FINAL REPORT

Carbon Risk Management Strategies for Forest Owners in New Zealand





Prepared for

Ministry of Agriculture and Forestry

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Glossary

Term	Definition
AAU	Amount Assigned Units
CCBA	Climate, Community and Biodiversity Alliance
CCX	Chicago Climate Exchange
CDM	Clean Development Mechanism
CER	Certified Emission Reduction, 1 t CO2e under the CDM
CFI	Certified Financial Instrument
CO2	Carbon dioxide
CO2e	Carbon dioxide equivalent
COP	Conference of Parties to the UNFCCC
COP	Conference of the Parties to the Kyoto Protocol
ETS	Emissions Trading Scheme
EUA	European Allowances
GGAS	NSW Greenhouse Gas Reduction Scheme
GHG	Greenhouse Gas
ha	hectares
IET	International Emissions Trade
IPCC	Intergovernmental Panel on Climate Change
JI	Joint Implementation
m3	Cubic metres
MAF	Ministry of Agriculture and Forestry
NGAC	NSW Greenhouse Abatement Certificate
NPV	Net Present Value
NSW	New South Wales
NZ	New Zealand
NZU	New Zealand Unit
Offset	Abatement of one t CO2e
REC	Renewable Energy Certificate
REDD	Reduced Emissions From Deforestation and Degradation
RMU	Removal Unit
UNFCCC	United Nations Framework Convention on Climate Change
URS	URS Forestry
VCS	Voluntary Carbon Standard
yr	Year

Executive Summary

URS Forestry has been engaged by The New Zealand Ministry of Agriculture and Forestry (MAF) to prepare a report discussing the major risks for forest owners participating in the New Zealand Emissions Trading Scheme (ETS). The report is intended to inform post-1989, exotic forest owners in their decision as to whether to opt in to the ETS; and to provide guidance on potential risks and risk management strategies for both pre-1990 and post-1989 forest owners that are required to, or are voluntarily participating in the ETS.

The report includes the following elements:

- Establishment of a risk assessment framework;
- Literature review of documentation related to previously implemented forest carbon projects and emissions, in relation to risks associated with forest carbon projects;
- Identification of key risks for forest owners participating in the New Zealand ETS; and
- Discussion of potential risk management strategies that could be adopted by New Zealand forest owners, to help manage risks associated with participation in the scheme.

A summary of key risks and potential possible ETS risk management strategies for New Zealand forest owners is summarised in Table ES-1.

Executive Summary

Table ES-1 Potential ETS risk management strategies for New Zealand forest owners

Risk type	Risk item	Mitigation strategies
Participatory	All risks associated with ETS participation	• Elect not to participate in the ETS (post-1989 forest owners) • Apply for exemption from participation (pre-1990 forest owners with < 50 ha) • Participate in the voluntary market
Carbon accounting	Liabilities at harvest or deforestation	• Estate averaging (large forest owners) • Carbon pooling (small forest owners) • Maintain a buffer reserve pool of carbon
	Measurement or modelling error	• Use accepted/prescribed standards and models • Establish detailed criteria, procedures and tolerances for measurements • Incorporate periodic independent verification of carbon sequestration estimates
Market	Carbon price fluctuations	• Retain NZUs to cover future liabilities • Sell NZUs if price increases faster than the required rate of return on investment • Modify rotation length
	Unplanned carbon loss	• Obtain insurance / financial assurance • Make-good or buy out provisions • Source replacement credits from the market
	Forward selling	• Place a high risk premium on credit to reduce price • Implement quality checks to avoid purchase/sale of future credits
	Transaction and compliance costs	• Carbon pooling • Apply a risk-based approach to verification for activities to reduce verification workload and costs • Centralised or third party registry for efficient record keeping
Forest / Project management	Liabilities at harvest or deforestation	• Plant a range of age classes to smooth the emissions profile • Geographic dispersion of estate • Change rotation age, depending on prices
	Unplanned carbon loss	• Implement fire management plans • Conduct pest and disease elimination programs • Thinning and feather edges of wind prone stands • Careful site selection to reduce climate change risk
Regulatory and legislative	Regulatory changes	• Force majeure provisions in long term contracts
	Uncertain property rights	• Develop contracts or imposed conditions between parties, including linkage of obligations to land title • Formal registration of credit and buffer stocks with a centralised agency that has legal identity and enforcement powers • Negotiation / settlement of land and forest ownership prior to participation

Section 1 Introduction

The New Zealand Ministry of Agriculture and Forestry (MAF) has engaged URS Forestry to undertake a review of the major risks for New Zealand forest owners associated with participation in the New Zealand Emissions Trading Scheme (ETS). The report is intended to help inform post-1989, exotic forest owners in their decision as to whether to opt in to the ETS; and to provide guidance on the potential risks and risk management strategies for both pre-1990 and post-1989 forest owners that are required to, or are voluntarily participating in the ETS. The risk assessment is intended to be applicable to both eligible small[1] and large-scale forest owners, and distinctions have been made between these two types of forest owners where relevant. The report is not intended to cover ETS implementation risks for the New Zealand Government, nor does it cover risks for indigenous forest owners, participants in the Afforestation Grants Scheme or the Permanent Forest Sinks Initiative,

The risks identified and assessed are based on a review of project documentation from previously implemented forest carbon projects, as well as URS' own experience in implementation of forest carbon projects. The relevance of identified risks are considered for forest owners in New Zealand operating under the scheme. The analysis is based on the information available at the time of writing, and the *Climate Change (Emissions Trading and Renewable Preference) Bill*, as introduced into Parliament.

1.1 Risk context

Risk can arise from the internal or external environment, and may include exposure to economic or financial loss or gain, physical damage, failure of a project, client or stakeholder dissatisfaction, negative publicity, mismanagement, failure of equipment and fraud[2]. The concept of risk has two key elements; the likelihood of an event occurring and the consequences if it happens.

Risks are commonly interpreted as hazards or negative impacts, however a broader view of risk incorporates exposure to the consequences of uncertainty and potential deviations from what is planned or expected. If managed effectively, risks can be transformed into opportunities for forest owners to improve their business.

1.2 Risk assessment framework

In this report, the magnitude of risk is assessed in terms of:

- The likelihood of an event and its associated consequences occurring (this incorporates consideration of the frequency of the event and the probability of the consequences occurring each time the event occurs); and
- The magnitude of potential consequences of the event.

Risk can be assessed using quantitative, qualitative or semi-qualitative processes. Quantitative risk analyses require a detailed background analysis of each risk, producing detailed numerical data that can be analysed, ranked and presented in various charts and tables. Qualitative risk analyses use purely subjective evaluation criteria, which are useful when data is scarce. Finally, semi-qualitative analyses are a blend of both qualitative and quantitative assessment methods

[1] Does not include forest owners with less than two hectares of forest that are not eligible to participate in the ETS.

[2] New Zealand Society for Risk Management: http://www.risksociety.org.nz

Section 1 Introduction

As this report if focused on broad risk management strategies, URS Forestry has adopted a qualitative approach to risk assessment. It is also difficult to generalise the impact of risks, due to the unpredictability of certain risks (e.g. carbon loss due to wildfire or climate change); or because it too soon to observe quantitative trends on carbon market behaviours, due to the infancy of the market. URS used a combination of qualified judgement, monitoring of market behaviour in international carbon markets; and knowledge of domestic climate policy developments to qualitatively assess the likelihood and consequence of the project, market and regulatory risks identified for ETS participant forest owners in New Zealand.

Section 2 Literature Review

In this section, we review publicly available forest carbon project and related emissions trading documentation in relation to risks associated with forest carbon projects. The literature review includes an overview of New Zealand's ETS; the Kyoto Protocol and associated trading mechanisms; experience from Australian greenhouse gas reduction programs; applications for certification under the Community, Climate and Biodiversity (CCB) Standard, as well as other voluntary forest carbon project initiatives.

2.1 New Zealand's ETS

The *Climate Change (Emissions Trading and Renewable Preference) Bill* was introduced into Parliament in December 2007. If passed into law in its current state, forestry will be the first sector included in the scheme, with eligible participants having obligations in relation to changes in forest carbon stock from 1 January 2008. Other industry sectors are scheduled to join the ETS in a phased approach, with the stationary energy and other heavy emitting industries joining in 2010, the transport sector scheduled to join the scheme in 2011, and finally the agriculture and waste sectors joining in 2013, although the original timeline for full sectoral coverage by 2013 has now been delayed.

The primary domestic unit of trade will be based on New Zealand Units (NZUs). Basic features of the scheme are that (Ministry for Agriculture and Forestry, 2007):

- Owners of forested land established from after 1989 onwards can voluntarily elect to participate in the ETS. If they decide to participate, they will receive one NZU for each tonne of carbon dioxide equivalent (CO_2e) sequestered in their forests after 1 January 2008. They will be liable to report changes in carbon stock due to harvesting and growth. They will be eligible to receive NZUs up to the maximum carbon storage in their forest. There is no additionality requirement under the scheme;
- Owners of forested land established pre-1990 will be liable for all emissions due to deforestation, however they will not be required to report changes in carbon stock due to harvesting and growth. They will not be eligible to earn NZUs created from sequestration, although they will be 'gifted' a one-off allocation of 39 NZUs per hectare of forest land; and
- If post-1989 forested land owners elect not to participate, they will forfeit all NZUs and associated liabilities to the New Zealand Government.

The more detailed features of the scheme are described below.

Liabilities

ETS participants with pre-1990 forests will be liable to surrender NZUs in proportion to the emissions associated with deforestation, but only if the forest is not replanted within four years of the deforestation. To assist pre-1990 forested land owners in meeting liabilities, and also as compensation for reduced flexibility in land use, pre-1990 forest owners will be gifted with 55 million NZUs at a rate of 39 units per hectare. Approximately 21 million NZUs would be available in the 2008 to 2012 period.

Owners of participating post-1989 forested land will be liable for emissions due to all disturbances, including harvest, even if the forest is immediately replanted. However for the first commitment period (2008 – 2012), they will only be liable for emissions equivalent to the number of NZUs previously earned from sequestration. This is often referred to as the 'fast growing forest fix' (Ministry for Agriculture and Forestry, 2007).

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Monitoring and reporting

Owners of pre-1990 forested land will be required to report annually on deforestation only. If deforestation has not occurred, they will not be required to submit a report. Emissions from deforestation will be calculated using emission yield tables, specific to region and species. Deforestation of areas less than two hectares will be exempt from the scheme.

ETS participants with post-1989 forests will be required to submit a carbon stock assessment at the end of the 2008 to 2012 period, but may elect to report more frequently at intervals of not less than one year. Monitoring will be based on 'real time' estimates of carbon stock change, meaning that participants are not required to adopt averaging approaches.

Trading and scheme administration

NZUs can be traded within New Zealand, and from 2008 to 2012 will be interchangeable with Kyoto Protocol Assigned Amount Units (AAUs), which will enable forest owners to trade internationally.

The ETS will be administered by a central agency and carbon stock assessments will be undertaken by Registered Carbon Certifiers, likely to be forestry consultants. Satellite data and site visits by Government agencies will support compliance efforts.

2.2 International compliance based schemes

A compliance-based emission involves a legal requirement for participants to reduce emissions. The major international compliance based GHG reduction scheme is currently the Kyoto Protocol. Approximately USD 60 billion (AUD 64.3 billion), or 2.7 billion tonnes of CO_2e was traded in global compliance-based carbon markets in 2007, which represents an 80 percent increase in trade value from 2006 levels, or a 64 percent increase in trade volume (Environmental Expert, 2008).

2.2.1 Kyoto Protocol

Article 3.3 of the Kyoto Protocol allows carbon sequestered by new forests to be used by Annex I (developed) countries to meet their emission reduction targets. For forestry projects to be eligible to obtain offsets or 'Removal Units' (RMUs) under Article 3.3, the forest must (UNFCCC, 1997):

- Have been planted on land that was previously non-forest (i.e. meet the definition of 'afforestation'[3] or 'reforestation'[4]);
- Have been planted after 1 January 1990;
- Have minimum tree crown cover of between 10 and 30 percent;
- Have minimum tree height of between 2 and 5 metres; and

[3] "Afforestation" is the direct human-induced conversion of land that has not been forested for a period of at least 50 years to forested land through planting, seeding and/or the human-induced promotion of natural seed sources.

[4] "Reforestation" is the direct human induced conversion of non forested land through planting, seeding and/or the human-induced promotion of natural seed sources, on land that was forested but that has been converted to non-forested land. For the first commitment period, reforestation activities will be limited to reforestation occurring on those lands that did not contain forest on 31 December 1989.

- Have a minimum area of between 0.05 and 1 hectare.

Plantations under Article 3.3 are not required to be planted in addition to business-as-usual activity, as long as they were planted after 1990. The Kyoto Protocol requires that once a forest is registered under Article 3.3, changes in forest carbon stock should be accounted for in perpetuity.

Accounting methodologies under Article 3.3 assume that if a forest is harvested for timber production, all carbon that has been sequestered is emitted in the year of harvest. Therefore it does not account for carbon storage in harvested wood products. This significantly reduces the net amount of carbon that can be claimed in commercial plantations under Article 3.3.

Article 3.4 of the Kyoto Protocol specifies that carbon sequestration due to 'additional forest management activities' in existing managed forests, that do not meet the definition of afforestation or reforestation in Article 3.3, could be used to meet emission reduction targets. Kyoto signatory countries were required to indicate whether or not they would account for carbon storage in their managed forests for the first commitment period. The New Zealand, Australian, and Canadian Governments all elected not to account for additional forest management activities, either because they feared their managed forests may be a source of emissions, or that the cost of measurement would exceed the benefits.

Ratification of the Kyoto Protocol allows New Zealand to trade units internationally, via any of the three Kyoto flexibility mechanisms: Joint Implementation (JI); Clean Development Mechanism (CDM); or International Emissions Trading (IET). Each is described below.

- The JI mechanism, defined in Article 6 of the Kyoto Protocol, allows Annex I parties to supplement their domestic GHG reduction activities with emission reduction or sink enhancement activities conducted in other Annex I countries.
- Article 12 of the Kyoto Protocol establishes the CDM. The CDM is a project-based mechanism whereby Certified Emission Reductions (CERs) from implementation of sustainable development projects in developing countries can be generated.
- IET has been included as a mechanism under Article 17 of the Kyoto Protocol. IET enables a party to trade units between Annex I countries.

Under both JI and CDM, credits can only be generated from activities that are additional to business-as-usual activity. This has largely precluded traditional commercial forestry activities from participating in these mechanisms.

Discussions at the thirteenth Conference of the Parties (COP 13) to the Kyoto Protocol considered means to incentivise Reduced Emissions from Deforestation and Degradation (REDD). A key outcome of COP 13 was a commitment for consideration of methodological issues and policy approaches towards inclusion of REDD activities within the UNFCCC framework (UNFCCC, 2008). This issue is to be discussed further at COP 14 in Copenhagen, December 2008.

2.2.2 Analysis

To date, global demand for forest carbon in compliance based markets has been relatively low. This is partly because countries that might generate RMUs, are likely to use them to meet their own domestic emission reduction targets. This is also because the world's largest market, the EU ETS, which traded around USD 50.1 billion worth of carbon during 2007, does not recognise forestry offsets (Capoor and Ambrosi, 2008). The European Commission has reviewed proposals to include forestry within the post-

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2012 EU ETS, and there are strong indications that forestry is likely to continue to be excluded from the scheme (European Commission, 2008). This is because the European Commission considers that acceptance of forestry projects within the EU ETS "could undermine the environmental integrity of the EU ETS", as it considers that forestry abatement activities are "temporary and reversible"; would require significant improvements and monitoring and reporting systems; and that their inclusion would compromise the "simplicity, transparency and predictability of the ETS" (ibid, 2008). Given the EU's opposition to forestry emission reduction projects, there is a small risk that the EU may attempt to negotiate for post-Kyoto emission reduction agreements that separate forestry sequestration from emission reductions in fossil fuels. For example, separate fund-based agreements are one of the options currently under discussion to accommodate REDD. More probably, the EU will continue to exclude RMUs from its ETS in the medium term.

Allowing New Zealand forest owners to trade AAUs rather than RMUs gives New Zealand forest owners access to the potentially lucrative EU carbon market. However, international trade under the Kyoto Protocol is subject to New Zealand meeting its 'commitment period reserve', which requires that Annex I countries must retain 90 percent of their AAUs. There is a risk that if international prices for AAUs are substantially higher than domestic prices for NZUs, New Zealand forest owners may seek to convert all NZUs to AAUs and sell them on the international market (Bertram and Terry, 2008). This might result in depletion of New Zealand's commitment period reserve, in which case the New Zealand Government may need to shut down all international trades. Remaining NZUs may be discounted in value as a result.

There is also a risk that if the international market price for carbon is lower than the price for NZUs, then forest owners will not be able to sell NZUs domestically.

The rules of the New Zealand ETS are highly compatible with the rules of Article 3.3 of the Kyoto Protocol. This theoretically should mean that New Zealand would readily be able to trade RMUs on the international market (with the exception of the EU ETS), if this were permitted by the New Zealand Government. Australia, Japan and Canada might also be considered potential buyers of New Zealand's RMUs or AAUs. Should the US ratify the Kyoto Protocol or join the post-2012 UNFCCC framework, then it too might be considered a key market.

If introduced within the framework of the Kyoto Protocol or the UNFCCC, the magnitude of supply of REDD credits is unknown. The high rate of deforestation reported in the Asia-Pacific suggests that REDD credits are a potentially significant source of emission reductions within the region. It is possible that REDD credits have the potential to 'flood the market' and outcompete NZUs. However COP discussions on this issue have generally considered that the stringency of emission reduction targets would be tightened commensurate with the potential supply of REDD credits, were REDD mechanisms included within the post 2012 Kyoto framework.

2.3 Voluntary carbon initiatives

Voluntary carbon initiatives have emerged that allow individuals and firms to reduce greenhouse gas (GHG) emissions in order to demonstrate their environmental responsibility, without a specific legislative requirement to do so. Global demand for carbon in voluntary markets has been strong, with approximately 65 Mt CO_2e traded in 2007, which was three times the volume transacted in 2006 (Hamilton et al, 2008). Forestry offsets accounted for approximately 36 percent of all voluntary market transactions in 2006, while this declined to 15 percent in 2007 (Hamilton et al, 2007; 2008). The declining popularity of forestry offsets in the voluntary carbon market was attributed to the negative media and perceived lack of integrity that has sometimes been associated with voluntary forest carbon projects.

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Global demand for forest carbon in the voluntary carbon market is likely to remain strong providing that public perception issues can be addressed, although it is possible that REDD projects, which are generally not yet eligible in compliance based markets, will absorb a significant proportion of demand for forest carbon in the voluntary market in the short to medium term. Notwithstanding these issues, a selection of voluntary carbon initiatives that include forest carbon are briefly described below.

2.3.1 Chicago Climate Exchange

The Chicago Climate Exchange[5] (CCX) is a voluntary but legally binding scheme, whereby participants commit to achieving a six percent GHG reduction target by 2010. The program is based in Chicago, USA, but is open to participants anywhere in the world. Forestry offset providers are eligible to create credits, known as Carbon Financial Instruments (CFIs), under the scheme, providing they do not have significant emissions of their own. The scheme runs in compliance phases, with phase II running from 2003 until 2010. Three types of forestry projects or carbon pools are eligible under the scheme:

- Afforestation, including urban tree planting;
- Carbon storage in harvested wood products; and
- Managed forests, including avoided deforestation projects.

Risks associated with project development and offset delivery in the CCX are partially addressed through the requirement for all projects to be independently verified by a CCX-approved verifier. Risk of carbon loss due to disturbance events or measurement error is also addressed through the requirement to maintain a reserve pool of carbon, equivalent to 20 percent of the CFIs generated by the project. At the end of the market period, all CFIs remaining in the pool will be returned to the project developer. As an additional safeguard, the forest owner must demonstrate that the forest is sustainably managed though independent third party certification.

2.3.2 Climate, Community and Biodiversity Alliance

The Climate, Community and Biodiversity Alliance[6] (CCBA) is a partnership between non-government organisations, private companies and research groups that aims to provide 'land management solutions' around the world. The CCBA developed voluntary standards to help design and identify land management projects that simultaneously address climate change, support sustainable development and conserve biodiversity. These standards incorporate the requirement to identify risks to a particular project and include contingencies to manage these if they occur.

2.3.3 Voluntary Carbon Standard

The Voluntary Carbon Standard (VCS) was initiated by The Climate Group, the International Emissions Trading Association, and the World Economic Forum in late 2005. The World Business Council for Sustainable Development joined the initiative as a founding partner in 2007. The standard is maintained by a Steering Committee with seven technical working groups that provide advice on VCS governance, additionality, validation and verification, registries, land use change and forestry, general policy issues and performance standards. VCS credits must be real (have happened), additional (beyond business-as-

[5] http://www.chicagoclimateexchange.com/
[6] http://www.climate-standards.org/index.html

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usual activities), measurable, permanent (not temporarily displace emissions), independently verified and unique (not used more than once to offset emissions)[7].

In July 2008, the VCS appointed four financial institutions to run the VCS registry. The online registry will provide greater security for buyers of Voluntary Carbon Units (VCUs) under the VCS, and may pave the way towards full online trading of VERs. Other risk management mechanisms embedded with the VCS standard include (VCS, 2007a):

- Non-allowance of forward crediting, ie: emission reductions or avoidance that have not yet occurred;
- Requirement to use an approved VCS GHG program methodology;
- Verification of new methodologies with two separate independent third party assessments;
- Requirement to provide evidence that emission reductions have not been double-counted; and
- Requirement to undertake stakeholder consultations.

The VCS also includes additional guidance for agriculture, forestry and other land use projects, which outlines the process for risk rating assessment for each project. An appropriate risk management buffer must then be maintained, with its size in proportion to the risk rating and the number of years of VCS verification.

Risk ratings under the VCS are assigned based on the guidance in the table below.

[7] www.v-c-s.org

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Table 2-1 VCS guidance on risk assessment for forestry projects

Risk factor	Risk rating
Project longevity/Commitment Period	
Long-term commitment with harvesting	Medium
Medium-term commitment with harvesting	High
Short-term commitment with harvesting	Fail
Long-term commitment (i.e., many decades or unlimited) with no harvesting	Low
Long-term commitment with no harvesting in politically unstable countries	Medium
Medium-term commitment (i.e. a few decades) with no harvesting	High
Short-term commitment with no harvesting	Fail
Ownership type	
Established NGO or conservation agency; owner-operated private land	Low
Rented or tenant-operated land	Medium
Uncertain tenure but with established user rights	High
Uncertain land tenure and no established user rights	Fail
Technical capability	
Proven technologies and ready access to relevant expertise	Low
Technologies proven to be effective in other regions under similar soil and climate conditions, but lacking local experimental results and having limited access to relevant expertise	Medium
Financial capacity	
Demonstrable backing from established financial institutions, NGOs and governments	Low
No external financing	Medium
Management capacity	
Substantial previous project experience (≥ 5 projects) with on-site management team	Low
Limited project experience (<5 projects) with on-site management team	Medium
Limited project experience (<5 projects) without on-site management team	High
Future income	
Appropriate management plan and financial analysis include future income to finance future management activities (e.g. carbon finance to be used for project management, tending operations, etc.)	Low
Future costs and income not considered	High
Future/current opportunity costs	
Alternative land uses are unlikely to occur in the future	Low
Project is competing with other land uses that are likely to become more attractive in the future	High
Endorsement of project or land-use activity by local or national political establishment	
Endorsement given and not likely to change in the future	Low
Endorsement given but may be subject to change in the future	Medium
No endorsement given	High

Source: VCS, 2007b

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Once the overall project risk rating is assessed and verified, the size of the buffer can be determined based on the following risk categories:

- High risk: 40 - 60 percent buffer;
- Medium risk: 20 - 40 percent buffer; and
- Low risk: 5 – 20 percent buffer.

The VCS also includes guidance for risk management in REDD and improved forest management projects, although these were not considered relevant to forest owners in New Zealand under the current ETS rules.

2.3.4 Analysis

The rules for forestry projects under voluntary carbon initiatives and standards have evolved to become increasingly prescriptive. They generally consider a broad range of socio-economic and well as economic criteria. The range of eligible activities for forests is generally wider in the voluntary scheme than under compliance based schemes, for example carbon storage in wood products and avoided deforestation is accepted under the CCX.

It is possible that forest owners electing not to participate in the New Zealand ETS may choose to participate in voluntary markets. There is a risk that a forest owner could double-sell their carbon into the voluntary carbon market as well as the national ETS, although this risk is likely to be reduced with the growing sophistication of voluntary and compliance-based registry systems. This risk would generally be borne by the voluntary carbon market buyer.

It is possible that a perceived lack of stringency in voluntary carbon markets, particularly for forestry offsets, may also negatively impact demand for forest carbon in compliance-based markets. Poor public perception of forestry offsets also attributed to the declining proportion of forestry offsets purchased in the global voluntary market (Capoor and Ambrosi, 2008).

2.4 Australian initiatives

Australia has implemented one State-based compliance ETS, one major voluntary emission reduction scheme, and has committed to implement a national compliance based ETS by 2010.

2.4.1 NSW Greenhouse Gas Reduction Scheme

The New South Wales (NSW) Greenhouse Gas Reduction Scheme[8] (GGAS) was established in 2003. Under the scheme, NSW electricity retailers are required to reduce their GHG emissions through:

- Generation of low emission intensity electricity (e.g. wind or solar energy);
- Demand side abatement activities (e.g. installation of energy efficient light bulbs); or
- Carbon sequestration in forests.

Participants are deemed to be compliant with the scheme if they ‘surrender’ a sufficient quantity of NSW Greenhouse Abatement Certificates (NGACs) to meet their target. Each NGAC is equivalent to one

[8] http://www.greenhousegas.nsw.gov.au/acp/forestry.asp

tonne of CO_2e. Participants can buy NGACs created from forestry and other abatement activities to achieve compliance with the scheme. Accounting rules for the NSW scheme are similar to the rules for afforestation and reforestation under Article 3.3 of the Kyoto Protocol, with the following exceptions:

- Only carbon sequestered from 2003 onwards is eligible for the scheme; and
- The forest must have 100-year Carbon Sequestration Rights registered on the land title.

A total of six forestry offset providers are currently registered under the scheme, although most of the forestry credits created have been from a single supplier (Forests NSW). Small forest growers have generally not participated in the scheme, as the legal costs involved in establishing carbon sequestration rights for small packages of land appear to be prohibitive.

2.4.2 Greenhouse Friendly

The Greenhouse Friendly scheme is a voluntary certification program, run by the Australian Government Department of Climate Change[9] (DCC). Under the program, products, services, individuals or businesses can be independently certified as 'carbon-neutral', meaning that all GHG emissions associated with their product or service have been eliminated or offset. The program provides independent verification of credits from forestry abatement projects, and allows these credits to be used to assist emitters to become carbon-neutral. Only carbon sequestered from 18 June 2001 onwards is eligible for the scheme, and the forest owner must provide evidence that the forest will be maintained for at least 70 years.

Like the GGAS, eligibility for carbon sequestration in forests under the Greenhouse Friendly scheme is assessed in a similar way to Article 3.3 of the Kyoto Protocol, except that the project must result in GHG reductions or sequestration that are additional to 'business-as-usual' practices, similar to the JI or CDM. The inclusion of an additionality requirement under the Greenhouse Friendly scheme has precluded traditional commercial forest growers from participation. This is because commercial forests have been (or would be) planted under routine business practices, for the production of wood products. Forest offset providers that have become accredited under the scheme are generally those that undertake biodiversity plantings; and/or plantings in areas marginal for traditional commercial plantations.

2.4.3 Proposed national Emissions Trading Scheme

The Australian Government has committed to implementation of a national ETS by 2010, with the design of the system to be finalised by the end of 2008. A 'Green Paper' outlining the proposed ETS design was released in July 2008. This included the following proposals in relation to inclusion of forestry in the ETS:

- Full coverage of all forests meeting the definition of afforestation or reforestation under the Kyoto Protocol;
- No liability for deforestation of ineligible forests; and
- No additionality requirements.

Further details on the design of the scheme are to be provided in a 'White Paper', to be released in late 2008.

[9] http://www.greenhouse.gov.au/greenhousefriendly/index.html

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2.4.4 Analysis

The eligibility requirement to demonstrate long term maintenance of forest cover, under both the GGAS and Greenhouse Friendly scheme, has acted as a disincentive to participation of small forest growers due to prohibitive legal costs. URS has anecdotal evidence that this requirement has also deterred large scale forest owners from participation, due to the reduced flexibility of land use. The ongoing carbon monitoring costs for small forest growers may have also deterred small forest growers, however these generally have a high level of compatibility with routine forest inventory procedures already carried out by commercial forestry companies. There is a growing number of carbon pooling structures entering the voluntary carbon market in Australia, which are allowing increased participation of small forest growers through achievement of economies of scale.

2.5 Summary

Based on URS' review of the literature identified above, URS has identified the following risks and risk management strategies as being potentially relevant to forest owners in New Zealand:

Table 2-2 Risks and risk management strategies identified in the literature review

Risk	Risk management strategy
Measurement error	Establish reserve pool of carbon
Carbon loss due to wildfire	Wildfire suppression training, support of volunteer fire brigades, fire breaks, patrols during dry season, develop fire management plan
Carbon loss due to pests, insects and diseases	Monitoring of pest outbreaks, controls including pesticides, fencing to prevent incursion of grazing animals, communication with neighbours
Carbon loss due to illegal logging/firewood collection	Surveillance, direct communication with local communities to explain project, negotiate with local authorities for alternative forms of wood
Sale of land	Legally establish contract with landowner, requiring retention of vegetation in the event of changes in land title
Inadequate management capacity	Appropriate training and recruitment, financial analysis, supply documentation of financial support
Lack of public support	Inclusion of local communities in the project, community development projects to maximise employment generation opportunities, education programs, support to displaced landowners if applicable
Solvency of the business	Prepare a transfer of management plan in the event of business difficulties, but may be out of control of project developer
Negative environmental impacts	Involve environmental NGOs in project development, achieve forest certification, undertake environmental impact assessment
Failure to legally define carbon rights	Seek legal advice
Double counting	Supply documentation from applicable emission reduction scheme that offsets have not been double-counted

Source: URS, VCS (2007) and selected project design documents listed on the CCB website

Of note is the failure of most literature reviewed by URS to identify and address market risks associated with participation in an ETS. We will attempt to discuss such risks, as well as those identified in the literature, in the context of forest owners in the New Zealand in the following section.

Section 3 Identification of Key Risks

Participation in the ETS introduces new or augmented risks for operation of a forestry business in New Zealand. The risk profile differs for pre-1990 and post-1989 forest land owners, as well as forest owners with different management intentions. In this section we discuss the risk profiles, where relevant, for the following six types of forest owner:

- Pre-1990 forest owners:
  - With no intention to deforest in future; or
  - That may wish to deforest in future.
- Post-1989 forest owners:
  - With mid- or late-rotation forests as at 1 January 2008;
  - With early rotation forests as at 1 January 2008;
  - Intending to exit the industry or deforest; and
  - With no previous forest holdings as at 1 January 2008 (new investors).

Differential risks associated with issues of scale are also discussed where relevant.

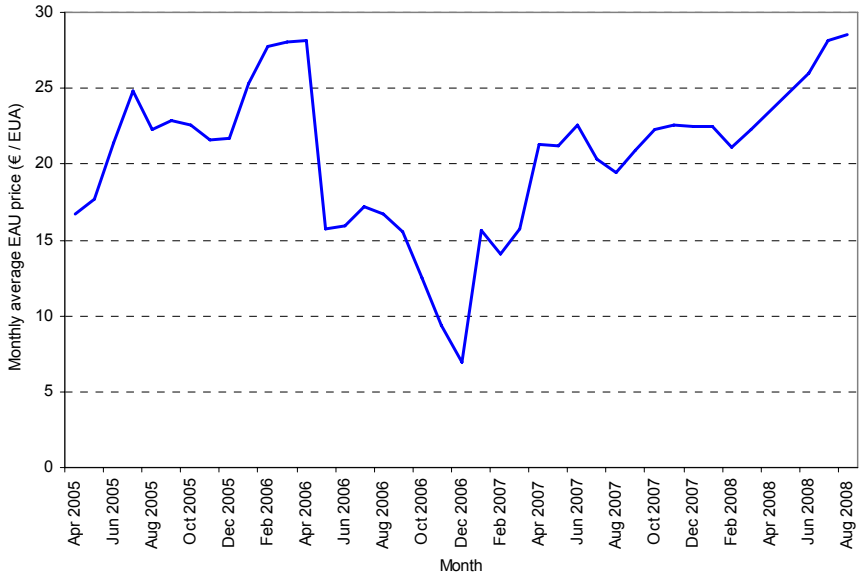
The assessment does not pertain to forest owners with less than two hectares of forest land that are not eligible to participate in the ETS.

3.1 Carbon price fluctuations

The price of carbon varies over time, depending on a myriad factors, such as the stringency of emission reduction targets; date of delivery (vintage); type of unit (e.g. AAU, RMU); and the price of oil. For example, Figure 3-1 below depicts fluctuations in EU Allowance (EUA) market prices on the European Climate Exchange.

Section 3 Identification of Key Risks

Figure 3-1 Fluctuations in EU Allowance (EUA) prices: 2005 - 2008



Source: European Climate Exchange, 2008

Similar to risks taken in financial markets, carbon price volatility is a risk for ETS participants, as it will determine whether they would be better off to retain NZUs for future sale or retirement, or sell them and re-invest the sales revenue elsewhere. It may also impact the timing of harvest or deforestation.

Understanding and forecasting carbon prices is likely to be challenging for some, if not all forest owners, particularly during the early stages of ETS implementation. This may lead to opportunistic behaviour where knowledge asymmetries exist, or where assumptions made at the time of transactions turn out to be incorrect. Incorporating carbon cost and revenue streams into forest valuations will be challenging in the short term, when appropriate market indicators for NZU prices are limited, and where the forest and NZUs are owned by separate parties.

Fluctuations in carbon prices relative to timber prices may also affect choices about the timing of harvest. Until the forest reaches the senescent stage, the older the forest, the more carbon it sequesters. Therefore if the carbon price is high relative to the price of timber, forest owners may choose to extend the rotation length. Conversely, if they expect a carbon liability, they may also choose to harvest at a time when carbon prices are low. Table 3-1 shows the results of an analysis of net present values (NPV) of a stand of lodgepole pine in northern British Columbia, Canada, under various carbon prices, with the peak NPV at each respective CO_2e price shaded.

Section 3 Identification of Key Risks

Table 3-1 Net present value/ha by harvest age and CO2e price (CAD)

Harvest age	CO2e price ($/t)					
	$0	$10	$20	$30	$40	$50
50 years	241	1104	1966	2828	3690	4553
60 years	303	1237	2171	3106	4040	4975
70 years	271	1258	2244	3230	4216	5202
80 years	213	1235	2257	3279	4302	5325
90 years	154	1201	2248	3295	4360	5389
100 years	107	1170	2233	3296	4371	5423

Source: Armstrong, G. University of Alberta, Canada

The analysis assumed a privately managed forest where the decision maker sought to maximise NPV over multiple rotations. The discount rate, harvest costs and revenues were kept constant[10]. The general trend is an increase in optimal rotation length as the price of carbon increases. Similarly, regional modelling of the economics of carbon and timber production in northern Sweden, found that increasing the carbon price led to decreasing harvest levels. Thinning activities decreased more than clear-cut activities when the carbon prices increased (Backéus et al, 2006).

3.2 Forward selling/buying

Forward selling or buying of carbon is essentially a sales contract, where a seller agrees to deliver a specified number of emission credits at a fixed time in the future, at a price agreed when the contract is signed[11]. Forward selling can help buyers meet their emission reduction commitments in advance, and potentially at discount than if the carbon had been purchased in the year of delivery. Forward selling can also benefit forest owners in providing up-front finance to help fund ETS compliance costs, or to be used for other investments.

The forward sale of NZUs creates the risk that the predicted sequestration will not occur, or will occur later than expected. This might be due to lower than expected forest productivity, natural disturbance, or financial or management failure of the seller. The risk to the seller is that the revenue from forward sales of NZUs is less than the revenue they would have received from sale of NZUs at the time of delivery.

3.3 Liabilities at harvest

Under the proposed ETS rules, pre-1990 forest owners will not be liable for emissions from commercial harvesting operations, as long as the forest is replanted within four years of harvest. Post-1989 forest owners electing to participate in the scheme, however, are liable for fluctuations in forest carbon storage due to harvesting, thinning, pruning and natural disturbance (discussed below). These liabilities must be covered either by:

- Sequestration of an equivalent amount of carbon elsewhere in the estate;
- Surrendering an appropriate number of NZUs to the scheme administrator;

[10] Assumptions included: Log price:50 CAD/m3, cost of logging: 5000 CAD/ha, carbon price: 20 CAD/tC02, discount rate: 5%/year

[11] www.tz1.com

Section 3 Identification of Key Risks

- Purchasing an appropriate number of NZUs from other market participants; or
- Purchasing an appropriate number of AAUs or other equivalent units from the international carbon market.

Because older forests store more carbon than younger forests, liabilities for emissions are likely to be greater for mid- or late-rotation forests. For the first commitment period, this emissions liability is limited by the fast growing forest fix rules Therefore the only major risk associated with harvesting during first commitment period (beyond normal business risks associated with harvesting operations), is the reduced opportunity for mid- or late-rotation forests to sequester NZUs during that period. This is likely to give early rotation forest owners an advantage over mid- or late-rotation forest owners during the early stages of the ETS.

It is unclear at this stage weather the fast growing fix rule will be extended for the second commitment period. This rule, together with other regulatory risks, is discussed in section 3.7.

3.4 Unplanned carbon loss

Unplanned loss of forest carbon can occur for a number of reasons. For example, if a forest is damaged by wildfire; wind; pests and disease; or if illegal logging occurs. The risk of unplanned carbon loss is potentially quite low for pre-1990 forest owners, since they have no carbon liability unless the forest is not replanted within four year of the disturbance event. The major risk for pre-1990 forest owners might be difficulty in re-establishing the site, and even then, they are given ten years for the regenerating forest to reach least 30 percent crown cover and five metres in height. Therefore discussion on risks associated with unplanned carbon loss will refer to post-1989 forest owners from here on.

Natural disturbance events tend to be geographically confined, therefore forest owners with a geographically dispersed estate can spread the risk of carbon loss across their estate. Likewise, forest estates that have a dispersed range of age classes may be able to buffer carbon losses in one area of forest with sequestration in other forests. Because large forest owners are more likely to have a geographic dispersed estate with a range of age classes, the risks of unplanned carbon losses are considered to be higher for smaller forest owners.

There is also a risk that insurance costs for fire, windthrow and other natural disturbance, will increase as a result of ETS participation.

3.5 Measurement error

The ETS compliance framework is based on a self-assessment approach where the owners will be responsible for determining their own liability and for surrender of credits to cover it. Theoretically the self-assessment approach associated with the ETS will assist in reducing compliance costs, but it will mean owners must clearly understand their reporting obligations. Inadvertent non-compliance will result in a requirement to make good any shortfall of units, plus a penalty per NZU shortfall, and publication of the non-complying party's identity. The requirement and penalty will be higher for deliberate non-compliance, and be combined with criminal penalties (including imprisonment) for individuals and the directors of companies.

The look-up table approach contained in the draft forestry regulations is intended to simplify self-assessment of deforestation of pre-1990 forest land, and to provide estimates of carbon stock changes for post-1989 forest owners electing not to measure their forests. The regional look-up tables are based

Section 3 Identification of Key Risks

on broad regional estimates of carbon stock for particular forest types at various ages. There is a risk that the regional tables will over-estimate the carbon liability for low-productivity forests.

Post-1989 forest owners have the option of implementing their own forest carbon inventory. This is likely to involve standard inventory procedures, whereby diameter, stocking and potentially also height are input to an allometric equation to estimate aboveground biomass. URS considers that there are three types of uncertainties associated with the measurement approach:

- Inventory uncertainty (equipment or calibration error, area estimation);
- Model uncertainty (mean standard error of allometric equations); and
- Parameter uncertainty (due to sub-sampling a proportion of the population, and use of default values).

While the details of the acceptable measurement approach(es) under the New Zealand ETS are not yet available, it is likely that such errors will need to be reported. It is possible that the appropriate amount of carbon will need to be deducted in proportion to this error. If this is the case, then there is a risk that inventories resulting in high uncertainty will reduce the amount of NZUs that are available for sale.

3.6 Modelling error

Post-1989 forest owners may wish to develop forecasts of estimated carbon sequestration, either for the purpose of forward sales of NZUs; to calculate their future estate level emissions liabilities; or to assist in valuations, or due diligence for new investments. A number of tools are available to develop such forecasts, including the regional look up tables, allometric equations, empirical and process-based forest growth models.

If the forecast estimate of carbon sequestration exceeds the actual estimate, then the forest estate has performed below expectations. In the case of new investors, this may mean financial losses or lower than expected revenue. In the case of forward sales, this may mean the buyer will have received less than their purchased amount of NZUs. Depending on the terms and conditions of the contract, the forest owner may be required to 'make good' with NZUs from elsewhere in the estate or from the market, again resulting in lower than expected financial performance.

3.7 Regulatory changes

A significant factor in environmental markets is regulatory risk. Forestry is a long-term industry and is susceptible to changes in government policy. There is a risk that at some point in future, the government may change the ETS rules in a detrimental way. For example, if the Government decided to cease issuance of NZUs for carbon sequestration in post-1989 forests; or if the fast growing forest fix rule was discontinued for the second commitment period. A major risk to ETS participant forest owners could be if the New Zealand Government inadvertently creates an oversupply of NZUs in the market, through free allocations to some industry and the agriculture sectors. For example, it is proposed that agriculture will be compensated through allocation of NZUs equivalent to 90 percent of their 2005 level of emissions. Sectors receiving free allocations are likely to have a lower demand for NZUs from forestry.

It should also be noted that changes in rules could also be beneficial for forest land owners, for example if the ETS recognised carbon storage in wood products.

Section 3 Identification of Key Risks

While the government has made provisions in the *Climate Change (Emissions Trading and Renewable Preferences) Amendment Bill* for continuation of the ETS in the absence of an international scheme, there are some views that investing in forest sink credits that will largely accumulate post-2012 carries the risk that the credits may not be recognised, or cannot be widely traded either domestically or internationally beyond 2012, impacting investment confidence in the New Zealand forest sector.

The future rules and targets for the Kyoto Protocol, and interpretation beyond 2012 are another source of uncertainty for the forestry sector, as they are yet to be negotiated.

3.8 Changes in competitive interactions

The phased entry and the level of free allocation for other sectors covered by the scheme have the potential to alter the competition dynamics for both land use decision making and in forest product markets.

Some forest owners are at risk of facing a higher cost base than prior to the implementation of the ETS, while others will have new opportunities. The phased entry of alternative land uses could be seen to favour those uses over some forest owners temporarily. However, given the free allocation of 90 percent of 2005 emissions to the agricultural sector is based on a year in the past (i.e. 2005), any increase in emission in that sector will incur a cost. In addition, those in the agricultural sector may use forestry as a means to mitigate increases in agricultural emissions and the phase out of free-allocations. As such, establishing post-1989 forests is likely to become an increasingly attractive land use in the medium to long term as free allocations to the agricultural sector are phased out.

Creation of incentives for the increased use of renewable energy under the ETS, including bioenergy derived from wood waste, may also impact the sector by potentially placing upwards pressure on pulpwood prices.

International market competition

The ability for New Zealand ETS participants to purchase credits from the international market may reduce demand for domestically produced NZUs. As described in section 2.2.2, there is also a risk that NZUs could not compete with international market prices for other Kyoto units. Supply of AAUs from other countries is unclear, as most Annex I countries, with the exception of Russia and other Eastern European countries, are likely to use them to meet emission reduction targets or hold them. There is a risk that the REDD mechanism, if included within the framework of a post-2012 Kyoto agreement, might create a significant supply of low cost credits that will out-compete NZUs.

The international competitiveness of New Zealand's forest owners may change if its major market competitors receive more or less favourable carbon market conditions, in respect to their own domestic greenhouse gas reduction policies.

3.9 Uncertain or unresolved property rights

Uncertain or unresolved property rights are a risk to the forest owner if the party with responsibility for potential liabilities is unclear. A significant proportion of pre-1990 forest is on land subject to Crown Forestry Licences and unresolved Treaty Claims, and other leasehold arrangements.

Forest owners that do not own the land also face the potential loss of flexibility in forest management as any disturbance activity including activities such as road construction may create liabilities for the landowner. Existing forestry rights or lease agreements are unlikely to contain provisions to cover

responsibilities for ETS liabilities. Negotiating parties will need to be aware of the impost the ETS places on pre-1990 forest land and factor this into their negotiations.

For post-1989 forest owners, where a lease or forestry right exists, the forestry right holder or lessee will be the participant in the ETS entitled to the NZUs and responsible for liabilities. Under the ETS both the landowner and the forestry right holder/lessee must agree to participate thus allowing them to negotiate management of NZUs and liabilities. As is the case for pre-1990 forest owners, it is unlikely existing agreements will provide for matters relating to the landowner's and the forestry right holder's ETS obligations.

3.10 Compliance costs

While it is currently proposed that pre-1990 forest owners would not be liable for ETS administration costs, it is likely that internal and external costs will be incurred through the need to obtain expert advice for legal, financial and technical aspects of the scheme, particularly with respect to review of existing forest ownership, management, application for exemptions and free allocations, and wood supply agreements.

Post-1989 forest owners participating in the scheme will need manage to the compliance costs associated with meeting their obligations, including the costs of legal/financial advice, any fees and charges from the administration agency, ongoing monitoring, reporting, and auditing. Fees and charges from the administration agency, scaled by the size of the forest estate, have been published (for consultation) in the draft forestry regulations (May 2008). This will enable growers to factor them into their decision on whether or not to participate in the ETS. In addition to the initial cost of application for entry into the scheme, agency costs associated with emissions returns will vary from a few cents per hectare for larger forest owners to around NZD10-15 per hectare for small to medium forest owners.

Legal and registration fees and any costs incurred in developing agreements are likely to be in the order of a few hundred to a few thousand dollars, depending on the extent of independent advice forest and/or land owners wish to seek.

Forest measurement and verification would be required at least at the beginning and end of each commitment period (2008 to 2012). Medium to large scale forest owners are likely to be required to transition to direct measurement of carbon stocks over time and cover the cost of doing so. Typical pre-harvest forest inventories cost around NZD 25 per hectare. It is understood similar levels of measurement will be required under the ETS and around 20 percent of the land area may need to be independently verified. Costs are likely to reduce over time as baseline information is established and referenced on subsequent measurements.

3.11 Transaction costs

Pre-1990 forest owners that wish to sell their allocated NZUs are likely to incur market transaction costs, relating to identifying and selecting trading partners, and due diligence activities. Likewise, pre-1990 forest owners that intend to deforest will also incur transaction costs associated with purchase of additional NZUs or other Kyoto units to cover their deforestation liability. The magnitude of market transaction costs will be dependent on experience of the participant and their search procedures, but are likely to be higher for small forest owners that are limited by scale.

Section 4 Risk Management Strategies

This section outlines possible risk management strategies to assist forest owners manage ETS-related risks. Potential risk mitigation strategies for forest owners in New Zealand, categorised according the risk type, are summarised in Table 4-1.

Table 4-1 Potential ETS risk management approaches for New Zealand forest owners

Risk type	Risk item	Mitigation strategies
Participatory	All risks associated with ETS participation	• Elect not to participate in the ETS (post-1989 forest owners) • Apply for exemption from participation (pre-1990 forest owners with < 50 ha) • Participate in the voluntary market
Carbon accounting	Liabilities at harvest or deforestation	• Estate averaging (large forest owners) • Carbon pooling (small forest owners) • Maintain a buffer reserve pool of carbon
	Measurement or modelling error	• Use accepted/prescribed standards and models • Establish detailed criteria, procedures and tolerances for measurements • Incorporate periodic independent verification of carbon sequestration estimates
Market	Carbon price fluctuations	• Retain NZUs to cover future liabilities • Sell NZUs if price increases faster than investment hurdle rates • Bring forward or back rotation length, depending on price
	Unplanned carbon loss	• Insurance / financial assurance • Make-good or buy out provisions • Source replacement credits from the market
	Forward selling	• Place a high risk premium on credit to reduce price • Implement quality checks to avoid purchase/sale of future credits
	Transaction and compliance costs	• Carbon pooling • Apply a risk-based approach to verification for activities to reduce verification workload and costs • Centralised or third party registry for efficient record keeping
Forest / Project management	Liabilities at harvest or deforestation	• Plant a range of age classes to smooth the emissions profile • Geographic dispersion of estate • Bring forward or back rotation length, depending on price
	Unplanned carbon loss	• Implement fire management plans • Conduct pest and disease elimination programs • Thinning and feather edges of wind prone stands • Thinning of drought-prone stands • Careful site selection to reduce climate change risk
Regulatory and legislative	Regulatory changes	• Force majeure provisions in long term contracts
	Uncertain property rights	• Develop contracts or imposed conditions between parties, including linkage of obligations to land title • Formal registration of credit and buffer stocks with a centralised agency that has legal identity and enforcement powers • Negotiation / settlement of land and forest ownership prior to participation

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Risk mitigation strategies identified in Table 4-1 that have been incorporated into the design of the ETS include:

- Buy-out provisions that allow losses in carbon stocks to be replaced with other compliant credits;
- Formal registration with a centralised agency;
- Linking of obligations to land title;
- Use of accepted or prescribed standards and models for carbon accounting;
- Establishment of detailed criteria, procedures and tolerances for measurements; and
- Periodic independent verification of carbon sequestration estimates.

The above strategies will not be discussed in detail given they are part of the design of the ETS and will be inherently adopted by participants as a result. Risk management strategies that forest owners can pursue in addition to those associated with meeting the participation requirements of the New Zealand ETS are discussed in more detail below.

4.1 Participatory risk management strategies

The ultimate risk management strategy for post-1989 forest owners would be to elect not to participate in the ETS, and thereby avoid many of the aforementioned risks associated with participation in the ETS. Likewise, pre-1990 forest owners with less than 50 hectares of forest land could apply for an exemption from the scheme. Non-participation, however, might expose the forest owner to a new set of risks, and these might include:

- Reduced competitive ability compared with ETS participants;
- Exposure to greenhouse gas reduction policy for non ETS participants;
- Increased vulnerability to land use changes;
- Preclusion from the ETS in case of more favourable ETS rules;
- Potential reputational risk;
- Reduced leverage for input to subsequent revisions of ETS rules, and;
- Inability to offset against transport or other emissions attributable to the forest owner in future.

Non-participation, however, does allow the opportunity for forest owners to participate in the voluntary carbon market. The risks associated with participation in voluntary carbon markets were discussed in section 2.3.

4.2 Carbon accounting strategies

4.2.1 Estate averaging

The New Zealand ETS rules require participating post-1989 forest owners to report changes in carbon stock change every one to five years. Forest owners with a number of forest stands can report changes in carbon stock at the estate level, rather than reporting on an individual stand basis. This allows large forest owners with a number of stands to offset liabilities due to harvesting, thinning or disturbance,

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through sequestration in other actively-growing stands. In this way, only the estate level change in carbon stock is reported and traded.

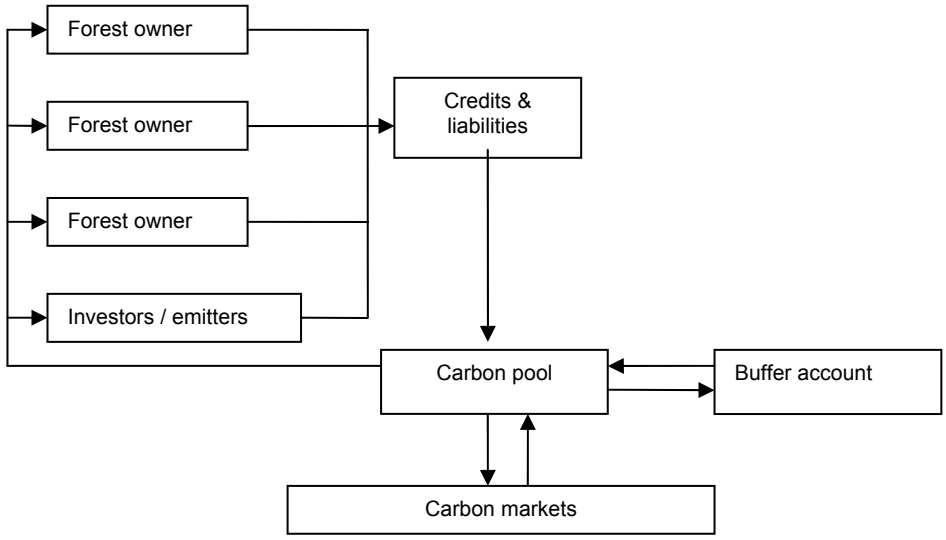
Estate averaging allows the forest owner to sell the maximum amount of carbon, while minimising or eliminating the liability at harvest. For forest owners with an uneven aged estate, the estate level forest carbon profile is likely to fluctuate over time. In this case, a prudent manager might only sell a portion of their forest carbon in order to avoid having to refund NZUs at the time of harvest. The stock change approach is susceptible to risk-taking behaviour, whereby a forest manager could sell all of their carbon up to peak carbon storage, but may not be able to refund carbon at the time of harvest. In this case, they would need to source NZUs from the market.

A long term estate averaging approach may be less attractive if the price of NZUs declines over time, as the forest owner may be better off to sell early, and to source NZUs from the market at the time of harvest. Estate averaging is also difficult for small forest growers, who cannot average out harvesting emissions across a larger estate, unless they participate in a cooperative pool arrangement, as described below.

4.2.2 Carbon pooling

Carbon pooling refers to a business structure whereby a group of ETS participants agree to monitor, report, market and trade forest carbon as a single collective unit, rather than individually. A carbon pool manager would usually manage the collective carbon sequestration activities by entering into agreements for rights to the sequestered NZUs with forest owner(s). The NZUs could then be on-sold in a single parcel to investors/emitters. The basic structure and functions of the carbon pooling process is presented in Figure 4-1.

Figure 4-1 Overview of carbon pooling concepts



Source: URS Forestry, adapted from Australian Greenhouse Office (2005)

The benefits of establishing or joining a carbon pooling initiative are:

- Allowing a group of small forest growers to achieve the benefits of estate averaging, therefore reducing liabilities from harvest or unplanned carbon loss by spreading these among all pool participants;

Section 4 Risk Management Strategies

- Providing the opportunity for small scale operators to sell large parcels of NZUs, thereby realising the benefits of economies of scale;
- Collective marketing may improve market access;
- Facilitating bulk-buying of NZUs or other units in case of pool liabilities; and
- More experienced members or the carbon pool manager can provide technical assistance and expertise to others.

While carbon pooling provides a degree of risk sharing among participants, there are potential downsides to the arrangement, including loss of control/flexibility, administration costs payable to the carbon pool manager, and whether or not the structure of the carbon pooling entity is suited to the needs and circumstances of potential members. Entities offering carbon pooling services are emerging in New Zealand in response to the envisaged need for these services.

4.2.3 Creation of a buffer reserve pool of carbon

A proportion of NZUs can be retained in a buffer reserve pool of carbon, to be used in case of unplanned carbon loss, and/or measurement and modelling error. This is also known as 'self-insurance'. Buffer reserves are usually around 10 to 30 percent of calculated carbon stock, although the size of the reserve may be proportional to the particular risk rating for the project, as discussed in section 2.3.3. This approach is often used in CDM projects where external insurance is impractical or cost-prohibitive.

The size (if any) of buffer reserves is entirely up to the forest owner, and this is ultimately is a trade off between the amount of saleable NZUs, the cost of external insurance and the level of risk protection sought.

4.3 Market-based strategies

4.3.1 Sell or retain NZUs in accordance with carbon price fluctuations

In general, a forest owner might choose to retain their NZUs if they assume the rate of increase in NZU prices is greater than their required rate of return. Conversely, a forest owner might sell their NZUs if their required rate of return is higher than the expected rate of increase in the NZU price. Where NZUs are sold, prudent forest owners might invest the money to create a fund to be used for purchase of replacement NZUs, if required at the time of deforestation.

Risk adverse forest owners participating in the ETS that expect estate level future liabilities, would likely choose to retain NZUs sufficient to cover liabilities at the time of harvest. This strategy would avoid the risk that NZUs sold today will be worth less than the cost of meeting the liability at a future point in time. However, taking the time-value of money into account, this strategy precludes forest owners from generating income from the forest as it grows, a factor considered a key benefit of participating in the ETS. Assuming typical hurdle rates for investors in plantation forests, the price of NZUs would need to increase by around 8 to 10 percent per annum over the life of the rotation for it not to be worthwhile selling NZUs as they are sequestered.

Susceptibility to regulatory changes could be addressed by immediately selling all NZUs upon allocation. The longer the time until harvest or deforestation, the greater the risk of regulatory changes prior to the time of harvest. Therefore the risks associated with retention of NZUs to cover future liabilities are the greatest for early-rotation post-1989 forest owners.

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4.3.2 Forward sales/purchases

Forward purchasing of NZUs may reduce risk, where forest owners expect a carbon liability in future that cannot be managed from within their own estate. A forward sale often locks in the NZU price for a period of time prior to delivery of the NZUs. Therefore, if a forest owner expects the price of NZUs to rise, they may be prudent to forward purchase NZUs at current prices, to be delivered at the time of liability. Conversely, if a forest owner considers that NZU prices will likely decline in future, or if they have an immediate need for capital, they might consider selling their NZUs via a forward sales contract.

Examples of trading in response to carbon price fluctuations

Examples of risk management strategies associated with carbon price fluctuations are provided for six types of forest owner in the table below. The analysis assumes that other factors (for example land values and log prices) remain constant, that forest owners act rationally in order to maximise profit, and a typical required rate of return on investment is applied for investments. The analysis is based on behaviour for an individual forest stand, not a forest estate.

The information below is based on simplified scenarios to demonstrate the divergent strategies that might result from various carbon price fluctuations. It also highlights the increased complexity under which forest and land owners may be making forest management and/or land use decisions. In the future quantitative risk-based simulations and optimisation models could play an increasingly important role in supporting such decisions.

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Table 4-2 Potential risk management strategies to address carbon price fluctuations

Category of forest owner	Forecast NZU price*	Potential risk management strategy (individual stand)
Pre-1990 no intention to deforest	Increase	• Retain gifted NZUs to sell in future
	Decrease	• Sell gifted NZUs as soon as possible
Pre-1990 may deforest in future	Increase	• Deforest as soon as possible to minimise financial liability • Retain gifted NZUs to cover future liability, or • Secure forward contracts for future delivery of NZUs at current prices
	Decrease	• Delay deforestation to minimise financial liability • Sell gifted NZUs as soon as possible
Post-1989 mid rotation	Increase	• Retain sequestered NZUs to cover liability at harvest, or sell sequestered NZUs and buy replacement credits from international market if they are cheaper • Consider harvest in the first commitment period to capitalise on fast growing forest fix rule, depending on timber price • If expecting a future liability, secure forward contracts for future delivery of NZUs at current prices • Low value stands may be better off left unharvested • Sell excess NZUs when the required rate of return exceeds rate of carbon price increase
	Decrease	• Sell sequestered NZUs as soon as possible • Buy replacement credits from the market at time of harvest • Consider harvest in the first commitment period to capitalise on fast growing forest fix rule (depending on log prices) • Consider selling future sequestration at current prices via forward contracts
Post-1989 early rotation	Increase	• Retain sequestered NZUs to cover liability at harvest, or sell sequestered NZUs and buy replacement credits from international market if cheaper • Consider extending rotation length to maximise sequestration • Low productivity stands may be better off left unharvested • Retain excess NZUs as long as they continue to appreciate at rate that exceeds interest rate • If expecting future liability, secure forward contracts for future delivery of NZUs at current prices
	Decrease	• Sell sequestered NZUs as soon as possible • Buy replacement credits from the market at time of harvest • Consider selling future sequestration at current prices via forward contracts
Post-1989 intending to deforest	Increase	• Consider not opting into the ETS
	Decrease	• Sell credits as soon as they are accumulated

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Category of forest owner	Forecast NZU price*	Potential risk management strategy (individual stand)
Post-1989 new investors	Increase	• Biodiversity (unharvested) plantations may become more attractive in marginal areas • Retain NZUs if intending to harvest; plant long rotation species • Forward contracts may be disadvantageous, consider other sources of finance
	Decrease	• Reconsider investment if investing for NZUs only • Forward contracts at current prices may be good way to finance project

Source: URS. *'Increase' implies that rate of price increase in NZU exceeds typical required rates of return; 'Decrease' means that the price of NZUs is predicted to decrease in future, or increase at a rate that is lower than typical required rates of return;

URS considers that as other sectors are gradually introduced into the ETS, demand for NZUs should theoretically increase, placing upwards pressure on the price of NZUs. However future policy decisions, competition from international credits, as well as compensation to other sectors may reduce demand for domestic NZUs, therefore placing downwards pressure on prices.

4.3.3 Risk premium for forward sales

Kyoto-compliant units may be purchased from the market to cover liabilities, however some credits carry higher risks than others. Prices are linked to the extent to which an agreement to provide credits guarantees delivery. A breakdown of indicative prices and risk categories is shown in Table 4-3.

Table 4-3 Indicative price risk categories (2006/07)

Category	Description	Price range (USD/t CO_2e)
1	The seller does its utmost to deliver a flexible/non-firm volume, whereas the buyer commits to buy what the seller delivers.	CER: 5-9 ERU: N/A
2	The seller does its utmost to deliver a flexible/non-firm volume, whereas the buyer commits to buy if the seller delivers. The contract is only valid on a set of preconditions.	CER: 6-13 ERU: 6-10
3	The seller guarantees to deliver a firm volume; the buyer commits to buy if the seller delivers. The contract is only valid on a set of preconditions and usually has a strong force majeure clause.	CER: 11-15 ERU: 6-15
4	The seller guarantees to deliver a firm volume, and the buyer guarantees to buy if seller delivers.	CER: 12-15 ERU: N/A

Source: Point Carbon

Forest owners seeking to offset liabilities through purchase of low-priced credits from the market must understand the nature of the deal they have entered into, and ensure the credits purchased meet the requirements of the New Zealand ETS.

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4.3.4 Due diligence

When seeking to offset liabilities through purchase of credits from the market, prudent forest owners might consider the following questions:

- What unit of trade does this credit provide and is it eligible for use in the NZ ETS?
- Do the credits result from specific sequestration projects? Where is/are the project/s?
- What standard is used to ensure the quality of the credits you sell?
- Have the credits been validated against a particular standard by a credible third party?
- Will the credits accrue in future? If so how long into the future?
- Can it be demonstrated that the credits will not be sold to multiple buyers?

4.3.5 Make-good and buy-out provisions

Make-good provisions are elements of an offset agreement established between a buyer and seller, where in the event of carbon stock depletion, future offset credits are held until the carbon stock reaches pre-disturbance levels. Buy-out provisions are those that allow losses in carbon stocks to be replaced with credits sourced from the market. Establishment of make-good provisions are relevant where NZUs have been forward sold outside the NZ ETS as any liabilities from deforestation or natural disturbance must be offset immediately under the NZ ETS. Buy-out provisions are inherently in place in the New Zealand ETS, as any liabilities must be repaid to the government immediately.

4.3.6 Insurance / financial assurance

ETS credits and liabilities are valuable assets which will require protection from loss or damage. A forest owner could take out insurance so the forest can either be restored, or alternatively compensation will be provided to the party that has suffered the loss. The level of insurance should have regard to the value or cost of credits or liabilities, and should also be periodically reviewed. Responsibility for insurance could lie with either the forest owner or the buyer. If the forest owner or investor is borrowing in order to finance the project, it is likely the debt provider would require insurance to be taken out.

4.4 Forest and project-based risk management strategies

Forest and project-based risk management strategies are those implemented at an estate or forest stand level to reduce risk of carbon stock depletion and/or losses, and/or manage business risks associated with sale of NZUs.

4.4.1 Fire, pest, disease, windthrow and drought management

There are a myriad of silvicultural techniques to minimise unplanned carbon losses due to fire, insect attack, disease, windthrow and drought. These activities should be outlined in a project and risk management plan, capturing all risk management activities relating to a forest owner's carbon liabilities and credits. This plan can also serve as a useful point of reference for investors to assess risk of the project. Risk management activities that might be included in this plan these are listed in the table below

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Table 4-4 Forest risk management strategies to minimise unplanned carbon loss

Risk	Risk management strategy
Fire	Geographic dispersion of estate, restrict burning near forests in periods of high fire danger; plant fire-resistant species if possible, wildfire suppression training, equip fire brigades, establish fire breaks, patrols during dry season; utilise post-harvest residues for bioenergy production, which reduces fuel loads; maintain machinery to reduce sparking and wildfire ignitions
Pest and disease	Thin drought-stressed stands; monitor pest outbreaks, apply pesticides and herbicides as appropriate; maintain fences to prevent incursion of grazing animals, conflict mediation with neighbours when necessary
Windthrow	Establish exposed forest edges parallel to prevailing wind, feather forest edges, selective thinning of wind prone stands
Drought / Climate change	Careful site selection, plant drought resistant species, selective thinning to relieve drought stress; fire prevention activities; investigate use of water-holding gels.

4.4.2 Adapting rotation length to carbon price

A forest owner can choose to bring forward a harvest or planned deforestation to coincide with a time of low NZU prices, and therefore reduce their financial liability. Conversely, a forest owner with no liability expected in future might choose to delay harvest or deforestation, if they expected NZU prices to rise. Clearly this would also depend on timber prices and other factors (as discussed in Section 4.3).

4.4.3 Even age class distribution

Forest estates with an even age class can assist forest owners in managing the risks associated with participating in the ETS, because the emissions/sequestration profile is smoother, thereby reducing exposure to liabilities and price risks. A forest owner with an uneven age class forest may aim to stagger harvesting in order to smooth their emissions profile. Likewise, forest owners may smooth their emissions profile by establishing new forests.

4.4.4 Geographic dispersion of risks

By maintaining a range of forests across a broad geographic area, the risk of carbon loss from the entire estate due to catastrophic events is reduced. This is because windthrow, fire and pest impacts normally occur within a geographically confined area.

4.5 Regulatory and legislative risk management strategies

4.5.1 Registration of carbon rights and obligations

Formal registration of credit and buffer stocks with a centralised agency that has legal identity and enforcement powers is likely to be most effective method of transparency between all parties, and to avoid double-counting. This is a key function of the New Zealand ETS administering agency. Where commitments are made outside the scheme, credible trading platforms and/or qualified independent validation processes should be implemented to provide assurance that parties are in a position to trade with respect to carbon credits and liabilities. In some cases, such as the VCS, participants are required to provide evidence of any participation in another emission reduction scheme to the scheme administrator.

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4.5.2 Contractual arrangements

Negotiating the sharing of NZUs and liabilities will involve a careful review of the current terms of the forestry right or lease, to determine whether the parties are contractually bound in this regard already. When entering into any new forestry right, the landowner and the holder/lessee will need to clearly set out who is entitled to any NZUs (if any) in relation to the property, and who is responsible for any potential liabilities.

A buyer purchasing pre-1990 forested land before the free NZU allocation occurs must ensure that the sale agreement includes the requirement for the owner of the land, as at 1 September 2007, to submit an application to receive the free allocation of NZUs. Following the free NZU allocation, a buyer purchasing must recognise that it is acquiring land that is subject to obligations under the ETS if deforested, and that the vendor may not also be selling NZUs allocated to the land.

For post-1989 forests, a buyer of forest land would need to determine whether the seller has opted in to the ETS. If the seller has not opted into the ETS, then, assuming the time window was still open to enter into the ETS (currently suggested as 18 months from the enactment of the legislation), the buyer could elect whether or not to enter into the ETS. If the seller has entered into the ETS, the seller would retain all NZUs and liabilities for the period up to settlement, and the buyer would want to be entitled to receive NZUs for future carbon sequestered and accept future liabilities.

4.6 Conclusion

Risk management strategies identified in the review of forest carbon projects were found to be varied in their approach and coverage. Of note, none of the initiatives reviewed explicitly identified market risks associated with participation in an ETS. However, our review found that uncertainty around carbon prices has linkages to the majority of the risks identified, and there are a number of important risk management strategies for forest owners to consider with respect to fluctuations in carbon prices. These include:

- Explicit contractual provisions to deal with ETS or carbon offset agreement obligations;
- Project management plans incorporating risk management;
- Carbon pooling;
- Thorough due diligence in emissions trading markets, quality checks for assurance on purchase or sale of future credits;
- Transition to an even aged estates;
- Geographic dispersion of the forest estate; and
- Conservative carbon stock estimation methods including estate averaging and creation of buffer reserves.

All of these types of strategies have relevance for forest owners in New Zealand; however the extent to which they could apply will depend on the classification of the forest under ETS rules, the size of the estate, the level of geographic dispersion and age class structure of the forest(s) under management and ultimately, the level of risk acceptable to the forest owner.

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Section 6 Limitations

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