen et al. 2009). Australian Treasury figures show land-use change (clearing of forests and woodlands) still accounts for 74 Mt CO₂-e per annum, equivalent to 13% of Australia’s emissions using 2005 figures. For most of its history, Australia’s deforestation reform via regulation has had mixed results at best (Macintosh 2012), and would potentially achieve a much needed boost through carbon markets.

**Trading in the Voluntary Market**

The CFI trades in both the voluntary and compliance carbon markets, the latter dominated by the CDM, which does not allow offsets from the ecosystem sector. This voluntary market is tiny, with 95 Mt CO₂-e transacted in 2011 across 61 countries worth $576 Million, or about 0.1% of the global carbon markets. Mostly this market comprises energy-based projects. Of the total volume in 2011, 15% was from afforestation/reforestation and REDD projects (7.6 Mt CO₂-e and 7.3 Mt CO₂-e respectively). Overall, nearly three quarters of the world’s forest projects were developed only in the past two years. Over the past three decades 312 projects have contracts to develop forest offsets (Diaz et al. 2012). The average price for Verified Emissions Reductions (VERs) is low at $6.20/t CO₂-e.

That the market has set a key requirement for projects that deliver benefits to biodiversity is indicated by the fact that nearly half of the forest-based projects are also tagged with the additional Climate Community and Biodiversity Standard, although a price premium for these credits was not detected (Diaz et al. 2012).
Due to the complexity of rules and high transaction costs, most forest-based projects in the world are located on private land and dominated by a handful of heavy players. This is exemplified in South America where 60% of the REDD market is derived. Two countries, Brazil and Peru dominate largely because ownership of carbon is clear in these places (Diaz et al. 2012). VCS REDD credits from Africa stem from two mega projects (> 1 Mt CO₂-e) in Kenya and the Congo from the same project developer (Peters-Stanley 2012). Arguably, the complexity of rules has resulted in perverse outcomes that currently militate against local people and communities.

In New Zealand, prescriptive rules intended to constrain activities of “carbon cowboys” have deterred new activity (Peters-Stanley 2012). The value of forest credits in NZ is tied to the price of CERs, which are so low as to stall foresters selling units (Diaz et al. 2012).

In Australia, an indication of the impact of trading in the voluntary market can be seen by recent Treasury figures (Australian Government 2011) (Table 2).

Under the ‘medium global action’ scenario, which broadly reflects a CFI regime, reforestation activities sequester 72 Mt CO₂-e accumulatively by 2050, or just under 2 Mt CO₂-e/yr on average. Under the ‘ambitious global action’ reforestation activities sequester 865 Mt CO₂-e accumulatively or about 23.4 Mt CO₂-e/yr on average. This ambitious action is broadly similar to figures calculated for the Australian Government’s earlier-proposed Carbon Pollution Reduction Scheme (CPRS) scenario where forestry was voluntarily able to opt-in under the legislation and receive a higher price. The lower estimates for the CFI credits are mainly due to trade in the global offset market. This has considerably lower prices than if forestry credits were part of Australia’s ETS, and traded at the domestic price as was to be the case in the CPRS. Permanence restrictions, water interception and pricing, risk
of reversal buffer and other restrictions add to the limited role forestry has under the CFI regime.

Table 2 – Predicted impact of trading carbon credits in the voluntary market

<table>
<thead>
<tr>
<th></th>
<th>Medium global action</th>
<th>Ambitious global action</th>
</tr>
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<tbody>
<tr>
<td></td>
<td>2013</td>
<td>2020</td>
</tr>
<tr>
<td>Agriculture</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Abatement (Mt CO2-e/year)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land use change</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Abatement (Mt CO2-e/year)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Forestry</td>
<td>&lt;1</td>
<td>&lt;1</td>
</tr>
<tr>
<td>Sequestration (Mt CO2-e/year)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total abatement</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>(Mt CO2-e/year)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Abatement from the CFI (from Australian Government 2011).

In reality even these lower estimates may be difficult to achieve under the CFI. For example, one methodology is currently under consideration for native forest protection, essentially a REDD project (http://www.climatechange.gov.au/en/government/initiatives/carbon-farming-initiative/methodology-development/methodologies-under-consideration/native-forest-protection-projects.aspx). This methodology is associated with a single project of about 7,000 t CO₂-e/yr (http://www.forestcarbonportal.com/projects), which is a small fraction of the estimated 4 Mt CO₂-e scenario presented in the above table for 2013.

How to incorporate biodiversity as if it really mattered

Australia has made the unprecedented step of allowing the creation of compliance-grade carbon credits broadly from the ecosystem sector. Given this, perhaps the single most important outcome for biodiversity is for widespread uptake of the CFI.
A way to do this is to move quickly and comprehensively to landscape-scale and standardized approaches.

However, despite the generous coverage of the CFI, the design, complexity and cost, and price will all likely militate against this. Global experience has warned about the disproportionate focus on complex, conservative and restrictive methodologies and integrity standards at the expense of emissions reductions and environmental outcomes (World Bank 2010, Platonova-Oquab et al. 2012). In Australia, where 86% of agriculture and forestry businesses are small businesses (ClimateWorks Australia 2010), high transaction costs associated with this approach will favour large land holdings and specifically discriminate against small holders from participating in the CFI.

To enhance uptake, a shift to more streamlined and standardized approaches has recently begun internationally including using standardized sector and regionally specific baselines, and a shift to rewarding certain activities (such as no-till practices) rather than individual project level emissions (World Bank 2010, Platonova-Oquab et al. 2012). In Australia, it would be possible for instance to set regional baselines for avoided deforestation as was done in a pilot scheme, developed for the Wet Tropics Region in northern Australia (van Oosterzee et al. in review).

Using a regional baseline it would be possible to use a streamlined approach that allows landholders to opt-in to regional-scale avoided deforestation opportunities using standardized templates. This would also mean moving away from assessing 100% of projects, and instead using quality control and risk based approaches to focus on non-compliance as is done in other frameworks such as financial due diligence (Platanova-Oquab et al. 2012).
In the short term, Kyoto-based activities should be able to immediately opt-in for coverage under the CE Act, to obtain a sustainable price for mitigation, cancel the need for integrity standards such as for additionality, and enhance uptake of sustainable farming initiatives. Other activities should be opted-in as Australia begins to account for them.
Chapter Three

Seeing REDD: Issues, Principles and Possible Opportunities in Northern Australia
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Context

This paper, drafted in 2007 as part of a special edition, provides a snapshot of the issues surrounding the land-based carbon market when there was no market framework for carbon credits available in Australia, other than the global voluntary carbon market. The Rudd Labor Government was elected late in 2007, and the new government’s first official act was the ratification of the Kyoto Protocol on December 3rd 2007 a week before the 2007 Bali Conference of Parties (COP 13) of the UNFCCC. Reducing emissions from deforestation and degradation (REDD), introduced at the 2005 Montreal COP (COP 11), became part of UNFCCC processes at Bali with instructions to consider and stimulate action on it (United Nations Framework Convention on Climate Change 2008b).

The politics and ideology that resulted in the overall forfeit of forests from climate mitigation policies in the 1997 Kyoto Protocol is more fully elaborated in this chapter against a background of continuing global and local loss of forests. The chapter shows that climate change policy debates in Australia tracked and reacted to those occurring internationally in the period surrounding the 2007 Bali COP.
While the term ‘REDD’ has come to focus on developing countries, this chapter uses the international issues and terms surrounding the role of forests in climate mitigation, as the basis for tackling deforestation occurring in Australia, particularly in the Northern Territory. Here two avoided deforestation opportunities are possible: one on the Tiwi Islands and the other in the Daly River basin.
Abstract

When the Kyoto protocol was drafted, a major opportunity was lost to conserve existing stands of rainforest, particularly in developing countries through the recognition of the benefits of reduced emissions from deforestation and degradation (known as REDD). Even post-Kyoto, arguments persist for excluding REDD and related schemes from carbon accounting systems. The gap in mandated procedures, however, has to some extent been filled by the voluntary market, which draws investment from companies wishing to demonstrate their environmental credentials to investors. This innovative market has products, which extend beyond carbon to biodiversity and social benefits. The issues and principles involved are addressed in this article, along with reference to two possible REDD opportunities in northern Australia. Sadly, one of these opportunities has just been missed. For the other, institutional mechanisms will be needed to allow owners of intact forests to benefit from their carbon value and related environmental services potential.

Introduction

While it has long been recognised that forests contain a substantial proportion of the world’s carbon, and that cutting them down releases that carbon to the atmosphere, there have been difficulties in accounting for biosequestration within formal debate on managing anthropogenic climate change. Part of the problem has been scientific; how to measure carbon in the forests and the soils, and how to verify whether it had been preserved intact. Part of it has been political; the idea that developed countries could pay for their profligacy by preventing development in poorer countries seemed like a perpetuation of colonial domination of the world economy (Lohmann 2001). But as the science of carbon accounting has improved, and destruction of tropical forests has accelerated along with all other measures of environmental degradation, the urgency to negotiate equitable solutions to the problem of forest clearing,
particularly of tropical forests, has broken down many of the barriers. Indeed, the
giving of a value to carbon is now seen as the only way tropical forestry can be
sustainable (Pearce et al. 2003). Accordingly, the issue of greenhouse gas
emissions (GHGEs) being reduced through the cessation of forest clearing and
related activities—known as REDD for ‘reduced emissions from deforestation and
degradation’—is very much on the agenda of climate change mitigation.

This article explores the recent history of the debate concerning REDD, particularly
in relation to the Kyoto Protocol and the voluntary carbon market. It identifies
possible opportunities for the Northern Territory of Australia to take advantage of
developing markets. Unfortunately, one of the opportunities has just been missed.

REDD, LULUCF and Kyoto

Out with the bath water

Reduced emissions from deforestation and degradation is part of the land-use, land-
use Change and forestry (LULUCF) provisions of the United Nations Framework
Convention on Climate Change (UNFCCC). REDD gained prominence at the 2005
Conference of Parties of the UNFCCC when the governments of Papua New
Guinea and Costa Rica asked that it be considered for inclusion in the Kyoto
Protocol in exchange for equal participation within global markets (United Nations
Framework Convention on Climate Change 2005). Both countries, and many of
those who supported the proposal, wished to develop the capacity to save their
remaining stands of rainforest before they were felled by putting a value on at least
one of their ecosystem services.

Forests, and sustainable landuse management generally, provide essential
ecosystem services to humanity such as food, shelter, water quality, the diversity of
life on earth, and a livable climate. These are additional to the services forests
provide as carbon sinks - a fact underscored by the UNFCCC, which emphasises
the role of the Earth’s natural ecosystems in regulating climate. For instance, rainforests drive regional climate and influence global climate. Deforestation-driven reductions in rainfall in the Amazon, for instance, have affected the Brazilian grain belt, and were probably a factor in the crippling drought and ensuing energy crisis of 2003 when the hydroelectric reservoirs dried up (Nepstad et al. 2007). Deforestation can result in irreversible and rapid ecosystem regime shift from forest to savannah, and savannah to shrub-land. Together with poor agricultural practices, this can result in eutrophication, a decline in fisheries, salinity, crop failures and loss of biodiversity (Line et al. 2008).

Given that tropical deforestation accounts for at least a quarter of all anthropogenic carbon emissions, advocates of forest conservation could be forgiven for thinking that climate change at last provides an effective motivation to stop deforestation; a solution tied to the broad acceptance that international carbon markets could help drive reduction in deforestation and, thereby, correct the market failure of not properly valuing forests. Increasing recognition of the values of forests comes at a time when global efforts to reduce tropical deforestation over the past several decades - by business-as-usual measures, such as philanthropy, government (e.g. legislation and the creation of national parks) and international development aid - have patently failed. This failure was appreciated as the Kyoto protocol was being negotiated. Yet, almost incomprehensibly, the architects of the Protocol failed to create provisions to reduce emissions sequestered as a result of sustainable land use and forestry activities, apart from strictly defined afforestation and reforestation projects. From a global market perspective, this action suggested forests were worth more dead than alive (Mitchell quoted in Tollefson 2008). Fearnside (2001) lamented that ‘if we wait until after Kyoto Protocol’s first commitment period in 2013 [to discuss the inclusion of forests], there would not be much tropical forest left to save’.
Rainforest Politics

Fearnside (2001) and Laurence (2007) provide convincing commentary that, instead of there being any objective scientific reason for exclusion, deforestation was excluded for political reason. In particular, the Europeans objected to the possibility that the United States and other wealthy countries, including Australia, could ‘buy their way out’ via investment in avoided deforestation and sustainable land management and, thus make no real effort to reduce their energy emissions. This sentiment was not helped by the actions of the US trying to claim credits for a huge tranche of business-as-usual domestic forest activities in 2000 when the role of forests under Kyoto was being discussed at the sixth Conference of the Parties (COP-6) in The Hague.

Brazil, represented by the Brazilian Foreign Ministry and with 40% of the world’s remaining tropical rainforest, added to the general confusion by coming out against protecting forests, mainly because of national sovereignty issues and the fear that environmental protection would be used as an excuse to ‘internationalize’ the Amazon. Fearnside (2001) records, however, that the Brazilian Foreign Ministry’s view was not shared by the governors of the Amazonian states, Brazil’s scientific community, the Minister of Environment and most Brazilian environment groups who had ‘been living at the front lines of an environment battle that gives them much better credentials than anyone in European NGOs’.

The dissembling nature of arguments used by European countries and NGOs such as Greenpeace and WWF that their concern was for the veracity of scientific underpinnings of climate change was emphasized by the fact that, outside the context of the Kyoto Protocol and the UNFCCC, Germany, France and the UK were key players in drafting the G-7 Pilot Program to Conserve the Brazilian Rainforest (Fearnside 2001). This had an overall objective of reducing the contribution of Brazilian rainforests to global carbon emissions. Since Kyoto, however, these
countries opposed assigning any value to avoided deforestation based on notions of permanency and certainty; being notions not as strictly applied to other Kyoto areas, and notions that deny the importance of maintaining carbon in forests even if uncertain and impermanent. While permanence, certainty and the construction of baselines are not easy, they are also not impossible (as discussed below) and not inherently different from problems in the energy sector.

If the global figures for deforestation can be used as an indicator, about 130 million hectares (using conservative figures from the Food and Agriculture Organisation of the United Nations, 2006) have been destroyed since the Kyoto protocol was first signed. Excluding forests can only be said to have added to the very certain, permanent and massive losses of biodiversity and ecosystem services in exchange for little, if any, gain for climate and no influence whatsoever on US consumption patterns. The figure of 130 million hectares also does not include increases in the area of degraded forest, which is about 25% more (derived from figures in Markku et al. 2007). Ironically, one of the main factors driving deforestation today is European demand for biofuel which releases 17-420 times more CO₂ than the annual GHG reductions that these biofuels would provide by displacing fossil fuels (Fargione et al. 2008).

Attitudes towards REDD are as confusing now as they were in 2001. At the December 2007 COP13 meeting in Bali, rainforest nations finally thought they had found a place at the negotiating table and an acknowledgement that deforestation should be part of future global warming treaty. But little more than a month later the European Commission released a proposal that would once again ban forestry credits of any kind from the world’s carbon market until 2020. The Commission’s view was once again that forestry credits would not be real GHGEs reductions; and since deforestation accounts for 5-6 Gt of (presumably real) CO₂ annually compared with 2 Gt in the entire European trading scheme, the market would be flooded
(Tollefson 2008). This, however, assumes that all the forestry credits would come on-line simultaneously, an event that is highly unlikely. As it is, forestry could theoretically take up no more of the market that the 25% of anthropogenic emissions it currently causes. Nevertheless, the Commission suggests channeling a portion of the proceeds from the carbon market into reforestation programs - as a bureaucratic business-as-usual initiative cutting out real involvement by developing countries.

Apart from the European rainforest politics, criticism of forestry-related carbon offsets mainly hinges on proof that the carbon that is sequestered and sold is real, permanent and verifiable (Smith 2007). In Australia Hamilton (2008) also states that reforestation will let polluters off the hook ‘because growing forests can at best do no more than delay the need to cut carbon emissions’. Downie (2007) warns against offsets, particularly those associated with forestry projects (and presumably sustainable land use) because ‘sooner or later the forest will be felled, burned or destroyed’. According to Downie (2007), an Australian scheme should be integrated with the European Union’s scheme which excludes forestry projects entirely.

Such simplistic views deny the complexity of the issue, not least being the different circumstances of different countries and regions. These need to be acknowledged so that they can all become part of a global solution. In the Australasian region, Indonesia is the third largest emitter due to deforestation, and New Guinea has emissions as high as Australia due to land use change. It is time to move beyond Kyoto, a sentiment also reflected by Garnaut (2008).

Excluding forestry and sustainable landuse in the Kyoto Protocol has also denied public and political willingness to pay for deforestation and reforestation. Most importantly, it has denied the fact that time itself has value in mitigating climate change, so that postponing global warming with its droughts, floods and other disasters represents a permanent prevention of all the damages that would have
occurred during even a temporary period (Fearnside 2001). In northern Australia such losses might include a 40% reduction in livestock, a 50% decrease in ‘generic timber yield’, bleaching of the Great Barrier Reef and loss of 80% of Kakadu’s wetlands (Garnaut, 2008).

Measures to correct market failures through innovation, research and development, including the valuation of forests and sustainable land use practices, would be more sensible and effective than rejecting whole sectors. Garnaut (2008) recognised that in Australia there is considerable potential for sequestering large amounts of carbon through changes in land, forestry and agricultural practices, and that incentives to realize this potential are in place as early as possible in the life of any emissions trading scheme.

Despite the attitude of the European Union, the UNFCCC continues to discuss inclusion of measures aiming to reduce deforestation. A recent meeting has sought to iron out methodological issues relating to REDD in developing countries (United Nations Framework Convention on Climate Change 2008c).

REDD in Theory and Practice

Principles
GHGE reductions from LULUCF, and latterly REDD, are a way of curbing deforestation using carbon trading, with prospects of larger financial resources and the ability to determine new ways of reducing tropical deforestation. Largely because rainforest politics failed to include such provisions in the Kyoto Protocol, the worldwide demand for forestry related offsets has been responded to by the global voluntary market. Since the public and business remain keen to support LULUCF activities, the voluntary carbon market is burgeoning. It is also evolving rapidly, innovatively branching out to incorporate, amongst other things, carbon mitigation and sequestration areas not covered under the Protocol.
Hamilton et al. (2008) estimate that, in 2007, the over-the-counter market as transacted business to business at least tripled to 42.1 million tonnes of CO$_2$ equivalent. The transactions on the voluntary Chicago Stock Exchange more than doubled in the same period. These figures come on top of a doubling of the market in 2006. The global voluntary markets were worth a total of US$331 million in 2007, about 240% greater than the 2006 market value (Hamilton et al. 2007). Some 18% of this voluntary market is in the broad category of forestry. Businesses are the largest buyers, with corporate social responsibility being their main motivation; essentially to ‘walk the talk’ in terms of environmental stewardship.

The voluntary market is a significant player in exploring, piloting and shaping future carbon markets including value-added carbon such as carbon with biodiversity values (or biocarbon). The highest prices for carbon in the voluntary market are paid for projects with strong quality and verifiability attributes, such as the more publicly visible forestry projects which also involve long term sustainability.

There is a growing consensus that methodological issues are no longer major obstacles for LULUCF, and that best practice against global standards is emerging. An example in northern Australia is the Degree Celsius Wet Tropics Pilot Project joint venture, which is currently carrying out a regional verification case for LULUCF against the global Climate, Community and Biodiversity Standards (CCB). These standards can be applied to both Kyoto compliant afforestation and reforestation cases, and also to non-Kyoto compliant LULUCF as long as they generate additional community and biodiversity benefits as well as robust carbon.

The Degree Celsius initiative is currently working in the substantially cleared and relatively degraded catchments of the Great Barrier Reef. It is, perversely, the relatively degraded nature of these catchments that make such a case possible because LULUCF rewards regions or countries that are clearing their forests, and
punishes those who have been good land managers. Targets under Kyoto, and any
future REDD are based on baselines of past pollution levels and deforestation
levels. Accordingly, again perversely, REDD could be an incentive to deforest as
quickly as possible.

Australia has used the same logic in setting its Kyoto target. The national
government relied on the decrease in land clearing from a 1990 baseline – which
was a particularly high clearing year - to justify its claim that Australia remains on
track to meet its Kyoto targets. Indeed it was Australia, which by threatening not to
sign the Protocol, managed to persuade other Parties to endorse an amendment to
Article 3.7. This Article basically prescribed that countries for whom LULUCF were
a net source in 1990 were to include baseline emissions by sources, minus all
removals by sinks from land use change (Macintosh 2007).

Since finally signing up, Australia has been greatly aided in its capacity to participate
in Kyoto protocol by the development of the National Carbon Accounting System
(NCAS). This has allowed the creation of a sound baseline, which was one of the
main methodological stumbling blocks for LULUCF (including REDD) projects being
recognised under the Kyoto Protocol. The NCAS was initiated by the Australian
government in response to the reporting and compliance requirements of the
UNFCCC’s National Greenhouse Gas Inventory (NGGI). As part of these
requirements, Australia produced inventories of LULUCF annually from a 1990
baseline year. Such is the quality of the Australian system that a partnership was
recently formed with the Clinton Climate Initiative to adapt NCAS for developing
countries (Wong 2008).

For the voluntary carbon markets, an additional set of standards has been
developed that take into account a range of factors. For instance the broader CCB
Standards require 23 criteria to be evaluated. Fifteen of these are required criteria
and eight are optional ‘point scoring’ criteria leading to silver and gold levels of validation. The criteria are divided into four categories: general, climate, community and biodiversity. The evaluation requires exhaustive analysis of business-as-usual scenarios of not only carbon, but also of biodiversity and socio-economic variables against those predicted by the project being evaluated. It requires the use of rigorous, IPCC-approved methodologies for measuring different carbon pools; the modeling and mitigation strategies of any leakage such as offsite climate impacts as a result of the project; and rigorous monitoring plans for climate, biodiversity and the community. There should be no land tenure disputes in the project area, and the project must be based on a solid legal framework and satisfy applicable planning and regulatory requirements.

The situation in Australia’s Northern Territory

In terms of REDD and LULUCF schemes, the Northern Territory is in a bind. In many ways, it is at least as undeveloped as undeveloped countries. Very little forest was cleared before 1990, so there is little scope for reforestation of cleared land. Also, much of that which was cleared is not available for reforestation. Pastoral Leases, which cover about 50% of the Territory, are strictly leases to graze cattle and to develop the lease for that purpose alone. The Crown asserts ownership of all timber on leasehold land and, in doing so, makes no provision for differentiating natural from planted timber; accordingly there is no incentive for leaseholders to plant trees on leasehold land as a means of claiming carbon credits. In addition, the small amount of freehold land which was cleared before 1990, and is thus eligible under the Kyoto Protocol for carbon credits for reforestation, would have difficulty meeting current guidelines. While forestry is being practiced at an increasing rate, the plan in most cases is to harvest trees after 20 years, thus violating the provisions for permanency (Whitbread et al. 2003). Notwithstanding this, possible
opportunities have existed on Aboriginal freehold land on the Tiwi Islands and in the Lower Daly basin.

From the 1960s to the 1980s, the Australian and Northern Territory governments converted nearly 5,000 ha of native forest on Melville Island in the Tiwis to a pine plantation. After ownership of these forests were transferred to the Tiwi islanders, the Tiwi Land Council and the forestry company Sylvatech Limited jointly sought and obtained government approval under the Environment Protection and Biodiversity Act 1999 to clear fell 31,200 ha of native vegetation to establish plantations of the fast-growing Acacia mangium. By the end of 2007, some 27,000 ha had been converted to plantations by Sylvatech or by its successor Great Southern Plantations. Thus in 2008, there were another 4200 ha that could be cleared under approvals current at the time.

Great Southern Plantations are one of the largest forestry and agricultural investment managers in Australia managing $1.9 billion of managed investments. With 240,000 ha of forestry land in its national estate, it is Australia’s leading plantation manager. Its latest annual report (Great Southern Plantations 2007) lists among its key achievements the ‘record planting of 9,563 ha of Acacia mangium on Melville Island’. It employs 18 Tiwi Islanders full-time, and funds a further 10 Tiwi people as land and sea rangers. Overall, the forestry operations contributes about A$1 million to the community through land lease payments, forestry income and employment (Great Southern Plantations 2008). The Managing Director talks about environmental and climate benefits of its plantations thus (Great Southern Plantations 2007):

‘Forestry has….become very much a ‘front and centre’ issue in recent times with the focus on climate change and the environment. At the recent United Nations conference in Bali, the major outcomes were the development of a road map for a
climate change agreement by 2009, and increased pressure to halt deforestation, particular in developing countries. In this post-Kyoto era, forestry is rightly being recognised as of increasing importance, and as a company that manages in excess of 275,000 ha of forestry land, Great Southern is very well positioned to take advantage of the opportunities this brings.'

In 2008, one of these opportunities could have been for Great Southern Plantations, and possibly also the Tiwi Land Council, to have used a REDD scheme to gain returns from the remaining uncleared forest, particularly the 4,200 ha for which permits to clear are secured. REDD is fundamentally about shifting the balance away from economic incentives that favour deforestation or forest conversion by providing a market that competitively values existing forests. Basic calculations for money earned via a REDD scheme on the Tiwi Islands suggest that there is in fact greater value in not clearing the forest; see box below.

<table>
<thead>
<tr>
<th>Possible returns on a REDD scheme in the Tiwi Islands</th>
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<tbody>
<tr>
<td>4,200 ha x 180 tons* of C/ha = 756,000 C</td>
</tr>
<tr>
<td>756,000 x 3.67(^1) = 2,774,520 t CO(_2)-e</td>
</tr>
<tr>
<td>2,774,520 x ($19-$40(^1) or more/t) = $52,715,880 - $110,980,800(^3)</td>
</tr>
</tbody>
</table>

*Estimated using IPCC default values
\(^1\)Conversion to CO\(_2\)-e
\(^1\)These figures are indicative with the lower of them being based on the precedent set by the May 2008 deal between AGL and Westpac, and the higher one being the current trading price for carbon on the European Climate Exchange.

\(^3\)Investment averages over the past 10 years have shown that a 13% return in Australian shares is an expected average so that investing could result in an annual return of $6,853,064 - $14,427,504 without touching the Capital (Russell-ASX 2008).

In the voluntary market prices of US$50/t are being obtained for verified, forestry related carbon offsets with environmental and social benefits, so the figures presented are reasonable if not conservative. This is particularly so since major
technical issues facing REDD in developing countries - secure tenure, leakage, the
displacement of forestry to another area - are not a problem in Australia. Nor are
the monitoring or the setting of a national baseline, since NCAS as a world-class
accounting platform is already in place.

The alternative to running a REDD scheme in the voluntary market under a global
would have required transparency in a number of crucial areas including in the
calculation of GHGEs and reductions, in socio-economic and biodiversity
accounting, and in monitoring and auditing. Accordingly, it would appear to have
been better overall for Great Southern Plantations, with the support of the Tiwi Land
Council, to have offered REDD credits to its investors which properly accounted for
the value of the forests to the Tiwi people as owners and expert land managers.

In the lower Daly River basin, the situation is more complex than on the Tiwi Islands.
Here, a moratorium on all clearing on both freehold and leasehold land was
declared in 2004 and will remain until the Northern Territory government is satisfied
that there were unlikely to be adverse effects, particularly on the flow of water down
the Daly River. Thus, no avoided deforestation credits are presently available
because no deforestation is permitted in the first place.

There is now a danger that, should the moratorium be lifted, there will be numerous
applications for permits to clear freehold land, including land for which there is no
intention to clear, in the hope of obtaining either the right to clear immediately, or, in
essence, a right-related recognition of carbon credits for possible future sale.

In the circumstances, it would seem sensible for the government to acknowledge
that the continued ban on clearance will not only avoid GHGEs which could in future
be available as saleable carbon credits, but also enable the long-term provision of
fire management services to be negotiated with Indigenous owners along the lines
of the West Arnhem Land Fire Abatement project addressed elsewhere in this
special edition. If the government understood this and were prepared to accept the challenges involved, an appropriate set of institutional mechanisms would need to be designed and put in place to facilitate and regulate the arrangements.

**Concluding Comments**

REDD schemes, and LULUCF arrangements generally, remain the subject of vigorous debate, with political argument undermining the potential benefits of both forests and the people and countries who own and are responsible for them. The retention of forests and their effective fire management as bases of sensible REDD initiatives ought to be seriously addressed worldwide as important contributors to the mitigation of climate change. This concerns all forests and related land as a matter of public interest, locally, nationally and internationally, whatever the ownership and management arrangements.
Chapter Four

Catching the baby: accounting for biodiversity and the ecosystem sector in emissions trading
Chapter Four

Catching the baby: accounting for biodiversity and the ecosystem sector in emissions trading


Context

This chapter clarifies the link between the ecosystem sector and biological diversity in the context of their contribution and importance to climate change policy. Biodiversity is a necessary component of functioning ecosystems and therefore the ecosystem sector, and linked to economic production. As indicated in Chapter Three, the Kyoto Protocol of the United Nations Framework Convention on Climate Change forfeited the potential of the ecosystem sector. This forfeiture decoupled ecosystems and their biodiversity from climate change considerations resulting in discordant policy.

This chapter demonstrates how these discordant policy outcomes affected a landscape scale pilot study in the Wet Tropics Region in north-eastern Australia, and describes how Australia’s regional natural resource management (NRM) framework could be used to aggregate multiple small projects across the ecosystem sector for the carbon market; an approach that also delivers sustainable agriculture, water quality and community benefits across the landscape.
Abstract

The agriculture, forestry and other land-use sector is a crucial sector, second only to the energy sector, in fighting climate change, and provides an important greenhouse gas abatement opportunity for the world. Recently released figures for Australia, for example, suggest that agriculture, forestry and other land-uses, which depend on healthy functioning ecosystems, could abate as much as three quarters of the country’s emissions. The United Nations Framework Convention on Climate Change was concerned primarily with ecosystems and humankind, but the Kyoto Protocol of the Convention forfeited the potential of using agriculture, forestry and other land-uses for global climate mitigation. This had the effect of de-coupling biodiversity and ecosystems from carbon pollution reduction and climate change considerations. The Australian Carbon Pollution Reduction Scheme, one of the first emission trading schemes in the world to follow Kyoto ‘rules’, excludes the agriculture, forestry and other land-use sector, apart from plantation reforestation, potentially creating perverse incentives that themselves can turn into threatening ecological processes. We use Australia and its emerging emissions trading scheme as a case study of the potential effects of this de-coupling, and demonstrate the potential impacts on a landscape scale regional greenhouse gas abatement and carbon sequestration project.

Introduction

The services provided by healthy, biodiverse ecosystems are the foundation for human well-being (Secretariat of the Convention on Biological Diversity 2006). Biodiversity is a necessary component of functioning ecosystems, which in turn provide essential services to humanity such as food, shelter, water quality, the diversity of life and a climate that nurtures life (Millennium Ecosystem Assessment...
The relationship between economic production and biodiversity conservation is largely inseparable (Steffen et al. 2009) so that any risks to ecosystems and biodiversity are also investment risks to the global finance sector (Biodiversity & Ecosystem Services Work Stream 2008). Without early, vigorous and ongoing climate change mitigation measures, there is a high probability of more severe climate change and the associated risk of much higher future rates of biodiversity loss than those already experienced (Steffen et al. 2009).

It is not possible to avoid dangerous climate change without taking into account the natural and agricultural ecosystems of the planet: each year, tropical forests draw down 15% of global emissions (Trumper et al. 2009), while deforestation and agricultural emissions are responsible for over 20% of global emissions (McKinsey & Company 2009). Protecting and manipulating biodiversity also offers an opportunity to influence positively carbon sequestration in forested ecosystems (Díaz et al. 2009). Agriculture could offset from 5 to 14% of global annual carbon dioxide emissions, with costs ranging between US$20 to US$100 per tonne of carbon dioxide equivalent (CO₂-e), from improved cropland and grazing land management, and restoration of degraded lands and cultivated organic soils (Smith et al. 2008). This compares favourably with an estimated cost of US$730 per tonne of CO₂-e for abating and mitigating emissions from industrial projects, amounting to about US$20 trillion in total (Hansen et al. 2008).

The agriculture, forestry and other land-use sector (Intergovernmental Panel on Climate Change 2006) provides an abatement opportunity, and is second only to the energy sector in the potential to mitigate greenhouse gas emissions (McKinsey & Company 2009). Agriculture, forestry and other land-use comprise a third of the global abatement opportunity and about half the cost-effective mitigation available between now and 2030 (McKinsey & Company 2009). In the context of current policy on climate change and greenhouse gas abatement, however, it is difficult to
provide an economic value to this sector. One reason is that biodiversity, and hence ecosystems (natural, agricultural and forest), and climate change mitigation are rarely considered together (Díaz et al. 2009). Here, we consider this discordance, examine its possible outcomes in the case of Australia’s emerging emissions trading scheme, and provide policy recommendations.

**Ecosystems and Kyoto**

Concerns about the increasing loss of biodiversity globally motivated the Convention on Biological Diversity which, together with the United Nations Framework Convention on Climate Change, was adopted at the United Nations Conference on Environment and Development in Rio de Janeiro in 1992. Though the two conventions are intrinsically linked (Intergovernmental Panel on Climate Change 2004), integration of the conventions remains in its formative stages; it was not until 2003 that a formal report on the inter-linkages between biodiversity and climate change within the framework of the Convention on Biological Diversity was forthcoming (Secretariat of the Convention on Biological Diversity 2006). In 2008, a decision at the ninth meeting of the Conference of the Parties to the Convention on Biodiversity stressed the importance of the role of biodiversity in climate mitigation and adaptation activities, and resulted in a second formal report (Secretariat of the Convention on Biological Diversity 2009).

The Convention on Climate Change, under which the Kyoto Protocol sits, is concerned primarily with the adverse effects of anthropogenic climate change on both natural ecosystems and humankind (United Nations 1992). As well as ensuring that food production and economic development can “proceed in a sustainable manner”, the Objective, at Article 2 of the Convention, is to ensure stabilization of greenhouse gases in the atmosphere at a concentration, and within a
timeframe, “to allow ecosystems to adapt naturally to climate change” (United Nations 1992, p4).

Tropical deforestation, which accounted for most of the agriculture, forestry and other land-use sector’s and around a quarter of all anthropogenic carbon emissions in the 1980s and 1990s (Laurance 2007), is a major focus for global climate mitigation. But negotiations leading to the Convention’s Kyoto Protocol forfeited using the full potential of the agriculture, forestry and other land-use sector to mitigate climate change. Only narrowly defined afforestation (the direct human-induced conversion of land that has not contained a forest for at least 50 years to forested land), and reforestation (the direct human-induced conversion of non-forested land as of 31 December 1989 to forested land) (United Nations Framework Convention on Climate Change 2002) were permitted within the Protocol’s Clean Development Mechanism (Schlamadinger et al. 2007). This new market mechanism, which allows emission-reduction projects in developing countries to earn carbon credits, can be used by industrialized countries to meet part of their emissions reduction targets (Robledo & Blaser 2008). Avoided deforestation was not included in agreements until later, as discussed below.

Most of the resistance to providing incentives for the agriculture, forestry and other land-use sector to manage carbon better is political rather than technical (Havemann 2009), and an analysis of European opposition to forests in the lead up to Kyoto is best explained as taking an opportunistic blow at United States’-led consumption (Fearnside 2001). Political sides were taken in the lead up to the Kyoto Protocol, with the European environment movement broadly ‘against’ the inclusion of forests in the Protocol, while the US environment movement was ‘for’ forests (Fearnside 2001). The debate was, and remains, closely tied to the differing views of the potential of offsets in mitigating climate change. Instead of seeing offsets working together with abatement as a way of driving deeper cuts earlier, the
Europeans objected to the possibility that the United States and other wealthy countries, including Australia, could buy their way out of making cuts by making investments in ecosystems, and thus make no real effort to reduce their energy emissions (Laurance 2007).

The opportunity to use the Kyoto Protocol to correct the failure of not properly valuing forests was lost. Business-as-usual measures such as philanthropy, government action (e.g. legislation and the creation of national parks) and international development aid continue to fail. Since the Kyoto Protocol was signed, about 130 million hectares of forest (mostly rainforest) have been destroyed (FAO 2006). Using conservative figures (FAO 2006) and assuming around 200 t C per ha in these forests (Ramankutty et al. 2007), this amounts to about 117.5 Gt CO₂-e, (about 195 times Australia’s yearly CO₂-e emissions). Excluding forests from the Kyoto equations has instead added to the certain, permanent and massive loss of biodiversity and ecosystem services in exchange for no gain for climate and no influence whatsoever on US consumption patterns (van Oosterzee & Garnett 2008), effectively throwing the baby out with the bathwater by discarding the very thing that it was essential to keep.

Largely as a result of this continuing loss of forest and climate change mitigation potential, tropical deforestation gained attention again at the 2005 Conference of the Parties to the Convention on Climate Change when the governments of Papua New Guinea and Costa Rica, supported by eight other parties, proposed a mechanism of financially compensating countries for reducing emissions from deforestation and land degradation (REDD) (Parker et al. 2009). At the thirteenth session of the Conference of the Parties in Bali in 2007, a decision was made to consider and stimulate action on REDD (United Nations Framework Convention on Climate Change 2008b) in the lead up to the fifteenth Conference of the Parties in Copenhagen in December 2009, where a framework for climate change mitigation
beyond 2012 is to be negotiated. More recently a plus symbol (“+”) has been added, indicating that REDD+ projects consider conservation with enhancement of carbon stocks. This draws attention to a future REDD mechanism which would recognise that REDD+ simultaneously addresses conserving biodiversity, ecosystem services and climate change (Parker et al. 2009).

While REDD has come to focus on developing countries, deforestation continues in industrialized countries such as Australia (Macintosh 2007), and in other biomes such as the boreal forests (Bradshaw et al. 2009).

**Decoupling biodiversity from climate change - the Australian case**

Excluding the agriculture, forestry and other land-use sector from the Kyoto Protocol has decoupled ecosystems and their biodiversity from carbon pollution reduction and climate change considerations, leading to some discordant policy. Here we focus on Australia and its emerging emissions trading scheme, the Carbon Pollution Reduction Scheme, as a case in point. If passed through the Australian Parliament before the 2009 Copenhagen Conference of the Parties, Australia will be the first country to have implemented an emissions trading scheme using the framework of the Kyoto Protocol. Other countries which are using the Kyoto Protocol as a framework to develop emissions trading schemes, albeit in different stages of development, include Canada, Japan and New Zealand (Garnaut 2008).

The main predicted effects of climate change in Australia include sea level rise at the upper end of forecast projections of about 0.8m by 2100, recurring severe droughts and continuing drying trends in major parts of the continent, increases in heat waves, floods and bushfires, and increasingly acidic and hotter oceans (Steffen et al. 2009). Impacts on biodiversity from these effects are likely to include changes in migratory patterns of species, interaction with other disturbance regimes such as
fire and grazing, resulting in increasing woody plant density over large areas, and disruption of forest composition due to fragmentation, resulting in reduced species dispersal (Gitay et al. 2002).

In Australia, deforestation accounted for 129 Mt CO$_2$-e, or 23% of Australia’s total emissions in the 1990 base year (Macintosh 2007). In 1999, Australia was the fifth highest deforester in the world (Steffen et al. 2009). Australian Treasury figures show land-use change (clearing of forests and woodlands) still accounts for 74 Mt CO$_2$-e per annum, equivalent to 13% of Australia’s emissions using 2005 figures, and agriculture currently accounts for 15% of Australia’s total emissions (Australian Government 2008). Despite these high figures, avoidance of deforestation and land degradation (REDD activities) and avoided emissions and improved sequestration from agriculture cannot be traded within the current model of the emissions trading scheme because it follows Kyoto ‘rules’ (Australian Government 2008) which specifically exclude the agriculture, forestry and other land-use sector. In Australia, only reforestation will be included as an allowable activity for the issue of carbon credits.

Given the high contribution to total emissions, the agriculture, forestry and other land-use sector could potentially transform Australia’s mitigation effort and influence global mitigation effort (Garnaut 2008). A recent Commonwealth Scientific and Industrial Research Organisation study (Eady et al. 2009), which assessed greenhouse gas abatement potential through change in rural land-use, demonstrated for the state of Queensland that the overall attainable greenhouse gas abatement was 140 Mt CO$_2$-e per year, or 77% of that state’s emissions. National estimates, where available, suggest a similar outcome (Eady et al. 2009).

While the abatement potential from activities such as reforestation is high, caution is required in how this is implemented, as mitigation efforts could themselves turn into
threatening ecological processes (Steffen et al. 2009). The draft Carbon Pollution Reduction Scheme will allow reforestation in the form of the planting of monoculture or mixed plantations of any species (Commonwealth of Australia 2009) for carbon or for biofuels, for instance, which could lead towards highly simplified industrial landscapes with low biodiversity when compared with native mixed plantations (Keenan et al. 1997, Hartley 2002, Sayer et al. 2004, Marcot 2007). Such industrial landscapes would have deleterious outcomes for biodiversity because they would not provide the space and opportunities for natural ecosystems to self-adapt and reorganize, and would deny the maintenance of fundamental ecosystem processes that underpin vital ecosystem services (Steffen et al. 2009).

One of the challenges to incorporating the agriculture, forestry and other land-use sector under the Convention on Climate Change and its Kyoto Protocol is the lack of regionally differentiated management approaches, since climate change causes regionally differentiated impacts that require local knowledge to manage effectively (Steffen et al. 2009). The response to climate change also requires regionally-specific technical solutions and management approaches, and incurs regionally different transaction costs (Robledo & Blaser 2008).

Regional approaches to natural resource management have been evolving across the globe for several decades, and are appropriate to effective landscape-scale management of natural resources (Dale et al. 2008). A region in the Australian context refers to a landscape-scale area, such as described in the Interim Biogeographic Regionalization of Australia (Commonwealth of Australia 2005), and used to define Natural Resource Management regions. By 2000, Australia had an emerging regionalism of international significance (Dale & Bellamy 1998), and has increased its capacity for regional natural resource management through its regional natural resource planning and management system (Dale et al. 2008).
This institutional framework could be adapted for managing the landscape-scale impacts of climate change, including the management of the co-benefits of carbon sequestration. Natural resource management carried out at the regional scale through Natural Resource Management Plans already contributes to sustainable economic development by integrating economic, social and environmental policies across regions through on-ground implementation (Williams et al. 2005). Regional Natural Resource Management is already an important institutional response to managing the threats to Australia’s biodiversity (Steffen et al. 2009). A key finding of the Assessment of Australia’s Terrestrial Biodiversity 2008 (Department of the Environment Water Heritage and the Arts 2009) is that the strengthening and consolidation of the regional delivery model for Natural Resource Management has assisted delivery of biodiversity outcomes. Natural Resource Management regions provide a geographical basis for the assessment of biodiversity and the consequent reporting on state and trend (Wentworth Group 2009) including in the Australian State of the Environment Reports (Beeton et al. 2006).

A pilot scheme has been developed for the Wet Tropics Region in north-eastern Australia which demonstrates how the Natural Resource Management activities of Australia’s existing regional Natural Resource Management bodies can be aggregated for both regional and larger scale delivery of climate mitigation and abatement (Fig 1).
Figure 1 Australian Wet Tropics Natural Resource Management Region showing locations of current carbon sequestration projects.
The Degree Celsius Wet Tropics Biocarbon Sequestration and Abatement Project aggregates multiple ‘small-scale’ sub-projects which are too small to be profitable by themselves in the carbon market, considering the transaction costs. Project activities include avoided deforestation, avoided degradation, reforestation and agricultural land management through fertilizer reduction. Aggregating carbon abatement and sequestration activities using native species also improves biodiversity and water quality outcomes across the region. By using the existing accredited regional Natural Resource Management plan as the framework for the aggregation of carbon sequestration activities for the market, the Wet Tropics Project could deliver complementary biodiversity, sustainable agriculture, water quality and community benefits (Wentworth Group 2009). The Project used existing methodologies of the Clean Development Mechanism of the United Nations Framework Convention on Climate Change (e.g. United Nations Framework Convention on Climate Change 2008a) and of the Intergovernmental Panel on Climate Change (2006). The nitrous oxide emission calculation guidelines of the Inter-Governmental Panel on Climate Change (Volume 4, Intergovernmental Panel on Climate Change 2006) were used to calculate the abatement effect of reduced use of fertilizers on agricultural land. The National Carbon Accounting Toolbox FullCAM program (Department of the Environment and Heritage 2005; Richards & Evans 2009) was used to model reforestation and avoided deforestation and forest degradation activities.

In Australia, investment in natural resources is at least two orders of magnitude smaller than that in physical capital, partly due to the inability to establish markets (Steffen et al. 2009). Currently, regional Natural Resource Management bodies are supported to invest in actions that uphold national and state governments’ priorities, but they lack resources to implement initiatives and follow them through to completion. They also are subject to short-term, erratic funding cycles due to the
shifting politics of both state and federal governments. This constrains actions that help build resilient regional landscapes (Robins & Dovers 2007). The benefits from aggregating multiple Natural Resource Management activities of landholders and trading the resultant credits in carbon markets could be a strong driver of investment in natural resource management groups on a consistent basis.

Activities conducted by landholders could potentially earn money for both the Natural Resource Management groups and for the landholders and contribute to reducing deforestation and degradation, increasing reforestation and improving agricultural practices. The on-going deforestation rate of both remnant and non-remnant regrowth forests in the Wet Tropics is between 990 and 1700 ha per year, equivalent to a release of at least $4.5 \times 10^5$ t CO$_2$-e per year. By putting a carbon monetary value on these non-remnant, unprotected forests, farmers would have an incentive to retain them and thereby reduce the emissions caused by clearing them. In the Wet Tropics, forest practices such as logging are degrading biodiverse remnant forests. Degradation in the form of logging of remnant forests for timber is also an on-going practice and, based on recent trends in submitting notices of intention to log (unpublished data from Dept of Environment and Resource Management database sources, first half 2009), the potential savings in avoided degradation in the Wet Tropics could be over $1.2 \times 10^6$ t CO$_2$-e per year, if landholders who intend to log choose to retain their trees to sell the carbon sequestration benefits. By contrast, historic data show that reforestation using environmental plantings is occurring at about 40 ha per year, which is small compared to the area being cleared (at least 990 ha per year). This is less than 1% of the potential sequestration benefits of avoided deforestation and degradation, but with financial incentives to plant, the reforestation rates would increase.

Sugarcane plantations cover over 180,000 ha of the Wet Tropics region (McDonald & Weston 2004), and lie in the catchment of the Great Barrier Reef. The average
application of nitrogenous fertilizers to sugarcane was estimated to be 200 kg per hectare. The emissions from these fertilizers averaged $5 \times 10^5$ t CO$_2$-e per year, averaged over ten years of records (N. Preece, unpublished data – see Appendix to Chapter Four below). The Wet Tropics carbon project would help to reduce this application rate by 20% or more by encouraging farmers to trade the difference in emissions. Landholders in the region have shown strong interest in measures to reduce their fertilizer use and trade the reduced resultant emissions.

The Wet Tropics Project, when it was being planned in 2006 and 2007 and until the introduction of the Carbon Pollution Reduction Scheme Bill, was intended to meet all the requirements of the Voluntary Carbon Standard (Voluntary Carbon Standard Association 2007) for sale of carbon credits on the international carbon trading market. The Carbon Pollution Reduction Scheme, in the form it had when we reviewed it, would have the effect of disintegrating the Wet Tropics Project’s coherent approach by replacing it with an assortment of disconnected approaches, which mostly ignore the potential of the agriculture, forestry and other land-use sector in carbon mitigation. Only reforestation is included under the proposed Scheme. Avoided deforestation and degradation are treated differently. While both are excluded from the Scheme, deforestation is counted as part of Australia’s Kyoto accounts and cannot be traded in the international carbon markets. Avoided degradation is not counted toward Australia’s Kyoto accounts and could be traded in international carbon markets. Agriculture, including offsets such as fertilizer reduction, is not to be considered until 2013 for possible inclusion in the CPRS in 2015.

Contradicting the trends at home, Australia has proposed to the United Nations Framework Convention on Climate Change a forest carbon market mechanism for developing countries, which would include REDD, reforestation and afforestation. The mechanism is designed to ensure “environmental integrity, and to not create
perverse outcomes, including for biodiversity” (Australian Government 2009), something Australia has not considered for its own emissions trading scheme.

Conclusions

Excluding ecosystems from the Kyoto Protocol decoupled ecosystems and biodiversity from carbon and climate change considerations, and ignored the substantial synergies that exist between them. The integration of biodiversity into climate mitigation and adaptation activities including emissions trading schemes needs to occur rapidly in order to reduce the continuing destruction of rainforests, which has added to certain, permanent loss of biodiversity.

Landscape-scale management and institutional frameworks for natural resource management already exist. These could also become frameworks for managing carbon abatement with simultaneous biodiversity and water quality services. The agriculture, forestry and other land use sector could be integrated into such frameworks using accepted international methodologies for measuring carbon benefits.
Appendix to Chapter Four

Published as additional supporting information found in the online version of the article.

Nitrous Oxide from Sugarcane Crops Methods for calculation


1. Introduction

This analysis addresses the losses of nitrous oxide from the nitrification and denitrification of applied synthetic fertilizers and other practices, leading to volatilization of N₂O from the soil. Sources of N₂O emissions include synthetic fertilizers, and other direct emissions, such as organic fertilizers, applied urine and dung, crop residue, added soil organic matter, and leaching of nitrogen from the soil (Intergovernmental Panel on Climate Change 2006, p4). It documents the methods for calculating the gains made by reducing fertilizer application and therefore nitrous oxide (N₂O) emissions from sugarcane farming in the Wet Tropics region of Far North Queensland. It relies on the following methodologies:


2. Methods

2.1 Calculating emissions - IPCC N₂O Tier 1 default and Tier 2 values

The project has considered the choice of method for calculating losses of N₂O from sugarcane crop soils. Three choices are available, based on the IPCC Tier Structure. Definitions of the Tier structure are provided below in box 1.

<table>
<thead>
<tr>
<th>Box 1 - Framework of tier structure in the good practice guidance (source: Table 3.1.1 from IPCC Good Practice Guideline for LULUCF, 2003)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>The Tier 1 approach employs the basic method provided in the IPCC Guidelines (Workbook) and the default emission factors provided in the IPCC Guidelines (Workbook and Reference Manual) with updates in this chapter of the report. For some land uses and pools that were only mentioned in the IPCC Guidelines (i.e., the default was an assumed zero emissions or removals), updates are included in this report if new scientific information is available. Tier 1 methodologies usually use activity data that are spatially coarse, such as nationally or globally available estimates of deforestation rates, agricultural production statistics, and global land cover maps.</strong></td>
</tr>
<tr>
<td><strong>Tier 2 can use the same methodological approach as Tier 1 but applies emission factors and activity data which are defined by the country for the most important land uses/activities. Tier 2 can also apply stock change methodologies based on country-specific data. Country-defined emission factors/activity data are more appropriate for the climatic regions and land use systems in that country. Higher resolution activity data are typically used in Tier 2 to</strong></td>
</tr>
</tbody>
</table>
correspond with country-defined coefficients for specific regions and specialised land-use categories.

Direct emissions from N fertilizer application can be calculated from either IPCC 2006 default (Tier 1) values or from Australian Tier 2 values.

Tier 1 default values for direct N\textsubscript{2}O emissions from managed soils reported in IPCC 2006 Guidelines for NGGI Volume 4 AFOLU-Chapter 11, are provided below in Table 1. Values derived from studies in Australia suggest that emissions are higher in Australia, at 0.016 (1.6 kg N\textsubscript{2}O-N (100 kg N))\textsuperscript{-1} (Dalal \textit{et al.} 2003). More recently the National Greenhouse Gas Inventory (NGGI) for Australia has reported emission factor for sugarcane at 0.0125 (1.25 kg N\textsubscript{2}O-N (100 kg N))\textsuperscript{-1} (Department of Climate Change 2008; Table 6.17).

Emission factors for Organic fertilizers were reported in the NGGI for Australia also, and are shown in Table 1 (Department of Climate Change 2008; Table 6.18). The organic fertilizers are referred to as sourced from manure, so the emission factor may not be applicable to non-manure organic fertilizers, such as mill mud and mill ash, which are the residues from sugarcane processing. It is unclear how to account for the different emission factors for synthetic fertilizers and for organic fertilizers in equation 1.

Table 1 Emission Factors to Estimate Direct N\textsubscript{2}O Emissions from Managed Soils

<table>
<thead>
<tr>
<th>Emission factor</th>
<th>Default value</th>
<th>Uncertainty range</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Default EF\textsubscript{1} for N additions from mineral fertilisers, organic amendments and crop residues, and N mineralised from mineral soil as a result of loss of soil carbon (kg N\textsubscript{2}O–N (kg N))\textsuperscript{-1}</td>
<td>0.01</td>
<td>0.003 - 0.03</td>
<td>IPCC 2006 Table 11.1</td>
</tr>
<tr>
<td>Australian EF\textsubscript{1} for N addition - Agriculture \textsuperscript{a}</td>
<td>0.016</td>
<td></td>
<td>Dalal \textit{et al.} 2003</td>
</tr>
<tr>
<td>Australian EF\textsubscript{1} for N addition – Sugarcane</td>
<td>0.0125</td>
<td></td>
<td>DCC 2006 National Inventory Report Vol 1</td>
</tr>
<tr>
<td>Australian NGGI Organic (manure) fertilizer</td>
<td>0.0156</td>
<td>0.0021 – 0.0331</td>
<td>DCC 2006 National Inventory Report Vol 1</td>
</tr>
<tr>
<td>Sugarcane (general, but also Qld specific)</td>
<td>0.028</td>
<td></td>
<td>Denmead \textit{et al.} 2008</td>
</tr>
<tr>
<td>Sugarcane on ASS</td>
<td>0.21</td>
<td></td>
<td>Denmead \textit{et al.} 2008</td>
</tr>
</tbody>
</table>

IPCC (2006) allows the use of Tier 2 or Tier 3 values where they are known and published, using Equation 11.2 of IPCC 2006 (Vol 4 Ch 11, p11.10). As Australia has Tier 2 values for N\textsubscript{2}O emissions, equation 11.2 is used for calculating the emissions from sugarcane soils in the Wet Tropics Project area.
Equation 1 (from equation 11.2 of IPCC 2006 Guidelines):

\[ N_{2O_{Direct}} - N = \sum_i \left( F_{SN} + F_{ON} \right)i * EF_{1i} + \left( F_{CR} + F_{SOM} \right)i * EF_i + N_{2O_{OS}} - N_{OS} + N_{2O_{PRP}} \]

Where:

\( N_{2O_{Direct}} - N \) = annual direct \( N_{2O} \) emissions produced from managed soils, kg \( N_{2O} \) yr\(^{-1}\) (Emission of \( N_{2O} \) in units of Nitrogen – IPCC GPGAUM, 2001, Chap 4 Agric, p4.67)

\( N_{2O_{OS}} \) = annual direct \( N_{2O} \) emissions from managed organic soils, kg \( N_{2O} \) yr\(^{-1}\)

\( N_{2O_{PRP}} \) = annual direct \( N_{2O} \) emissions from urine and dung inputs to grazed soils, kg \( N_{2O} \) yr\(^{-1}\)

\( F_{SN} \) = annual amount of synthetic fertiliser \( N \) applied to soils (adjusted to account for the amount that volatilises as \( NH_3 \) and \( NOx \) – IPCC GPGAUM, 2001, Chap 4 Agric, p4.54), kg \( N \) yr\(^{-1}\)

\( F_{ON} \) = annual amount of animal manure, compost, sewage sludge and other organic \( N \) additions applied to soils (Note: If including sewage sludge, cross-check with Waste Sector to ensure there is no double counting of \( N_{2O} \) emissions from the \( N \) in sewage sludge), kg \( N \) yr\(^{-1}\)

\( F_{CR} \) = annual amount of \( N \) in crop residues (above-ground and below-ground), including N-fixing crops, and from forage/pasture renewal, returned to soils, kg \( N \) yr\(^{-1}\)

\( F_{SOM} \) = annual amount of \( N \) in mineral soils that is mineralised, in association with loss of soil C from soil organic matter as a result of changes to land use or management, kg \( N \) yr\(^{-1}\)

\( F_{OS} \) = annual area of managed/drained organic soils, ha (Note: the subscripts CG, F, Temp, Trop, NR and NP refer to Cropland and Grassland, Forest Land, Temperate, Tropical, Nutrient Rich, and Nutrient Poor, respectively)

\( F_{PRP} \) = annual amount of urine and dung \( N \) deposited by grazing animals on pasture, range and paddock, kg \( N \) yr\(^{-1}\) (Note: the subscripts CPP and SO refer to Cattle, Poultry and Pigs, and Sheep and Other animals, respectively)

\( EF_{1i} \) = emission factor for \( N_{2O} \) emissions from \( N \) inputs, kg \( N_{2O} \) (kg \( N \) input)\(^{-1}\) (Table 11.1 of IPCC 2006)

\( EF_{1i} = \) emission factors developed for \( N_{2O} \) emissions from synthetic fertiliser and organic \( N \) application under conditions \( i \) (kg \( N_{2O} \) (kg \( N \) input))\(^{-1}\); \( i = 1, \ldots, n \). (Table 11.1).

According to IPCC 2006 (p11.10), the above equation may be modified in a variety of ways to accommodate any combination of \( N \) source-, crop type-, management-, land use-, climate-, soil- or other condition-specific emission factors that a country may be able to obtain for each of the individual \( N \) input variables (\( F_{SN}, F_{ON}, F_{CR}, F_{SOM}, F_{OS}, F_{PRP} \)).

As an indication of the mass of \( N_{2O} \) emitted from sugarcane in the Wet Tropics, if we ignore the contributions from factors \( F_{OS} \) and \( F_{PRP} \) the equation can be modified to:
Equation 2 (modified from Equation 11.2 of IPCC 2006 Guidelines)

\[ N_2O_{\text{Direct}} - N = \sum_{i} (F_{SN} + F_{ON})_i \times EF_{1i} + (F_{CR} + F_{SOM}) \times EF_1 \]

This takes account of added synthetic and organic fertilizers, and crop residue and soil organic matter. Synthetic fertilizers are those sold commercially as mixed fertilizers, with differing proportions of nutrients, and the suppliers provide information on the ratios of N, P, K and other elements in the fertilizers. Organic fertilizers for sugarcane in the Wet Tropics Region include residues from sugarcane mills, including ‘mill mud’ and ‘mill ash’, on which data were not available at the time of publication. Crop residue in the form of legume crops has been modeled for N contribution. Soil organic matter in the form of organic carbon percentage is one of the analytes recommended for testing in soil tests of sugarcane soils.

In order to calculate the \( N_2O \) emissions accurately, some elements of Equation 2 need more specific data. These are discussed further in the following sections, and conclusions made in sections 2.3 to 3.

2.2 Conversion to \( N_2O \) & \( CO_2 \)-equivalent

Conversion of \( N_2O \)-N emissions to \( N_2O \) emissions for reporting purposes is performed by using the following equation:

\[ N_2O = N_2O-N \times \frac{44}{28} \]

The Global Warming Potential for \( N_2O \), kg-CO\(_2\)-e (kg-N\(_2O\))\(^{-1}\) is 310 (IPCC default = 310, valid for the first commitment period) (EB33 Report Annex 16).

3. Results

3.1 Baseline Nitrous Oxide emissions from N fertilizer applications for FNQ region

The minimum baseline estimates for \( N_2O \) (and CH\(_4\)) emissions have to be based on verifiable management records (e.g. fertilizer purchase records, manure production estimates, livestock data) averaged over the 5 years prior to project establishment (VCS 2008 Tool for AFOLU Methodological Issues, section II, item 13, p6).

In 2001, the estimated usage of nitrogen fertilizers contributed about 4970 tonnes of N (as N fertilizer) to the Wet Tropics region (21,611 km\(^2\)) and the rate of application of N fertilizers was calculated to be 2.3 kg/ha (McDonald & Weston 2004) on average for the region. Area under agriculture is around 2,399 km\(^2\) (239882 ha) which is about 11% of the total. In 2004 there were about 182,355 hectares under sugarcane (McDonald & Weston 2004) (Terrain NRM (2004) Plan Vol 1, background). This averages to around 20.7 kg/ha as applied to the intensive agricultural areas, including sugarcane.
But the rate of application of N fertilizers to sugarcane in the Wet Tropics as estimated by Incitec Pivot Fertilizers (Sept 2008, unpublished data which is around 60-70% of the fertilizer sold in the region (Incitec Pivot, pers. comm.)), as shown in Table 2 below, is much higher than the regional average for agriculture.

Table 2 – Average N Rates (kg/ha) by Year – Wet Tropics (Tully to Mossman, including Atherton Tablelands) (Incitec Pivot data 2008, extrapolated from 70% estimated market share)

<table>
<thead>
<tr>
<th>Year</th>
<th>1998</th>
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<th>2000</th>
<th>2001</th>
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<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
</tr>
</thead>
<tbody>
<tr>
<td>kg/ha N</td>
<td>197</td>
<td>206</td>
<td>216</td>
<td>213</td>
<td>210</td>
<td>196</td>
<td>207</td>
<td>203</td>
<td>204</td>
<td>207</td>
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</table>

Nitrous oxide and CO₂-equivalent emissions from N fertilizer application to sugarcane crops for the region can be calculated from these figures, using Equation 2, and Australian Tier 2 emission factor of 0.016 and the more recently determined emission factor of 0.028 for sugarcane (Denmead et al. 2008). As noted in section 2.1.1, the global warming potential of N₂O in CO₂-equivalent value is a factor of 310. Emission values for each year are shown in Table 3.

Table 3 – Nitrous oxide and CO₂-equivalent emissions (in tonnes) from N fertilizer applied to sugarcane – Wet Tropics of FNQ

<table>
<thead>
<tr>
<th>Year</th>
<th>1998</th>
<th>1999</th>
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<th>2004</th>
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</thead>
<tbody>
<tr>
<td>N₂O emissions (t)</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aust Tier 2 (EF 0.0125)</td>
<td>706</td>
<td>737</td>
<td>773</td>
<td>762</td>
<td>752</td>
<td>701</td>
<td>742</td>
<td>727</td>
<td>732</td>
<td>742</td>
</tr>
<tr>
<td>Sugar Qld (EF 0.028)</td>
<td>1582</td>
<td>1651</td>
<td>1731</td>
<td>1708</td>
<td>1685</td>
<td>1570</td>
<td>1662</td>
<td>1628</td>
<td>1639</td>
<td>1662</td>
</tr>
<tr>
<td>CO₂ equiv. Emissions (t)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aust Tier 2 (EF 0.0125)</td>
<td>218910</td>
<td>228428</td>
<td>239532</td>
<td>236359</td>
<td>233186</td>
<td>217323</td>
<td>230014</td>
<td>225255</td>
<td>226841</td>
<td>230014</td>
</tr>
<tr>
<td>Sugar Qld (EF 0.028)</td>
<td>490358</td>
<td>511678</td>
<td>536551</td>
<td>529444</td>
<td>522338</td>
<td>486804</td>
<td>515231</td>
<td>504571</td>
<td>508124</td>
<td>515231</td>
</tr>
</tbody>
</table>

The differences between the volume (mass) of CO₂-equivalent emissions using the revised emission factor of 0.028 (Denmead et al. 2008) are substantial. The trend in nitrous oxide emissions (as CO₂-equivalent emissions) from N fertilizer application to sugarcane in the Wet Tropics of Far North Queensland, supports the interpretation from Dalal et al. (2003) of no decline since 2000.

The recommended rate of application to sugarcane in the Wet Tropics, at around 160 kg/ha of N, is based on the ‘district yield potential’ for sugarcane of 120 tonnes/ha. According to studies by CSIRO, sugarcane needs 1.4 kg N per tonne up to a yield of 100 tonnes/ha and 1 kg per tonne/ha thereafter (Schroeder et al. 2007). Adoption of improved practices would reduce the amount of N fertilizer added to
sugarcane in the Wet Tropics region by around 20%, based on the fertilizer supply records provided in Table 2 above.

A 20% reduction in fertilizer use could reduce N2O emissions (as CO2-equivalent) by around 100,000 tonnes per annum across the region (using the revised emission factor of 0.028 (Denmead et al. 2008)).

References for appendix


Chapter Five

iREDD hedges against avoided deforestation’s unholy trinity of leakage permanence and additionality
Chapter Five

iREDD hedges against avoided deforestation’s unholy trinity of leakage permanence and additionality


Context

Chapter Four asserts that climate change and the role of ecosystems have become decoupled in the iterations of international policy frameworks. This decoupling hinders workable financial mechanisms that underpin the key ecosystem sector abatement opportunity of reducing emissions from deforestation and forest degradation that contributes significantly to total global anthropogenic CO₂ emissions.

Chapter Five analyses three key administrative shackles – leakage, permanence and additionality - that continue to hinder not only the integration of the ecosystem sector and climate change mitigation, but also the international community’s efforts to implement workable financial mechanisms. These efforts, up to the 2011 Durban Conference of Parties, are described with particular relevance to REDD.

Much of the activity and innovation associated with REDD’s implementation is occurring at the project-level. This chapter provides a practical financial solution to
project-level private investment that focuses on assessing, reducing and monetizing the perceived risk embedded in leakage, permanence and additionality, through a proven insurance-based policy - iREDD. The principles of iREDD are explained and a hypothetical example provided.

iREDD integrates REDD projects and their perceived risk within the context of governance, project management, liquidity, integration within national and international approaches and politics.
Abstract

Workable financial mechanisms are essential to abate greenhouse gas emissions. Deforestation, which contributes a large proportion of total global emissions, must be avoided as an effective emissions-reduction tactic, and to alleviate biodiversity loss and poverty. However, incentives to Reduce Emissions from Deforestation and forest Degradation (REDD) have had mixed and sub-optimal success because of administrative and technical issues, in particular leakage, permanence and additionality. We show that these concepts can be ambiguous, potentially contrived and in some cases generate perverse outcomes. Encumbering avoided-deforestation projects with these administrative shackles risks massive increases in global deforestation and a concomitant loss of biodiversity, ecosystem services and emissions-reduction opportunities. We offer a solution built on a proven insurance-based hedging principle, a concept we call iREDD that could indirectly address specific technical and administrative challenges whether real or contrived. Project-specific iREDD insurance policies and premiums would be negotiated upfront using a simple assessment of risk based on governance quality, the integrity of management plans, liquidity, monitoring and evaluation frameworks, and political acceptability. iREDD acts as both an incentive for prudent forest management given the seller’s potential financial windfall if forests are diligently managed, and guarantees not to disenfranchise the buyer.

Introduction

The international community's scramble to implement workable financial mechanisms that effectively abate greenhouse gas emissions is at the heart of climate change mitigation policy worldwide. Rapid global deforestation contributes a large portion of total global anthropogenic CO₂ emissions (Intergovernmental Panel
on Climate Change 2007, Asner et al. 2010), but conversely, afforestation, the reduction in deforestation and forest degradation, and forest restoration (REDD, together with REDD+ are used here interchangeably) also provides possible mitigation options through global carbon finance mechanisms. After the 2011 United Nations Framework Convention on Climate Change meeting in Durban, however, the nature of these mechanisms still remains divisive and highly debated (Andrews 2012) continuing a trend that began in the early 1990s.

In summary, in the 1990s negotiations leading to the Kyoto Protocol of the United Nations Framework Convention on Climate Change failed to use the full potential of forests to mitigate climate change. Only afforestation of land deforested for at least 50 years, and reforestation of land deforested before 1990, were allowed for funding under the Clean Development Mechanism established by the Protocol.

At the 2005 Conference of Parties to the United Nations Framework Convention on Climate Change the idea of compensating countries for reduced emissions for deforestation and forest degradation resurfaced with its popular name of REDD. The 2007 Conference of Parties, in Bali, decided to consider and stimulate action on REDD in preparation for the 2009 Copenhagen Conference of Parties. At Copenhagen, REDD+ (incorporating conservation and management of forests) was recognized as crucial in mitigation efforts. A commitment was made to establish a Green Climate Fund to support a range of activities including REDD+. The term “REDD+” itself was only clearly defined later at the 2010 Conference of Parties at Cancun to include reduced emissions from deforestation, forest degradation, conservation and management of forests and enhancement of forest stocks (United Nations Framework Convention on Climate Change 2011).

The Cancun Conference of Parties provided some clarity for REDD but faltered on finance. As well as defining the REDD concept itself, the Cancun meeting set out
basic steps for countries to prepare themselves for the provision of finance for REDD programs including developing a national strategy or action plan, a national forest emissions reference level, a robust and transparent monitoring system, and a system for providing information on how safeguards (e.g., good governance, respect for indigenous peoples’ rights, and biodiversity considerations) would be implemented (United Nations Framework Convention on Climate Change 2011). Country-level REDD programs were recommended to be implemented in phases: (1) readiness planning for REDD programs; (2) implementation; and (3) results-based actions. The underpinning issue of how REDD should be financed, however, was not resolved at the Cancun meeting, with the role of market versus non-market based approaches continuing to be divisive.

Many multilateral funds have been established to assist with REDD financing at the country level. The most important of these are the World Bank’s Forest Carbon Partnership Facility (FCPF), launched at the 2007 Bali Conference of Parties, the United Nations-REDD, and the World Bank’s Forest Investment Program. The FCPF provides grant funding to help with readiness planning; the United Nations-REDD programme, launched in 2008, also provides assistance for development and implementation of REDD programs. The Forest Investment Program, also launched in 2008, is to provide larger-scale funds for national forest investment strategies based on pilots in selected countries. Despite being in their infancy, only 7% on average of the funds has been disbursed (Creed & Nakhoda 2011) demonstrating the complexity of rules, difficulty of coordinating country-level projects, high transaction costs, comprehensive application of safeguards and general due diligence.

Several critical reviews of the FCPF and the United Nations REDD Program suggest that the analysis of problems surrounding law enforcement, corruption and land tenure have been shallow, and consideration of governance has not moved beyond
basic concepts (Bofin et al. 2011). Indeed, poorer relative governance quality is linked to high rates of deforestation, biodiversity loss and environmental degradation (Jepson et al. 2001, Smith et al. 2003, Ewers 2006, Li and Reuveny 2006, Bradshaw et al. 2010). The World Bank and recipient governments have also been accused of colluding to mask defects in FCPF operations and planning (Dooley et al. 2011). Thus, although REDD emerged from a sense of crisis in global carbon emissions and biodiversity, it seems that an effective, seamless, global response to REDD is unlikely in the near future.

Private investment in carbon-market projects has already started to decline due to continuing uncertainty in climate negotiations, and there is a risk that more delays could stall interest altogether (Zhu et al. 2010). In reality, while REDD financing remains controversial, a basket of financial options from which individual countries can choose depending on their circumstances, is the most likely means of resuscitating the concept. At the Durban Conference of Parties, the final REDD+ agreement opens the way for both public and private sources of finance, and for new market-based approaches (Boyle 2011). We provide one such approach for site-level projects that could generate immediate action and provide critical means of channeling investment while helping REDD maintain momentum.

**Leakage, permanence and additionality**

To operationalize REDD (used henceforth to incorporate all REDD programs and its variants), countries will need to include specific projects in their accounting system – it is at the project level is where much of the activity and innovation in REDD approaches are taking place (Angelsen 2008). But for individual projects, there are many obstacles associated with REDD’s implementation and acceptance (Miles and Kapos 2008, Kintisch 2009, Phelps et al. 2010). These can be summarized as additionality/baseline, leakage, measuring and monitoring, permanence, and socio-
economic aspects (Trines et al. 2006). Paramount among these is accounting for the problems of leakage, permanence, and additionality, which tend to form an unholy trinity against REDD implementation by encumbering projects with administrative shackles and concerns about credibility. The general concept of leakage (Miles and Kapos 2008) refers to the unanticipated increase in emissions outside an avoided-deforestation project’s accounting boundary (Murray 2008). Leakage can be further categorized as activity shifting, and market leakage (Meyfroidt and Lambin 2009). Recent studies of activity-shifting ‘spill overs’ found only small and not easily detected shifts (Angelsen 2008). A review of carbon projects across Africa, found it difficult to show direct causal links between project activities and leakage (Rayden et al. 2010). The first apparently clear evidence (Ewers and Rodrigues 2008) of activity-shifting leakage can be sourced to a 2007 study on avoided deforestation through protection and forest concessions in the Peruvian Amazon (Oliveira et al. 2007), but the construction of new roads, long known to facilitate deforestation (Laurance et al. 2001) and not associated with the project, confounds this conclusion. Protection can in fact stimulate reduced deforestation in adjacent unprotected areas and alleviate poverty in neighboring communities (Andam et al. 2010). Indeed, protected areas in Sumatra and in the Brazilian Amazon promoted protection in adjacent areas (Gaveau et al. 2009), and resulted in a net reduction in regional deforestation presumably because the creation of protected areas discourages illegal land-grabbing (Soares-Filho et al. 2010). Although leakage is a legitimate concern, the cost and complexity of accounting for it, particularly given the difficulty of finding direct causal links, results in major impediments to project implementation.

Accounting for market leakage assumes that market demand must be met (Pearson et al. 2006). Market demand for forests and biodiversity globally is mainly driven by agriculture, urban growth and household consumption (DeFries et al. 2010, Gibbs et
al. 2010, UNEP 2010); worldwide, household consumption drives 72% of GHG emissions, and a doubling of household income results in 81% more CO₂ emissions (UNEP 2010). It would seem inevitable that forests give way to the pressures of agriculture, urban growth and household consumption unless they can play in the market place. Overly complex rules for accounting for leakage might simply hamper REDD actions without doing anything for avoiding deforestation.

Permanence is the guarantee that avoided deforestation will remain so for a meaningful time. The Kyoto Protocol's Clean Development Mechanism deals with permanence in its afforestation and reforestation projects by issuing either long-term or temporary certified emission reductions. Both of these have expiry dates and must be replaced by permanent certified emission reductions from energy projects. This reduces demand, lowers the price, and weakens the competitiveness of planted forests (Wang 2010). Other risk-based standards such as the Verified Carbon Standard estimate the risk that sequestered carbon is eventually released again within the timeframe of the project. The risk buffer generated compensates for future losses. This means that ‘permanent’, fully eligible and tradable carbon (part of a regular carbon market) can be generated.

The final obstacle addressed here, invoked by the Clean Development Mechanism, is the additionality criterion. Additionality means that activities must demonstrate emissions reductions that would not otherwise have occurred without the support of the Mechanism or, in the voluntary market, the project monies. “What would otherwise have happened” is an ambiguous concept and essentially immeasurable (Raymond 2010). Markets, and especially the private sector, eschew ambiguity because it translates to risk. Risk introduces uncertainty that, as is the case for permanence, reduces the attractiveness of the investment, demand, and hence the price of carbon. This implies that the opportunity cost of not harvesting a forest increases, thus perversely incentivizing accelerated deforestation. Projects
implemented in Africa have not been chosen based on where there is the greatest threat to carbon stocks; instead, they are placed where pressure on forests is high, people are most receptive, and where there are fewer political obstacles (Rayden et al. 2010).

Meanwhile, as we debate the merits of REDD and continue to raise obstacles against it, deforestation, not surprisingly, continues apace (Bradshaw et al. 2009) as is evident through various examples. Deforestation in Brazil continues (Instituto Nacional de Pesquisas Espacias 2011), and in insular Southeast Asia, it has continued steadily since the turn of the century with an overall 1.0% average yearly decline in forest cover (Miettinen et al. 2011). Indeed, the eastern lowlands of Sumatra and the peatlands of Sarawak, Borneo have lost around 50% of the peat swamp forest area available in 2000 (Miettinen et al. 2011).

The estimated resources needed to reduce emissions from REDD by 50% range from US$17 to 28 billion per year (O’Sullivan et al. 2010), and since the 2009 Copenhagen climate conference, additional funds of US$4 billion per year from 2010 to 2012 have been pledged to REDD efforts, which is barely a third of the lowest estimates needed (Swickard and Carnahan 2010).

In reality, the issues of leakage, permanence and additionality are indicators of real-world complexities, not necessarily unique to carbon projects (Rayden et al. 2010). Unfortunately however, it seems that carbon projects bear the disproportionate burden of accounting for what ultimately may be contrived concepts. This results in marginal benefits to project proponents that, in turn, act to stall potential investment. If we care about forests (as clearly we must), scaling up private investment is, however, essential. Currently, much of the activity and innovation in REDD is happening at the project level where critical private-sector investment has occurred and should be maintained to ensure adequate financing and program effectiveness.
(Swickard and Carnahan 2010). Here we suggest an elementary, practical, yet robust financial mechanism that would help encourage private sector involvement in REDD to complement public efforts and avoid REDD becoming peripheral to climate change mitigation. The basic premise of this financial instrument is that it desires to reduce the risk embedded in an uncertain future through an insurance mechanism that has the potential to benefit both the buyer and the seller of the carbon at the date of contract maturity, while simultaneously reducing the negative aspects of leakage, permanence and additionality.

**iREDD**

The REDD industry (or market) has already started to address some of these aforementioned challenges by introducing measures such as reserve carbon pools and risk discounts (Lopes 2009). Although these measures can address the risk profile of the project, they are insufficient to overcome the challenges the market is posing against leakage, permanence and additionality. We offer a strong solution to these problems based on proven insurance-based hedging principles – a form of REDD insurance policy which we call ‘iREDD’. This is not the first time that insurance has been linked either to conservation in general, or to REDD specifically (Angelson et al. 2009, Holland 2010). Ours is, however, probably the first proposal of a formal framework where insurance can play a meaningful role in addressing the challenges seriously constraining current REDD development.

The first element of iREDD concerns the risk profile. At the beginning of a forest carbon project, the proponent would normally elaborate the risk profile, provide details on how the risks would be managed and, under some standards (such as the Verified Carbon Standard), suggest a buffer discount. Under iREDD, the risk profile of each project would be ascertained and negotiated beforehand by both the buyer and the seller combined. Before entering into a REDD contract, both parties would
be obliged to agree on the perceived risk, effectively monetizing it. The outcome of the risk analysis is that the higher the risk concerning leakage, the lack of permanence, and low additionality, the higher the insurance premium, and vice versa.

There is a wide range of project risk assessments available upon which market actors could agree to use in evaluating a project’s risk. Importantly from an iREDD perspective, however, is linking the risk profile as analytically and objectively as possible to an insurance premium. One option would be to use a Likert scale whereby the risk of the project is scored ranging from low (1) to high (5) risk in each of the following five categories: (1) governance structures, (2) management plans, (3) project liquidity, (4) acceptance and (5) political buy-in. Although this list might not be conclusive, and while market actors could certainly adapt our proposed system, this list has been developed successfully through practical experience in restoration-related activities (Aronson et al. 2006, Blignaut et al. 2007, Turpie et al. 2008, Blignaut et al. 2010). The purpose of these criteria is to develop and score a project’s risk profile, and to convert the score to a project insurance premium.

Project risk is thus assessed based on: (1) Quality of governance, such as the permanence and stability of the institutions involved, which can be determined inter alia by examining the balance sheets of the project management agency or related institutions (the implementing agent), as well as the implementing agent’s historical longevity and income flow; the weaker this ability, the higher the project risk, and hence, the greater the insurance premium. (2) There must be a well-defined management plan with deliverables, including mitigation plans for disasters such as fire and illegal deforestation, well-documented human migration predictions within the proposed area, and an account of current and future land-tenure structure. The weaker and less robust such management plans, the higher the project risk and hence the insurance premium payable. (3) Project liquidity is essential to ensure
enough cash and in-kind resources are available to execute the management plan: for example, building fire breaks, policing boundaries, monitoring, fencing, basic maintenance and salaries. If the project does not possess sufficient cash, the likelihood that it would be in the position to implement any form of disaster management, or even be able merely to implement its stated management plan, would be low. Such risk increases the project’s overall risk and hence, the required insurance premium. (4) A successful and low-risk project must be able to integrate with existing monitoring, evaluation and reference groups, projects and networks, such as the sub-national ‘nested approach’ (Pedroni et al. 2009). The more a project (and its implementing agent) is connected to other groups, and the more developed its own self-policing system, the more these will signal the agent’s willingness and openness to prudent land and project management. (5) The project must have political acceptability, that is, whether the project is considered a policy priority in the relevant jurisdictions to address unemployment, education, biodiversity legislation and international agreements. If a project operates outside the boundaries of nationally stated priorities, then the risk of the project becoming marginalized is greater than what would otherwise be the case, and hence, the higher the project risk.

The second major consideration in an iREDD scheme is deciding on the size of the premium. While the market actors can and would derive their own project-specific formula, we suggest the following four aspects to determine the size and application of the negotiated premium: (1) the project’s risk profile as discussed above; (2) the premium size relative to the risk profile; (3) the type of insurance investment that will be made (i.e., the form of the investment); and (4) the terms of use of the trust fund or insurance policy and varying conditions of performance. Once the project risk has been determined, the next step would be to decide upon an investment vehicle, that is, the destination and the management of the insurance premium. The two most
obvious insurance investments include trust funds at a recognized financial institution, and genuine insurance policies. The terms of use of the trust fund or insurance policy would have to be negotiated and be made part of the project’s contract.

A simple example (Table 3) suffices to illustrate how an iREDD project might proceed once the combined Likert-scale risk profile and premiums had been assessed and concurred among parties. If, for example, the negotiated price of the carbon credit is $15 per tonne CO₂, and the project has low risk, then a small amount (e.g., $1 per tonne CO₂) is set aside in a trust fund or to buy an insurance policy. Should the risk be high, this amount could rise to, for example, $5 (see the developed example in Table 3). Although it remains the prerogative of the market actors, it is unlikely that iREDD projects would remain viable should the insurance premium exceed one third of the carbon credit price because anything larger would imply that the actual payout to the sellers would be reduced by too much, reducing the incentive (and even the liquidity necessary) to maintain and operate a functional program. Doing so would imply that the project risk is too high and that the bulk of the carbon payment is deferred to a later stage. The balance between the purchase price (e.g., $15 per tonne CO₂) and the premium (e.g., $5 per tonne CO₂) is paid to the seller of the credits. The premium, as it has accumulated plus interest, is shared between the buyer and the seller when the contract has reached maturity according to the principles discussed below (Table 3).

iREDD therefore provides a monetary tool and mechanism through which project risks can be financially hedged, and most importantly, managed. Under iREDD, ongoing project monitoring and evaluation is intrinsic to determine the degree to which the project attained its objectives and targets. The built-in insurance approach makes ‘risk’ an integral part of the management process. Additionality, leakage and permanence are ongoing problems, but iREDD makes it explicit and
provides a management and intervention tool to account ex post for these risks, in a way that current ex ante approaches, applied during the time of highest uncertainty, cannot.

Specifically, leakage is addressed at set intervals from contract settlement through the activities listed and described in the management plan where evidence compared with actual land use changes and evidence for any activity shifting. Instead of attempting to predict leakage beforehand under classic REDD approaches (normally an impossible task), iREDD provides an evidence-based mechanism to account explicitly for, and to mitigate financially, that risk. Where leakage occurs beyond contract specifications (according to frequently updated risk-profile assessment schedule), an amount equal to the value of the ‘leaked’ carbon credits should be paid to the buyer to re-invest in carbon transactions elsewhere (Table 3). The sellers therefore have a direct incentive to limit leakage, and the buyers are hedged in that in the case of any losses, they will be compensated.

Carbon credits have ‘permanence’ within an iREDD contract’s parameters if the terms are met diligently within the project’s time frame; if not, then some project failure is accepted and buyers are appropriately compensated, enabling them to invest in another project to attain the required number of carbon credits. In this way the buyer will obtain permanence even if that implies one or more contracts or projects.

Although additionality is, by definition, a concept fraught with challenges, an evaluation of ‘what would have happened otherwise’ upon contract maturation could be done by comparing the project with reference or baseline sites not included within the project boundaries. It would be advantageous to set those reference site boundaries beforehand, but it is not strictly necessary. The number of carbon credits can therefore be adjusted accordingly prior to final disbursement of trust fund or
insurance returns. iREDD thus acts both as an incentive for prudent land and project management, and as a guarantee not to disenfranchise the buyer. The buyer’s risk is therefore minimized, and the sellers have the distinct incentive to reduce risk as far as possible given the considerable financial windfall that might surface upon project completion if their forests are diligently managed.

Using iREDD is therefore a powerful, yet simple method to deal with leakage, permanence and additionality. It will also contribute meaningfully towards diligent project management. Afforestation, the reduction in deforestation and forest degradation, and forest restoration projects can now take their rightful place in the quest to combat climate change and biodiversity loss.
Table 3. Hypothetical example of an iREDD evaluation: sequestration (s) rate of 5,000 t CO₂ yr⁻¹ for 20 years (y) in which the gross price for the carbon credit (p₁) fixed at US$15 t⁻¹ CO₂. (a) Assessment at the start and (b) end of the project. Each risk category is scored between 1-5 on the Likert scale relative to perceived (and agreed between parties) risk (1 = lowest risk; 5 = highest risk). The mean score across all 5 risk categories represents the risk premium used to adjust the iREDD insurance premium. The simplest method uses the mean risk value to adjust the capital value of the project. Thus, the 2.2 risk premium (r) in this example is multiplied by the total carbon credits to become a capital value of $220,000 for 100,000 t CO₂, which is adjusted according to current per annum market interest rates (i) over the duration of the project (20 years [y] in the example). During and post-project assessment identifies a loss of 5,000 t CO₂ from leakage to nearby forest degradation and loss, a non-compliance of project terms (e.g., some forest loss/degradation through illegal logging) equating to 8,000 t CO₂ (loss due to non-permanence), and 2,000 t CO₂ lost from post-project assessed additionality (the carbon amount that would have been sequestered in the project area without any REDD investment as estimated from baseline comparisons outside of the project area). This 15,000 t of ‘lost’ carbon (l) is charged at the per-unit carbon price at the project’s completion (p₂ = US$25 t⁻¹ CO₂) for a total of $375,000; this component of the premium is paid to the buyer, and the remainder ($574,454) is disbursed to the seller. Over the 20 years then, the buyer receives 85,000 t-worth of carbon credits and a cash return due to non-compliance of $375,000 that can be re-invested in other projects to make up for the loss of 15,000 t CO₂. The seller receives $1,280,000 REDD funding disbursed at agreed intervals over the 20-year project plus $574,454 of the risk capital fund accumulated over time for a total income of $1,854,454.
### (a) Risk categories

<table>
<thead>
<tr>
<th>Risk categories</th>
<th>Leakage</th>
<th>Permanence</th>
<th>Additionality</th>
<th>Possible Range **</th>
<th>Actual Score</th>
<th>Risk Premium *</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Quality of governance</td>
<td>✔️</td>
<td></td>
<td></td>
<td>1-5</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>2. Management plan</td>
<td>✔️</td>
<td></td>
<td></td>
<td>1-5</td>
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<td>3. Project liquidity</td>
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<td>4. Integration</td>
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<td>5. Political acceptability</td>
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### (b) Project insurance premium

- Carbon sequestered ($s \cdot y$) $100,000$ t
- Unit risk value ($r$) $2.2$ credit
- Capital risk value ($s \cdot y \cdot r$) $220,000$
- Interest ($i$) $0.08$ ($8\%$) yr$^{-1}$
- Insurance premium at project end $r \cdot s \cdot y (1 + i)^{y-1}$ $949,454$

### Losses of carbon credits

- Leakage $5,000$ t
- Permanence $8,000$ t
- Additionality $2,000$ t

**Total** ($I$) $15,000$ t

### Value of carbon credit losses

- Unit price at end of period ($p_2$) $25$ t$^{-1}$ CO$_2$
- Total value of loss incurred by buyer ($I \cdot p_2$) $375,000$

### Distribution of premium

- Buyer ($I \cdot p_2$) $375,000$
- Seller ($r \cdot s \cdot y (1 + i)^{y-1} - I \cdot p_2$) $574,454$

### Attribution summary

- **Buyer**: $85,000$ t ($s \cdot y - I$) carbon credits + $375,000 (I \cdot p_2)$ cash return
- **Seller**: $1,280,000 ([p_1-r] \cdot s \cdot y) + 574,454 (r \cdot s \cdot y (1 + i)^{y-1} - I \cdot p_2) = 1,854,454$
Various methods can be used to convert the range of the risk to the value of the risk premium. The simplest, yet most transparent, way is to equate the average of the risk premiums across all risk categories to be equal to the $ value of the risk premium. This premium has to be dedicated, either through a trust fund or an insurance policy, towards addressing the potential differential between the actual project performance and the contracted performance. Once the mean score (and hence risk premium) exceeds 33% of the carbon price, the risk is probably too high to continue with the project; in the current example, the mean risk premium of 2.2 represents 14.7% of the carbon price.

**Where 1 denotes ‘low’ and 5 ‘high’ risk.**

§In the unlikely event that the loss incurred by the buyer exceeds the premium value at project end, the deficit is borne by the buyer. That would constitute a real loss in value. This necessitates the careful determination of the risk premium from the outset.
Chapter Six

An Australian landscape-based approach: AFOLU mitigation for small holders
Chapter Six
An Australian landscape-based approach: AFOLU mitigation for small holders


Context

Chapter Four demonstrated how discordant outcomes of policy shifts affected a landscape scale pilot study in the Wet Tropics Region in north-eastern Australia, and describes how Australia’s regional natural resource management (NRM) framework could be used to aggregate multiple small projects across the ecosystem sector for the carbon market; an approach that also delivers sustainable agriculture, water quality and community benefits.

Chapter Six further develops this policy framework for integrating the ecosystem sector, referred to in this chapter as Agriculture, Forestry and Landuse (AFOLU), into climate mitigation opportunities. A lack of regionally differentiated management approaches is identified as a significant gap in the integration of AFOLU into climate change mitigation. The Chapter further develops the case that Australia’s existing NRM framework could provide guidance to manage carbon abatement with simultaneous biodiversity, food security and water quality services benefits. The Wet Tropics Project demonstrates how local NRM activities can provide larger scale delivery of climate mitigation and abatement.
Abstract
In Australia agriculture, forestry and landuse (AFOLU) could abate as much as three quarters of the country’s emissions and deliver improved landscape-scale adaptation in the face of climate change. As a nation of predominantly small landholders, regional aggregation of AFOLU activities will be required to successfully mitigate climate change. This chapter outlines an innovative approach that is emerging in Queensland’s Wet Tropics. Lessons from Australia’s Wet Tropics Project can help define and highlight implementation issues that move beyond land tenure, governance and technical capacity; issues Australia has largely resolved.

Introduction
It is not possible to avoid dangerous climate change without taking into account the natural and agricultural ecosystems of the planet (Trumper et al. 2009), a sector second only to the energy sector in its potential to mitigate greenhouse gas emissions. Each year, tropical forests draw down 15% of global emissions (Trumper et al. 2009), while deforestation and agricultural emissions are responsible for over 20% of global emissions (McKinsey & Company 2009).

In Australia, the AFOLU sector provides the largest abatement opportunity available, accounting for 25% of the country’s total emissions (Australian Government 2010). A recent assessment of greenhouse gas abatement potential through change in rural land-use demonstrates for the state of Queensland, the second largest state in Australia, that the overall attainable greenhouse gas abatement was 140 Mt CO$_2$-e per year, or 77% of that state’s emissions (Eady et al. 2009). By 2020 rural landuse is projected to offer about 40% of the low cost emissions reductions opportunity (ClimateWorks Australia 2010). Given the high contribution to total emissions, the AFOLU sector could potentially transform Australia’s mitigation effort and influence global mitigation effort (Garnaut 2008). At the same time, the right landscape
actions, including improved farming practice, wetland restoration, and forest, grazing and cropland management, could also support landscape adaptation to the impacts of climate change (Verchot et al. 2007).

**Regional approaches**

One of the challenges to incorporating the AFOLU sector under the Convention on Climate Change and its Kyoto Protocol is the lack of regionally differentiated management approaches, since climate change causes regionally differentiated impacts that require local knowledge to manage effectively (Steffen et al. 2009). The response to climate change also requires regionally-specific technical solutions and management approaches, and incurs different transaction costs (Robledo & Blaser 2008). Impacts, such as catchment disturbance, biodiversity loss and pollution can act in unison at a regional scale, suggesting that fragmentary approaches to management should be replaced by integrative strategies that seek to alleviate multiple sources of threat (Vorosmarty 2010). But even potentially climate-friendly activities such as reforestation need to be implemented with some caution since single-species plantations for carbon or for biofuels, for instance, could lead to highly simplified industrial landscapes with stressed hydro-ecological systems and low biodiversity when compared with native mixed plantations or agro-forestry systems (Keenan et al. 1997; Hartley 2002; Sayer et al. 2004; Marcot 2007; Verchot et al. 2007).

**Australia’s Natural Resource Management Framework**

Landscape-scale management across regions and institutional frameworks for natural resource management (NRM) already exist in Australia, largely through adaptively managed and collaborative frameworks negotiated between the Federal and State governments. These nationally coordinated and bi-laterally agreed arrangements become a firm framework for managing carbon abatement with
simultaneous biodiversity, food security and water quality services. In terms of climate change mitigation, the agriculture, forestry and other land use sector could be integrated into such frameworks using accepted international methodologies for measuring carbon benefits.

The foundations for natural resource management in Australian are embedded in formally negotiated Commonwealth-State arrangements. The Commonwealth of Australia comprises six states, each with its own legislature and parliament. Each state also has a number of definable agro-ecological regions that form a sensible management scale in biophysical, social and administrative terms. For example, Figure 2 displays the location of the Wet Tropics region within the Queensland State context.
Figure 2 The location of the Wet Tropics region within the state of Queensland.
Regional approaches to natural resource management (NRM) have been evolving across the globe for several decades, and are appropriate to effective landscape-scale management of natural resources (Dale et al. 2008). As the two levels of government cooperate in many areas in Australia, one important area is in the delivery of community-based NRM through strategic investment at a regional scale. The NRM regions generally mirror one or more bioregions of the Interim Biogeographic Regionalisation of Australia, which are large areas (mostly > 10,000 km²) defined by similarity of biophysical attributes (Commonwealth of Australia 2005).

Under these community-based arrangements, regional NRM bodies – regionally constituted groups that undertake strategic planning, deliver natural resource programs and engage the majority of the community’s interests – develop regional NRM plans. These plans are jointly accredited by State and Commonwealth governments and comprise scientifically informed, but regionally negotiated targets and priorities. These targets comprise time-bound Resource Condition Targets (e.g. ‘halt of the decline of water quality into the Barrier Reef Lagoon by 2020’) and associated Management Action Targets (e.g. ‘rehabilitate 25 kilometres of region’s riparian zone by 2015’).

These plans have been built around nationally consistent targets and principles, but are flexible enough to address regional needs and priorities. Once designated by both Commonwealth and State agencies, these plans form the basis for investment in implementation of identified strategic natural resource management actions from Australian, State and Local governments and the community and private sectors.

Regional NRM plans require the engagement of a wide range of sectors as they seek to secure regional consensus regarding critical aspirational and resource condition targets aimed at securing the health of defined natural assets (e.g. soil,
water, biodiversity and other assets). NRM bodies are usually steered by Boards, which are representative of landholders in their regions. Regional plans are developed by NRM body staff in consultation with landholders. Through consequent Regional Investment Strategies, regional NRM bodies work with a wide range of capable local delivery agents (e.g. landcare groups, industry bodies, local councils, etc.) to motivate and engage all small holders to improve their natural resource management practices and to take on collaborative local projects. This gives Regional NRM bodies a very wide reach to a region’s landholders on issues pertaining to the effective management of natural resources, including those activities that might deliver opportunities in the AFOLU sector. This approach is facilitated by Australia’s secure land tenure system and clearly defined property rights embedded in law. It also is able to deal with Australia-wide diversity of property sizes from extensive grazing properties (ranging from hundreds to thousands of square kilometres), intensive farms (that can be smaller than 10 hectares), traditional owner homelands and major and minor conservation holdings. Landholders are not bound by the NRM plans, but elect to become part of the NRM process, either through their own volition or as a result of NRM extension activities. The NRM bodies often provide funding and other resources to landholders to implement actions to fulfill the objectives of the NRM bodies.

This institutional framework can be adapted for managing the landscape-scale impacts of climate change, and for aggregating greenhouse gas abatement and sequestration activities including integrating and managing co-benefits. Regional NRM already contributes to sustainable economic development by integrating economic, social and environmental policies across regions through on-ground implementation (Williams et al. 2005). A key finding of the Assessment of Australia’s Terrestrial Biodiversity 2008 (Department of the Environment Water Heritage and the Arts 2009) is that the strengthening and consolidation of the regional delivery
model for NRM has also assisted delivery of biodiversity outcomes because regions provide a geographical basis for the assessment and reporting of biodiversity trends (Wentworth Group 2009).

Regionalizing NRM planning and delivery activities also allows for decentralization of decisions closer to the community - at the property and local scales (e.g. at a sub-catchment or locality scale). This facilitates and enables more open participatory decision-making. Integration of effort is the key since, as Australia does not have regionalized governments that deal with NRM issues, there is a tendency for local, state and federal government agencies to focus on narrow sets of fragmented objectives and to operate within the confines of their own agendas.

Currently, Regional NRM Bodies are supported to invest in actions that uphold national and state governments’ priorities. This, unfortunately, subjects them to short-term, erratic funding cycles based on shifting politics, constraining actions that help build resilient regional landscapes (Robins & Dovers 2007). Consequently, the benefits from aggregating multiple NRM activities of small landholders and trading the resultant credits in carbon markets could be a strong driver of investment in Australian natural resource management and regional NRM groups on a consistent basis.

**The Degree Celsius Wet Tropics Project**

A project, developed for the Wet Tropics Region in north-eastern Australia, demonstrates how the NRM activities of Australia’s existing regional NRM bodies can be aggregated for both regional and larger scale delivery of climate mitigation and abatement. The Degree Celsius Wet Tropics Biocarbon Sequestration and Abatement Project aggregates multiple ‘small-scale’ sub-projects, which are too small to be profitable by themselves in the carbon market. Landholders have elected to join the Wet Tropics Project, and agreed to sell their rights to carbon through the
project. They have provided information on their activities to the project, and advised on practices they have implemented. They have also enabled establishment of permanent monitoring plots on their properties. In Australia, 86% of agriculture and forestry businesses are small businesses (ClimateWorks Australia 2010).

Three of the major land uses of the Wet Tropics NRM region are shown on Figure 2. Much of the accessible land is privately owned, while the more rugged parts of the region are mainly leasehold land, State forest or National Park. Most of the forest in these areas is contained and protected within the Wet Tropics World Heritage Area.

Agriculture is the main land use with, in year 2001 figures, nearly 130,000 ha under cropping and about 47,000 ha under horticulture. Improved pasture for grazing accounted for about 65,000 ha. In the coastal areas the main crops are sugar cane and bananas. Extensive grazing is the main land use in the western part of the region. Forestry as an industry has declined in recent times, though rainforest vegetation covers about 350,000 ha of freehold land (Department of Environment and Resource Management 2009).

The main land uses on the lowlands include small (100-1000 ha) sugar farming and other agriculture (e.g. bananas and tropical fruits), livestock, private forestry and aquaculture. The relative balance between and extent of these crops fluctuates over time depending on commodity prices.

Potential greenhouse gas mitigation and abatement project activities in these industries include avoided deforestation, avoided degradation, reforestation using native species and agricultural land management through fertilizer reduction. Using the existing accredited regional NRM plan, with its established priorities, as the framework for the aggregation of carbon sequestration activities for the market, the Wet Tropics Project ensures the delivery of complementary biodiversity, sustainable agriculture, water quality and community benefits (Wentworth Group 2009).
The Wet Tropics Project currently uses existing methodologies of the Clean Development Mechanism of the United Nations Framework Convention on Climate Change (e.g. United Nations Framework Convention on Climate Change 2008a) and of the Inter-Governmental Panel on Climate Change (Intergovernmental Panel on Climate Change 2006). The nitrous oxide emission calculation guidelines of the Inter-Governmental Panel on Climate Change (Volume 4, Intergovernmental Panel on Climate Change 2006), for instance, were used to calculate the abatement effect of reduced use of fertilizers on agricultural land. The National Carbon Accounting Toolbox FullCAM program (Department of the Environment and Heritage 2005; Richards & Evans 2009) - which was initiated by the Australian government in response to the United Nations Framework Convention on Climate Change for National Greenhouse Gas Inventory reporting, and for Kyoto Protocol compliance monitoring - is used to model reforestation and avoided deforestation and forest degradation activities.

Specific Regional Ecosystem (RE) mapping data for the state of Queensland (Environmental Protection Agency 2007), which are based on a finer mapping scale, augmented the national data. The RE mapping provides an important tool in both assessing the carbon sequestration of the project area and allocation of zones into potential future land use categories. High-resolution digital ortho-rectified aerial photography supplemented the RE mapping layer. This enabled categorization of the vegetation into environmental plantings and farm forestry (ARR), avoided deforestation and reduced or avoided logging (REDD). Calculation of the carbon stocks in the project area was based on a pooled value of site specific NCAT modeling informed by the combination of spatial imagery and historical data. The NCAT modeling resulted in a set of Tier 2 values for the carbon pools of individual sites.
Activities conducted by landholders could potentially earn money for both the regional NRM groups and for the landholders and contribute to reducing deforestation and degradation, increasing reforestation and improving agricultural practices. This would significantly enhance the capacity of regions to secure the aspirational targets in their NRM plans.

Australia is currently in the process of legislating the “Carbon Farm Initiative” (CFI) a scheme to facilitate the sale of verified carbon credits to national and international voluntary markets (http://www.climatechange.gov.au/en/media/whats-new/carbon-farming-initiative-detail.aspx; accessed 31 January 2011). The initiative will have clear rules for the recognition of the carbon credits. The CFI is derived essentially from the offsets provisions of Australia’s proposed Carbon Pollution Reduction Scheme (CPRS), a national emissions trading scheme, which was shelved in 2010. In 2009, the original CPRS took a narrow view of offsets, essentially following the Clean Development Mechanism in only including afforestation and reforestation. After significant public input an amended (and subsequently shelved) scheme provided a national framework to include abatement from agriculture, forestry and landuse, which was a world first.

Without a national emissions trading scheme, the CFI can allow trading only within voluntary markets. This poses a number of significant challenges for rural small holders, in particular the lower prices available in these markets compared to a carbon price established under a national scheme. Compounding this would be the high transaction costs associated with administration, and verification under voluntary schemes. The carbon price and the amount of carbon revenues are the two main factors that will generate meaningful offsets based on AFOLU. Internationally, administrative and transaction costs have acted to stall AFOLU projects, and have resulted in a loss of carbon revenue opportunities of nearly a
billion dollars, without any commensurate environmental benefits (World Bank 2010).

The on-going deforestation rate in the Wet Tropics, for example, over the past 20 years is over 1700 ha per year (Department of Environment and Resource Management 2009), equivalent to a release of at least $4.5 \times 10^5$ t CO$_2$-e per year. The aspirational target for the region’s biodiversity is to maintain and enhance existing native vegetation. If farmers could be rewarded for the carbon stored in these non-remnant, unprotected forests, they would have an incentive to retain them, reducing the emissions caused by clearing and helping to secure the region’s biodiversity targets.

Additionally in the Wet Tropics, forest practices such as logging are degrading biodiverse remnant forests. Degradation, in the form of logging of remnant forests for timber is also an on-going practice, and based on recent trends in submitting notices of intention to log (unpublished data from Dept of Environment and Resource Management database sources, first half 2009), the potential savings in avoided degradation in the Wet Tropics could be over $1.2 \times 10^6$ t CO$_2$-e per year, if landholders who intend to log choose to retain their trees to sell the carbon sequestration benefits.

By contrast, recent data show that reforestation using environmental plantings is occurring at about 40 ha per year, which is small compared to the area being cleared (>1700 ha per year over the past 20 years). Current reforestation, therefore, accounts for less than 0.5% of the potential sequestration benefits of avoided deforestation and degradation, but with financial incentives to plant, the reforestation rates would increase.

Sugarcane plantations cover over 180,000 ha of the Wet Tropics region (McDonald & Weston 2004), and lie in the catchment of the Great Barrier Reef. The average
application rate of nitrogenous fertilizers to sugarcane was estimated to be 200 kg ha per year (N. Preece, unpublished data from Incitec Pivot). The emissions from these fertilizers averaged $5 \times 10^5$ t CO$_2$-e per year, averaged over ten years of records, modeled using algorithms developed by IPCC (Intergovernmental Panel on Climate Change 2006). The Wet Tropics carbon project would help to reduce this application rate by 20% or more by encouraging farmers to trade the difference in emissions below legislated regional baselines. Landholders in the region have shown strong interest in measures to reduce their fertilizer use and trade the resultant reduced emissions.

**Conclusions**

Lessons from Australia’s Wet Tropics Project can help define and highlight implementation issues that move beyond land tenure, governance and technical capacity; issues Australia has mostly resolved. In some States, the rights to carbon have not yet been assigned. While the Australian government has accounted for Australia’s greenhouse gases regardless of the tenure of the land, it is the right of the States to determine ownership of carbon on private land. In Queensland, for instance, the rights to carbon are assigned through legislation to landholders on freehold land, but not yet on leasehold land. In this light the Queensland government has established a policy that those rights will be assigned to leaseholders when a carbon trading scheme is enacted. Once issues such as this are resolved, then the Australian Wet Tropics model of aggregating smallholdings could be appropriate as it provides the processes and mechanisms to aggregate multiple small carbon sequestration projects and reduces transaction costs, which often are impediments to carbon trading.

Most importantly, the Project is built on approaches and innovations developed through existing NRM frameworks, which have well-established regional priorities.
Australia’s national NRM framework is itself built on an integrated, regional planning process that focuses not only on economic sustainability but also on ecologically sustainable management, biodiversity and water quality.

Each regional plan is founded on inclusive community-based engagement involving community working groups as well as separate stakeholder and science reference groups, ensuring that all sectors are involved in setting regional priorities, and that information is available from the earliest stages. The regional plans themselves integrate both national and state-level statutory programs with non-statutory programs, and identify targets and actions beyond regulation.

The Wet Tropics NRM provides the framework for the aggregation of AFOLU activities using existing international and national methodologies. This grounding in existing robust systems also allows for capacity building and development of new methodologies, and refinement of existing methodologies. The Wet Tropics Project aggregates activities across the Wet Tropics landscape, reducing transaction costs.

The aim of the Australian government’s proposed Carbon Farming Initiative is to provide the financing mechanism through legislating clear rules for the recognition of carbon credits for the international and national markets.

Keeping rules simple while demanding high integrity standards will be a major challenge for Australia. Frameworks and rules which are too restrictive may come at the cost of an overall environmental outcome.
Chapter Seven

Integrating agriculture and climate change mitigation at a landscape scale: implications from an Australian case study
Chapter Seven

Integrating agriculture and climate change mitigation at a landscape scale: implications from an Australian case study


Context

Following Chapter Six, which describes how Australia’s regional natural resource management (NRM) framework could be used for aggregating multiple small ecosystem sector projects across the landscape, this chapter briefly reviews the theoretical foundations for integrated NRM. The chapter reviews Australia’s historical legacy of environmental degradation as a result of top-down decision making, and the emergence of regional or catchment scale natural resource management as a more systemic framework for natural resource governance. This chapter also notes the last decade of initiatives in governance aimed at more devolved regional approaches.

The Wet Tropics Project is again used to show how the integrated NRM framework can set a governance framework for aggregation of ecosystem sector activities. As a social-ecological system, such a framework could achieve a more resilient landscape.

The integrated NRM framework is particularly relevant given that the need for landscape approaches has recently emerged as part of the United Nations climate change processes discussed in the introduction to this thesis. In 2012, at the Doha
Conference of Parties (COP), it became apparent that overlapping concepts such as Landuse, Landuse Change and Forestry (LULUCF), Agriculture, Forestry and Landuse (AFOLU), agriculture, Reducing Emissions through avoided Deforestation and Degradation (REDD), and Nationally Appropriate Mitigation Actions (NAMAs) may best be addressed through a landscape approach.

Recent shifts in policy have reverted to a more centrist approach that can undo many of the hard-won benefits of devolved governance, and this chapter tracks these policy shifts as part of a continuing theme of the influence of policy on the integration of the ecosystem sector and climate change mitigation.
Abstract

Rural areas provide the ecosystem services for increasingly urbanized communities across the globe. These ecosystem services provide vital opportunities in securing climate change mitigation and adaptation. Their integrated management in the face of climate change, however, can be confounded by fragmented and uncertain institutional arrangements concerned with natural resource management. This suggests the need for a more systemic approach to continuous improvement in the integrated and adaptive governance of natural resources.

This paper briefly reviews the theoretical foundations for integrated natural resource governance and its emergence in Australia. From this foundation, we review the last decade of initiatives in governance regarding the integration of agriculture and forests across the entire Australian landscape. This includes the shift towards more devolved regional approaches to integrated natural resource management (NRM) and recent progress towards the use of terrestrial carbon sequestration at the landscape scale to assist in climate change mitigation and adaptation. These developments, however, have been tempered by sudden shifts in policy, a significant raft of new land sector regulations that have tended to be based on a more centralist philosophy that landowners should be providing ecosystem services for the wider public good without substantive reward, and a narrow project-based approach to the development of land sector offsets for climate mitigation. These influences can undo many of the hard-won benefits of a stable regional approach to natural resource governance.

Given this background, we explore a case study of efforts taken to integrate the governance of landscape-scale agro-ecological services in the Wet Tropics of tropical Queensland. This has been achieved primarily through regional NRM planning linked to targeted regulatory effort and the development of aggregated
terrestrial carbon offset products at a whole of landscape scale via a pilot aggregating project. Finally, the paper investigates the barriers and opportunities being experienced in improving landscape-scale governance, leading to discussion about the global implications for managing climate change, income generation and poverty reduction.

**Introduction**

Rural areas provide the ecosystem services for increasingly urbanised communities across the globe (International Union for the Conservation of Nature 2006, Daily et al. 2009). These services include productive soils, forests and pastures, quality water, bio-energy, temperature control and shade, storm and wave attenuation and faunal and floral biodiversity. They provide the foundations for life and underpin our economy and our social and cultural wellbeing. Integrated and sustainable management of the natural resources that supply these services helps to balance competing demands for them and, through synergies, could potentially enhance the role of rural regions in the delivery of greenhouse gas abatement (World Bank 2009). Healthy and inter-related ecosystem services provide the best opportunities for regional landscapes and communities to adapt in the face of climate change (Tompkins and Adger 2004).

Conventional management practices in production-oriented systems tend to be uni-dimensional, however, favouring policies for the use of natural resources for short-term enterprise profits. This comes at the expense of other ecosystem services on which rest the foundations of our society (United Nations 1997, Millennium Ecosystem Assessment 2005). Grazing pressures in certain pasture and soil types, for instance, are often aimed at securing maximum beef production in the short term at the expense of longer term soil health, productivity and other essential ecosystem services. In many places across the tropical world, water quality has declined or
water has been allocated beyond the flows that are required for a healthy river system (United Nations Environment Program 2008). Land has been over-cleared, creating threats to biodiversity and local climate and emitting considerable atmospheric carbon. Soil health (including organic carbon levels) has often declined, enhancing erosion, reducing longer term productivity and requiring an ever increasing dependency on energy-intensive cultivation and nutrient inputs (Doran 2002).

Alternatively, moving away from such a uni-dimensional approach to production can often both enhance longer-term productivity and enhance multiple ecosystem services across the landscape, including carbon biosequestration (Eady et al. 2009). Taking grazed riparian zones out of pastoral production and providing incentives for reafforestation with native vegetation, for example, can sequester carbon, create new habitat for endemic biodiversity, increase connectivity between habitats, reduce heat stress in livestock and enhance water flows and quality (Fleischner 1994).

Optimizing long term agricultural productivity and achieving local and regional food security will rely on better integrating multiple ecosystem service benefits in agricultural landscapes. Poorly integrated catchment and floodplain management (inclusive of both water quality and quantity issues) is increasing the risk of food security problems as well as exacerbating the impacts of extreme climatic events like droughts, floods and cyclones (Penning de Vries et al. 2003). The main impacts of climate change on agriculture include soil production decline, water security declines, increasing frequency of weather extremes and sea level rise (Hoffman 2011). These impacts increase the risks of political instability and food security in both the developing and developed world (Holden et al. 2005). How land is managed is central to achieving a balance between productive and other ecosystem services, locally, regionally, and in the case of greenhouse gas budgets, globally (Houghton 2007).
A key international challenge facing the improved management of ecosystem services in the face of climate change is the lack of regionally differentiated management approaches since climate change causes regionally differentiated impacts (Steffen et al. 2009). The global response to climate change and food security will require regionally-specific solutions, management approaches and transaction costs (Robledo & Blaser 2008). Regions, in this instance, refer to agro-ecological regions (Williams et al. 2002), many of which are also closely aligned to recognizable socio-political communities and/or cultural landscapes. Many of the issues of agricultural sustainability and natural resource management such as water quality and quantity, biodiversity and the sustainable use of soil and pasture resources can be measured and addressed technically best at a regional scale, closer to the local community (Holling and Meffe 1996) following the principle of polycentric governance (Walker et al. 2009), where organisations have considerable autonomy at a range of scales, and subsidiarity (Marshall 2008), where tasks are decentralized to the lowest level of governance capable of dealing with them satisfactorily. Regional organisations are often best placed to provide improved integration of politics and the administrative arrangements needed to balance the economic, social and ecological dimensions of development. Integrated approaches to land management at the regional scale have been evolving across the globe for several decades and are seen increasingly to be appropriate for effective landscape-scale management of natural resources (Dale et al. 2008).

Through a case study in Australia’s Wet Tropics, this article explores the associated link between climate change mitigation and adaptation in agricultural landscapes using Australia’s regional natural resource management framework as the basis for aggregating the abatement activities of small landholders. We provide a brief history of regionalism as it pertains to agriculture and natural resource management in Australia and examine the barriers and opportunities experienced in using this pilot
approach. While the case-study is an ongoing learning-by-doing experience not yet fully travelled, we suggest that providing incentives for abatement activities within this natural resource management framework can achieve a more resilient system in that it will have the ability to shift and transform rural landscapes and communities in the face of continuing climate change. The framework provides the potential to contribute to both mitigation and landscape-scale adaptation, enhancing longer-term food security. We also show how sudden shifts in policy can potentially undo many of the hard-won benefits of a stable regional governance approach.

While the concepts of mitigation and adaptation are often treated as being separate, in agricultural landscapes they are integrally linked. Mitigation builds the adaptive capacity of a landscape, which results in enhanced resilience. Preventing soil carbon emissions through improved agricultural practices, for example, both mitigates new emissions as well as making soil more resilient to water and nutrient loss and erosion risk (Doran et al. 1998). Rehabilitating tropical watercourses both sequesters new carbon and can help secure flows for consumptive use, and so on.

We have also made an attempt to use the case study in this article to inform new and related theoretical constructs on resilience and social-ecological systems, greenhouse gas mitigation, climate change adaptation and longer-term decision-making about natural resource management and food security. While we write from a developed world perspective, our experience could provide lessons worldwide. Our discussion and conclusions outline the case study implications and some lessons for tropical agriculture.

The limits of centralized regulation as the primary approach to landscape management

In recent historical times, Australia’s primary response to natural resource problems has been to regulate the management of key natural resources. While this has
achieved significant environmental outcomes, it has come at an economic and social cost to the rural and remote communities that manage these resources through unpaid opportunity costs (Productivity Commission 2003). Implicit in much of the thinking behind more regulatory approaches have been assumptions that rural and regional communities alone should pay for securing the ecosystem services required by wider (largely urban) society. Poorly managed regulation has hence led to resentment towards government and less than adequate management outcomes. Adopting changed practices or new innovations are mostly driven by landholders’ self-interests (Marsh & Pannell 2000). Limited and well-defined vested interests enable cooperation and stewardship, even though recent studies (Gilmour et al. 2012) have shown resource users’ behaviour to be complex and best contextualized within the circumstances. Having no vested interest in managing the forests on their land, on the other hand, landholders can directly or indirectly undermine the outcome (Ostrom 2010). In the long-term, the future of biodiversity, water management and biosequestration potential in Australia is largely dependent on activities on private land, which in turn are dependant on landholders operating in a governance framework that allows them to value and take commercial advantage of the multiple ecosystem services that they provide within the landscape (Department of the Environment Water Heritage and the Arts 2009).

Additionally, regulatory protection of the landscape alone does not create the financial resources needed to manage and restore natural systems and their ecosystem services. Legislation to protect vegetation from clearing, for example, does little to prevent biodiversity decline via poor grazing practices, weed encroachment, altered fire regimes and feral animal pests (van de Koppel & Reitkerk 2000); problems best managed through other (non-clearing) vegetation management practices (e.g. grazing, fire management and weed control). In a sense, regulation itself has tended to become the default baseline for management
and this results in little incentive for improved practices since the foundation is blunt and inflexible - a focus on what can’t be done versus what should be done. Theoretically, using regulation in this way could be seen as a panacea where a single solution has been applied to a multi-dimensional problem with potentially unsuccessful results (Ostrom 2010).

This problem is compounded by the fact that, up until recently, most investment in the physical works required to restore and further protect Australia’s degraded ecosystem services have been funded by relatively small and ephemeral tax-payer funded programs (Department of the Environment Water Heritage and the Arts 2009, Lane et al. 2009). This under-resourced and stop-start approach incorrectly works on the premise that NRM issues once tackled are fixed (Ryan et al. 2010). The resultant under-resourced and short term projects do not provide durable biodiversity, water management and sustainable agricultural outcomes, and do not represent the mix of approaches that encourage long-term decision-making and the cohesive outcome monitoring that are required (Department of the Environment Water Heritage and the Arts 2009). In a world of uncertainty, the decision-making framework itself needs to be adaptive (Stafford Smith et al. 2011) over a long time scale if landscape and agricultural sustainability are to be secured.

Despite these historical limitations, Australia’s evolving national framework governing the management of landscapes has established, almost incidentally, a potentially good foundation for creating tradable markets in ecosystem services. The emerging international and national markets in offsets for terrestrial carbon present the first opportunity for major market driven investment that actually pays landholders for the management of multiple ecosystem services (van Oosterzee et al. 2010). These arrangements could present an opportunity for wider society to contribute to optimizing the management of ecosystem services in the landscape to
achieve food security while protecting multiple ecosystem services, an achievement that does not require the radical redistribution of land title rights and responsibilities.

**From fragmented regulation...**

The Commonwealth of Australia comprises six states and two territories, each with its own legislature and parliament. Australia has a secure land tenure system and clearly defined property rights embedded in law. States in Australia are subject to both their own constitutions, and that of the Commonwealth. While the two levels of government cooperate in many areas, constitutional responsibility for natural resource management and the regulation of agriculture rests with the States.

In the developed and developing world alike agricultural policies affect how land is used, farmer livelihoods, environmental services and carbon emissions. Since European settlement there has been a major impetus for development for agriculture and grazing in Australia. In forest-rich areas such as central Queensland, government sponsored development schemes allowed for closer settlement through incentives such as cheap land and low interest loans. These were conditional on landholders ‘improving’ the land by clearing the forest (Fensham & Fairfax 2003). State governments also offered free one-on-one agricultural extension services. Clearing gathered momentum with bulldozers and chains so that the sustained clearing in central Queensland, until about 1998, was higher than rates from South America.

In the 1970s, as a reaction to this unfettered (and once government-backed) developmentalism, environmental issues began to take a higher profile in society. These issues focused on urban and industrial water and air pollution and the predominant State approach to dealing with them was compliance-oriented regulation. This narrow regulatory approach was not easily transferrable to natural resource management problems, rural landscapes, industries and communities.
At the same time government agencies withdrew their one-on-one free agricultural extension services partly because of the mixed success that this approach produced as evidenced by increasing natural resource degradation (Robins 2007). While this retreat was designed to force landholders to use services available on the open market, it failed to recognise that, while commercial service providers in pure agronomic services do exist, sustainable production and landscape management services often are not purchased or are not available to landholders (Marsh and Pannell 2000).

In a parallel movement over the same period and across the Australian landscape, many landholders (the people managing the bulk of the nation’s natural resources) were starting to come together at the local scale to embrace a new, or to articulate an existing ethic of local stewardship (Lockie and Vanclay 1997). The state government of Victoria was among the first to help galvanize this movement by introducing the concept of Landcare as a state wide, holistic land protection programme to facilitate locally based community groups (Prager & Vanclay 2010). The Landcare theme - individuals and local communities banding together to repair their land and rivers at a grass-roots level - struck a chord in the Australian psyche. The Landcare movement eventually saw both the Australian conservation and farming sectors strike a national accord in the 1980s, leading to the first Australian government investment via national, grant-based funding provided during the ‘Decade of Landcare’ (1990-1999). Over time, Landcare also expanded from being a predominantly farmer based movement to one representing other forms of local collective action in resource-dependent communities including Bushcare, Coastcare, Waterwatch, Indigenous Land and Sea Management and similar grass-roots action groups.

Some sense of regional or catchment scale coordination of these regulatory and/or voluntary activities began developing within individual states from the 1980s via the
emergence of Integrated Catchment Management (ICM) Groups (Lockie and Vanclay 1997). The form and purpose of these groups varied widely across the nation, ranging from early statutory Catchment Management Authorities (including some with regulatory powers in densely populated states like Victoria) to voluntary Catchment Management Associations in less populated states like Queensland, Tasmania and Western Australia. In both cases, a key theme was the need for the development and implementation of integrated catchment management plans encompassing strategies and support for coordinated on-ground action.

From the 1990s, however, international agendas and treaties including on climate change, sustainable development and World Heritage allowed the Commonwealth government to play an increasingly major role. They have done this primarily through tied national grants, which required a bilateral agreement with the States and matching cash or in-kind contribution, and the establishment of a regional approach to NRM (Robins 2007).

The fragmented foundations of strong regulatory and weak grant-based approaches in the 1980s and 1990s failed to stem the inevitable public exposure of several latent natural resource crises, including the collapsing health of Australia’s most productive river (Murray Darling Basin Authority 2010), the increasing threat of poor water quality in the Great Barrier Reef lagoon (Australian Government and Queensland Government 2009) and the widespread and insidious creep of dryland salinity and its impacts on infrastructure and agricultural productivity (Australian Government 2001). A key finding of the recent Assessment of Australia’s Terrestrial Biodiversity (Department of the Environment Water Heritage and the Arts 2009) is that Australia’s biodiversity is still in decline and its threats are ongoing and compounded by climate change.
State-based regulatory approaches also triggered vocal rural resistance and declining trust by communities that had traditionally seen governments as their most reliable partner in improving agricultural production via infrastructure provision and technical extension services (Productivity Commission 2003). In 2009, for instance, a moratorium imposed by the Queensland government on clearing of regrowth forest vegetation for expanding agriculture resulted in widespread landholder resentment and mistrust. This pervasive sentiment is likely to impact on uptake of other government-run programs (Gowen 2009), and to result in growing mistrust in the permanency of other laws including those associated with the creation of carbon credits under the recently introduced Carbon Farming Initiative, which established a domestic offsets scheme for the Australian land sector in 2012.

...to integrated natural resource management...

This overall ad hoc approach failed to resolve the bigger picture strategic and integrative issues facing the sustainability of Australia’s rural landscapes, and led to a theoretical shift in thinking concerning natural resource governance (Commonwealth of Australia 1999, Robins 2007). The combined result was the Australian government looking to become more involved in natural resource management in agricultural landscapes from around the turn of the century. The shift aimed to secure a move from a geographically (e.g. state by state) and sectorally (e.g. water versus biodiversity) fragmented approach with its focus on single issues towards a more systemic and integrated national framework (Dale et al. 2008). This new approach aimed to improve both the functional and structural aspects of the nation’s natural resource governance systems (McDonald et al. 2005), particularly focusing on enhancing connectivity among decision makers, and improved knowledge use, capacity-building and organizational health within institutions (at different scales) to undertake planning, implementation, monitoring and evaluation.
From 2001 onwards, formally negotiated Commonwealth-State arrangements spearheaded important reforms in the delivery of community-based natural resource management through strategic investment at a regional scale where Regional NRM Bodies - groups that can demonstrably represent the majority of the community - develop Regional NRM Plans. The planning process requires securing regional consensus on aspirational targets and resource condition targets across a wide range of natural assets and community (including agricultural) sectors. NRM Bodies are governed by Boards, which represent various skills and regional sectors. Regional investment strategies developed by the community focus on motivating and engaging landholders to improve their management practices. Programs and projects are delivered by a variety of partner organisations such as Landcare groups or other sub-regional groups, industry bodies, local councils or consultants. Landholders elect to become part of the NRM process on their own volition or as part of extension and incentive activities. Collaborative local projects are encouraged and funds or other resources are often provided to implement priority actions. The efforts of Regional NRM Bodies are also required to account for and link in with relevant regulatory planning and management processes.

Regions, in the Australian context, generally refer to a sub-provincial geographic scale considered appropriate to the effective landscape-scale management of natural resources. There are 56 defined natural resource management regions (see Fig 3). Most are based on definable agro-ecological regions that form a sensible management scale in biophysical, social and administrative terms, and largely match biogeographic boundaries (Commonwealth of Australia 2004).

Under these community-based arrangements, Regional NRM Bodies were designated by State and Commonwealth governments on the basis of their capacity to undertake strategic planning, deliver effective natural resource programs and to engage the majority of the regional community’s interests in the development and
implementation of Regional NRM Plans. Regional NRM Plans were jointly accredited by State and the Commonwealth governments and comprise scientifically informed, regionally negotiated targets and priorities. These targets comprise time-bound Resource Condition Targets (e.g. halt and reverse the decline of water quality into the Barrier Reef Lagoon by 2020) and associated Management Action Targets (e.g. rehabilitate 25 kilometres of the region’s riparian zone by 2015). These plans have been built around nationally consistent targets, but are flexible enough to address regional priorities. Once agreed to by Commonwealth and State agencies, the plans form the basis for investment in implementation of identified strategic management actions from governments, local government and the community and private sectors.

Since 2001, when the new regional arrangements emerged, there have been continuing improvements in the capacity of landholders and agricultural industries across the nation in a number of areas (Robins and Dovers 2007). With their extensive landholder networks, Regional NRM Bodies (together with industry organisations and local Landcare groups) have provided the technical and facilitative services for sustainable agriculture required by many rural landholders, particularly after a nationwide retreat from government provision of extension services.

Regional body staff, because they are often trusted more than government workers (Marshall 2009), have tended to be a key point of property-scale extension to a wide range of natural resource management knowledge, advice, funding and support for integrating the management of key assets (such as water, biodiversity, soils and carbon) and threats (e.g. weed and feral animal management, climate change and variability, and salinity). Regional bodies (in association with other delivery agents) have been key drivers of collective farmer action to resolve critical common
problems, and have frequently worked to support planning and improved decision making with both local and regional scale farmer-based and agri-industry bodies.

Essentially, natural resource management carried out at the regional scale via these consensus-driven Regional NRM Plans contributes to sustainable regional and rural development by integrating economic, social and environmental policies via on-ground implementation (Williams et al. 2005). The Regional Bodies, to varying degrees of capacity, have the required deep reach into the catchment, local government, Landcare and landholder-based delivery systems required to achieve complex project management and on the ground outcomes. Regional Bodies also are able to report effectively in a nationally consistent way on progress towards the achievement of targets. Integration with wider regional economic and social development and land use planning processes is also encouraged.

![Australia's 56 natural resource management regions outlined, each supported by Regional NRM Bodies.](image)

**Fig. 3:** Australia’s 56 natural resource management regions outlined, each supported by Regional NRM Bodies.
These regional arrangements for natural resource management have also enabled the scaling up of solutions to cross-regional natural resource management problems. In 2007, for example, Regional NRM Bodies, plus the dairy, sugar, horticultural, cotton and pastoral industries, and the conservation sector (through the World Wide Fund for Nature) jointly recognised the need to address declining reef water quality. This alliance developed a set of agreed pollution reduction targets and a proposal for enhancing the uptake of sustainable practices across all catchments in the reef lagoon. This resulted in the Australian government’s $200 million Reef Rescue Program.

Implementation of this new national framework, while still experimental, with varying strengths and weaknesses across different regions (Lane et al. 2009), has generally resulted in a shift towards more devolved regional approaches that can achieve more integrated natural resource management. A recent review of NRM by the Commonwealth government also conceded that Regional Bodies are effectively building and maintaining relationships with NRM groups and are providing leadership, valuable knowledge and on-going engagement of stakeholders in regional prioritization and decision making (Caring for our Country Review Team, 2012). Much still needs to be done, however, and an analysis of Australia’s NRM governance system and its ability to meet future challenges (Ryan et al. 2010) points out that one of the recurring governance shortcomings is that linkages between development planning and NRM are weak even though development planning causes much of the impact on landscapes.

Because they are based on strong agricultural and rural foundations, Australia’s regional natural resource management system is able to concurrently support and integrate concepts and processes concerning the management of a wide range of ecosystem services, the prosperity of natural resource dependent communities,
climate change adaptation and the need to maintain and enhance regional, if not national, food security. Common NRM practices successfully promoted to land managers and farmers by regional bodies and their sub-regional delivery agents, such as establishing perennial vegetation, revegetation and protective fencing, soil remediation, maintaining ground-cover and zero or minimum tillage cropping (Marshall 2009), are also activities that mitigate GHG emissions. For this reason, this national framework is well positioned to deliver on the extensive co-benefits possible through supplying services to the new carbon-trading markets. At the same time, the decentralization of decision-making closer to the local community increases the adaptive capacity of regions to manage natural resources by matching the scale of governance with the scale of ecological and social processes that need to be managed and mobilized (Walker et al. 2009).

Regional approaches take a longer-term, target-focused, landscape-scale perspective in comparison with the blunt and fragmented, regulatory resource use regimes of the past. These social-ecological systems take into account variables, such as farm income, rural community culture, regional social attitudes, longer-term land use and native vegetation changes and the associated changes in carbon stocks. Many of these are “slow” variables because they change via the accumulation of many small actions (e.g. patch-based vegetation clearing), eventually having relevance at wider scales and driving other slow variables (e.g. changing water tables following clearing). An integrated natural resource management framework, because it deals with these slow variables, can be seen to be more resilient in the face of change and shocks compared with fragmented programs managed remotely (Walker et al. 2009). They can be adapted also for managing the landscape-scale impacts of climate change by guiding and facilitating the aggregation of greenhouse gas abatement and sequestration activities in line with spatially articulated priorities for action within the landscape and regionally
agreed management action targets set out in a region’s integrated natural resource management plan.

…and back again.

Most recently, however, there has been a significant retreat from this more polycentric and democratic approach, which undermines Australia’s hard won regional model in a number of significant ways (Robins & Kanowski 2011). The retreat coincided with a change of government intent on differentiating itself from its predecessor with a new business approach to investment to better target national priorities (Robins 2010). Despite the applause of earlier Labor governments for the democratizing regional model, the new Rudd Labor Government set a largely unexpected course (Robins & Kanowski 2011) with the new Caring for our Country (CfoC) program for natural resource governance.

CfoC has swung the pendulum away from the regional framework that is capable of tackling complex problems requiring integrated approaches (Robins 2010) to an approach focused on a range of tailored investments (Caring for our Country Review Team 2012) similar to the single-issue programs of the 1980s. The framing and delivery of the CfoC program has undermined the regional governance model in a number of key ways including its re-centralized control; its narrow focus on short-term, measurable outputs; and its threat to ongoing investment by state governments (Robins & Kanowski 2012).

Base-level funding which allows Regional bodies to function was cut by 40%, and some regional organisations have had to reduce their staff numbers significantly as a result. Other CfoC funds were allocated on a competitive basis to small groups and individuals who, under the regional framework, had been working collaboratively to help manage the complex problems involving many stakeholders. The 2009-10 CfoC round of competitive grants resulted in 1300 proposals, of which
59 were successful: a success rate of five per cent overall and one per cent for Regional NRM bodies. The cost of the exercise was calculated to be around 16 per cent of the already limited funds (Robins & Kanowski 2011). As a result of all this, many stakeholders in the Australian landscape now find themselves disengaged and unlikely to help with the delivery of NRM outcomes in the future (Robins 2010, Robins & Kanowski 2011).

From 2008 to 2012, NRM plans have been circumvented as the primary mechanism for articulating and delivering regional NRM outcomes and, instead of continuous improvement through joint accreditation of the plans with State governments, the Australian government “shifted away from investment in a complex regional accreditation framework” (Caring for our Country Review Team, 2012, p 9). The centrality of regional NRM plans as the platform for allocating funds has lost ground together with integrated approaches to NRM (Robins 2010). The peak NRM body, the Regional NRM Chairs, was left to express concern that the relationship between the Australian government and the Regions had suddenly been altered with little shared discussion about the impacts on the delivery of NRM (Ryan et al. 2010). The resulting uncertainty frays relationships built on trust over long timeframes.

Against this backdrop, another layer of complexity in natural resource governance has been introduced with the addition of the Clean Energy Future package – the Australian government’s climate change plan and legislative package – which includes a Land Sector package of grants, and the Carbon Farming Initiative (Caring for our Country Review Team 2012). At odds with the stated desire to shift away from accreditation of regional plans, is the fact that the ‘Clean Energy Future plan is focusing on the update and use of regional NRM plans to play a central role in the delivery of NRM’, which according to the government ‘will be the most productive, effective and efficient way of planning for Australia’s future at a scale that historically has been effective in maintaining and enhancing regional values, including
communities, and targeting NRM investment’ (Department of Sustainability, Environment, Water, Population and Communities 2012).

Any application under the Carbon Farming Initiative for an offset project must provide a generic statement about whether the project is consistent with the Regional Plan. A small budget of AUS$24 M has been allocated to the 56 Regions of Australia to upgrade their plans within five years with the funding allocated on a competitive basis. This is a surprising approach given the central role of NRM plans and seems to emulate earlier approaches to natural resource management: top down, blunt and fragmented with funds spread thinly across landholders and landscapes with the potential to produce non-strategic results. A genuine repositioning toward a more democratic approach seems more distant than ever.

**Australia’s Carbon Price Mechanism and the Carbon Farming Initiative**

**A short history**

Coinciding with the natural resource crises of the mid-1980s, climate change emerged as a real issue for the Australian government under Labor leaders Bob Hawke and Paul Keating. At that time Australia was an enthusiastic participant in the United Nations Framework Convention on Climate Change negotiations and was the eighth sovereign state to ratify it (Wilder & Fitzgerald 2008). Australia set an ambitious policy, called the National Greenhouse Response Strategy (NGRS), aimed at stabilizing national GHG emissions at 1988 levels by 2000 with a further 20% reduction by 2005. These aspirational targets were not met, however, and with strong lobbying by the energy, mining and transport sectors against any carbon tax the NGRS together with a subsequent non-binding policy failed to achieve any traction.
In 1996 a new Australian government under Liberal leader John Howard shifted climate policy from the decade of multi-lateralism to one based on protecting Australia’s national interest, in particular its strong energy and mining sectors. In negotiations leading to the Kyoto Protocol, Australia advocated differentiated emission commitments, not only for developing countries but also for developed countries and, unlike most other developed countries, was one of the few to negotiate an increase in emissions (Depledge 2000), which was 108% of the 1990 baseline. In 1998 Australia refused to ratify the Kyoto Protocol. Howard continued to rule out an emissions trading scheme, despite a detailed design for one developed by his own Ministers.

Nevertheless, growing public awareness of climate change and an impending election saw climate change become a major issue in 2007, and in the lead up to the election the Labor opposition ran hard on the ratification of the Kyoto Protocol and the introduction of an emissions trading scheme. At the last instant the Howard government reversed the 11-year-old Liberal policy against an emissions trading scheme but that did not halt the election of the Labor Party to Government (Wilder & Fitzgerald 2008) under Kevin Rudd, who had famously stated that climate change was the greatest moral challenge of our time. One of Rudd’s first acts on winning the election was to sign the Kyoto Protocol.

In May 2009 the Rudd government announced the proposed Carbon Pollution Reduction Scheme to be introduced as legislation in 2010. Of the AFOLU sector, this Scheme included reforestation only, with agriculture to be considered later, and deforestation and forest degradation not considered. Fearing rejection of the Scheme in the Senate (one of Australia’s two houses of parliament), significant changes were negotiated with the opposition in November 2009. These changes included introducing amendments for crediting the full suite of AFOLU emissions that are counted toward Australia’s Kyoto accounts. The Senate, however, failed to
pass the CPRS in late 2009. After a disappointing result in Copenhagen, Rudd effectively scrapped the CPRS, which triggered his ousting in June 2010.

**Australia’s Clean Energy Future**

Australia’s Clean Energy Future package and accompanying legislative package establishes an emissions trading scheme. Similar to that in Europe, the Scheme imposes obligations on industry to reduce greenhouse gas emissions through the surrender of tradable permits or the use of domestic or international offset projects (Carbon Market Institute 2011). The Scheme started on 1 July 2012 and will capture about 500 of the nation’s biggest polluters.

Emissions from the land sector, including agriculture, are not covered by the Scheme, allowing the sector, instead, to generate tradable carbon credits under the Carbon Farming Initiative (CFI) (http://www.climatechange.gov.au/en/government/initiatives/carbon-farming-initiative.aspx; accessed 6 January 2012). The CFI is the first national offset scheme in the world to include the broad suite of AFOLU activities. The objectives of the CFI are to help Australia meet its obligations under the Kyoto Protocol; to create incentives for people to undertake land sector abatement; and to do that in a manner consistent with protecting Australia’s environment (Commonwealth of Australia 2011). The CFI works in conjunction with Australia’s Clean Energy Act and accompanying legislative package, but trades in the voluntary market.

The CFI offsets are generated from project-level baseline and credit activities differentiated into sequestration (in vegetation and soils) and emissions avoidance projects (from avoidance of methane and nitrous oxides from feral animals and agriculture); essentially activities pursued for good natural resource management.

The credits, called Australian carbon credit units (ACCU), can be used for compliance under the Scheme and also sold into international and domestic carbon
markets. The meanings of the definitions used in the CFI are derived from accounting commitments under the Kyoto Protocol and, uniquely, Australia has recognised a broad coverage of offsets of two kinds, those that are Kyoto-consistent (that Australia counts toward its Kyoto Protocol emissions reporting inventory) and those that are not. Kyoto-consistent ACCUs include reforestation, reduction in nitrous oxide emissions from fertilizer use and managing methane emissions from piggeries and dairies. Non-Kyoto consistent ACCUs include soil carbon and improved forest management. Only Kyoto-consistent ACCUs are eligible for trade within compliance schemes. Non-Kyoto consistent ACCUs are not able to be surrendered to acquit compliance liabilities. They can only be used in voluntary markets or in domestic government programs.

The CFI project development process is complex, and involves a number of steps and processes, each with their own complexity. Before a project can be developed to generate ACCUs a methodology for the project type must be approved through the statutory Domestic Offset Integrity Committee. Once there is a methodology, the processes to implement a project include; becoming an eligible offset project; opening a registry account; undertaking a project according to approved methodologies; submitting regular audit reports; and applying for credits and having them issued. Rigorous requirements to guarantee genuine abatement include proving additionality, and permanence of 100 years for sequestration projects.

ACCUs are considered financial instruments and this further triggers policy frameworks established under Australia’s Corporations Act and other legislation. For instance, a project proponent must hold an Australian Financial Services Licence to trade them, and general consumer provisions under other legislation are also triggered, incurring additional transaction costs.
Polluters can purchase international permits (e.g. from the European Union and Clean Development Mechanism) to meet Scheme obligations after an initial fixed price period to bed the Scheme in. This is aimed to provide access to the lowest cost abatement, and means that the price for ACCUs generated by the land sector in Australia, going on present trends, will track EU permits.

**The greenhouse gas market and the Australian landscape: a case study**

The agriculture, forestry and land use sector in Australia account for 25% of Australia's total emissions (Australian Government 2010). A recent assessment of greenhouse gas abatement potential through change in rural land-use demonstrate for the state of Queensland, the second largest state in Australia, that the overall attainable greenhouse gas abatement was 140 Mt CO$_2$-e per year, or 77% of that state’s emissions (Eady et al. 2009). By 2020, rural land use is projected to offer about 40% of the low cost emissions reductions opportunity (ClimateWorks Australia 2010). This is the largest abatement opportunity available in this country. Given the high contribution to total emissions, the AFOLU sector could potentially transform Australia’s mitigation effort and influence the global mitigation effort (Garnaut 2008).

A pilot scheme, developed for the Wet Tropics Region in northern Australia (Figure 1), aimed to demonstrate how the natural resource management activities of Australia’s existing Regional NRM Bodies could be aggregated for both regional and larger scale delivery of climate mitigation and abatement. The Project was built on the Wet Tropics Natural Resource Management framework, which has well-established regional priorities built on an integrated, regional planning process that focuses not only on economic stability but also on ecological sustainable management, biodiversity and water quality. Community-based engagement through community working groups as well as separate stakeholder and science
reference groups ensured that all sectors were involved in setting these regional priorities. This governance framework allows for the integration of national and state-level statutory programs with non-statutory programs.

The Wet Tropics Natural Resource Management framework provided the framework for the aggregation of AFOLU activities, which used international and national methodologies. The Degree Celsius Wet Tropics Biocarbon Sequestration and Abatement Project aggregated multiple ‘small-scale’ sub-projects, too small by themselves to be profitable in the carbon market. In Australia, 86% of agriculture and forestry businesses are small businesses (ClimateWorks Australia 2010). Trade in regional carbon in the Wet Tropics was estimated to be in the order of 100,000 tonnes of CO$_2$-e in 2009, increasing to at least 500,000 tonnes of CO$_2$-e per annum by 2013 (Degree Celsius 2009a).

The Wet Tropics Region of Australia comprises about two million hectares. The traditional land management practices of rainforest Aboriginal people shaped the ecosystems of the Wet Tropics region for thousands of years. European colonization had a devastating effect on Aboriginal people and ecosystems. The European history of the region started in the early 1800s and by 1875, people arrived to work in the goldfields and as timber cutters. By 1881 timber cutters had reached the western margin of the Atherton Tablelands. Cattle grazing was introduced to supply meat for the growing coastal settlements, and rainforest was progressively cleared from the lowlands to make way for sugar cane. Government land schemes required settlers to clear the land in specified timeframes. As early as the 1930s there were criticisms of the impacts of extensive land clearing, and a few decades later, forests began to be secured for selective timber harvest. Logging was a major industry until 1988 when the Wet Tropics World Heritage Area was listed (McDonald and Lane 2000).
Currently, land use in the region largely comprises conservation, tropical agriculture, urban, tourism and rural residential development and indigenous land uses. Much of the accessible land is privately owned, while the more rugged parts of the region are mainly leasehold land, State forest or National Park. Most of the forest in these areas is contained and protected within the Wet Tropics World Heritage Area. Agriculture is the main productive land use; in 2001 there were nearly 130,000 ha under cropping and about 25,000 ha under horticulture, 20,000 under dairy and 700,000 under extensive pastoralism. Improved pastures for grazing accounted for about 65,000 ha. In the coastal areas, the main crops are sugar cane and bananas. Extensive grazing is the main land use in the drier, western part of the region. Forestry as an industry has declined in recent times, though rainforest vegetation covers about 95,000 ha of freehold land. The main land use trends include, on the lowlands, ongoing sugar farming and horticultural activities (e.g. bananas and tropical fruits), livestock, private forestry and aquaculture. The relative balance between the extent of these crops fluctuates over time depending on commodity prices (McDonald & Weston 2004).

The Region incorporates most of the Wet Tropics of Queensland World Heritage Area (around 1.2 million hectares) and all catchments in the Wet Tropics also flow into the lagoon of the Great Barrier Reef, another World Heritage asset of national significance. Consequently tourism, based on the integrity of the region’s world-heritage assets and rural landscape, ensures an active regional debate about the need for integrated management of multiple ecosystem services. Losses of agricultural sediments, nutrients and pesticides, apart from diminishing productivity, reduce the resilience of reef ecosystems, while clearing for agricultural expansion competes with the protection of terrestrial world heritage values and the viability of economically important iconic species such as the cassowary.
In recent years, there has been a particular focus on regulating land management practices to reduce nutrient, sediment and chemical runoff into the reef, and vegetation management also has been heavily regulated. Activities conducted by landholders, consistent with the Regional NRM Plan, could further enhance the achievement of critical regional targets through greenhouse gas trading, earning investment for both the Regional NRM Bodies as well as for the landholders undertaking the activities. In turn, this incentive could contribute to reducing deforestation and degradation, increasing reforestation and improving agricultural community and industry uptake of best management practices, which in turn would significantly enhance the capacity of the region to secure the Resource Condition Targets agreed to in their Regional NRM Plan. Since water quality issuing from Great Barrier Reef catchments is a key driver of Great Barrier Reef health (De’ath et al. 2012), arguably it will be the integrated regional management of the Great Barrier Reef catchments that will determine how the Reef survives climate change now and into the future.

With no other market framework available, The Wet Tropics Project when it was being planned in 2006 and 2007, intended to meet all the requirements of the Voluntary Carbon Standard (as it was then) (Voluntary Carbon Standard Association 2007), and was going through the final stages of an audit against the Climate Community and Biodiversity Standards (Degree Celsius 2009a). The Wet Tropics Project used existing methodologies of the Clean Development Mechanism of the United Nations Framework Convention on Climate Change (e.g. United Nations Framework Convention on Climate Change 2008a) and of the Inter-Governmental Panel on Climate Change (Intergovernmental Panel on Climate Change 2006). The nitrous oxide emission calculation guidelines of the Inter-Governmental Panel on Climate Change (Volume 4, Intergovernmental Panel on Climate Change 2006), for instance, were used to calculate the abatement effect of reduced use of fertilizers on
agricultural land. The National Carbon Accounting Toolbox FullCAM program (Department of the Environment and Heritage 2005; Richards & Evans 2009) was used to model reforestation and avoided deforestation and forest degradation activities. NCAS is based on resource inventories, field studies, modeling and an extensive remote-sensing program, and calculations of carbon emissions and sequestration use the National Carbon Accounting Toolbox (NCAT).

The on-going deforestation rate in the Wet Tropics, for example, has averaged 1660 ha per year for the past 20 years (Department of Environment and Resource Management 2009), equivalent to a release of at least 450,000 t CO₂-e per year. The Resource Condition Target for the region’s biodiversity is to maintain and enhance existing native vegetation. By putting a carbon monetary value on these unprotected forests, farmers could have an incentive to retain them, reduce the emissions caused by clearing and help secure the region’s biodiversity targets. Additionally in the Wet Tropics, forest practices such as logging are degrading biodiverse remnant forests. Degradation, in the form of logging of remnant forests for timber is also an on-going practice, and based on recent trends in submitting notices of intention to log (unpublished data from Dept of Environment and Resource Management database sources, first half 2009), the potential savings in avoided degradation in the Wet Tropics could be over 1.2 M t CO₂-e per year, if landholders who intend to log choose to retain their trees to sell the carbon sequestration benefits.

By contrast, historic data show that reforestation using environmental plantings is occurring at about 40 ha per year (upper estimate, based on 91 ha planted from 2005 to 2011 in the main environmental planting program in the region - http://www.barronriver.org.au/green-corridor/green-corridor/; accessed 4th December 2011), which is small compared to the area being cleared (at least 990 ha per year). This is less than 1% of the potential sequestration benefits of avoided
deforestation and degradation, but is achieved as a result of the financial incentives to plant trees. As such, under a workable carbon market, reforestation rates would increase in ways that would secure the required regional land management target. Alternatively, the current regulatory system, supplemented by limited and ad hoc government funding for tree planting, is not able to stem the tide of continued biodiversity loss within the region (Department of Environment, Water, Heritage and the Arts 2009). This means that, without a solid market mechanism in place, the plan’s biodiversity targets will not be achieved, and all remaining unprotected vegetation may eventually be cleared. Further regulation would result in new pre-emptive clearing activities and further social costs for landholders.

Reduced fertilizer pollution is a key Management Action Target, resulting coincidently in reduced nitrous oxide emissions. Sugarcane plantations cover over 130,000 ha of the Wet Tropics region (McDonald & Weston 2004), and as mentioned, lie in the catchment of the Great Barrier Reef. The average application of nitrogenous fertilizers to sugarcane was estimated to be 200 kg ha per year. The emissions from these fertilizers averaged 500,000 t CO$_2$-e per year, averaged over ten years of records (N. Preece, unpublished data, modeled using algorithms developed by Intergovernmental Panel on Climate Change 2006). Consequently, the Wet Tropics Project would help to reduce this application rate by 20% or more by encouraging farmers to trade the difference in emissions below legislated regional baselines. Landholders have shown interest in measures to reduce their fertilizer use and to trade the resultant reduced emissions.

Potential greenhouse gas mitigation and abatement project activities in these industries and land uses - most securing a range of multiple ecosystem service benefits - include avoided deforestation, avoided degradation, reforestation using native species, and agricultural land management through increasing soil carbon, pasture cover and fertilizer use reduction. Using the existing accredited Regional
NRM Plan as the framework for guiding the aggregation of carbon sequestration activities for the market, the Wet Tropics Project aimed to ensure the delivery of complementary biodiversity, sustainable agriculture, water quality and community benefits (Wentworth Group 2009).

**Discussion and Conclusions**

In the face of climate change most countries will be seeking to institutionalize a mix of regulatory, government incentive and investment-based measures to achieve food security and ecosystem resilience, and this Australian case study of integrating mitigation and abatement suggests key lessons that can be considered from the local to the global.

Most profoundly, the price of carbon will determine the level of uptake of changed land management practices associated with the development of tradable carbon offsets. The Degree Celsius Wet Tropics Biocarbon Sequestration and Abatement Project was initiated in 2006 when the carbon price hit a peak of €32, and traded above €30 in 2008 (after the crash to near zero in 2007). Conceptually, the attraction of integrating mitigation with landholder NRM activities in securing landscape change was that it would secure improved landscape management at low cost and regionalized support for management activities that could also provide other co-benefits such as improved productivity, biodiversity and water quality outcomes. In reality the transaction costs of developing offset projects under the CFI have to date proved to be prohibitive. While it is possible to aggregate a number of areas, economies of scale are not reduced through the CFI because each area requires the same amount of scientific, technical, measurement, legal and administrative detail.

Being a creature of the Kyoto Protocol the CFI has adopted a raft of complex rules and processes, which result in high transaction costs. As an example of the sorts of
costs likely to be incurred, contracting a surveyor to map and register one stand of forest will cost in the order of $500-$10,000 or more depending on the complexity of the forest stand. At $10 per tonne CO₂-e, a cumulative return from sales might be in the order of $120 for one hectare of forest in the third year after planting (based on a wet tropics forest). This return would not cover the costs of registering legal rights to the carbon let alone the cost of survey and plan preparation or the costs of establishing the forest.

Recent Australian government estimates themselves confirm the limited abatement potential from the CFI (Australian Government 2011) (Table 4). These estimates are considerably lower than earlier estimates provided before the introduction of the CFI (Eady et al. 2009, Lawson et al. 2008) because the CFI credits trade in the global offsets market. Other restrictions introduced by the CFI, such as permanence and risk of reversal buffer, add to the limited role of forestry under the CFI.

Table 4 – Predicted impact of price in trading carbon credits

<table>
<thead>
<tr>
<th></th>
<th>Medium global action</th>
<th>Ambitious global action</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>2013</td>
<td>2020</td>
</tr>
<tr>
<td>Agriculture</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Abatement (Mt CO₂-e/year)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Land use change</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Abatement (Mt CO₂-e/year)</td>
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<td></td>
</tr>
<tr>
<td>Forestry</td>
<td>&lt;1</td>
<td>&lt;1</td>
</tr>
<tr>
<td>Sequestration (Mt CO₂-e/year)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total abatement</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>(Mt CO₂-e/year)</td>
<td></td>
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</tr>
</tbody>
</table>

*Abatement from the CFI (from Australian Government 2011).*
Under the ‘medium global action’ scenario, which broadly reflects a CFI regime, reforestation activities sequester 72 Mt CO\textsubscript{2}-e cumulatively by 2050, or just under 2 Mt CO\textsubscript{2}-e per year on average. Under the ‘ambitious global action’ reforestation activities sequester 865 Mt CO\textsubscript{2}-e accumulatively or about 23.4 Mt CO\textsubscript{2}-e per year on average. This ambitious action is broadly similar to figures calculated for the Australian Government’s earlier proposed Carbon Pollution Reduction Scheme (CPRS) scenario where forestry was voluntarily able to opt-in under the legislation and receive a higher price that matched the permit price (currently the price of permit for one tonne of carbon is AUD$23). The lower estimates for the CFI credits are mainly due to the price tracking the global offset market. This has considerably lower prices than if forestry credits were part of Australia’s ETS, and traded at the domestic price as was to be the case in the CPRS. Permanence restrictions, water interception and pricing, risk of reversal buffer and other restrictions add to the limited role forestry has under the CFI regime.

In reality even these lower estimates may be difficult to achieve under the CFI. For example, one methodology is currently under consideration for native forest protection, essentially a REDD project ([http://www.climatechange.gov.au/en/government/initiatives/carbon-farming-initiative/methodology-development/methodologies-under-consideration/native-forest-protection-projects.aspx](http://www.climatechange.gov.au/en/government/initiatives/carbon-farming-initiative/methodology-development/methodologies-under-consideration/native-forest-protection-projects.aspx)). This methodology is associated with a single project of about 7,000 t CO\textsubscript{2}-e per year ([http://www.forestcarbonportal.com/projects](http://www.forestcarbonportal.com/projects), which is a small fraction of the estimated 4 Mt CO\textsubscript{2}-e scenario presented in the above table for 2013.

Global experience has warned about the disproportionate focus on complex, conservative and restrictive methodologies and integrity standards at the expense of emissions reductions and environmental outcomes (World Bank 2010). The cost for developing a methodology is estimated to be around US$125,000 and takes two
years to develop from inception to approval (World Bank 2010). The idea that offsets associated with changes in land management are low cost should be reassessed. Most forest-based projects in the world are located on private land and dominated by a handful of heavy players due to the complexity of rules and high transaction costs (Diaz et al. 2012, Peters-Stanley & Hamilton 2012, van Oosterzee 2012).

In Australia such high transaction costs also will favour large land holdings, and specifically discriminates against small holders from participating in the CFI. Frameworks and rules that are too restrictive may come at the cost of an overall environmental outcome (van Oosterzee et al. 2010): at the time of writing no ACCUs had been issued as a result of land use, land use change and forestry activities, and only one offset project – a monoculture involving native conifers - had been registered (Clean Energy Regulator www.cleanenergyregulator.gov.au/Carbon-Farming-Initiative/Register-of-Offsets-Projects; accessed January 2013). Arguably, the complexity of rules has already resulted in perverse outcomes that militate against local people and communities.

As discussed, one of the challenges of incorporating AFOLU into policy frameworks is a lack of regionally differentiated governance approaches using local knowledge to manage climate change impacts at a regional scale (Steffen et al. 2009, van Oosterzee et al. 2010). Responses to climate change also require regionally-specific technical solutions and management approaches, which incur different transaction costs (Robledo & Blaser 2008). At the same time, well-considered landscape actions could support landscape adaptation to the impacts of climate change because impacts, such as catchment disturbance, biodiversity loss and pollution, often act in unison at regional scales, suggesting that fragmentary approaches to natural resource management should be replaced by integrative strategies that can alleviate multiple sources of threat (Vorosmarty 2010).
The scale and complexity of NRM can be handled sensibly at an agro-ecological regional scale in a way that engenders trust, and in partnership with communities using a devolved approach to governance. Because Australia has been through several major iterations of an emissions trading system and seen significant changes in direction and emphasis in regional governance frameworks, this case study and analysis could provide a valuable global example of this learning-by-doing approach to the treatment of ecosystem services provision such as carbon abatement using regional natural resource governance and frameworks. Integration of effort and strategic planning and coordination at the regional scale presents a real opportunity for cross-sectoral agreement and collaboration in achieving resilience and a balance between production and conservation values. Carbon and other ecosystem service markets present the transformational opportunities needed to secure significant and stable investment in production, biodiversity, water and mitigation and adaptation outcomes. Equally, no matter how evolved institutional arrangements and rule of law are, unilateral policy reversals can undo hard won gains, and constrain the durable actions needed to build resilient landscapes. The goal of integrating NRM and carbon markets to help regions adjust to climate change and its impacts rather than being overwhelmed by it seems a long way off.

Australia has made the unprecedented step of allowing the creation of compliance-grade carbon credits broadly from the ecosystem sector. Given this, perhaps the single most important environmental outcome is for widespread uptake of the CFI. A way to do this is to move quickly and comprehensively to landscape-scale and standardized approaches (van Oosterzee 2012). It would be possible, for instance, to set regional baselines for avoided deforestation as was done in the Wet Tropics Project. Using a regional baseline it would be possible to streamline an approach that allows landholders to opt-in to regional-scale avoided deforestation opportunities using standardized templates. This would also mean moving away
from assessing 100% of projects and large buffers which earn nothing, and instead using quality control, insurance and risk based approaches to focus on non-compliance as is done in other frameworks such as financial due diligence (Platanova-Oquab et al. 2012; van Oosterzee et al. 2012).

The Wet Tropics Project has been a useful prism through which to view the changing policy environments. For instance, the first version of the Carbon Pollution Reduction Scheme in early 2009 had the effect of disintegrating the Wet Tropics Project’s integrated approach and replacing it with an assortment of disconnected approaches, which mostly ignored the potential of AFOLU in carbon mitigation and abatement: only reforestation was to be included in the Scheme, on an opt-in basis; avoided deforestation was excluded from the Scheme even though deforestation is counted towards Australia’s Kyoto accounts; avoided degradation, or improved forest management, is not counted toward Australia’s Kyoto accounts and could have been traded only in international voluntary carbon markets. Agriculture was not to be considered until 2013, leaving this sector in limbo. The existence of the Wet Tropics Project, as a case study of the impact of the CPRS, was communicated to both opposition and government (e.g. Degree Celsius 2009b) and proved influential in the incorporation of the full suite of AFOLU offsets in the November 2009 amendments, a treatment that was later carried over to the CFI.
Chapter 8
Conclusions
Chapter 8
Conclusions

Context

This concluding chapter summarizes the research and its contribution to practice and policy. First, the chapter provides a synopsis on the contribution of each chapter to the overall thesis. Following this are reflections on the implications of this research on policy and practice showing where past debates still influence current policy. Examples of solutions are highlighted, such as risk-based approaches, a move toward landscape approaches, and examples of the incorporation of the ecosystem sector in national and sub-regional policies. The ability to use the chapters as hindsight in the light of continuing developments is a compelling aspect of this thesis.
Chapter by Chapter Conclusions

Chapter One

Chapter One (the Introduction) introduces the papers that comprise this thesis. The papers provide a review and consequences of shifting international and national climate change policy as it pertains to the ecosystem sector. The thesis also presents solutions to issues including financing reducing emissions by avoiding deforestation and degradation (REDD), and a framework for a landscape approach incorporating the ecosystem sector within climate change mitigation.

Chapter One introduces the United Nations Framework Convention on Climate Change (UNFCCC) processes, focusing on the Conferences of Parties (COPs), relevant to the ecosystem sector from 1992 to 2012. These processes are the backdrop for the chapters and include the most recent discussions at the 2012 Doha COP, which came after the papers were written.

Of note at Doha was acknowledgement of the overlap between different ecosystem sector concepts including nationally appropriate mitigation actions (NAMAs), REDD, landuse, landuse change, and forestry (LULUCF), and agriculture. This overlap has spurred a discussion of more appropriate approaches, such as a landscape approach for the ecosystem sector, which would better capture the emerging foundations of a global agreement not based on Annex 1/non-Annex 1 foundations (Boyle 2012). The Wet Tropics Project is one such approach.

The Wet Tropics Project is introduced as a landscape-scale case study that acts as a prism through which to view discordant outcomes of policy lurches in Australia. The case study analysis demonstrates that the actions of various international and national policy settings play out in often unintended and discordant ways.
Chapter Two

Chapter Two is primarily an overview paper that contextualizes Australia’s Carbon Farming Initiative (CFI) within UNFCCC processes, noting the politics that led to the forfeiture of the use of the ecosystem sector in the Kyoto Protocol of the UNFCCC. The concept of REDD is also discussed.

The CFI is the first national offset scheme in the world to broadly include the ecosystem sector. Notwithstanding its broad scope, Chapter Two concludes that some of the design of the CFI is a result of ideology embedded within the Kyoto Protocol’s Clean Development Mechanism (CDM). In particular, biodiversity is not integrated within the CFI but dealt with indirectly through safeguard measures that attempt to avoid perverse incentives and unintended harm. The chapter warns that CFI processes are overly complex and costly, reflecting those of the CDM, which were developed in reaction to the toxic politics of the 1990s. Overstated integrity principles such permanence, leakage and additionality underpin the CDM and CFI, and inhibit uptake. In particular the 100-year permanence rule for sequestration projects in Australia is one of the major obstacles to investment even though the logic of the rule is weak, and only one other scheme in the world uses it.

The complexity of rules has resulted in perverse outcomes including the fact that most forest-based projects in the world are located on private land dominated by a handful of heavy players. Uptake in Australia is also low. Most recent figures, obtained subsequent to the paper being written, show that only 37,846 ACCUs have been issued up to mid-2013 (Australian Government 2013b), which is less than 1% of the mitigation potential of the CFI estimated by the Australian Government’s Treasury (2011). The chapter argues for standardized approaches that move beyond Kyoto accounting rules, and outlines some examples.
Chapter Three

In Chapter Three the “rainforest politics” and ideology that resulted in the forfeiture of the ecosystem sector in climate mitigation is more fully elaborated. A snapshot of Australia’s land-based carbon market as it was in 2007 is provided as well as the missed abatement opportunities in the Northern Territory where deforestation is still occurring in a developed world context.

Chapter Three is particularly interesting for its historical context. The chapter discusses Brazil’s role in the rainforest politics of the 1990s, for instance, as being against protecting forests because of national sovereignty issues. The chapter notes, however, that governors of Amazonian states did not share this position. In 2011, a memorandum of understanding was agreed between the governors of California and the Amazonian state of Acre, and this is facilitating the incorporation of REDD into the California’s cap-and-trade program, the second largest carbon market in the world. Once implemented, this will be the first program in the world to incorporate REDD activities in a compliance market (del Valle et al. 2013). Perhaps not surprisingly, Brazil’s stance against using forests for international climate mitigation has softened.

While the term ‘REDD’ has come to focus on developing countries, this chapter uses the international issues and terms surrounding the role of forests in climate mitigation as basis for tackling deforestation occurring in Australia particularly in the Northern Territory.

The article was written at a pivotal time; the Rudd Labor Government had just been elected and its first official action was the signing of the Kyoto Protocol; the international voluntary carbon market remained the only market for creating carbon credits from ecosystem sector mitigation, and this was about to change; the 2007 Bali Conference of Parties (COP) was underway, and REDD was drafted into
UNFCCC processes (United Nations Framework Convention on Climate Change 2008b).

The chapter notes that little more than a month after the Bali COP the European Commission banned forestry credits of any kind from the world’s carbon market until 2020, a position it maintains to this day. The reasoning for such an action, the chapter suggests, is ideological. The chapter concludes that it would be more sensible to correct market failures through innovation, research and development, including the valuation of forests and sustainable land use practices, rather than rejecting whole sectors.

Chapter Four

Chapter Four makes the case that the “rainforest politics” leading to the Kyoto Protocol resulted in the decoupling ecosystems and their biodiversity from the formal climate change considerations of the UNFCCC. The Wet Tropics Project is presented as a prism through which to scrutinize the impact of this decoupling.

The paper that comprises Chapter Four was written as Australia was introducing its emerging emissions trading scheme, the Carbon Pollution Reduction Scheme (CPRS), the first scheme in the world to use the framework of the Kyoto Protocol. The paper discusses the impact of the CPRS on the landscape scale Wet Tropics Project, which incorporates a suite of ecosystem sector projects including avoided deforestation, reforestation and agriculture in an integrated approach. The Wet Tropics Project used the existing accredited regional Wet Tropics Natural Resource Management plan as the framework for aggregating multiple small scale projects which also deliver complementary biodiversity, sustainable agriculture, water quality and community benefits. This approach ensures the integration of the ecosystem sector within climate change considerations. Despite the high contribution to total emissions of the ecosystem sector that could potentially transform Australia’s
mitigation effort, only Kyoto compliant reforestation and afforestation were to be included in the CPRS as compliant activities.

The CPRS framework, as it was when the paper was written in 2009, had the effect of disintegrating the coherent approach of the Wet Tropics Project, and replacing it with an assortment of disconnected approaches, which stalled the Wet Tropics Project indefinitely. Deforestation, because it is counted in Australia’s baseline as part of its Kyoto accounts, could not be traded in international markets which undermined the key abatement opportunity identified in the Wet Tropics Project. Avoided degradation is not counted toward Australia’s Kyoto accounts and could be traded in international voluntary markets. Agriculture, including offsets such as fertilizer reduction was not to be considered until 2013.

The exclusion of forests and ecosystem from the Kyoto Protocol comes under harsh criticism in this chapter and throughout the dissertation. Chapter Four concludes that excluding forests from the Kyoto equations has instead added to the certain, permanent and massive loss of biodiversity and ecosystem services in exchange for no gain for climate change mitigation, effectively throwing the baby out with the bathwater by discarding the very thing that it was essential to keep.

Chapter Five

Chapter Five interrogates three key administrative shackles – leakage, permanence and additionality - that were raised as insurmountable technical barriers for the inclusion of the ecosystem sector, particularly forests, in negotiations leading to the Kyoto Protocol. These concepts continue to hinder not only the integration of the ecosystem sector, particularly REDD, and climate change mitigation, but also the international community’s efforts to implement workable financial mechanisms. The paper notes that the concepts, far from being insurmountable barriers to the uptake of ecosystem sector projects, are indicators of real world complexity, not necessarily unique to carbon projects, and not applied as strictly to other Kyoto areas.
Despite their potentially overstated or contrived nature, Chapter Five argues that leakage, permanence and additionality have become entrenched in international negotiations. Encumbering avoided-deforestation projects with administrative shackles such as these, risks massive increases in global deforestation and a concomitant loss of biodiversity, ecosystem services and emissions-reduction opportunities.

As a way of moving forward, Chapter Five focuses more constructively on the risk embedded in these concepts and provides a practical financial solution to project-level private investment that focuses on assessing, reducing and monetizing this perceived risk. The iREDD insurance policy is probably the first proposal of a formal framework where insurance can play a meaningful role in addressing the challenges seriously constraining current REDD development.

**Chapter Six**

Chapter Six introduces a model framework for integrating the ecosystem sector into climate mitigation approaches using Australia’s NRM framework. A lack of regionally differentiated management approaches is identified as a significant gap in the integration of the ecosystem sector into climate change mitigation. The community-based arrangements underpinning regional NRM bodies in Australia establish regional priorities for natural resource management. Regionalizing NRM planning and delivery activities also allows for decentralization of decisions closer to the community. The Wet Tropics Project demonstrates how local NRM activities such as reducing forest degradation, increasing reforestation and improving agricultural practice, can deliver larger scale delivery of climate mitigation and abatement.

Continuing policy shifts influencing the Wet Tropics Project are also discussed. At the time of writing the paper that comprises this chapter, the Carbon Farming Initiative was introduced to trade solely within voluntary markets. With no emissions...
trading scheme, the chapter predicted that low price and high transaction costs would militate against uptake.

**Chapter Seven**

Chapter Seven develops the integrative model for integrating including the ecosystem sector into climate mitigation approaches, using Australia’s NRM framework by reviewing the theoretical foundations for Australia’s regional NRM model, and analyzing the last decade of NRM governance approaches. The chapter is particularly relevant to, and contributes to, emerging landscape approaches being discussed in recent international negotiations. The chapter argues that Australia’s regional NRM framework has the potential to integrate multiple ecosystem service benefits within agricultural landscapes.

Catchment disturbance, biodiversity loss and pollution, often act in unison at regional scales, suggesting that fragmentary approaches to natural resource management should be replaced by integrative strategies that can alleviate multiple sources of threat. The NRM framework provides the potential to contribute to both mitigation, landscape-scale adaptation, and enhanced longer-term food security.

While Chapter Seven is written from a developed world perspective it provides insights, and outlines implications that are more broadly relevant. In particular it suggests that providing incentives for abatement activities within a formalized regional natural resource management framework can achieve a more resilient system that will have the ability to shift and transform rural landscapes and communities in the face of continuing climate change. Through the Wet Tropics Project case study, the chapter informs new and related theoretical constructs on resilience and social-ecological systems, greenhouse gas mitigation, climate change adaptation and longer-term decision-making about natural resource management and food security.
The chapter warns against recent shifts in Australian policy that have reverted to a more centrist and a narrow project based approach to the development of land sector offsets. This may undo many of the hard-won benefits of a stable regional framework for natural resource governance. The chapter tracks these policy shifts as part of a continuing theme of the influence of policy on ecosystem sector and climate change mitigation.

**General Conclusions and Discussion**

As a whole this dissertation contextualizes the role of the ecosystem sector within international and national processes, defining and highlighting issues at the international, national and regional levels, and in science (e.g. global mitigation modeling), finance, technical and accounting areas.

The ecosystem sector fell immediate victim to the political disputes that resulted in the forfeiture of landuse, landuse change and forestry provisions of the Kyoto Protocol, apart from narrowly defined afforestation and deforestation activities. In essence the European position against the US more broadly using forests was that the US would avoid reducing their emissions. The EU interpreted the Kyoto Protocol as a means to spur actions to reduce GHG emissions, ignoring the fact that focusing solely on human emissions was insufficient. The US however believed the point of the treaty was to reduce global atmospheric concentrations of GHG emissions, which could be done by including forests (Leal-Arcas 2011). The US also argued for legally binding differentiated emissions commitments for both developed and developing countries, a position that Australia also adopted.

The consequences of this fraught debate were that, from a global mitigation and ecosystem perspective, only insignificant afforestation and reforestation projects were permitted to play a global role in the Clean Development Mechanism. Afforestation and reforestation make up about 0.75% of total CDM projects which
itself accounts for about 13% of the global market. The largest global carbon market in the world, the European Union emissions trading scheme, accounting for 84% of the total 2011 market value (Kachi et al. 2012), does not accept ecosystem sector credits.

This dissertation demonstrates that debates entwined in long and bitter histories cloud the empirical observation. As we debate the merits of REDD and continue to raise obstacles against it, for instance, deforestation continues apace: about 200 million hectares have been destroyed, amounting to an estimated 147 Gt CO$_2$-e or 245 times Australia’s yearly CO$_2$-e emissions at current rates. While private-sector involvement and trade in REDD is debated, the global trade in forest products grows and is predicted to be worth approximately $450 billion per year by 2020 (del Valle et al. 2013).

The opportunity to correct the failure of not properly valuing forests arose again in 2005, as REDD, which was incorporated into UNFCCC processes as part of the Bali Roadmap in 2007 (United Nations Framework Convention on Climate Change 2008b). In the five years since then good progress has been made on REDD (del Valle et al. 2013), including multilateral, national and sub-national approaches, which are addressing the phantom “insurmountable obstacles” raised in the lead up to the Kyoto Protocol. Much technical work has also been achieved including guidance on national and sub-national forest monitoring, measuring, reporting and verification, determination of reference levels and implementation of country level REDD programs (la Viña et al. 2012, Dutschke 2013). Indeed, REDD is now seen as ‘mature’ and ready for provisional implementation (la Viña et al. 2012).

This dissertation describes how ideology, embedded in negotiations concerning the ecosystem sector and climate change, continues to cascade across scales and sectors. In the finance sector, the divisive debate about market versus non-market
approaches, for instance, stems from the ideological position that private investment in forests would allow industrialized countries to avoid reducing industrial emissions (Fearnside 2001). Today this view is one of the main factors now stalling REDD implementation, most recently arising in discussions concerning REDD in the 2012 Doha COP (Dutschke 2013). The estimated resources needed to reduce emissions from REDD by 50%, range from US$17 to 28 billion per year (O’Sullivan et al. 2010), and since the 2009 Copenhagen climate conference, additional funds of US$4 billion per year from 2010 to 2012 have been pledged to REDD efforts, which is barely a third of the lowest estimates needed (Swickard and Carnahan 2010). Clearly private sector investment is essential to help raise financial resources at the scale required (Hohne et al. 2013). Underscoring this is the fact that global climate finance flows reached about US$364 billion in 2011, with public sector investment amounting to a mere 5%, and the private sector contributing the rest (two thirds as solely private, and about one third as private-public partnerships).

At the technical level the definition of reforestation under the Kyoto Protocol, determined narrowly and in reaction to the politics of the time, now unhelpfully cuts across definitions of REDD. Since reforestation under the Kyoto Protocol is limited to areas that were deforested prior to 31 December 1990, logically all forests deforested in 1990 and before will be classified as applicable to REDD. The necessary data to determine this level of detail is often not available for developing countries (Dutschke 2013), and is not straightforward for developed countries to obtain, such as Australia, where various estimates of abatement for forest management exist (Mitchell et al. 2012).

Discussions related to accounting for REDD remain underpinned by historical contexts creating tensions and impasses. Recently, the UNFCCC Subsidiary Body for Scientific and Technology Advice (SBSTA) warned the debating parties that monitoring, reporting and verification “cannot be more burdensome for REDD+” and
that “parties shall not permit the introduction of more burdensome requirements for the MRV of REDD+ activities” (Subsidiary Body for Scientific and Technological Advice 2012a, paper A paragraph 6).

As history has demonstrated, it remains possible that REDD and the ecosystem sector could follow the path of LULUCF in the Kyoto Protocol, and fall victim to long drawn-out negotiations toward a strict, rules-based accounting regime, and overstated concepts of integrity with little gain for ecosystems or climate.

Australia’s CFI is modeled on the complex processes and high transaction costs embedded within the CDM. Estimates of the mitigation potential of the CFI vary between 6 Mt CO\textsubscript{2}-e and 9 Mt CO\textsubscript{2}-e per year beginning 2012 (Australian Government 2011, Kachi et al. 2012). But only 37,846 ACCUs have been issued up to mid-2013 (Australian Government 2013b), mostly from an Australian Government supported fire abatement project; a long way short of the estimated potential. While the uncertainties of the price of carbon have helped stall the market for CFI credits, at least part of the reason for the low uptake of the CFI is also the high transaction costs associated with the CFI process, examined in Chapter Two, and generally found to be associated with converting carbon trades from the ecosystem sector to tradable commodities (Cacho et al. 2013).

In the 1990s the appetite for investing in ecosystems, particularly forests, was high and this has subsequently waned (van Oosterzee et al. 2012), together with the ambition level in international emission reductions (Dutschke 2013). The loss of the ten years between the 1997 Kyoto Protocol and the 2007 Bali COP has meant a delay in the inevitable work of deriving a solution on the ecosystem sector’s role in climate mitigation. As a result the ecosystem sector is now snagged in the slowly moving international processes, consumed with broader issues of mitigation targets and the formulation of a binding legal instrument to be implemented after 2020.
REDD negotiations, for instance, have not materially advanced since 2010 at COP 16 at Cancun, and international REDD credits will not come on line until after 2020. This presents challenges for forest countries who have welcomed REDD programmes but now see no immediate pathway towards receiving the value of preserving their ecosystems (del Valle et al. 2013).

**Solutions**

Finding solutions is easier if notions of past conflict do not burden the debate. This thesis, comprising a body of peer-reviewed papers, not only contextualizes the ecosystem sector within international and national processes but also contributes some robust solutions to some issues, including an approach for private finance to fund project level REDD, and a case study that informs emerging landscape approaches.

This thesis recognises that the debates about concepts such as leakage, permanence and additionality essentially deal with risk, and thus can be handled using tried and true risk-based financial mechanisms, such as insurance policies (Chapter Five). iREDD is a financial mechanism that aims to use proven financial principles. The risk-based premium is based on five categories of assessment that bed projects within national and international processes, and safeguard biodiversity and social aspects through governance, project management and financial reward.

With progress on the incorporation of the ecosystem sector into climate mitigation policy mired in glacial UNFCCC processes, domestic policies, pilot projects and local case studies have been asked to provide directions (Boyle 2012, La Viña et al. 2012) that aim for climate-effective outcomes (La Viña et al. 2012). One example of a (non-Kyoto) sub-national policy is in California where REDD is being considered for its emissions trading scheme. If successful this will be the first REDD programme designed in the context of a compliance scheme (del Valle et al. 2013).
Another example is Australia’s emissions trading scheme, which is the first national scheme in the world to broadly include the ecosystem sector. Most recently - subsequent to the papers comprising this dissertation being published - Australia has chosen to count cropland management, grazing land management and revegetation towards its second commitment period accounts of the Kyoto Protocol (Australian Government 2013a). This is in addition to the requirement for all industrialized countries to count forest management in the second commitment period of the Kyoto Protocol (United Nations Framework Convention on Climate Change 2011b). Australia has effectively mustered its entire landscape in its approach to climate mitigation, as has been urged by several papers in this dissertation (Chapters Two, Four and Six).

This thesis make a significant contribution to the new realities of climate change – where developing countries now account for 60% of global emissions up from 45% in 2000 - through the development of a case study of a landscape approach to harnessing the potential of the ecosystem sector, using Australia’s existing integrated regional NRM framework. The Kyoto Protocol commitment period 2 (CP2), covers a mere 14% of global emissions, compared with 38% covered by signatories in the first commitment period (Morel et al. 2012). It is no longer appropriate to have a world divided into Annex 1 and non-Annex 1 countries (Marcu 2013). Internationally a new legal instrument is required that is climate-effective, applicable to all and requiring action by all according to “dynamic differentiation” (la Viña et al. 2012) - a nuanced interpretation of the Common but Differentiated Responsibility principle enshrined in the UNFCCC, and interpreted through the Kyoto Protocol as committing only industrialized countries to binding commitments on emissions reductions, and specifically excluding commitments from other countries.
Under these new realities all parties need to contribute meaningfully to UNFCCC objectives, including the use of new markets to promote mitigation actions (Marcu 2013). Recent discussions on such approaches include the use of “various approaches” and “new market mechanisms” which are broad and all-encompassing, including international, domestic, sub-national and sectoral approaches, and potentially units from the voluntary market (United Nations Framework Convention on Climate Change 2012).

It would be possible, for instance, for trading not only to occur among and within industrialized countries but also among and within developing and developed countries (Marcu 2013). It could be possible, for instance, for a developing country to buy an Australian avoided deforestation unit to meet its international commitments.

In preparation for these new realities the Subsidiary Body for Scientific and Technology Advice has recently agreed to consider a more comprehensive approach to the ecosystem sector such as a land-based approach (Subsidiary Body for Scientific and Technology Advice 2012b). The Wet Tropics Project with its emphasis in regional governance frameworks (Chapters Six and Seven) provides a good example of such an approach. Principles for a landscape approach that reconciles competing land uses have recently been enunciated (Sayer et al. 2013). These include adaptive management, stakeholder involvement and good governance. Australia’s integrated NRM framework, with its cross-sectoral agreements and community collaboration that balances production and conservation values, could set the governance framework for aggregation of ecosystem sector activities. As a social-ecological system, such a framework can achieve a more resilient landscape where carbon and other ecosystem service markets present the transformational opportunities needed to secure significant and
stable investment in production, biodiversity, water and mitigation and adaptation outcomes.

In a way this dissertation shows that we have come full circle with respect to the role of the ecosystem sector in climate mitigation. The disintegration of land use, land use change and forestry into afforestation and deforestation at Kyoto in 1997 shattered the coherence of using the entire ecosystem sector, but the new international realities are slowly beginning to put the pieces back together. It is tempting to raise the spectre of Humpty Dumpty - we will indeed need to put all the pieces back together again in a new global climate agreement if there is to be any chance of keeping global warming below the target of a maximum 2°C increase in this century, and reducing the decline in biodiversity.
References


Depledge, J. (2000). Tracing the origins of the Kyoto Protocol: an article-by-article textual history. UNFCCC.


Eady S., Grundy M., Battaglia M. & Keating B. (eds.) (2009). An Analysis of Greenhouse Gas Mitigation and Carbon Sequestration Opportunities from Rural Land Use. CSIRO, St Lucia QLD.


Framework Convention on Climate Change and its Kyoto protocol, In CBD Technical Series. SCBD, Montreal.


Subsidiary Body for Scientific and Technological Advice (2012b). Methodological Issues under the Kyoto Protocol Land use, Land-use change and forestry under Article 3, paragraphs 3 an 4, of the Kyoto Protocol under the clean development mechanism. FCCC/SBSTA/2012/L.30.


Options For Enhanced Cooperation Among The Three Rio Conventions.
United Nations Environment Programme.


Centre on Energy, Environment and Sustainable Development, Roskilde, Denmark.


World Bank (2009). Convenient solutions to an inconvenient truth: Ecosystem-based approaches to climate change. Environment Department, World Bank, MA, USA.