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The New Zealand forestry sector's experience in providing carbon sequestration services under the New Zealand Emissions Trading Scheme, 2008 to 2012

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Abstract:

New Zealand has been an active participant in global climate change discussions and was a proponent of the inclusion of the contribution of planted forests in the Kyoto Protocol, Article 3. New Zealand was a signatory to the Kyoto Protocol for the first Commitment period (but not the second), and established the New Zealand Emissions Trading scheme (NZ ETS) as the primary mechanism for achieving New Zealand's Kyoto obligations between 2008 and 2012. The legislation made planted forests the first sector to participate in the NZ ETS, starting in 2008. At the same time, other schemes to encourage carbon sequestration through forestry were also implemented.

The NZ ETS has not encouraged investment in new planted forests in New Zealand, and in some cases may have encouraged deforestation. It is suggested the liabilities created by participation in the NZ ETS are significant contributors to this behaviour. It is suggested that the way the New Zealand government has chosen to meet its international greenhouse gas emission commitments (including the acquisition of additional international credits), are a method of reducing the equivalent liabilities under the Kyoto Protocol.

The paper shows that participation in the NZ ETS is unlikely to contribute a long-term positive impact on profitability of commercial forestry, and suggests the NZ ETS is not the correct policy instrument to encourage carbon sequestration by planted forests.

1. Introduction

New Zealand has consistently been an active participant in global climate change negotiations, and was an advocate of the inclusion of the contribution of planted forests in the Kyoto Protocol under Article 3.3. New Zealand was a signatory to the Kyoto Protocol for the first Commitment Period (CP1, from 2008 to 2012), and established the New Zealand Emissions Trading scheme (NZ ETS) as the primary mechanism for achieving New Zealand's Kyoto obligations. Planted forests were the first sector required to participate in the NZ ETS, starting in 2008, with other sectors (except agriculture) entering during 2010. The government implemented also two other schemes to encourage carbon sequestration through forestry - the Permanent Forest Sink Initiative (PFSI) in 2007, and the Afforestation Grant Scheme (AGS) in 2008/09 (Review Panel, 2011).

This paper describes the implementation of the NZ ETS by the New Zealand government and New Zealand's emissions profile over CP1 (2008 to 2012). The impacts of the NZ ETS on management of existing forests, new investment in forests, re-investment and land-use change over this period are identified. Short- and long-term impacts on the profitability of forestry are discussed. The paper will conclude with a discussion of policy options to improve the outcomes, in terms of New Zealand's contribution to reducing emissions of green-house gases using planted forests.

2. New Zealand Emissions Trading Scheme Implementation

There are three policy mechanisms governments can use to manage and reduce the impact of negative externalities such as pollution: regulation, taxation and cap and trade schemes. A cap and trade

scheme operationalises Coase's Theorem, and entails the imposition of a cap on total pollution and allows emitters to trade permits rather than imposing quantitative limits on each emitter. Emitters will trade until their marginal costs of abatement are equal, at which point the economically-efficient solution has been reached. The New Zealand government elected, after initially appearing to favour a carbon tax (Bertram and Terry, 2010), to develop an emissions trading scheme.

The government's objectives in implementing the NZ ETS were described in 2015:

"...The New Zealand Emissions Trading Scheme (NZ ETS) is the Government's principal policy response to climate change. Its objective is to support and encourage global efforts to reduce greenhouse gas emissions by:

- assisting New Zealand to meet its international obligations
- reducing New Zealand's net emissions below business as usual levels.

The NZ ETS requires all sectors of New Zealand's economy to report on their emissions and, with the exception of agriculture, purchase and surrender emission units to the Government for those emissions. This price on emissions is intended to create a financial incentive for investment in technologies or practices that reduce emissions, and for carbon removals from forestry by allowing eligible foresters to earn New Zealand Units (NZUs) as their trees grow and absorb carbon..." (Ministry for the Environment, 2015c)

An earlier evaluation of the NZ ETS by Bertram and Terry (2010) raised concerns about the lack of an explicit cap, and the potential for concessions to be provided for politically-influential emitters. The NZ ETS will be evaluated in this paper against the stated objectives of government, but from the point of view of the impact of implementation on the forestry sector.

The legislation enabling the NZ ETS and forestry's participation in the scheme is incorporated in the Climate Change Response Act of 2002, by way of subsequent amendments, including the Climate Change Response (Emissions Trading) Amendment Act 2008 and Climate Change Response (Moderated Emissions Trading) Amendment Act 2009. This legislation included the creation of a domestic carbon credit (the NZU), with limited ability to exchange the NZU for international Kyoto-compliant units. It also specified transitional measures, so that emitting sectors were only required to surrender carbon credits for half their emissions ("2 for 1"), the price of NZUs was capped at \$25, and the entry of the agriculture sector (New Zealand's largest emitter) was delayed. Provision was also made for annual allocation of credits to "emissions-intensive and trade-exposed" industries to ensure their international competitiveness was not damaged by the implementation of the NZ ETS. These transitional provisions remain in place (however legislation has been enacted which will progressively remove the "2 for 1" provision over 2017 and 2018), and, over the study period, had the effect of reducing market demand for NZUs and limiting the profitability of the scheme for participating forest owners. The government has also permitted a variety of Kyoto-compliant credits¹ to be surrendered by emitters, as an alternative to NZUs, which has dramatically increased the supply of credits in the New Zealand carbon market.

The legislation also defined pre-1990 and post-1989 forest land (which was determined by the status of the land cover at 31 December 1989). Forests on pre-1990 forest land are regarded as permanent forests, and if the land owner wishes to change land use, there is a requirement to surrender credits for an estimate of the full stock of forest carbon on that land. This has effectively constrained the property rights of these land owners. To provide compensation, NZUs were allocated to these land owners on application, but in general the allocation only represented a small proportion of the total costs that

¹ These are all international (Kyoto compliant) carbon accounting units. AAUs = assigned amount units, CERs = certified emission reductions, ERUs = emission reduction units, RMUs = removal units. For further explanation see http://unfccc.int/kyoto_protocol/mechanisms/items/2998.php

would be incurred if these owners changed land use. Only forests on post-1989 land can earn revenue from participation in the NZ ETS, and participation is voluntary. Legislation was passed in 2014 to amend Section 191 of the Climate Change Response Act 2002, to require forest owners to use NZUs rather than international credits, if de-registering from the NZ ETS.

3. Response to the New Zealand Emissions Trading Scheme from the emitting sectors

Table 1 shows that New Zealand's net emissions are less than the commitment made under the Kyoto Protocol (309.6 Mt CO₂ eq.), but only because of net removals by planted forests (70.691 Mt CO₂ eq.)

Table 1: New Zealand's CO₂ equivalent emissions (Mt CO₂ eq.), by sector, 2008 to 2012

Sector	Mt CO ₂ eq.					TOTAL
	2008	2009	2010	2011	2012	
Energy	34.582	31.741	31.624	31.222	32.121	161.290
Industrial processes	4.139	4.158	4.549	5.284	5.277	23.407
Solvent and other product use	0.031	0.028	0.031	0.028	0.034	0.152
Agriculture	33.156	33.368	33.560	34.213	35.020	169.317
Waste	3.857	3.806	3.727	3.646	3.596	18.632
SUM	75.764	73.101	73.491	74.393	76.048	372.798
Afforestation and reforestation	-17.364	-17.836	-18.193	-18.576	-18.965	-90.933
Deforestation	3.167	5.616	4.087	3.376	3.996	20.243
Total (Article 3.3)	-14.197	-12.220	-14.106	-15.200	-14.969	-70.691
NET EMISSIONS	61.567	60.881	59.385	59.194	61.079	302.107

Source: UNFCCC (2015)

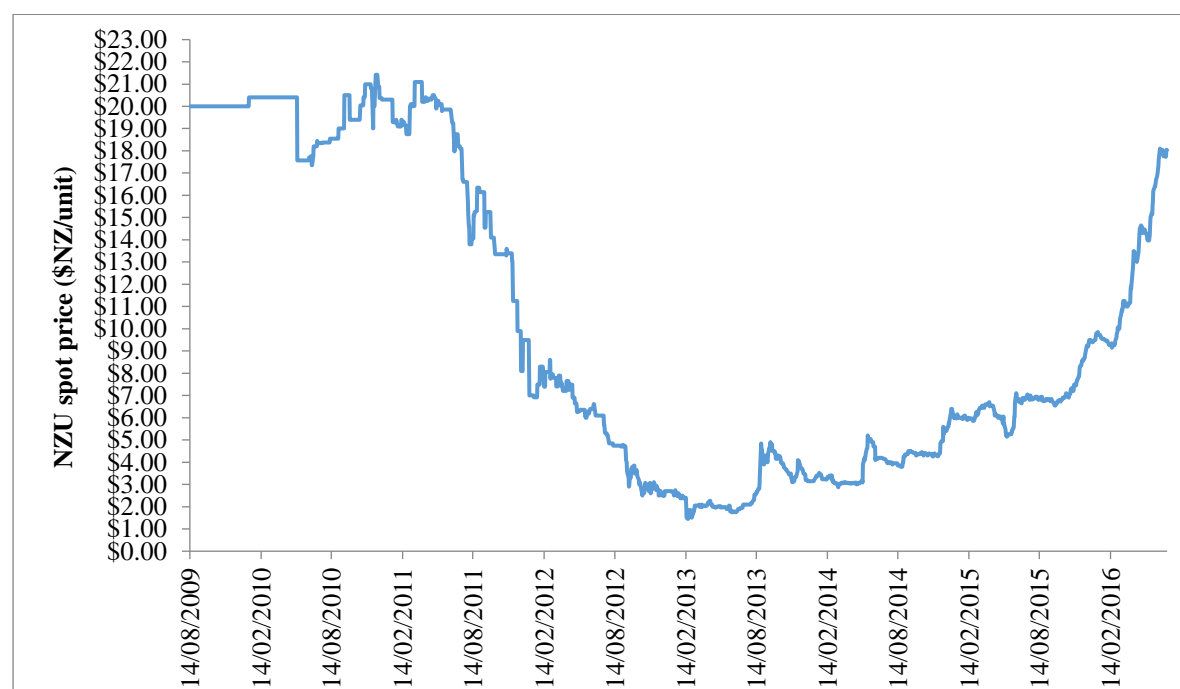
Table 2 shows that New Zealand emitters have changed from surrendering NZUs almost exclusively in 2010 to surrendering mostly international Kyoto-compliant credits in 2013. These credits have been bought very cheaply - they were valued in the NZ Government Financial Statements for year ending 30 June 2014 at \$0.37 each. This was significantly below the traded price of NZUs at the time. Figure 1 shows the trend of spot prices for the NZU, from when the market was first set up till 2016.

Table 2: Types of units surrendered by emitters to meet obligations under the NZ ETS (t CO₂ eq.)

	Forestry NZUs	Other NZUs	NZ AAUs	CERs	ERUs	RMUs	TOTAL
2010	5,325,191	2,513,839	262,883	133,150	0	0	8,235,063
2011	2,148,032	2,309,934	279,511	4,151,962	4,369,113	3,176,081	16,434,633
2012	553,219	441,959	166,854	3,316,685	19,079,809	3,520,192	27,078,718
2013	141,253	85,993	0	2,053,322	41,285,141	1,975,595	45,541,304

Source: Environmental Protection Authority (2014)

Figure 1: NZU spot prices, 2008 to 2016 (\$NZ/t CO₂ eq.)



Source: www.commtrade.co.nz

4. Response to the New Zealand Emissions Trading Scheme from the forestry sector

Participation in the NZ ETS by post-1989 forest owners and allocation of compensatory credits for pre-1990 forest owners are both indicators of the level of support for the NZ ETS from forest owners. Table 3 shows that only 277,212 hectares, or 42% of the eligible forest area was participating in the ETS in 2014, and the owners of 13% of pre-1990 forest area had not applied to receive their free allocation of credits. Neither of these statistics indicate particularly strong support for the scheme.

Table 3: Status of forest land participation in the NZ ETS, by category

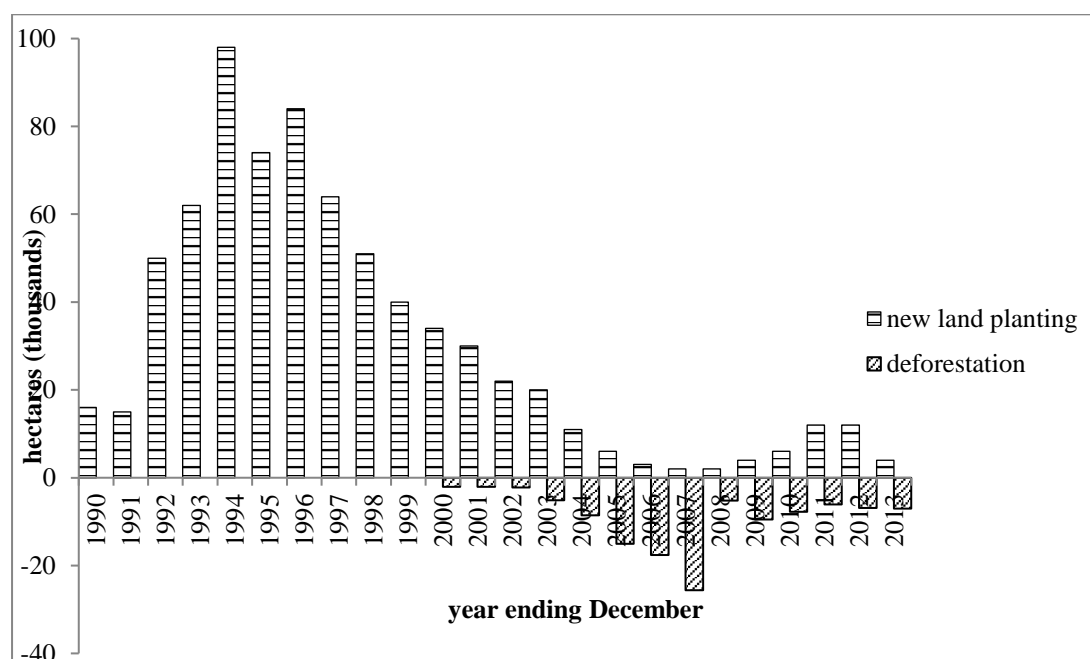
	area (ha)	Proportion
Pre-1990 forest land that received an allocation	1,229,709	86.6%
Possible pre-1990 forest land that did not receive an allocation	190,864	13.4%
Total pre-1990 forest land	1,420,573	100.0%
Post 1989 forest land registered in the ETS	277,212	42.0%
Possible post-1989 forest land not currently registered in the ETS	382,170	58.0%
Total post-1989 forest land	659,382	100.0%
< 50 ha exempt forest land	15,874	
total area granted a tree weed exemption	1,078	
Total planted forest	2,096,907	

Source: Environmental Protection Authority, 2015

Given the stated objectives of the NZ ETS, it is important to review the investment in planting new forests, and the area of land converted from planted forest to another land use. Figure 2 shows new land planting (afforestation), and change from forestry to another land use (deforestation). Over the

period from when the Climate Change Response Act was passed in 2002 till the end of the Kyoto CPI in 2012, the net planted forest area has declined, by around 50,000 hectares. When we consider that around 12,000 hectares of new land planting was carried out under the Afforestation Grant Scheme² and another 1,000 hectares of new forest was established under the PFSI (Emissions Trading Review Panel, 2011), it seems reasonable to assume that the NZ ETS has not been effective at encouraging the expansion of the planted forest estate in New Zealand or in facilitating increased sequestration of carbon from the atmosphere by forests.

Figure 2: New land planting and deforestation, planted forests 1990 to 2013



Source: Ministry for the Environment, 2015b

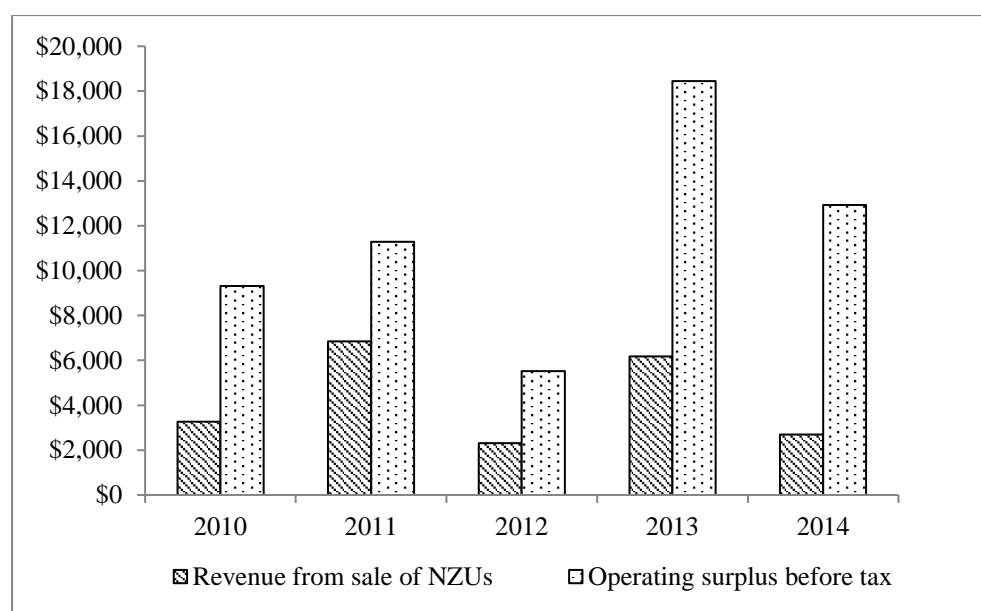
Individual forestry companies have nevertheless found it financially beneficial to participate in the NZ ETS. Figure 3 compares revenue from the sale of NZUs with operating surplus for City Forests Ltd, a New Zealand forestry company with 16,000 ha of planted forest, demonstrating that carbon revenue has been a significant proportion of total profit for this company, for a number of years.

Emitters entered into forward contracts with forest growers when the NZ ETS was first set up, at relatively high prices. The subsequent experience of having to complete those purchases at a considerable premium to the spot price may reduce the willingness of emitters to enter into forward contracts in the future. The view of City Forests Ltd towards participating in the NZ ETS was summarised in the 2014 Annual Report:

“...During the year the company purchased and surrendered ERU carbon credits at favourable prices to withdraw the majority of its post 1989 forests from the New Zealand Emissions Trading Scheme. The purpose of this transaction was to reduce future harvest liabilities. The company intends to re-register these post-1989 forest areas in the coming financial year. The company has retained its higher-value NZU carbon credits and has recorded a gain in the value of these credits as the market price increased throughout the year....Carbon revenues may once again become a contributor to company performance should carbon prices recover from current levels although this has not been included in financial forecasts...” (City Forests Ltd Annual Report, 2014)

² According to information at www.mpi.govt.nz/funding-and-programmes/forestry/afforestation-grant-scheme/ accessed 6th July 2016

Figure 3: Carbon revenue compared with operating surplus, City Forests Ltd 2010 to 2014



Source: City Forests Annual Reports, 2010 to 2014, www.dunedin.govt.nz/your-council/dunedin-city-holdings/city-forests-ltd accessed 25th July 2016

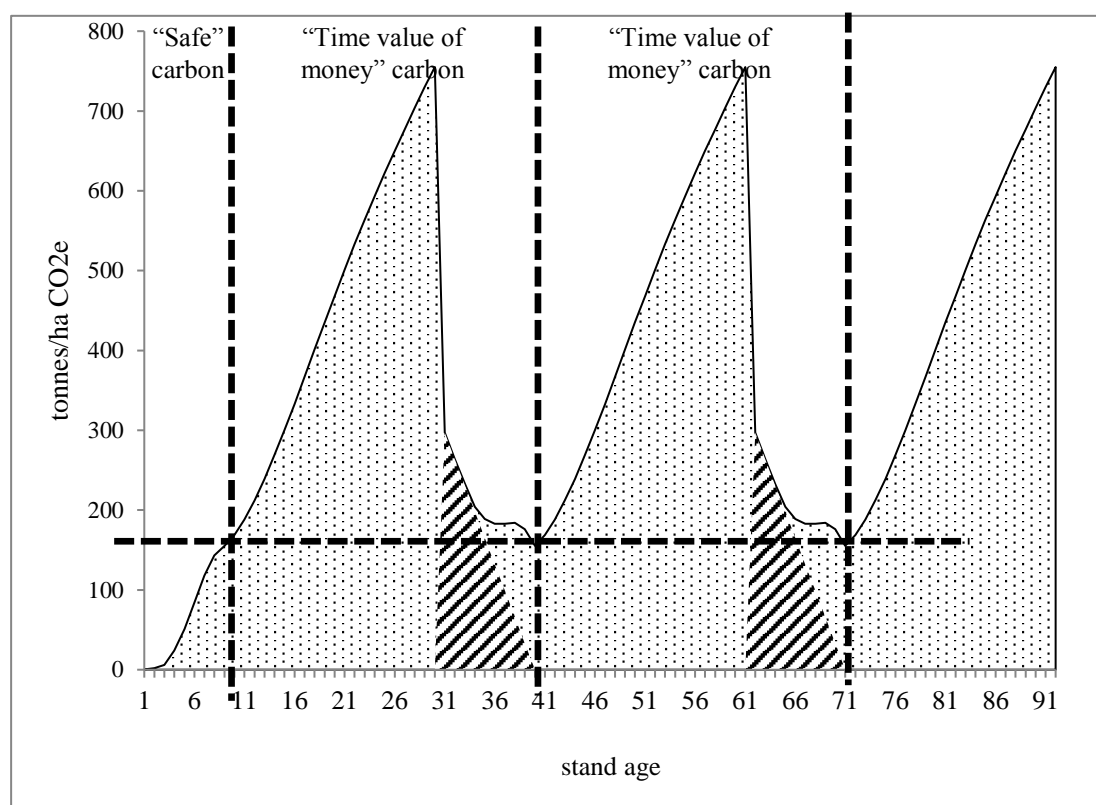
5. The impact of the NZ Emissions Trading Scheme on long-term profitability of New Zealand commercial forests.

It can be shown that returns from carbon forestry are dependent on the price of NZUs, silviculture, species and rotation age selected (see Maclaren et al. 2008; Manley and Maclaren, 2009).

Forest structure also has a material influence on forest profitability. A single age-class forest can provide on-going cash flow to the forest owner (Evison, 2008). Figure 4 shows the carbon stock for a typical radiata pine stand (single age class) which is clear-felled at age 30 and replanted immediately. The NZ ETS assumes immediate emission of carbon in logs sold at harvest, and that the residual forest carbon decays linearly over 10 years (the diagonally-hatched area in Figure 4). The net carbon stock from year 31 to 40 in Figure 4 is therefore the sum of the residual carbon from the first crop and the carbon sequestered in the second crop. If the stand continues to be managed in this way, forest carbon will never decline below the minimum point ("safe carbon") identified on the graph. Selling only the number of NZUs represented by this minimum point (Maclaren et al., 2008), means the owner will earn NZUs only for approximately the first 10 years of the first rotation, but, if the land stays in forest forever, these credits will never need to be surrendered (Figure 4). By contrast the NZUs earned after this initial period must subsequently be surrendered through the harvest and early part of the regeneration cycle, and so the benefit (assuming a constant NZU price) for the forest owner is solely due to the time value of money.

A forest estate that provides timber to industrial customers will tend towards a normal forest structure (that is, an equal area of forest in each age-class up to rotation age), because this allows a consistent supply of timber to industry. A forest of radiata pine in New Zealand with this structure, if entered into the NZ ETS, will only generate revenue for approximately the first 20 years, after which time the NZUs earned will exactly equal the carbon liabilities from the annual harvest (Evison, 2013). The more age-classes in a forest resource, the smaller the ongoing contribution to income and profitability from the NZ ETS. Single age-class forests are likely to be a small proportion of the total forest estate, and therefore in general, the NZ ETS will have little or no positive impact on the long-term profitability of planted forests in New Zealand.

Figure 4: Estimated carbon stock through 3 rotations of a single age-class stand of radiata pine.



6. Government policy direction

The New Zealand government was obliged to meet commitments under the Kyoto Protocol for CP1, and the total number of International Kyoto units it had available to meet these commitments in 2014 is shown in Table 4.

Table 4: Kyoto net position, and credits owned by the NZ government

Kyoto Units available	Mt CO ₂ eq.
RMUs from Article 3.3 forestry	71.6
International Kyoto units through NZ ETS	90
Assigned Amount Units	302.1
TOTAL	463.7
Total Emissions	372.8
Surplus	90.9

Source: Environmental Protection Authority (2014)

It is clear from Table 4 that the number of credits owned by the New Zealand government was far larger than the quantity New Zealand needed to meet its CP1 obligations, which were calculated and accounted for in 2015 and 2016 (see Table 5 below). The 90 million Kyoto international units shown in Table 4 were available to the government because New Zealand emitters have been permitted to use international credits to be used to meet their obligations under the NZ ETS.

A significant issue with using forestry to reduce net carbon emissions was noted by Manley and Maclaren (2009), when they stated: “it is apparent that while New Zealand’s Kyoto plantations will initially be very beneficial for meeting obligations, they will eventually create a liability...”. They also show that there would be no liability (at least until beyond 2040) with a forestry planting rate of 25,000 ha per year from 2009 to 2028. Therefore, in addition to the CP1 commitments the government has a contingent liability which has arisen from the RMUs issued to the NZ government as a result of its including post-1989 forests under Article 3.3 of the Kyoto Protocol. The same point has been noted by other authors (e.g. Bertram and Terry, 2010). This liability creates a strong incentive to “carry over” units from CP1 to CP2 (Commitment Period 2 from 2013 to 2020). The rules that control the ability to “carry over” units are described as follows:

“.. RMUs, tCERs and ICERs and ERUs from LULUCF projects may not be carried over. AAUs can be carried over without limitation. CERs and ERUs converted from AAUs may be carried over, up to a limit of 2.5% of New Zealand’s assigned amount for each of these two units. That is 7.5m CERs and 7.5m ERUs respectively...” (Environment Protection Authority, 2013).

An updated record of the New Zealand government’s holding of different types of units is shown in Table 5.

Table 5: New Zealand government Kyoto carbon units surrendered and requested to be carried over, 2016 (Mt CO₂ eq.)

	AAUs	ERUs	RMUs	CERs	Total
Retirement account	179.055	97.027	80.598	16.117	372.798
Requested to be carried over to CP2	123.749				
TOTAL	302.804				

Source: www.mfe.govt.nz/sites/default/files/media/units-requests-carry-over.xls
www.mfe.govt.nz/sites/default/files/media/units-retired.xls Accessed 6th July 2016

The New Zealand government has surrendered units that would have expired if they had not been used to meet CP1 obligations under Kyoto, and may have requested the AAUs to be carried over to CP2 to provide a hedge against the carbon liability that has arisen through the earning of RMUs on New Zealand’s post-1989 forests. Government policy has also emphasised the importance of access to international credits in its public consultation document (Ministry for the Environment 2015a), and this emphasis is also found in the research it has commissioned to inform the public consultation (Infometrics, 2015, Daigneault, 2015).

7. Conclusions

The NZ ETS is consistent and logical (to the extent that it reflects the biological realities of carbon sequestration by trees), but in practice it is unattractive to forest owners because it has the following undesirable features:

- It creates a contingent liability that exactly equals the number of credits earned. This liability is large, and is registered on the certificate of title of the land. In practice it makes forest land that is participating in the NZ ETS a less liquid asset than land that is not participating.
- There is a slow start to cash flow payments (reflecting the slow initial growth of trees); therefore, there needs to be confidence that the market for carbon credits will yield prices that generate a return to the participating forest grower.
- The significant impact of New Zealand government policies on the price of NZUs has generated a high level of investment risk for forest growers in New Zealand. The carbon price has not tended

to reflect the consensus view on the seriousness or urgency of the greenhouse gas emission problem, or the level of contribution required by New Zealand.

There are two critical questions that also need to be considered when reviewing the NZ ETS.

1. What is the appropriate role of new forests in contributing to New Zealand's efforts to reduce net greenhouse gas emissions?

Planting new forests is the only technology currently known and implementable at a large scale that has the capability to remove large amounts of carbon from the atmosphere, according to the University of Oxford's Stranded Assets Research Group (Caldecott et al., 2015). New Zealand's emissions reporting to UNFCCC demonstrates the significant contribution that planted forests can make to a country's net emissions.

Strategically the role of forestry should be to provide the country with "breathing space" to transition to a low-carbon economy. Kirschbaum, (2003) has shown that the benefit derived from forestry used in this way depends on a number of factors, however the establishment of new forest supporting solid-wood and fibre products industries will be most effective. Forestry could provide 20 years of such breathing space with new planting rates similar to those that occurred in New Zealand in the 1990s. If a government had a strategy to reduce the carbon emissions of an economy significantly in the medium term through implementation of low carbon emissions technologies in industry, energy production, transport and agriculture, this target to be reached much earlier through planting new forests.

2. Has the NZ ETS encouraged planting of new forests, which will reduce New Zealand's future net emissions?

The NZ ETS has not led to the establishment of new forests in New Zealand - the Afforestation Grant Scheme has been much more successful at encouraging new planting than the NZ ETS. The NZ ETS has increased investment and policy risks for forestry, and has diminished the property rights of the owners of two-thirds of the forest estate (the pre-1990 forest owners). The NZ ETS has perversely provided a real incentive to change land use away from forestry at times when the price of carbon units in the NZ ETS was very low. The treatment of the forestry sector by the government has been inconsistent - for example the Climate Change Response (Unit Restriction) Amendment Act 2014 prohibited forest owners from discharging their liabilities using international credits while allowing emitters who had been allocated NZUs to continue to do so.

The large fluctuations in the NZU price, and the long periods of very low prices, have damaged the credibility of the NZ ETS and called into question its utility as an instrument to encourage new forest planting. Emitters who entered into forward contracts with forest growers soon after the NZ ETS was implemented would now be very conscious of the potential impact of allowing externally-sourced credits to enter the market.

Forest owners who participate in the NZ ETS earn NZUs by removing carbon from the atmosphere, but they are encumbered with a contingent liability that cannot be valued until the time it is discharged. The international Kyoto-compliant units that the government has acquired (as a consequence of the decision to allow international credits to be used in the NZ ETS) were used to meet the CP1 commitments while retaining AAUs to cover liabilities in CP2. These liabilities will arise partly from net emissions from harvesting forests that earned RMUs during CP1, indicating the government is as uncomfortable with the long-term liabilities created by Article 3.3 as the forestry sector is uncomfortable with the long-term liabilities created under the NZ ETS. The way the NZ ETS is implemented for forestry is effectively like borrowing money at an interest rate that is only known at the time you pay back the loan. The creation of a contingent liability through the NZ ETS is too much of a burden for a sector that requires long-term thinking and investment to realise its full potential.

A normal forest of radiata pine in New Zealand would only earn income from carbon credits for about 20 years, and from that point on would be incurring compliance costs forever for a scheme that provides no on-going benefit, and further would be encumbered with a significant contingent liability. Any forest producing a sustainable supply of logs for the manufacture of solid wood and fibre products will tend towards a normal forest. Therefore the NZ ETS should rightly be seen as a distraction for the forestry sector, with no long-term benefit and severe long-term disbenefits. These findings support the conclusion of van Kooten (2015) that the "...only viable instrument for...[including forest ecosystems in efforts to mitigate climate change]...is a tax-subsidy scheme that integrates forest activities into a more general carbon tax scheme..."

A profitable and expanding forestry sector will contribute significantly to reducing New Zealand's greenhouse gas emissions in a sustainable way. Already the third largest export earner, forestry has the potential to be much bigger, through increased planting and more onshore wood processing. Much of this industry will be energy self-sufficient – burning renewable wood waste from sustainably-managed plantations. Forestry is one of the few sectors in New Zealand that can provide a significant growth in exports and national wealth, with positive environmental effects rather than negative ones. The forestry sector needs policy instruments that encourage forestry rather than those that damage profitability and the confidence of investors. Above all, the objectives of the government in establishing the NZ ETS are not necessarily consistent with encouraging investment in planted forests in New Zealand.

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