



Including Forestry in an Emissions Trading Scheme: Lessons from New Zealand

Thomas Carver, Patrick Dawson,
and Suzi Kerr

Motu Working Paper 17-11

**Motu Economic and Public Policy
Research**

July 2017

Document information

Author contact details

Suzi Kerr

Motu Economic and Public Policy Research

suzi.kerr@motu.org.nz

Thomas Carver

tom.carver.nz@gmail.com

Patrick Dawson

patrick.ma.dawson@gmail.com

Acknowledgements

We would like to thank the Aotearoa Foundation for its funding of the Low-Emission Future programme, and the Motu Education and Research Foundation, which funded Tom Carver's internship. We also thank OMF for providing us with carbon market data. We further appreciate and thank those who contributed interviews and other input towards this project: Nigel Brunel, Ollie Belton, Steven Cox, Blair Dickie, Peter Gorman, Arthur Grimes, Denis Hocking, Geoff Keey, Catherine Leining, Peter Lough, Dave Maré, David Rhodes, Kate Ryan, Nigel Searles, Joanna Silver, Cath Wallace, and Peter Weir.

Disclaimer

All opinions are our own and we are responsible for any errors or omissions.

Motu Economic and Public Policy Research

PO Box 24390 info@motu.org.nz +64 4 9394250

Wellington www.motu.org.nz

New Zealand

© 2017 Motu Economic and Public Policy Research Trust and the authors. Short extracts, not exceeding two paragraphs, may be quoted provided clear attribution is given. Motu Working Papers are research materials circulated by their authors for purposes of information and discussion. They have not necessarily undergone formal peer review or editorial treatment. ISSN 1176-2667 (Print), ISSN 1177-9047 (Online).

Abstract

New Zealand is the first, and still the only, country to include forest landowners as full and, in some cases, mandatory participants in a greenhouse gas (GHG) emissions trading scheme (ETS), the NZ ETS. Carbon sequestration by forestry continues to be an important part of New Zealand's contribution to its global obligations to reduce emissions. This paper describes the policy changes to the NZ ETS since 2008 that directly affect forestry; assesses the effectiveness of the scheme; explores who is benefiting from it; and outlines issues facing forestry in the NZ ETS moving forward. We find that forest owners have responded to the financial incentives from the NZ ETS in a rational way. Both afforestation and deforestation decisions appear to have been influenced by the emissions price and/or expectations about the emissions price in the future. However, the scheme has been beset by challenges. The collapse in the global carbon price and, associated with this, the proliferation of international Kyoto credits of questionable environmental integrity, combined with the government decision to delay New Zealand's delink from international markets until 2015, greatly reduced the price signal for forestry from the NZ ETS from 2012 to 2015. A weak price signal, coupled with ongoing policy uncertainty surrounding the NZ ETS, has limited the effectiveness of the scheme in achieving its forestry goals. Prospects going forward are more positive particularly if the current reform of the ETS can create clear predictable price signals and better manage the complexity of forestry rewards and liabilities, particularly as faced by smaller landowners who are not professional foresters but could potentially participate and reforest.

JEL codes

Q23, Q54, Q58

Keywords

Forestry, emissions trading, environment, New Zealand, Motu, carbon markets, evaluation

Summary haiku

Few new trees planted

Low price limited effect

Can reform fix this?

Table of contents

1	Introduction	1
2	Description of forestry's role in the NZ ETS	2
2.1	General description of the NZ ETS	2
2.2	Rules surrounding forestry in the NZ ETS	3
2.3	Key regulatory changes for forestry since the introduction of the NZ ETS	5
3	Observational assessment of NZ ETS impacts on forestry	10
3.1	Price signals	10
3.2	Deforestation and afforestation responses	14
3.3	Modelled forecasts	22
3.4	Participation in the NZ ETS	23
3.5	Econometric analysis	29
3.6	Overall impact	29
4	Key issues for forestry in the NZ ETS going forward	30
4.1	NZ ETS review	30
4.2	Other NZ ETS issues that affect forest sequestration	35
5	Conclusions	37
	Appendices	39
	Appendix 1: Commodity prices	39
	Appendix 2: Definition of deforestation in the NZ ETS	40
	References	41
	Recent Motu Working Papers	44

Tables and figures

Figure 1: Credits and liabilities over two forestry rotations	5
Figure 2: Daily carbon prices 2010–16	7
Figure 3: The effect of the carbon price on timber prices and afforestation 1990–2014	11
Figure 4: New Zealand dairy profit 1990–2013	13
Figure 5: New Zealand sheep–beef profit 1990–2013	14
Figure 6: Deforestation (as observed by satellite) 1990–2014	15
Figure 7: Notified deforestation versus carbon price	16
Figure 8: Average age of forest at harvest on land deforested, 2008–14	17
Figure 9: Harvesting age of pine forest 2001–14	17
Figure 10: Harvested area awaiting replanting, restocking and clear-fell (2001–14)	18
Figure 11: Conversion from pine to pasture, Waikato catchments 2001–12	19
Figure 12: New forest planting (afforestation) 1990–2014	21
Figure 13: Contracted nitrogen reductions for Lake Taupo 2007–18	22
Figure 14: Growth cycles for small and large forest owners	24
Figure 15: NZ ETS-registered forest versus total afforestation, hectares 1990–2014	26
Figure 16: Participation Rates in ETS (1990–2014)	27
Figure 17: Registered NZ ETS land by forest size 1990–2013	28
Figure 18: Net afforestation 1990–2014	30
Figure 19: Long-run carbon stock in 30 hectare uniformly distributed age forest	31
Table 1: Long-term safe credits per hectare of forest, by year of planting	25
Table 2: Size breakdown of NZ ETS participants (2015)	27

1 Introduction

New Zealand is the first, and still the only, country to include forest landowners as full and, in some cases, mandatory participants in a greenhouse gas (GHG) emissions trading scheme (ETS), the NZ ETS.¹ Carbon sequestration by forestry continues to be an important part of New Zealand's contribution to its global obligations to reduce emissions.

This paper seeks to, 1) describe the policy changes to the NZ ETS since 2008 that directly affect forestry; 2) assess the effectiveness of the scheme; 3) determine who is benefiting from it; and 4) outline issues facing forestry in the NZ ETS moving forward. The paper will be of interest within New Zealand as the government undertakes its third review of the NZ ETS, and internationally as others seek to learn lessons from how New Zealand has treated forestry.

The paper is informed by official documents, publicly available forestry data, extra data from an Official Information Act (OIA) request Motu made to the Ministry for Primary Industries (MPI),² and interviews with a range of stakeholders (including government officials, foresters, carbon market operators, forestry consultants, environmental non-governmental organisations, and researchers). We use both a quantitative and qualitative approach to assess effectiveness.

We find that the forestry sector is largely responding to the financial incentives provided by the NZ ETS in a rational way; however, these incentives have mostly been weak when performing as intended and have sometimes been perverse. We also find that policy uncertainty has been a significant factor in deterring forestry investment. Most of this uncertainty has been created by policy drivers: the NZ ETS is currently being reviewed for the third time in eight years and was delinked from international markets in 2015.

Karpas and Kerr (2011) provided context on forestry's role in the NZ ETS and a preliminary evaluation of its effectiveness. They found the scheme was functioning and showing promise, but highlighted concerns about investment uncertainty.³ Manley (2016a) suggested that the carbon price in 2011–12 influenced afforestation levels and deforestation intentions. The Ministry for the Environment (MfE) published an evaluation of the NZ ETS in February 2016, which claimed that the scheme had had a small impact on new planting.

This paper adds to the literature by considering newly available public information and considering a broader range of data sources. Given the NZ ETS's relative infancy, as time passes we continue to gain a better understanding of its impact. Recently, the domestic carbon price has recovered strongly (above NZ\$16 since mid-2016).⁴ If this persists, it may lead to stronger responses than we have seen to date.

¹ Or sometimes the forest owner.

² Publicly available at <http://motu.nz/our-work/environment-and-resources/emission-mitigation/emissions-trading/emissions-trading-scheme-forecasting-data>

³ For more general context on the NZ ETS, see Leining (2016) and Leining and Kerr (2016).

⁴ For the latest carbon price and recent history, see <https://www.comtrade.co.nz>.

The paper first provides a background on forestry's role in the NZ ETS, the rules surrounding it, and how these have changed. We then detail how prices relevant to forestry decisions have evolved over time, and assess how forestry owners have responded to these. We explain the ETS-related actions we would have expected to see and compare this with what has happened. Finally, we address the key policy issues facing forestry in the NZ ETS moving forward. For the purposes of this paper, we focus on commercial plantation forests. The NZ ETS also provides incentives for indigenous forest planting and regeneration.

2 Description of forestry's role in the NZ ETS

This section outlines how forestry is treated under the NZ ETS, briefly providing the context and rationale for the rules relating to the sector. For more detailed information, see Karpas and Kerr (2011). In Section 2.3 we present the key regulatory changes for forestry since the introduction of the NZ ETS.

2.1 General description of the NZ ETS

The NZ ETS was introduced in 2008 as a part of the country's efforts to meet its Kyoto Protocol obligations.⁵ The scheme is designed to enable firms willing to mitigate emissions to do so without loss of competitiveness, and to give other firms an incentive to reduce their GHG emissions. Under the scheme, firms are required to acquire and then surrender New Zealand Units (NZUs),⁶ or other eligible units,⁷ to account for emissions associated with their activities. Units can be traded on the domestic emissions trading market. The NZ ETS incentivises the planting of 'additional' forests, i.e. planting that would not have occurred in the absence of the scheme. To reduce administrative costs, the NZ ETS does not attempt to distinguish whether a forest planted after 1989 (the cut-off date under the Kyoto Protocol rules) was additional.⁸ Some forest owners have received windfall gains for forests that were planted independent of the NZ ETS (similar to the gains to pre-existing owners of renewable energy resources and the reverse of the issue of stranded assets for some large emitters), but this has no environmental implications.

⁵ For more information, see <https://www.climatechange.govt.nz/emissions-trading-scheme> and Leining (2016).

⁶ An NZU is New Zealand's emission unit, equivalent to one tonne of carbon dioxide equivalent.

⁷ Note that "since 1 June 2015, only NZUs, NZ AAUs [Assigned Amount Units], and 2nd Commitment Period CERs [Certified Emission Reduction Units] can be used to meet surrender obligations in the ETS" (http://www.epa.govt.nz/e-m-t/Pages/ETS_terms.aspx). However, the conditions under which those CERs would be accepted are limited, as the New Zealand Emissions Trading Register ceased international transactions from 19 November 2015 (http://www.epa.govt.nz/e-m-t/reports/carbon_market/Pages/transaction_trends.aspx).

⁸ The rules under the NZ ETS mimic the Kyoto Protocol forestry rules, but this was not necessary. It was a choice by the government of the time.

2.1.1 Role of forestry

New Zealand is the first, and still the only, country to include forest landowners as full participants in its ETS. This recognises the significant role the sector can play in helping the nation achieve its emission mitigation targets. Forests, and particularly afforestation, can act as a “carbon sink”, sequestering carbon and therefore counteracting the accumulation of carbon dioxide (CO₂) in the atmosphere, which is the main cause of climate change. Forestry can also face liabilities under the NZ ETS for reductions in carbon stocks on forestry land, either from harvesting (of post-1989 forests that have been registered in the ETS) or deforestation (mandatory for most pre-1990 forests).⁹ Deforestation was not significant in New Zealand in the 1990s; however, it has accelerated in the new millennium. Dorner and Hyslop (2014) showed that less than 0.25% of the plantation forestry area was deforested between 1997 and 2002, whereas this increased to almost 2% of a considerably larger area for the 2002–08 period. The New Zealand Greenhouse Gas Inventory (1990–2014) states that little deforestation occurred between 1990 and 2004, with most occurring since then (Ministry for the Environment 2016a).

Forestry activities eligible under the Kyoto Protocol sequestered net CO₂ equivalent to nearly 16% of New Zealand’s gross emissions in 2015.¹⁰ The sector more than completely offset the difference between New Zealand’s Assigned Amount under its target and New Zealand’s total gross emissions during Kyoto’s first commitment period (CP1).¹¹ Unfortunately, the age structure of New Zealand forests means that, under business as usual, there will be significant harvesting from around 2020. This could make forests a net carbon source, before they become a sink again with new growth in new and replanted forests (Ministry for the Environment 2013).

2.1.2 Forestry goals of the NZ ETS

Broadly speaking, the forestry component of the NZ ETS provides incentives to promote carbon sequestration and storage by 1) Discouraging deforestation of pre-1990 forests; and encouraging, 2) Planting of new post-1989 forests; 3) Replanting of post-1989 forests; and 4) Extending harvest rotations of post-1989 forests, and increasing their forest carbon density.

2.2 Rules surrounding forestry in the NZ ETS

Forests are distinguished based on their establishment date as either “pre-1990” or “post-1989”. This structure frames the key rules for forestry in the NZ ETS.

⁹ Harvesting is distinct from deforestation, in that deforestation is a conversion of forested land to another land use, while harvesting is the “removal of biomass from a site followed by reforestation (replanting or natural regeneration)” (Ministry for the Environment 2015b).

¹⁰ See table “Sector breakdown of units and emissions for 2013 to 2020” as at 26 May 2017 at <http://www.mfe.govt.nz/climate-change/reporting-greenhouse-gas-emissions/latest-2020-net-position>. The figure quoted was obtained by using “Kyoto Protocol forestry activities” units for 2013 as a percentage of “Gross emissions”.

¹¹ See <http://www.mfe.govt.nz/climate-change/reporting-greenhouse-gas-emissions/nzs-net-position-under-kyoto-protocol/update-net>.

2.2.1 Pre-1990 forest

When pre-1990 forest land is deforested, the owner compulsorily becomes an NZ ETS participant and must surrender emission units equal to the full reduction in carbon of the forest (Ministry for Primary Industries 2015a).¹² This provides the first incentive listed in Section 2.1.2. If the trees on the deforested land are less than nine years old, the liability is for the mature trees that were harvested/cleared in the previous nine years (Ministry for Primary Industries 2015b).¹³

Owners of pre-1990 forests don't face an obligation to surrender NZUs when harvesting trees if they replant or facilitate sufficient natural regeneration. They are ineligible to earn credits for sequestering carbon as their trees grow (Ministry for Primary Industries 2015a).

2.2.2 Post-1989 forest

Post-1989 forest landowners may voluntarily register as NZ ETS participants but are not obliged to do so. Participating post-1989 forests are eligible to earn units for net carbon sequestered by their trees from the time they are registered.¹⁴ The owner is then liable to surrender units equal to the release of carbon dioxide if that forest is harvested (the liability is limited to the number of credits received) (Ministry of Agriculture and Forestry 2011). After harvesting, stocks of around 200–300 tonnes CO₂-e per hectare remain (Ministry for Primary Industries 2015b). If post-1989 forest is deforested, the owner is liable to repay the net units issued to the deforested land. This process provides the second, third, and fourth incentives listed in Section 2.1.2.

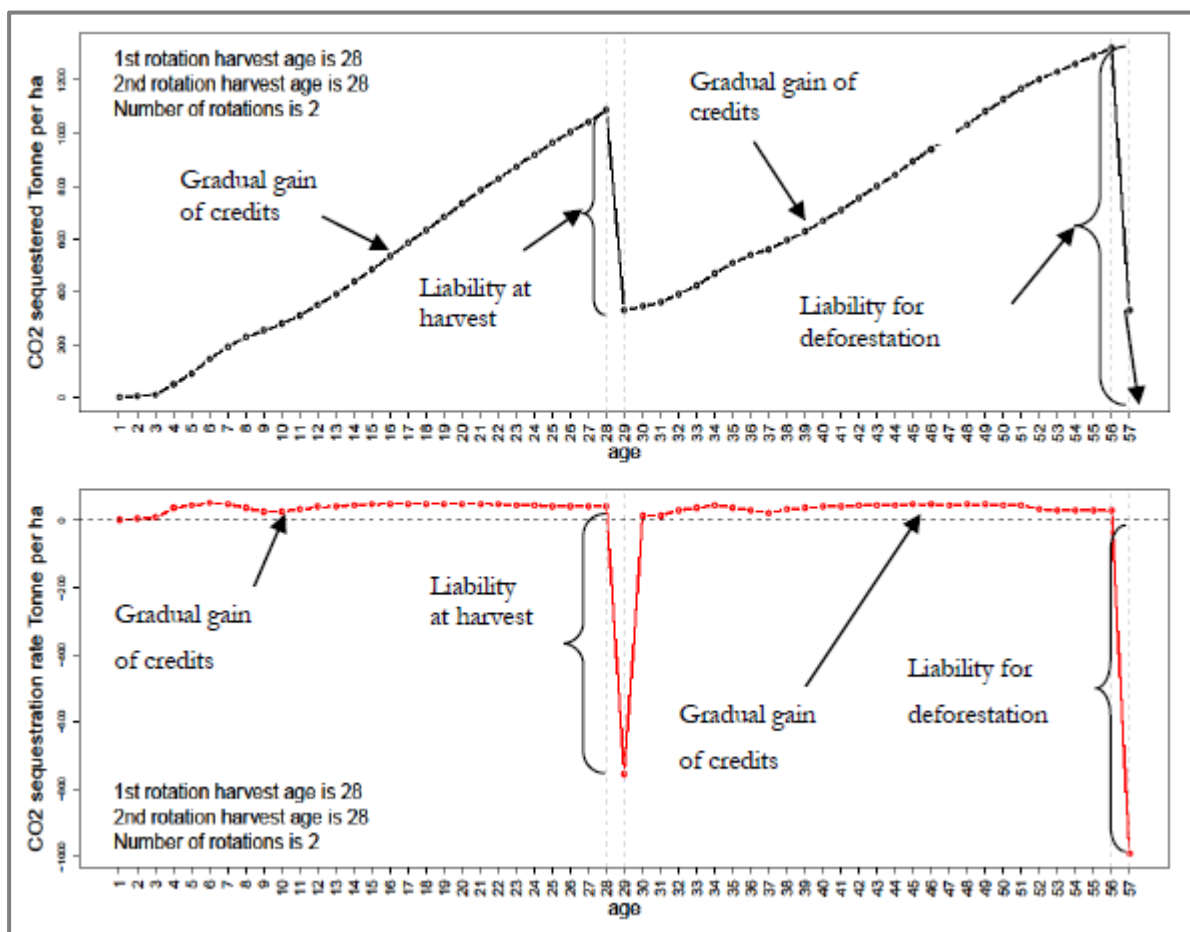
Figure 1 illustrates the carbon cycle for a single-age, single-species forest planted in 2008 or after. It assumes harvest followed by replanting for the first rotation, and harvest followed by land-use change for the second rotation.

¹² As defined in the NZ ETS, deforestation is the clearing of more than two hectares in each five-year period from 2008, followed by either a change in land use (e.g. from forestry to dairy farming) or the land not being re-established in forest in specified timeframes (Ministry for Primary Industries 2015a). There are some exemptions available to clear tree weeds and for owners of forests smaller than 50 hectares (Ministry for the Environment 2016a).

¹³ Clearing forests at nine years old may become attractive if carbon prices stay high. In Bruce Manley's 2014 deforestation intentions survey, one forest owner said that if carbon prices were higher than NZ\$12/NZU "we would allow natural regeneration [after harvesting] and convert after nine years" (Manley 2015). This strange situation arises from the way the international forestry accounting rules have been defined for pre-1990 forests. The government could resolve this but it would transfer some fiscal cost to taxpayers because it would create a divergence between international forestry rules and NZ ETS rules. The scale of inefficiency from this depends on how many forest landowners choose to deforest, which in turn depends on profitability of alternative uses and on emission prices. It is not an issue at very low emission prices, or very high, or when alternative profits are very high (so foresters will choose to pay the emissions price and not defer land-use change).

¹⁴ Before 2013, new registrants could claim units since 2008, the beginning of CP1. Participants must account for the change in carbon stocks in forests at least once every five years (Ministry for Primary Industries 2015a).

Figure 1: Credits and liabilities over two forestry rotations



Source: Karpas and Kerr (2011)

2.3 Key regulatory changes for forestry since the introduction of the NZ ETS

Three key changes to the NZ ETS particularly affect forestry: the introduction of the Field Measurement Approach (FMA) for measuring the carbon stock of a forest; pre-1990 forest offsetting; and the prevention of re-registration arbitrage. In this section, we briefly describe these changes, supplemented by opinions from industry stakeholders.

2.3.1 Introduction of the FMA (2011)

When the NZ ETS was first introduced, forest carbon stocks were assessed using look-up tables (Karpas and Kerr 2011). These were easy to implement and use, but provided inaccurate measures for specific forests. They also turned out to be inaccurate on average. On September 1 2011, the FMA came into force. It provides forest-specific, on-site assessment of the levels of carbon stored in the forest. The FMA is mandatory for owners of forests greater than 100 hectares, while the earlier look-up tables are still mandatory for owners of forests smaller than

100 hectares.¹⁵ See Karpas and Kerr (2011) for more context on the measurement of forestry carbon stocks.

Our interviewees generally responded positively on this issue. Both government and forestry industry representatives agreed that the FMA doesn't pose a significant cost for plantation forest owners and is reasonably easy to comply with.¹⁶ David Rhodes (Chief Executive, New Zealand Forest Owners Association) indicated that most owners of large forests already collect a lot of the required data. Peter Gorman (Former Senior Policy Advisor, MPI) estimated that some forests could receive 30–40% more carbon credits, while others may receive less than before. He mentioned that some owners had reduced their ETS-registered holdings to 99 hectares to avoid the cost of this new regulation.¹⁷

2.3.2 Pre-1990 forest offsetting (2012)

From 1 January 2013, in response to a change in international forestry accounting rules, the NZ ETS was amended to allow for offset planting for pre-1990 forests (Ministry for the Environment 2016c). Owners of pre-1990 forest can now deforest their land without having to surrender units, “provided they establish an equivalent forest (the offsetting forest) elsewhere” (Ministry for Primary Industries 2014b).¹⁸ The offsetting forest must be established either by planting or direct seeding; natural regeneration is not allowed. The forest must cover an area at least as large as the pre-1990 land and sequester an equivalent amount of carbon over the forest rotation.¹⁹ The forest can be established on eligible post-1989 land as well as deforested pre-1990 land that has satisfied any relevant carbon liability (Ministry for Primary Industries 2014b).

The forest established to “offset” the deforestation is classified as pre-1990; it is not eligible to earn credits for carbon sequestration (Ministry for Primary Industries 2014b). Offsetting is designed to allow landowners to “move” pre-1990 forests off land that would be best utilised for other purposes (e.g. farming), while maintaining previous levels of carbon sequestration.

Interviewees from the forestry industry, government, and NGOs were generally in agreement that it was fair to allow a forest owner to replant in a different location. When offsetting was introduced, the carbon price was very low and there was little interest in using it.²⁰ David Rhodes noted that offsetting involves significant costs associated with purchasing, preparing, and planting new forest land. However, Ollie Belton (Managing Director, Carbon

¹⁵ The mandatory nature of the policy is designed to avoid the possibility of an adverse selection problem, where only those who would be better off using the FMA would employ it.

¹⁶ For indigenous forests, the costs of FMA may be higher and this may constitute a barrier to involvement given the lower carbon returns. For more detail, see (Carver and Kerr 2017).

¹⁷ There may have been an element of adverse selection in these decisions, i.e. forest owners choosing to reduce to 99 hectares if they get more carbon credits from the look-up tables than from the FMA.

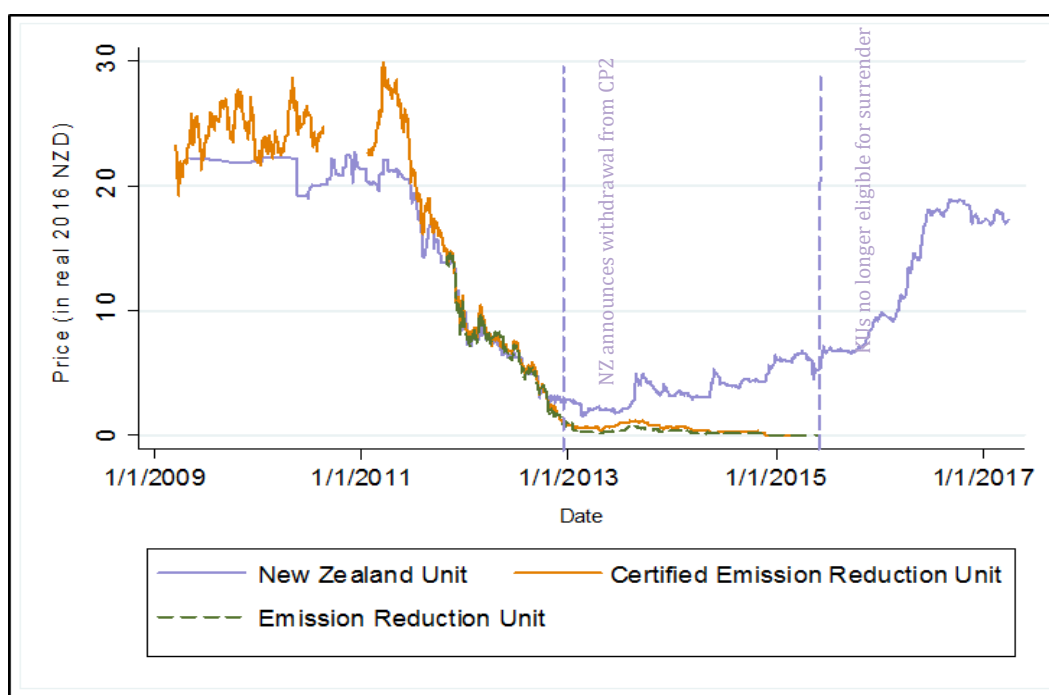
¹⁸ The new forest needs to be established on NZ ETS-eligible post-1989 land.

¹⁹ CCRA s186B(1)(c)(i)

²⁰ Our interviewees were also in agreement on this point.

Forest Services) feels that since the carbon price has recovered, interest in offsetting and uptake has surged. Bruce Manley's deforestation intention surveys tell a similar story: no respondent in his 2014 survey was intending to use offsetting. In Manley's 2015 survey, two respondents were intending to offset roughly 4,000 hectares of forest land, and other respondents were considering offsetting if the carbon price continued to rise (Manley 2015, 2016b).²¹ Since the 2015 survey, the carbon price has risen from NZ\$7.50/NZU to more than NZ\$17/NZU at the time of writing (March 2017), which may increase interest in offsetting even further (Figure 2).

Figure 2: Daily carbon prices 2010–16



Source: OMF (2016)

2.3.3 Preventing re-registration arbitrage (2014)

In November 2012, the New Zealand government announced that it would not sign up to the second Kyoto commitment period (CP2). As a consequence of this decision, New Zealand was barred from trading Kyoto units internationally from 19 November 2015, and the government prohibited the surrender of Kyoto units in the NZ ETS from 1 June 2015.²² Thus, the NZ ETS became a closed domestic scheme from 1 June 2015. See Ormsby and Kerr (2016) and Leining et al (2017) for more detail on the delinking of the NZ ETS from international markets.

NZUs received a price premium over international units after the government made its announcement not to join CP2 (see Figure 2). The main drivers of the NZU price premium were:

²¹ The carbon price during Manley's 2014 survey ranged between NZ\$4.30/NZU and NZ\$5.50/NZU, and international credits were still eligible to meet deforestation liabilities (Manley 2015). During Manley's 2015 survey, the carbon price was between NZ\$7.00/NZU and NZ\$7.50/NZU (Manley 2016b).

²² The New Zealand government allowed NZ ETS participants to surrender international Kyoto units to meet emissions liabilities until this date (Leining 2016).

their status as the only eligible units from June 2015; their bankability; and their relative scarcity compared to international credits. This presented an arbitrage opportunity, where a firm could surrender cheaper international credits and “bank” any NZUs it accrued.²³

Claiming NZUs multiple times for the same year is referred to as re-registration arbitrage. It is unique to post-1989 forestry participants, who had the potential to receive NZUs more than once for the same piece of land sequestering the same carbon in the same year. Post-1989 forestry is the only sector in the NZ ETS able to both earn and surrender units and voluntarily opt in and out of the scheme. To take advantage of the opportunity, an NZ ETS-registered forest owner would first claim NZUs for the carbon stored in their forest from the beginning of the Mandatory Emissions Reporting Period (MERP) current at the time.²⁴ Next, they would surrender cheaper Kyoto units to meet their liabilities and deregister. They would then repeat the process by re-registering and claiming credits from the start of the MERP. While this could, theoretically, have been done ad infinitum in the same year, the time required to lodge and process the applications would make it very difficult to carry out re-registration arbitrage more than once a year (The Treasury 2014).

The government moved to close this opportunity in May 2014 by amending the Climate Change Response Act.²⁵ Under this amendment, only NZUs can be surrendered when deregistering post-1989 forests. The amendment was introduced rapidly and without consultation, in order to avoid encouraging more arbitrage between the announcement and enactment of the legislation (Groser and Goodhew 2014).

It is useful to distinguish here between arbitrage and re-registration arbitrage. The re-registration arbitrage opportunity was unique to post-1989 forestry, whereas any NZ ETS participant eligible to earn NZUs could benefit from the arbitrage opportunity.²⁶ While re-registration arbitrage was potentially of greatest concern for the reputation of the NZ ETS within New Zealand, the financial scale of the arbitrage opportunity alone was large for foresters as well as others. Post-1989 forest owners could utilise this opportunity for all the credits they had earned on their forests since 2008.²⁷

Twenty-eight forestry participants definitely engaged in re-registration arbitrage relating to a total of 985,654 NZUs (EPA 2014). With an arbitrage gain of approximately \$3 per unit during the period, this is a gain for these participants of around \$3 million (OMF 2016) if they each re-registered once.

²³ Forestry receives NZUs for sequestration. Emission-intensive trade-exposed (EITE) firms also receive free allocations of NZUs to protect their competitiveness against overseas producers that do not face equivalent costs for emissions.

²⁴ A MERP is a five-year period used for reporting purposes. The current period is 2013–18, and the previous period was 2008–12. It was possible to claim NZUs for 2013 sequestration only from 1 January 2014 (The Treasury 2014).

²⁵ For more detail, see <http://disclosure.legislation.govt.nz/bill/government/2014/214>.

²⁶ Others include EITE firms that get given free allocations, and pre-1990 forestry that received free allocations of NZUs as compensation for reductions in land values.

²⁷ The NZU–Kyoto price differential averaged nearly NZ\$3 between June 2013 and May 2014 (OMF 2016).

Larger numbers of foresters took advantage of the opportunity offered by low-cost international units to deregister from the NZ ETS, and thereby cancel their future liability when they harvest (the NZUs they have received since joining). This allowed them to safely sell, at higher prices, the NZUs they held. In 2013, 346 forest participants claimed units and then deregistered, surrendering 8,520,089 units (many from sequestration in the period 2008 – 2012) (EPA 2014).²⁸ In 2013, 2,550,265 of these had been claimed as NZUs for sequestration.²⁹ Their immediate gain on these 2013 units was nearly \$6 million. Some participants who benefited from the arbitrage opportunity may have surrendered credits for other reasons (e.g. harvesting, leaving the NZ ETS for another reason). Any harvesting would have been of trees no older than 23–24 years, so it is unlikely this was widespread. A forest owner who “lost faith” in the scheme between January and May 2014, and subsequently regains faith in the NZ ETS before December 2017 (the end of the current MERP), will be able to benefit from re-registration arbitrage.

Most interviewees, including David Rhodes, appreciated that forestry had a unique opportunity to “double-dip” with re-registration arbitrage. Rhodes and Peter Gorman agreed that the government was right to act without consultation, as transparency could have led to a rush of last-minute arbitrage. Nigel Brunel (Director of Financial Markets, OMF) and Catherine Wallace (Vice-chair, ECO) claimed that the government had long been aware of the issue and should have acted sooner.³⁰ Peter Weir (Environmental Chair, New Zealand Forest Owners Association and Environmental Manager at Ernslaw One) and Rhodes, however, expressed dissatisfaction over what they saw as inequitable treatment of the forestry sector. Some non-forestry participants could also exploit the price differential by banking NZUs they were freely allocated and surrendering international units, albeit without the ability to “double-dip”. Moreover, there was a concern that “honest” forest owners who simply wanted to deregister may have been left with stranded international units after the Budget night change. This perceived unfairness and the overnight nature of the change further added to perceptions of ongoing policy instability.

²⁸ For context, approximately 11M NZUs are issued to post-1989 forestry annually (The Treasury 2014). It was possible to claim NZUs for 2013 sequestration only from 1 January 2014 (The Treasury 2014) so no re-registration arbitrage relating to 2013 sequestration occurred before then. It appears that no participant was able to take advantage of the re-registration arbitrage opportunity theoretically available in late November and December 2012. More NZUs could have been involved in re-registration arbitrage because this was during the previous MERP, but the price differential at the time was small and MPI processing of applications was slow.

²⁹ There is no arbitrage gain on the earlier units. Most foresters holding units at this point probably wished they had sold them earlier when the prices were high. Those who intended to change land use on harvest benefitted from the low international unit price, but not specifically from the arbitrage.

³⁰ Nigel Brunel claimed that the government was aware of re-registration arbitrage as a potential issue as early as 2011; however, there wasn't a significant price differential between NZUs and international Kyoto units until early 2013. The Treasury report states that the opportunity was identified in July 2013 (The Treasury 2014).

3 Observational assessment of NZ ETS impacts on forestry

This section details how the forestry sector has responded to the NZ ETS. First, we consider the price signals relevant to forestry decisions: timber, carbon, and commodities from competing land uses. Next, we assess how behaviour has responded to the NZ ETS both quantitatively and qualitatively. We focus on the first two incentives created by the NZ ETS stated in Section 2.1.2 (discouraging deforestation and increasing afforestation); it is too early to observe any results for the last incentives.

3.1 Price signals

3.1.1 Timber prices

Figure 3 shows the timber price from 1990 to 2014 (real log price in 2006 NZ \$ per cubic metre). There is an historic price spike from 1993 to 1995, which was associated with a surge in new planting in the mid-1990s. Since 2002, the price has remained relatively stable, at a level consistent with low afforestation.³¹

3.1.2 Carbon prices

The carbon price acts as both a cost for pre-1990 deforestation and a reward for post-1989 afforestation; however, for some of the NZ ETS period these activities have faced slightly different price signals. Deforestation and harvest liabilities can be met by any eligible emissions unit in the NZ ETS. Carbon sequestered by post-1989 forests, on the other hand, has always earned NZUs.

From November 2012 to May 2015, when the NZU price was higher than the international carbon price and international units were eligible in the NZ ETS, forest owners could choose the lowest-cost units to meet their obligations.³² For much of this period, international carbon credits were priced at less than NZ\$1, resulting in a very weak deforestation deterrent.

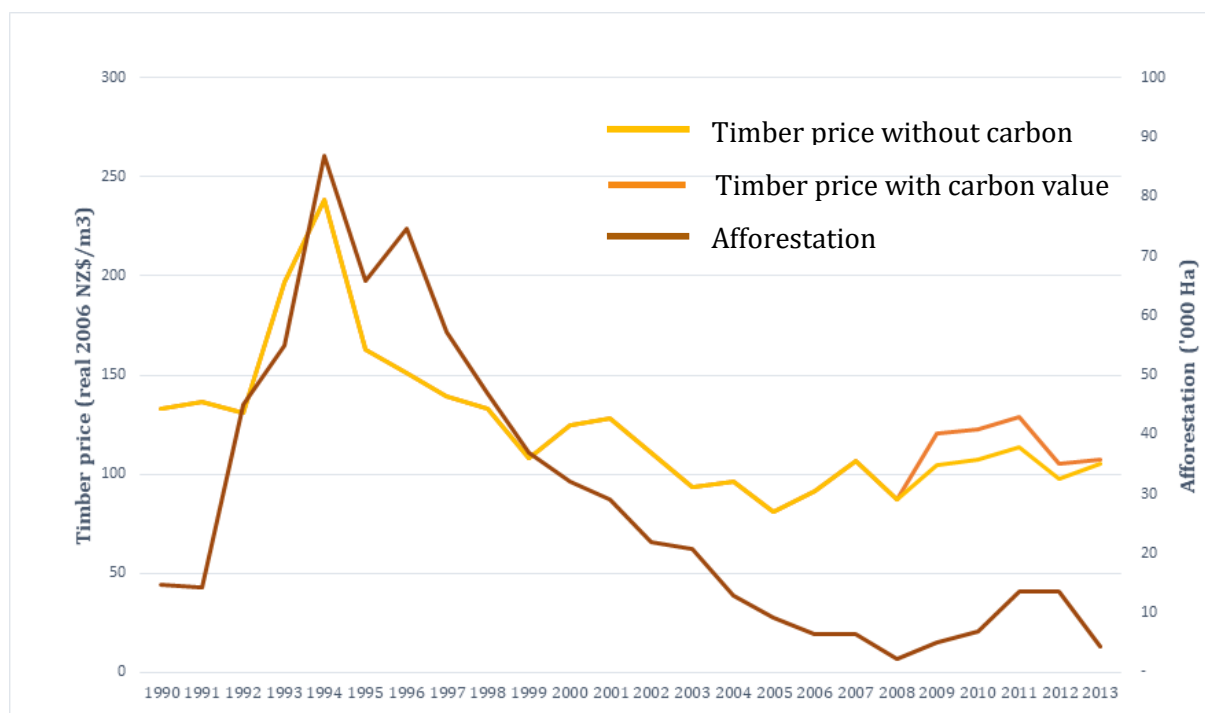
Figure 2 shows the New Zealand and global carbon price (in 2016 dollars). When the price was relatively high and stable (e.g. \$NZ15–20 from 2009 to late 2011), the NZ ETS may have been expected to deter deforestation and encourage afforestation. Since June 2016, the price has been back at similar levels; it has hovered around NZ\$17.50/NZU for the last year. The orange line in Figure 3 is the timber price plus the value of carbon that could have been expected at the

³¹ The average timber price from 1990 to 2001 was NZ14,848¢ per cubic metre (NZ13,159¢ per cubic metre if the historic price spike is excluded), compared with NZ10,151¢ per cubic metre from 2002 to 2014).

³² Ormsby and Kerr (2016) found that the overwhelming majority of credits surrendered in 2013–15 were international Kyoto units (including non-forestry participants).

time (the “effective” timber price facing a new forest investor).³³ The value of carbon added 15% to the effective timber price in 2009–11.³⁴

Figure 3: The effect of the carbon price on timber prices and afforestation 1990–2014³⁵



Sources: Ministry for Primary Industries (2016a); OMF (2016)

We calculate that an NZU price of NZ\$20 results in a net present value (NPV) from the sale of “safe”³⁶ carbon credits of approximately NZ\$2,000 per ha. We calculate this using the unweighted regional average carbon stock from the MPI look-up tables (Ministry for Primary Industries 2015b), and a real discount rate of 8%.³⁷ Manley (2016a) found similar numbers using levels of carbon storage for the Hawke’s Bay/southern North Island region.

To illustrate the significance of this incentive for forest owners, it helps to consider the NPV per hectare of forest land without a carbon price. Olssen et al. (2012) found that in the ten years prior to the establishment of the NZ ETS, there was no year with an average NPV per

³³ Assuming a discount rate of 8% and rate of growth in emission prices of 5%, and forest owners selling only the first ten years of NZU credits (up to the “safe” level). Every NZ\$1 increase in the NZU price is equal to a NZ\$0.86 increase in the timber price. This is calculated as the net future value (NFV) at time of harvesting using average CO₂ flows over all region look-up tables.

³⁴ If it is assumed that forest owners sell carbon credits up to the “average” level of their forest’s carbon stock (instead of the “safe” level), this increases to 25%.

³⁵ The dataset we used can be found on the MPI’s website at <https://mpi.govt.nz/news-and-resources/open-data-and-forecasting/forestry/wood-products-markets> under the tab “Annual exports”. We used the Excel data “Year ended 30 June 1981 to most recent”, and the “Logs and poles (000 m³)” series to calculate prices. We then adjusted these prices using the Reserve Bank Consumers Price Index, with 2006 as the base year. Note that all annual price/profit data is June year end (1 July 2011–30 June 2012 is classed as 2012).

³⁶ After harvesting, carbon stocks of approximately 200–300 tonnes per hectare remain

³⁷ The NPV per hectare for more regions where sequestration rates are higher are significantly greater (e.g. Gisborne = NZ\$2,700, Hawke’s Bay and southern North Island = NZ\$2,600). Given that these are also more profitable regions and therefore tend to have higher levels of forested land and afforestation, they may be more representative of the opportunity for forest owners. Use of the FMA may yield even higher returns.

hectare above NZ\$2,000 from logs alone.³⁸ In the five years prior to the implementation of the NZ ETS, the NPV per hectare was less than or equal to NZ\$1,000, meaning that a carbon price of NZ\$20 would represent at least a tripling of forestry profitability for those years. Thirkettle and Kerr (2015) found even lower levels of profitability for existing *Pinus radiata* forests in 2013. Using a 7% discount rate, they found that if you take an average over New Zealand *Pinus radiata* forest land of the NPV of expected forest profit as though it were planted in 2013, it is around NZ\$61 per hectare. Even in the most profitable regions (East Coast and central North Island), they found NPVs of NZ\$507 per hectare and NZ\$671 per hectare, respectively.³⁹

Whereas for commodities – including timber – recent prices are a reasonable forecast for future prices, this not true for carbon. Policy uncertainty has a significant influence on expectations around carbon prices and their subsequent impact on forest profitability. The NZ ETS is currently in its third review in only eight years of operation. The first two such reviews acted to moderate the price impact of the scheme (Leining 2016). Further, up until the Paris Agreement at the end of 2015 and even beyond, there has been a large degree of uncertainty surrounding the future of international agreements to fight climate change (Karpas and Kerr 2011).

Forestry is particularly sensitive to policy-related emissions price uncertainty. Very little carbon is sequestered by trees in the first few years, so the carbon price that matters can be more than five years ahead (Karpas and Kerr 2011). Domestic policy uncertainty may have become even more important since the NZ ETS has become a domestic-only scheme. As Joanna Silver (former Head of Ecosystem Markets at NZX subsidiary TZ1) pointed out, the government has a “big influence on both supply and demand” through its announcements.

3.1.3 Prices of other commodities

Forestry land-use decisions are not made in isolation; they are also influenced by the prices of other commodities. These prices will affect both the profitability of other competing land uses (or the relative profitability of forestry) and land values. In our interviews, both Peter Gorman and Peter Weir indicated that the improving profitability of other commodities had led to deforestation and/or reduced afforestation. Below, we focus on the profitability of dairy and sheep–beef farming; the prices of these commodities are shown in Appendix 1.

Dairy prices

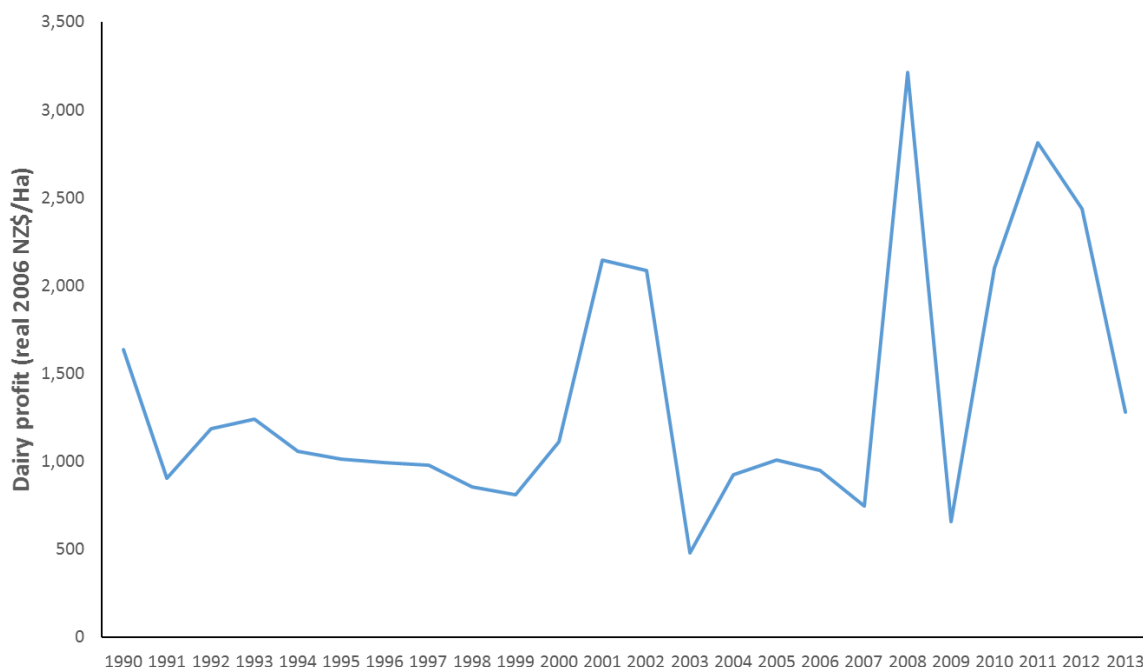
Since 2008, New Zealand’s dairy boom has been frequently in the press (e.g. Smyth 2014). Dairy’s increasing profitability has been seen as a key driver of deforestation (e.g. Greenpeace

³⁸ NPV per hectare is calculated as the discounted sum of profits from one harvest rotation.

³⁹ See table 8 in Thirkettle and Kerr (2015), which can be found at <http://motu.nz/our-work/environment-and-resources/lurnz/predicting-harvestability-of-existing-pinus-radiata-stands-2013-2030-projections-of-stumpage-profits-from-pre-90-and-post-89-forests>.

NZ 2010). Dairy conversion is the main reason cited for deforestation (Manley 2015).⁴⁰ Figure 4 shows the national average dairy profit from 1990 to 2013. Although profitability has been volatile, as a six-year average it doubled between the period 2002 to 2007, and the period 2008 to 2013 (from ~NZ\$1,000 per hectare to ~NZ\$2,000 per hectare).

Figure 4: New Zealand dairy profit 1990–2013⁴¹



Source: Ministry for Primary Industries (2012a)

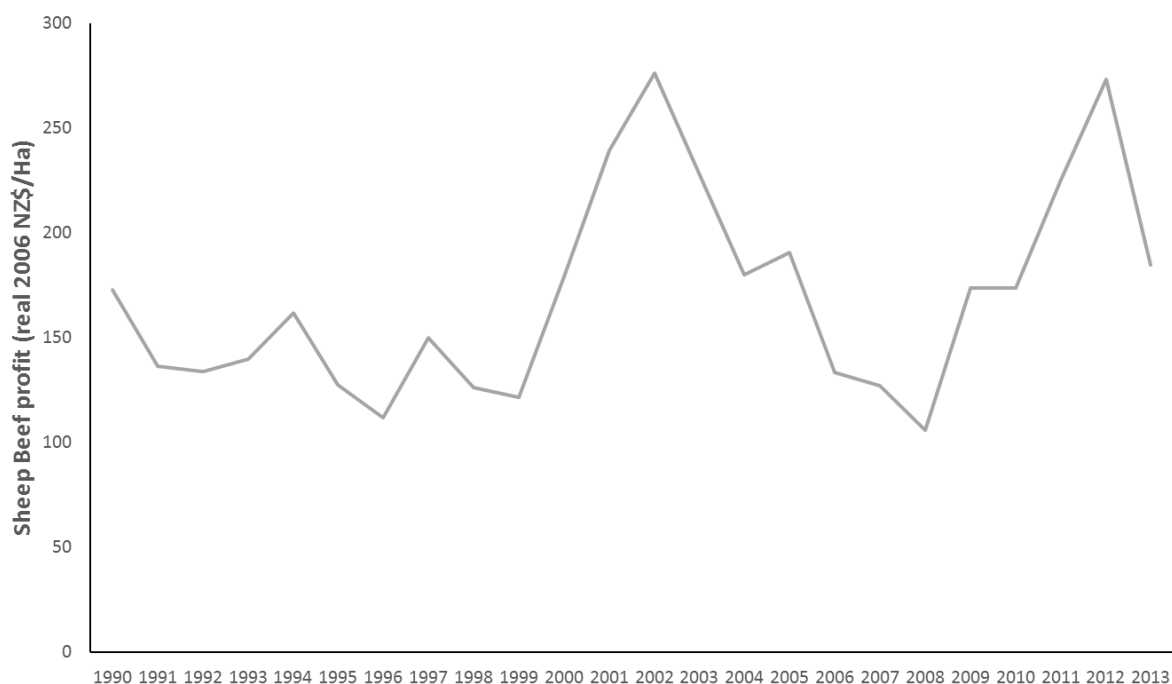
3.1.4 Sheep–beef

Sheep–beef farming accounts for most of New Zealand’s private rural land use, and can be found on a wide range of qualities of land.⁴² Fluctuations in the profitability of sheep–beef is commonly seen as influencing the opportunity cost of afforestation (Kerr et al. 2012). Figure 5 shows the sheep–beef profit (2006 NZ\$ per hectare) from 1990 to 2013. The average profits for the six years prior to the inception of the NZ ETS (2002–07) and the six years following (2008–13) are roughly equal; however, these averages disguise the upward trajectory of sheep–beef profit from 2008 to 2012.

⁴⁰ Manley’s 2014 deforestation survey reported that 91% of land intended to be deforested between 2014 and 2025 will be converted to dairy. In Manley’s 2013 survey, the corresponding number for deforestation between 2008 and 2020 was 86% (Manley 2014).

⁴¹ The full data series is no longer available online. See Allan and Kerr (2015) for more detail on both dairy and sheep/beef profitability.

⁴² In 2008, sheep–beef farming represented 64% of all private rural land in New Zealand

Figure 5: New Zealand sheep–beef profit 1990–2013⁴³

Source: Beef and Lamb New Zealand (2016)

3.2 Deforestation and afforestation responses

In this section, we assess how deforestation and afforestation have responded to the incentives detailed in Section 3.1, and investigate the extent to which the NZ ETS's goals for forestry have been realised.

3.2.1 Pre-2008 deforestation

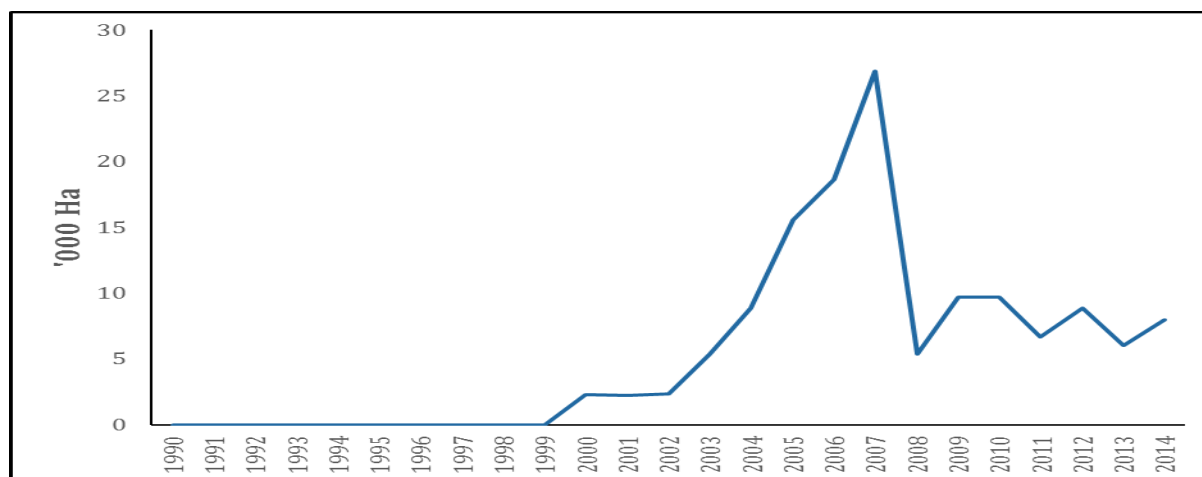
Prior to the introduction of the NZ ETS, the government had signalled that forestry was likely to be regulated. It was apparent that a cost for deforestation of pre-1990 land would be introduced (Karpas and Kerr 2011). Thus, we would expect forest owners who were considering deforesting to have done so in advance of facing these expected liabilities. Figure 6 shows that forest owners behaved as expected, with massive levels of deforestation in the three years prior to the introduction of the NZ ETS.⁴⁴ It is possible that much of this deforestation would have occurred without an ETS; however, if the government had not signalled its intentions so early and clearly, fewer forest owners would have been able to bring forward their deforestation.⁴⁵

⁴³ We used "New Zealand all classes" profit data. See data tables for more information: <http://www.beeflambnz.com/information/on-farm-data-and-industry-production/sheep-beef-farm-survey/nz>.

⁴⁴ The level of deforestation from 2005 to 2007 was more than the total afforestation that has occurred since the inception of the NZ ETS and represents half of the total deforestation that has occurred since 1990.

⁴⁵ Because of the way the Kyoto Protocol rules were defined, New Zealand faced no responsibility for deforestation of pre-1990 forests if this occurred before 2008.

Figure 6: Deforestation (as observed by satellite) 1990–2014



Source: Ministry for the Environment (2016a)

3.2.2 Deforestation since 2008

Figure 6 illustrates that the level of deforestation (in thousands of hectares) in 2009 and 2010 was higher than any other year in the 2008–14 period. Given the relatively high carbon price from 2008 to 2011, we would expect to see higher levels of deforestation in 2012–13 than 2009–10.

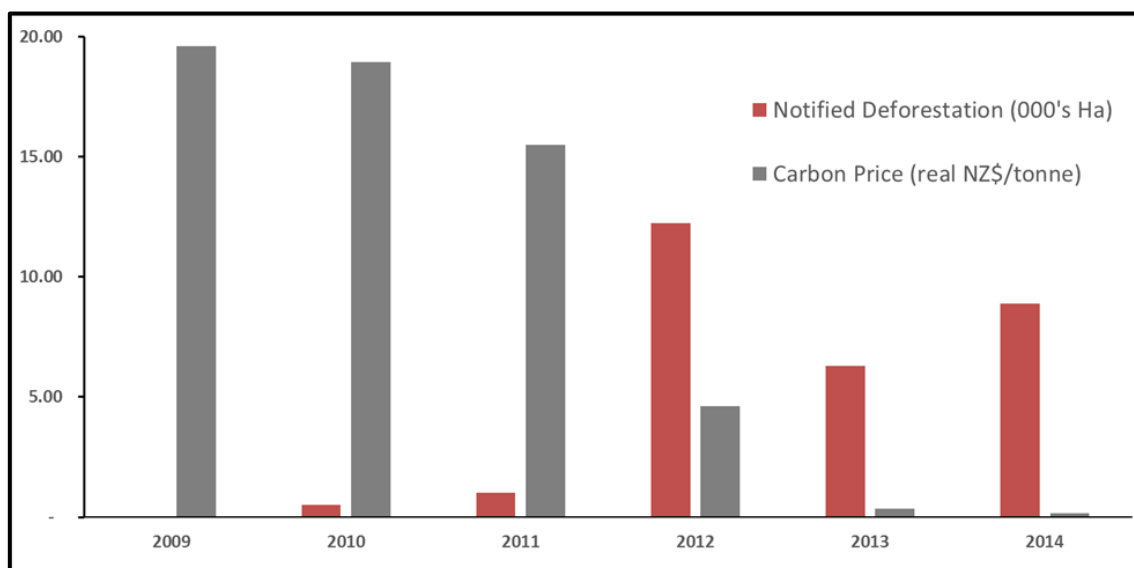
To understand this, we need to differentiate between deforestation reported in the MfE’s New Zealand Greenhouse Gas Inventory (“observed” deforestation) and “notified” deforestation reported by the Environmental Protection Authority (EPA). In the New Zealand Greenhouse Gas Inventory, deforestation is reported in the year of forest clearance, i.e. the year the trees were cut down. Notified deforestation is reported in the year that the land-use change decision was made (about which the landowner must notify MPI within 20 working days of commencing deforestation).⁴⁶ This land-use decision could be up to four years after harvest.

Figure 7 shows annual notified deforestation plotted against the annual average carbon price.⁴⁷ In sharp contrast to Figure 6, this graph depicts the expected relationship between the carbon price (the cost of deforestation) and the level of deforestation. Less than 2,000 hectares of notified deforestation occurred in 2008–11, compared with more than 30,000 hectares of “observed” deforestation in this period. This suggests that the decision to change land use for much of the land cleared in 2008–2011 occurred in 2012–14. Forest owners may have left land idle, cleared very immature trees (either after planting them or allowing them to regenerate), or been late in notifying MPI.

⁴⁶ See “Follow the steps for deforesting pre-1990 forest land”, “Step 2: Notify MPI”, at <https://www.mpi.govt.nz/growing-and-producing/forestry/forestry-in-the-emissions-trading-scheme/deforesting-forest-land>.

⁴⁷ The carbon price in the graph is the average of the daily price for the lowest-cost emission unit eligible to meet deforestation liabilities in the NZ ETS.

Figure 7: Notified deforestation versus carbon price



Sources: Environmental Protection Authority (2015); OMF (2016)

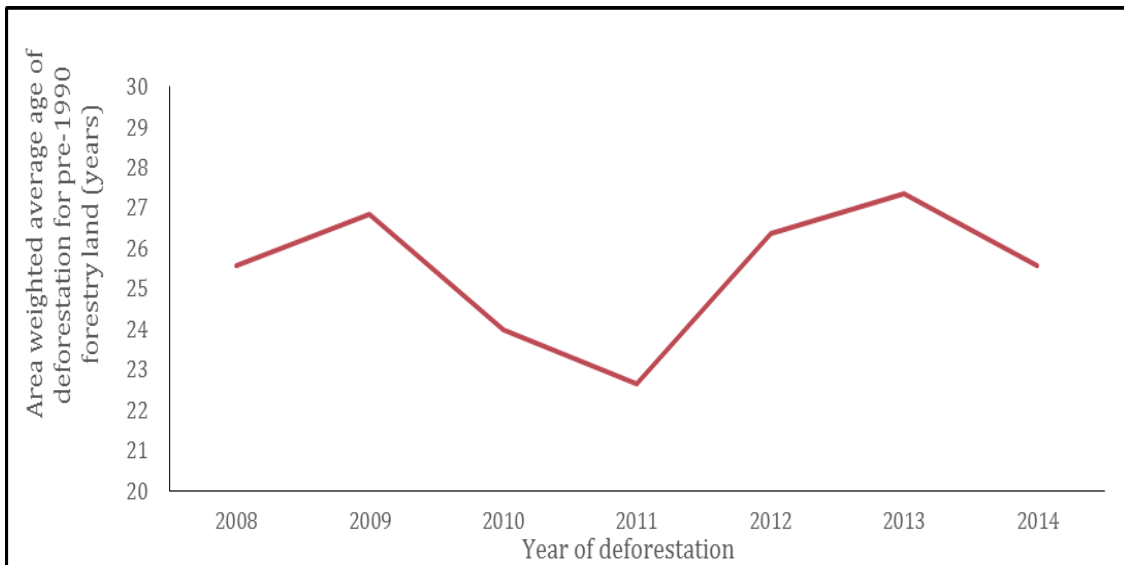
What was deforested?

For those who did not deforest before 2008 but still wanted to change land use, one way to avoid a high liability was to clear young forest with a low carbon stock, and hence low liability. Figure 8 depicts the annual area-weighted average age of deforested forest land between 2008 and 2014. The years on the x-axis refer to the year in which the harvesting that led to deforestation is reported to have occurred, which should correspond to “observed” deforestation above.⁴⁸ The years 2010 and 2011 stand out as having lower deforestation ages. Typically, trees in New Zealand are harvested when they are between 27 and 30 years old;⁴⁹ however, in 2010 and 2011 the weighted average age of deforested pre-1990 forests was 24 and 23 years, respectively.

⁴⁸ Email from Peter Lough, MPI (August 2016).

⁴⁹ The average age of “clear-felling” from the National Exotic Forest Description (NEFD) documents from 2002 to 2015 is 28.1 years. The 2001–07 average (27.8) is very close to the 2008–14 average (28.4). These data cover all harvest, not only deforestation. For the latest NEFD data, see <https://www.mpi.govt.nz/news-and-resources/open-data-and-forecasting/forestry/new-zealands-forests>. Unfortunately, it is not possible to observe harvest by age-class.

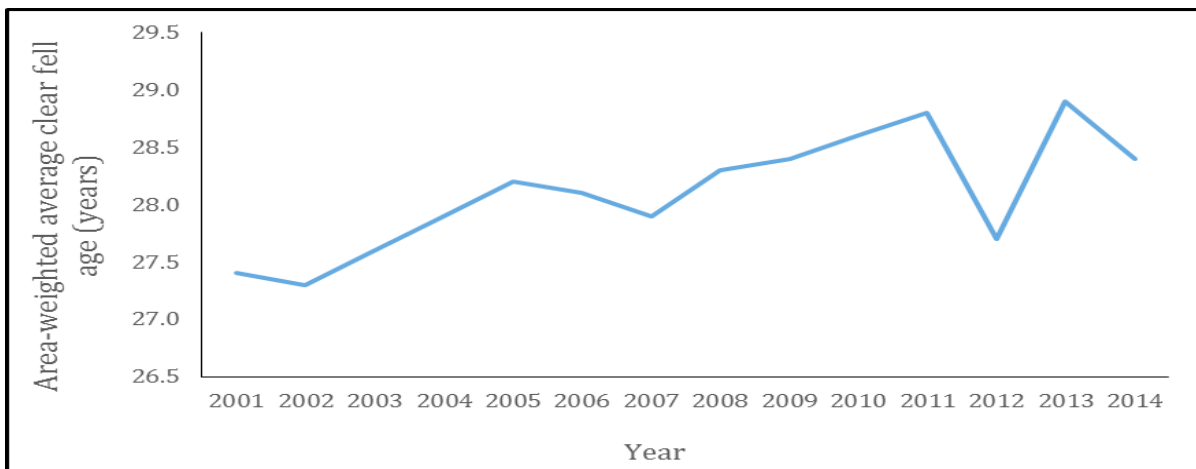
Figure 8: Average age of forest at harvest on land deforested, 2008–14



Source: Ministry for Primary Industries (2016c)

Figure 9, in contrast, shows the area-weighted average “clear-fell” (harvest) age of all pine trees from 2001 to 2014. It is not obviously responsive to carbon price signals.

Figure 9: Harvesting age of pine forest 2001–14



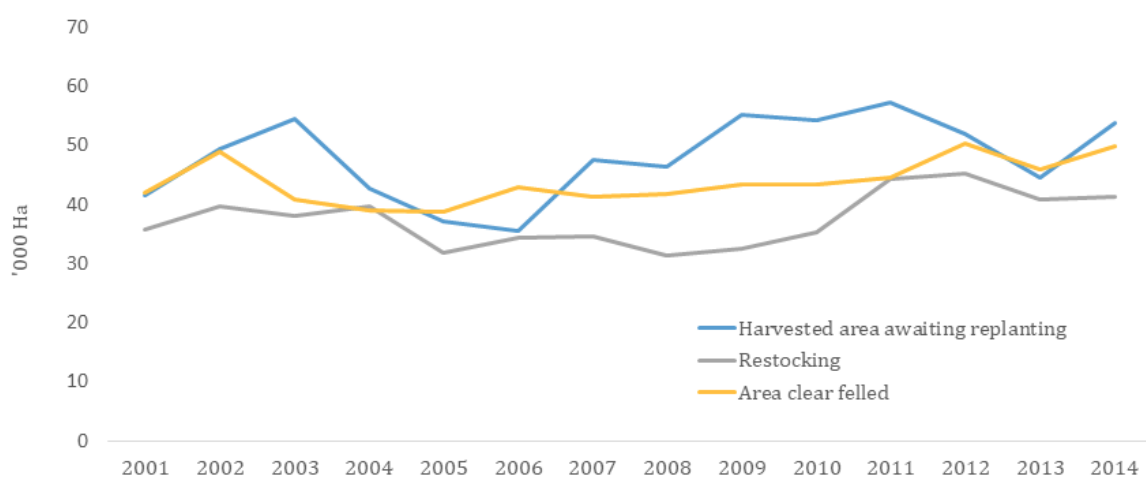
Source: Ministry for Primary Industries 2014a.

Figure 10 shows the level of harvested area awaiting replanting (blue line), along with the level of harvesting (yellow line) and level of restocking/replanting (grey line). The high level of area awaiting replanting relative to the area clear-felled, and the low level of restocking in the early years of the NZ ETS support the theory that land lay idle while pre-1990 forest owners decided how to react to the scheme.⁵⁰ The subsequent drop in the area awaiting replanting in

⁵⁰ The “area awaiting replanting” (blue line) increased by 20,000 hectares (more than 50%) between 2006 and 2011.

2012–13 without a comparable rise in restocking also supports the premise that forest owners made the decision to change land use then.⁵¹

Figure 10: Harvested area awaiting replanting, restocking and clear-fell (2001–14)



Source: Ministry for Primary Industries 2014a.

3.2.3 Deforestation expectations

Bruce Manley has carried out annual surveys of deforestation expectations for MPI since 2005. Between 2008 and 2011, deforestation intentions for 2013–20 remained stable at around 16,000 hectares. In 2012, however, with the fall in the carbon price, deforestation intentions for 2013–20 jumped to 55,000 hectares (Manley 2013). Conversely, after an increase in the carbon price from NZ\$4–5 to NZ\$7 between the 2014 and 2015 surveys, deforestation intentions for 2015–25 fell by 6,000 hectares (Manley 2016b). This demonstrates that planning by forest owners responds to fluctuations in the carbon price in a rational and expected fashion.

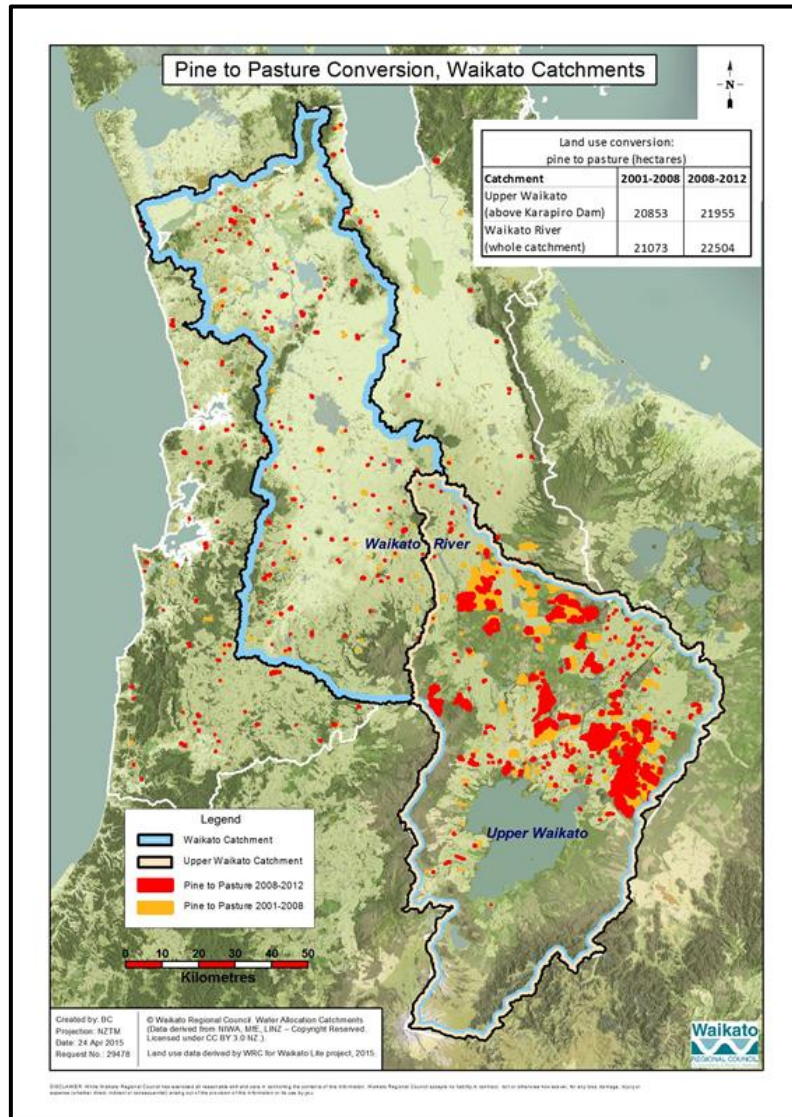
Deforestation example: upper Waikato

Figure 11 illustrates where deforestation occurred in the upper Waikato River catchment between 2001 and 2012. As with the national picture, it shows that there were significant levels of deforestation both before and after the introduction of the NZ ETS. Unfortunately, it does not separate the NZ ETS periods with high and low carbon prices. A Waikato Regional Council report postulates that the 2009 NZ ETS amendments (introduction of a price cap, delaying agricultural emissions, and halving the price impact on non-forestry sectors)⁵² encouraged the clearing of forest land for conversion to pastoral farming (Waikato Regional Council 2016b).

⁵¹ The “area awaiting replanting” dropped by more than 10,000 hectares from 2011 to 2013, despite the fact that harvesting outpaced restocking by 10,000 hectares in these two years (which, in the absence of deforestation, would lead to a 10,000-hectare increase in the amount of land awaiting restocking).

⁵² See Karpas and Kerr (2011) for more detail.

Figure 11: Conversion from pine to pasture, Waikato catchments 2001-12



Source: Waikato Regional Council 2016b

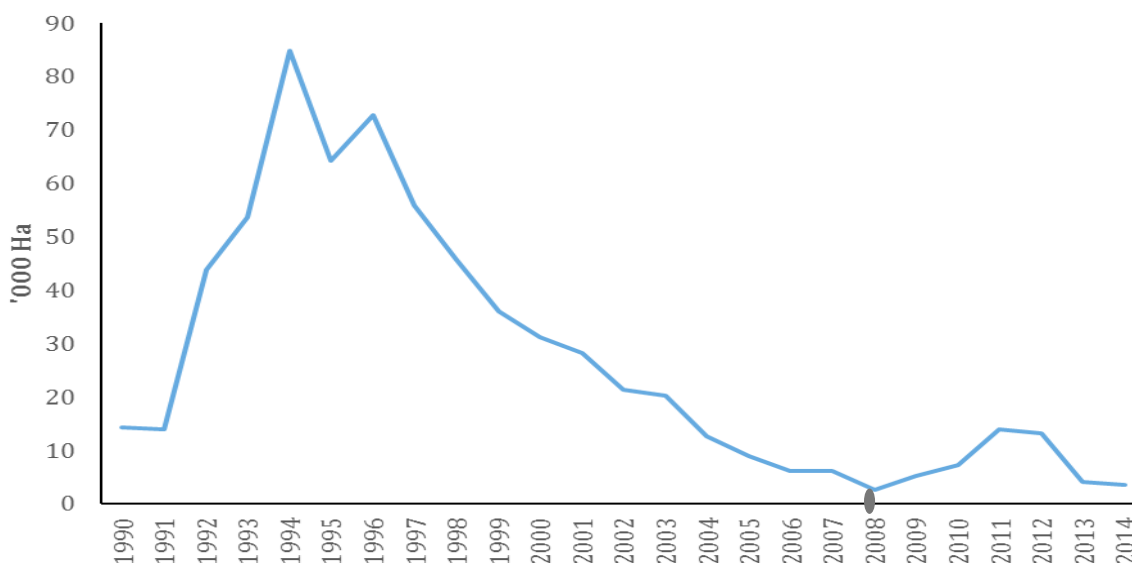
3.2.4 Afforestation

With respect to the NZ ETS, post-1989 afforestation is defined as the “The direct human-induced conversion of land that was not forest land on 1 January 1990 to forested land through planting, seeding and/or the human-induced promotion of natural seed sources after that date”.⁵³

⁵³ See <http://maxa.maf.govt.nz/climatechange/consultation/engagement/page-10.htm>.

Figure 12 depicts annual afforestation (in thousands of hectares) from 1990 to 2014. The low level of afforestation since 2004 is consistent with the low timber price in the same period. There is a slight uptick in afforestation in 2009–12, which may be associated with the relatively high carbon price through mid-2011 (Figure 2) and the higher effective timber price from 2009 to 2011 (Figure 3). Lower afforestation in 2013, following the collapse in the carbon price, is further supporting evidence of the impact of the carbon price on afforestation.

Figure 12: New forest planting (afforestation) 1990–2014



Source: Ministry for the Environment (2016a)

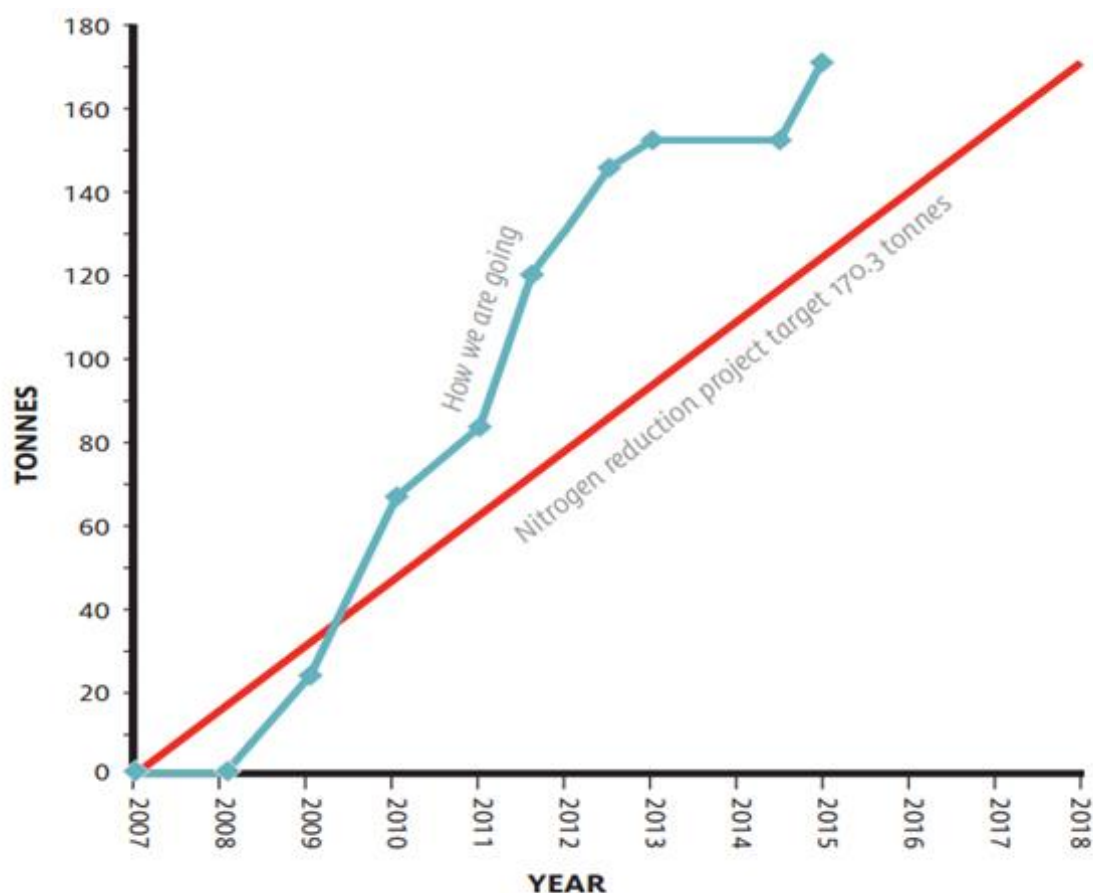
Unfortunately, this is far too limited a sample to establish a significant statistical relationship. However, our interviews with forestry industry participants do suggest that the carbon price influenced afforestation levels. David Rhodes felt that the carbon price was a critical factor in afforestation decisions on marginal forestry investments, while Peter Weir expressed the view that “planting did respond in about 2011 and 2012 to a price of NZ\$20 a tonne”.

Afforestation example: upper Waikato

The Waikato Regional Council’s 2016 *Let’s Talk Water* report (Waikato Regional Council 2016a) contains an example of how the NZ ETS encouraged afforestation and thereby helped achieve water-quality goals.⁵⁴ The regional council imposed a nitrogen cap and launched a nitrogen buy-back scheme to reduce the level of nitrogen run-off into Lake Taupo from its catchment areas (Kerr and Greenhalgh 2015). The NZ ETS “came into force during the early stages of the project” and was “instrumental in achieving the target three years in advance of project expectations”. The financial incentives from the NZ ETS supported the local nitrogen scheme by improving the relative profitability of forestry (Waikato Regional Council 2016b). It may have been difficult to achieve the target with the resources available had the NZ ETS not been in place. Figure 13 illustrates how the scheme over-performed in the early years of the NZ ETS.

⁵⁴ See also www.letstalkwater.nz for more detail.

Figure 13: Contracted nitrogen reductions for Lake Taupo 2007–18



Source: Waikato Regional Council (2016b)

3.3 Modelled forecasts

3.3.1 Modelling prior to the introduction of the NZ ETS

Prior to the introduction of the NZ ETS, predictions of the level of afforestation ranged from 20,000 hectares to 50,000 hectares per annum for 2008–20 (Karpas and Kerr 2011). Studies assumed a guaranteed carbon price of at least NZ\$25 between 2008 and 2020. With the benefit of hindsight, these assumptions now appear overly optimistic.⁵⁵

Some reasons for the divergence between forecasts and actual levels of afforestation under the ETS are that:

- The actual carbon price since 2008 was lower than that assumed by the predictions (most projections assumed a constant and guaranteed carbon price of at least NZ\$25);
- Most predictions assumed foresters would have access to mature futures markets, reducing the risk of selling too many credits;

⁵⁵ Forecasts made before the introduction of the NZ ETS all assumed fixed paths of carbon prices. Price uncertainty was considered only through discounting of future carbon returns.

- The returns to alternative land uses were higher than assumed;⁵⁶ and
- The models used to forecast the afforestation could not account for non-price-related nuances (e.g. policy uncertainty).

3.3.2 Modelling post the introduction of the NZ ETS

Kerr et al. (2012) projected an increase in forestry area of 370,000 hectares from 2008 to 2030 with a constant carbon price of NZ\$20, equating to 17,000 hectares on average per year.⁵⁷ This is very similar to the 18,200 hectares per year on average with a constant carbon price of NZ\$20 that Manley (2016a) predicted.⁵⁸ Adams and Turner (2012) predicted slightly lower levels of afforestation of 10,000–15,000 hectares per year for the 2008–20 period with a NZ\$20 carbon price.⁵⁹ In June 2016, MPI provided us with their forecasts in a response to an OIA request we made to them. This contains multiple scenarios, and predicts that with a carbon price between NZ\$12.5 and NZ\$25, there will be a “gradual increase to 15,000 hectares of new forest planting per year” (Ministry for Primary Industries 2016b).⁶⁰ These forecasts all point to levels of afforestation equal or greater than those seen in 2011–12, but much lower than in the 1990s.

3.4 Participation in the NZ ETS

Currently, only 45% of eligible forested land that has been planted since 31 December 1989 is registered in the NZ ETS (Ministry for Primary Industries 2016b). This is despite the potentially large NPV of the “safe” carbon credits a land owner who plants a new forest can earn by joining the scheme (see Section 3.1.2) and the scheme’s relatively low compliance costs.

One reason for the low level of participation is that forest owners earn credits only for net carbon sequestered by their trees from 1 January 2008. The “safe” level of carbon credits (the amount a forest owner can sell without having to pay back to meet harvesting liabilities, unless the land is deforested) corresponds to around ten years of growth. This dramatically reduces the incentive for owners of forests planted before 1999 to join the scheme. Less than 40% of all post-1989 planting has occurred since 1999 (Ministry for the Environment 2016a).

The above paragraph is an oversimplification. As we discuss below, some foresters who planted before 1999 could make a non-speculative gain. Moreover, there are other reasons a

⁵⁶ Most forecasts also assumed that agriculture would be included in the NZ ETS, which would have imposed an extra cost on these land uses, although at least in the Motu modelling (Kerr et al. (2012)) this had little effect.

⁵⁷ Compared to pre-2008 modelling, this assumes that foresters do not have access to futures markets for emissions units, and that the typical new forest is planted by a “small” forester, so they can sell only the “safe” credits generated during the first ten years. Carbon price uncertainty over the first ten years is still addressed only through the use of an 8% discount rate, which includes a risk premium.

⁵⁸ Manley (2016a) included uncertainty by scaling down the NPV from carbon by a factor “k”. He calculated this by interpreting 2011’s afforestation rate together with his own expectations. He then scaled this down by 25% to 0.375.

⁵⁹ Adams and Turner (2012) captured uncertainty through “different future viewpoints of agents” in their model. They assumed “that 40% of land owners have expectations of future returns that reflect the future carbon price to decline or fall to zero within five years”.

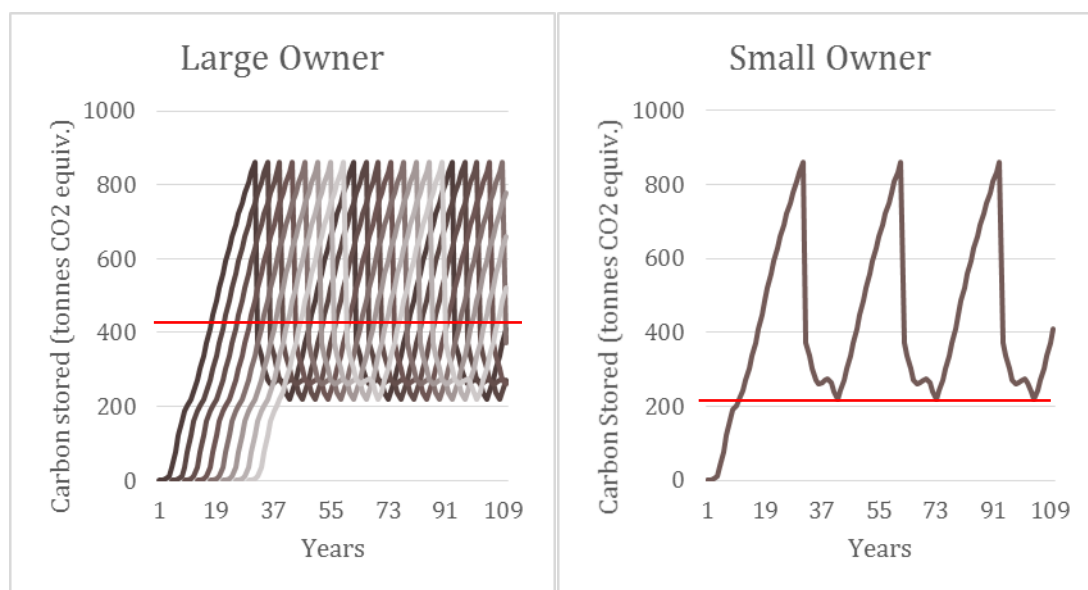
⁶⁰ We have made MPI’s response to our OIA public; to see it in full, go to <http://motu.nz/our-work/environment-and-resources/emission-mitigation/emissions-trading/emissions-trading-scheme-forecasting-data>.

forest may have been registered, e.g. the owner never planned to harvest, hoped to make a speculative gain with carbon credits, or mistakenly believed they could earn safe credits.

3.4.1 Who would we expect to register?

A “small” forest plantation owner (e.g. the average farm forester) harvests all at one time because of economies of scale in harvesting. On the other hand, we assume that “large” forest owners (e.g. forestry companies) have an even distribution of planting ages.⁶¹ The differences in carbon credits earned by each of these examples (on a “typical” hectare) is displayed in Figure 14.

Figure 14: Growth cycles for small and large forest owners⁶²



Source: (Ministry for Primary Industries 2015b)

Small forest owners may safely sell credits earned by their forest for the first ten years; all those beyond that point are “risky”, and will be liable for surrender upon harvest.⁶³ Large forest owners, however, have the advantage of a distribution of forest ages, which ensures that they will have *some* forest older than ten years of age at all times. As they harvest and incur liabilities, they can meet part of these through credits earned by their other forests. This more than doubles the number of safe credits relative to a small forest, and allows credits to be earned by trees that were planted more than ten years prior to 2008.⁶⁴ The red line in each graph indicates the long-term level of “safe” credits earned by the owner.⁶⁵ Access to adequate financial

⁶¹ This is an oversimplification – as Figure 13 shows, it would be very hard for post-1989 forests to have even age distributions when more than 70% of all post-1989 afforestation occurred before 2000. In reality, even large forest owners in New Zealand will likely only have a limited ability to smooth their carbon stock.

⁶² This example is for the Gisborne region, with a 30-year harvest age.

⁶³ A small forest owner may be better to wait until after the first harvest, and some decay of residual carbon, before registering. They can then sell safe credits.

⁶⁴ The numbers depend on the region and rotation age. The number of safe credits increases with harvesting age.

⁶⁵ Forest owners who cannot make a “safe” financial gain can still attempt to make a speculative profit from their NZUs (e.g. by selling them as they earn them and then buying them back when they need to harvest). Likewise, forest

instruments could also enable any forest owner to smooth their harvesting liabilities like a large owner.⁶⁶

The ability to smooth harvest liabilities gives large owners an incentive to register land planted in the 1990s. More generally, it gives them a stronger financial incentive to join the NZ ETS. Further, given their larger scale they should find it easier to comply with the scheme and the compliance costs are spread over more credits. Thus, we expect larger forests to be overrepresented. Table 1 shows the level of safe credits that “small” and “large” forests in the Central North Island can receive, by year of planting.

Table 1: Long-term safe credits per hectare of forest, by year of planting⁶⁷

Planting date:	Small owners:	Large owners:
1990	0	10
1993	0	118
1996	0	213
1999	33	271
2002	113	351
2005	160	398
2008	163	401

30-year rotation age for forest in the central North Island. All figures are per-hectare estimates.

Source: calculations based on data from Ministry for Primary Industries (2015b)

Forest owners have even stronger incentives to register older forests than those indicated by the number of “safe” credits. Plantation forests take five to ten years to ramp up their carbon sequestration. Forest land planted in the 1990s or early 2000s would therefore earn more credits in the first decade of the NZ ETS than forest land planted after 2008. The impact of discounting increases the relative incentive to register older forest land.

owners who can make a “safe” financial gain could seek to make a speculative gain off their “risky” NZ ETS credits (they could also speculate with their “safe” credits). Given the actual price movements, some foresters in the ETS are likely to have made large gains this way. They could however have lost.

⁶⁶ There are currently no readily available financial instruments that allow forest owners to smooth harvesting liabilities.

⁶⁷ Our calculations for large owners are for a uniformly distributed forest with one hectare of forest planted for each year of the harvesting cycle. We calculate the impact on the long-run “safe” level of credits of replacing a hectare of forest planted after 2008 with a hectare of forest that is one rotation younger (e.g. in this example, replacing a 2018 hectare with a 1990 hectare). The result is the same regardless of the start date of the forest.

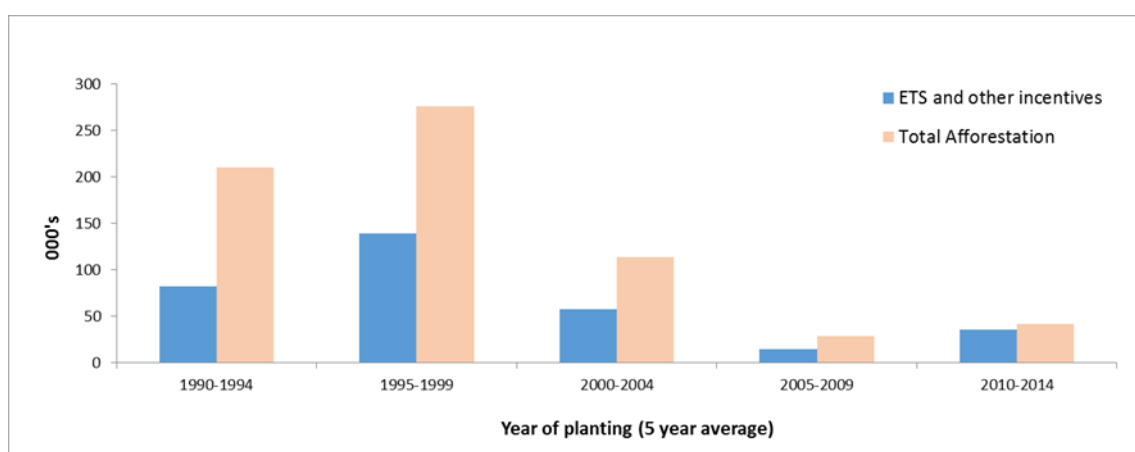
3.4.2 Who has actually registered?

From this above analysis, we would predict two general patterns in NZ ETS registration:

1. Higher rates of participation for forest land planted after the introduction of the scheme (and for land planted very soon before its introduction); and
2. Higher rates of participation for large forest owners (especially for forest land established in the 1990s or early 2000s).

Figure 15 shows the amount of post-1989 forest that has been registered in the NZ ETS or has received other incentives, relative to total afforestation, based on the date it was planted.⁶⁸ We include forest land registered under the Permanent Forest Sinks Initiative (PFSI) and the Afforestation Grant Scheme (AGS), in “ETS and other incentives” because these are close substitutes.⁶⁹ Nearly 90% of all forestry land planted since 2008 is registered under either the NZ ETS, or PFSI or received a grant under the AGS.⁷⁰ However, most post-1989 afforestation occurred before 2008, which is reflected in the NZ ETS. For example, forest land established between 1990 and 2004 accounts for 84% of land in these schemes.⁷¹

Figure 15: NZ ETS-registered forest versus total afforestation, hectares 1990–2014⁷²



Source: (Ministry for Primary Industries 2016c); (Ministry for the Environment 2016a); (Ministry for Primary Industries 2016b); (Ministry for Primary Industries 2012b)

⁶⁸ We've taken five-year averages for these comparisons as the data set that provides the denominator (table 11.3.1 in the New Zealand Greenhouse Gas Inventory 1990–2014) is not consistent with the data set that provides the numerator (the OIA request from MPI). In some years, the total area of NZ ETS-registered forest in the MPI data exceeds the total amount of afforestation in the New Zealand Greenhouse Gas Inventory.

⁶⁹ The PFSI “promotes the establishment of permanent forests on private land”. It enables landowners to earn carbon units for permanent forests planted after 1990 that were directly human-induced. For more details, see <https://mpi.govt.nz/funding-and-programmes/forestry/permanent-forest-sink-initiative>. The AGS promotes new planting by giving a NZ\$1,300 per hectare grant to smaller (5–300-hectare) forests. The landowner receives the grant upon establishing the forest, and in exchange the Crown gets the carbon credits for the first ten years. For more details, see <https://www.mpi.govt.nz/funding-and-programmes/forestry/afforestation-grant-scheme>.

⁷⁰ Less than 20% of afforestation in 2013–14 has been registered under the NZ ETS. This is potentially because forest owners have until the end of the next MERP (2017) to register and receive credits for their forests in this period.

⁷¹ This period accounts for 89% of all post-1989 afforestation. None of this forest will be registered under the AGS given that this scheme is only for establishment of new forests.

⁷² The “ETS and other incentives” figures include all NZ ETS-registered forest, not just those planted with *Pinus radiata* (e.g. indigenous, Douglas-fir). The total afforestation figures are from table 11.3.1 of the 2016 New Zealand Greenhouse Gas Inventory report and also include figures from all types of forestry.

As expected, there is a significant increase in NZ ETS participation (86%) in the 2010–14 period compared with the earlier periods (Figure 16). Participation rates for the five-year periods between 1995 and 2009 are relatively flat (roughly 50%), which is somewhat surprising.

Figure 16: Participation Rates in ETS (1990-2014)

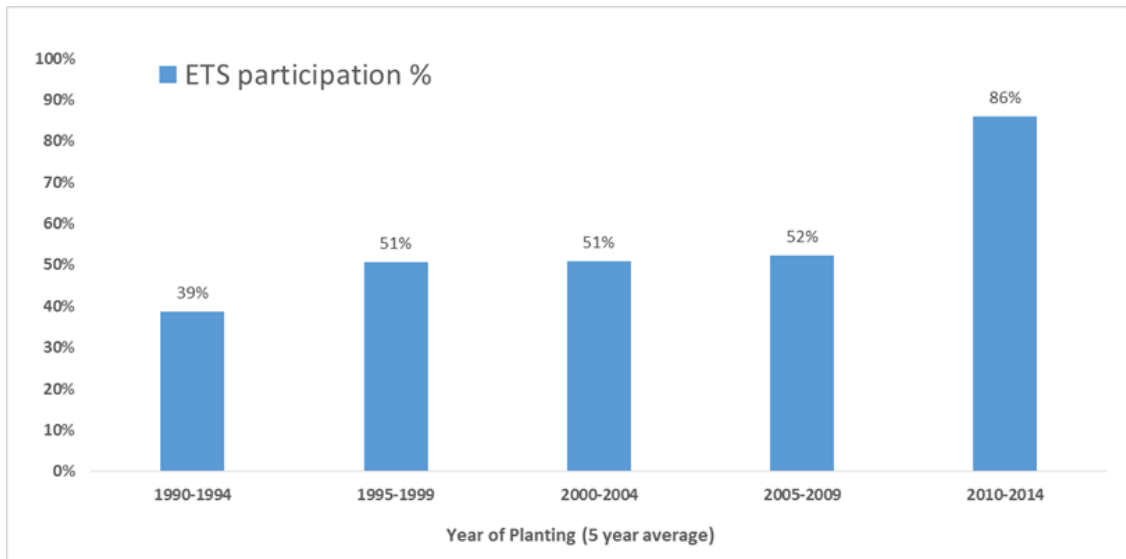


Table 2: Size breakdown of NZ ETS participants (2015)

Size class of forest	Number of participants ⁷³	Percentage of participants	Total area registered ('000 ha)	Percentage of land registered
1–49 ha	1,439	65%	26	9%
50–99 ha	353	16%	22	7%
100–499 ha	343	16%	66	22%
500–999 ha	24	1%	14	4%
1,000+ ha	45	2%	177	58%
<i>Total</i>	<i>2,206</i>	<i>100%</i>	<i>304</i>	<i>100%</i>

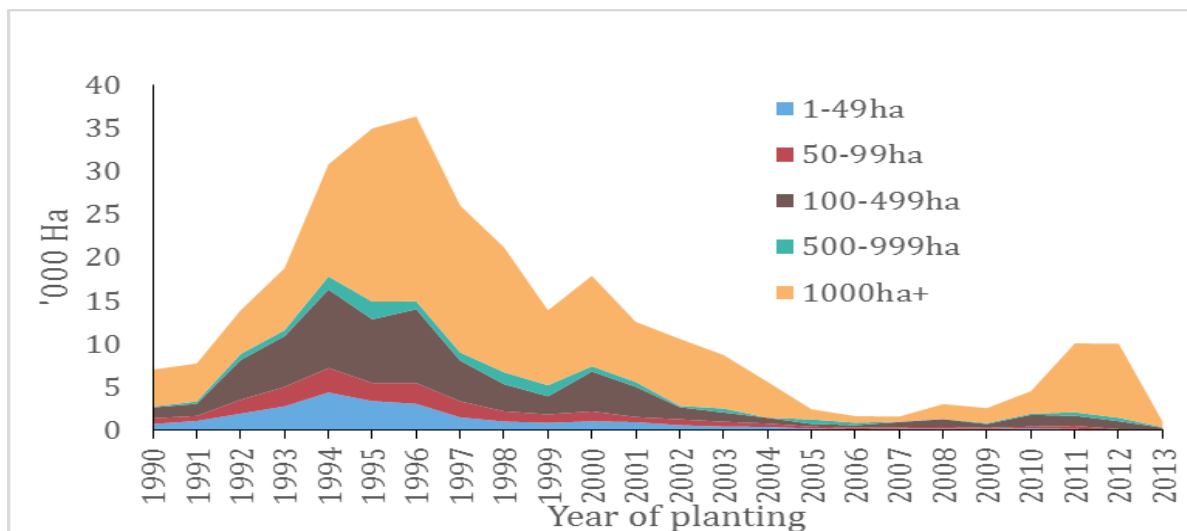
Source: Ministry for Primary Industries (2016b)

Table 2 shows that most NZ ETS participants own small forests but that most forest land in the NZ ETS is owned by large forest owners. Unfortunately, we don't have data on the size of post-1989 forests that are not registered in the NZ ETS, so cannot tell if one group is disproportionately represented.

⁷³ It is possible that these are not all unique. The same ultimate owner may have registered multiple times.

Figure 17 shows the size breakdown of NZ ETS-registered forests, by their year of planting. Interpretation is similarly limited by lack of data on the sizes of post-1989 non-NZ ETS-registered forests. The portion of small forestry plots in the NZ ETS is higher for forest land established in the 1990s compared with that established later. Forests of less than 100 hectares make up nearly 20% of all registered NZ ETS forestry land planted in the 1990s (peaking at 26–27% in 1992–93). Since 2008, these same forests make up ~5% (just 1% since 2012) of registered NZ ETS forestry land. This may simply reflect the fact that fewer small forests have been established since the 1990s. It may also in part be explained by smaller forest owners opting to join the AGS initially instead (which targets small to medium forests).⁷⁴ It's also possible that some small forestry owners who registered land planted in the early/mid-1990s misunderstood the NZ ETS incentives. This may have been due to poor advice from some forestry consultants. It would be hard for any of these NZ ETS-registered forests to have received any safe credits unless their owners intend never to harvest.⁷⁵ NZUs are not currently treated as a financial asset, and as such don't receive many of the protections for investors offered by the Financial Markets Authority.

Figure 17: Registered NZ ETS land by forest size 1990–2013⁷⁶



Source: Ministry for Primary Industries (2016c)

Figure 17 suggests that large forest owners are responsive to the financial incentives on offer from the NZ ETS. In 2011 and 2012, two years during which the NZ ETS is considered to have had a significant “additional” impact on new planting, forests greater than 1,000 hectares made up more than 80% of NZ ETS-registered land, compared with their pre-2008 average of

⁷⁴ The maximum size for the AGS is 300 hectares.

⁷⁵ Some small forestry owners may have made a speculative profit by selling their NZUs when the price was high and then buying them back at a lower price to meet their harvesting liabilities. Other small forestry owners may be intending never to harvest their forests and would thus not be worried about the “safe” level of credits.

⁷⁶ These figures include all NZ ETS-registered forest, not just those planted with *Pinus radiata* (e.g. indigenous, Douglas-fir).

56%. The AGS was available to smaller forests (less than 300 hectares) during this period, and around 3,000 hectares were registered each year from 2009 to 2011 (Ministry for Primary Industries 2011).

3.5 Econometric analysis

Kerr and Olssen (2012) found evidence that dynamics matter for land-use choices, and that a relationship exists between commodity prices and land-use decisions. We extended the authors' original time series data a further ten years to include the period from 2005 forward, during which the NZ ETS could potentially have affected forestry, and attempted to identify the impact of the NZ ETS on land-use decisions in a variety of specifications.⁷⁷ We were unable to separate the impact of the NZ ETS from other significant changes over time, which is unsurprising, given the short time series and small, short carbon price signal. However, "The absence of evidence is not evidence of absence."

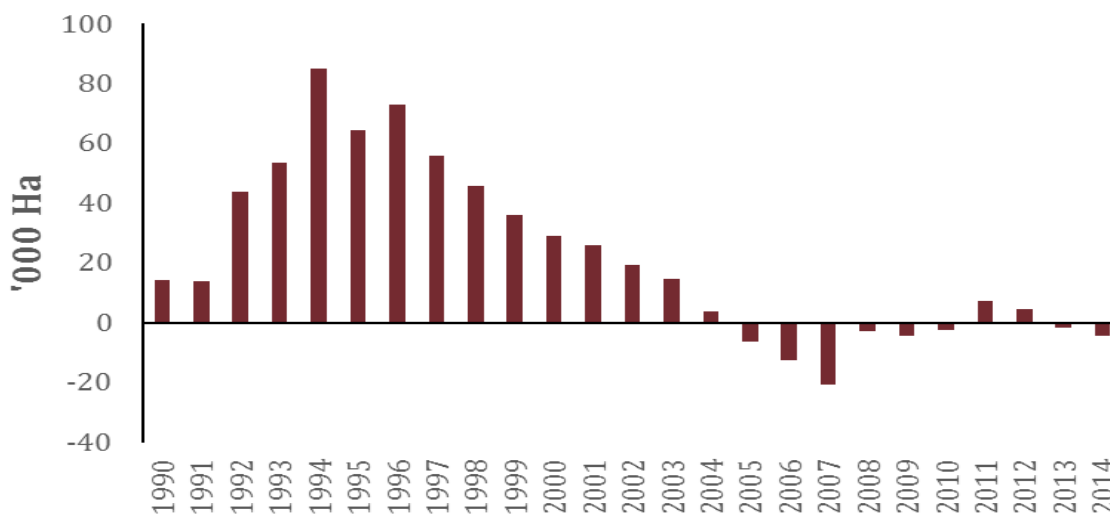
3.6 Overall impact

Figure 18 shows the annual net afforestation level from 1990 to 2014.⁷⁸ From this graph it is hard to conclude that the NZ ETS has had a positive impact on New Zealand's forestry sector although other contributing factors are not controlled for. This is consistent with the findings of the NZ ETS evaluation by MfE, which states: "The NZ ETS appears to have contributed, but only minimally, to changes in behaviour and decisions that have reduced net emissions below business-as-usual levels" (Ministry for the Environment 2016b). Bruce Manley's work similarly finds that the NZ ETS has had minimal impact (Manley 2016a).

⁷⁷ Our specifications to assess the impact of the carbon price included (but were not limited to): 1) including the log of the carbon price in the same manner as the other commodity prices (the change in carbon price in the short-run part of the model, and the lag of the price in the error-correction component of the model); 2) adding the carbon price to the timber price to create an "effective timber price" (see Section 3.1.2) and running the same model specification as Kerr and Olssen (2012); 3) following (2), with the addition of a dummy variable that =1 for years since the NZ ETS has been introduced; 4) following (1), with the NZ ETS dummy variable in the error-correction component of the model and the first difference of the NZ ETS dummy variable in the short-run component of the model and interacting the price terms with the NZ ETS dummy variable.

⁷⁸ Net afforestation = afforestation – deforestation.

Figure 18: Net afforestation 1990–2014



Source: Ministry for the Environment (2016a)

4 Key issues for forestry in the NZ ETS going forward

This section covers some key issues facing forestry in the NZ ETS. This is not intended as an exhaustive taxonomy of the issues, nor should it be read as a prescription for policy intervention. Our goal is to provide a brief outline of the relevant considerations as policy discussions around these issues evolves. We first cover the issues being addressed in the current NZ ETS review, before expanding our scope.

4.1 NZ ETS review

At the time of writing, the NZ ETS is being reviewed. The purpose of the review is “to assess the operation and effectiveness of the NZ ETS to 2020 and beyond” (Ministry for the Environment 2015a). An accompanying forestry technical note examines how different accounting settings could “change the scheme’s incentives for afforestation”. It reviews the potential impact of “averaging accounting” (averaging) and recognising carbon stored in harvested wood products (HWP) (Ministry for the Environment 2016c).⁷⁹

4.1.1 Averaging

Averaging would allow forest owners to earn NZUs only “as their forest grows to the long-term average carbon storage for that forest” and not face liabilities on harvest unless the land is deforested (Ministry for the Environment 2016c).⁸⁰ This would allow all forest owners to gain the benefits we associated earlier with “large” forest owners (see Section 3.4.1). Averaging was

⁷⁹ For more context, see Ministry for the Environment (2016c) or the full review report at <http://www.mfe.govt.nz/publications/climate-change/new-zealand-emissions-trading-scheme-review-2015-16-discussion-document>.

⁸⁰ This average would account for future harvest and replanting cycles.

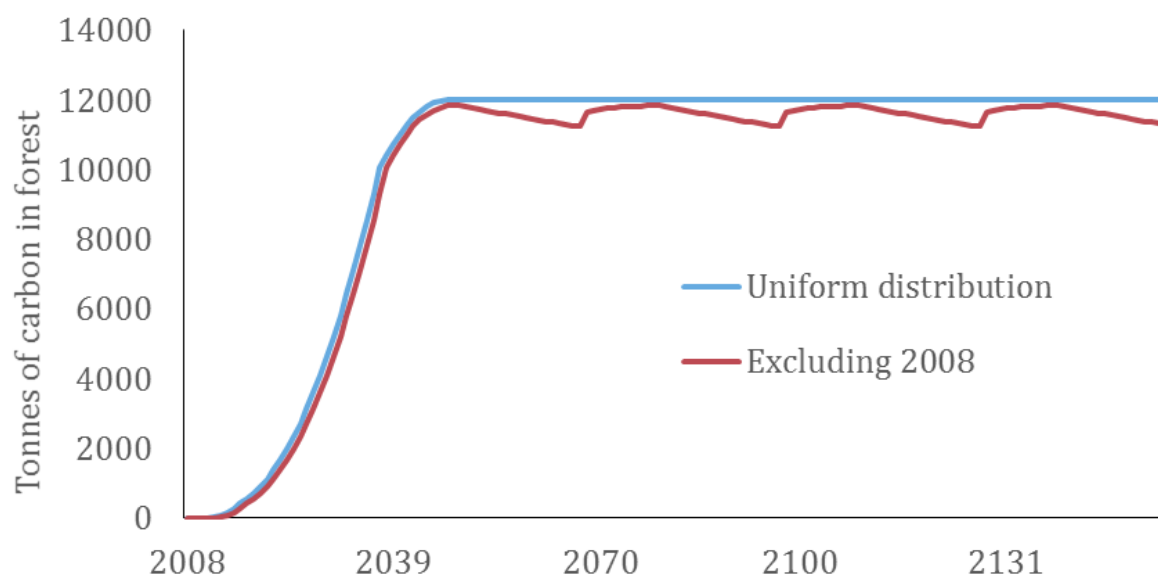
recommended by the 2011 NZ ETS review panel. It shares similarities with the “accounting methodology New Zealand proposes to apply to its 2021–30 emissions reduction target under the Paris agreement” (New Zealand Government 2015a).

Potential impacts

Averaging could provide a stronger and “more certain incentive for some foresters to participate in the NZ ETS” (Ministry for the Environment 2016c). It also reduces the complexity of accounting and compliance.

Figure 19 illustrates the value of this increase in “safe” credits to the average level of carbon storage even for a large forest that has diverse ages. The blue line represents the carbon stored by a uniformly distributed forest – with one hectare of forest for each year in the rotation cycle. The red line demonstrates the impact of losing just one year from this uniform distribution. By removing just one year, the “safe” level of credits per hectare drops by 3–4%.

Figure 19: Long-run carbon stock in 30 hectare uniformly distributed age forest



Assuming a 30-year rotation age forest in the central North Island.

Source: Ministry for Primary Industries (2015b)

Despite these benefits, averaging is a blunt instrument. Mandatory averaging could reduce or remove financial incentives for behaviour the NZ ETS is seeking to encourage. For example, averaging removes the incentive to increase rotation length, and could affect incentives to increase carbon density or to create permanent forest sinks. Even optional averaging requires fixed assumptions about future rotations (e.g. harvesting age, pruning regime, planting density). To prevent perverse incentives, averaging would therefore need to be accompanied by rules on

the forest management decisions of those who choose this option.⁸¹ This will increase the compliance burden for both the government and averaging foresters.

Considerations

Before incorporating this methodology into the NZ ETS, some issues should be considered.

Mandatory or voluntary?

Voluntary averaging would prevent the worst of its unintended consequences. Forest owners who wanted to plant permanent sinks, self-average or manage variability using financial instruments, and engage in behaviours to increase carbon sequestration would still have an incentive to do so. Forest owners who didn't want to average for other reasons would also not be forced to do so. However, voluntary averaging could reduce uptake of the NZ ETS, even among those who would benefit from it, because of increased complexity: it would be another form to fill out and another decision to understand. An opt-out model (where averaging is the default) might provide the best of both worlds.

Market or government?

Private actors should be able to offer averaging. In theory, a market instrument could allow forest owners to safely sell NZUs up to the average carbon stock while also being flexible enough to incentivise forest management techniques that increase the carbon stock (Coleman 2011). The government may need to facilitate this market. A legal framework to deal with counterparty risk may be a consideration. Bringing carbon credits under relevant financial security regulation may increase investor confidence.

Participation rates may be lower with financial instruments rather than an equivalent government programme. Incomplete information, the cost of participation or a lack of forest owner sophistication may reduce uptake. Investors may be less willing than government to transact with small forest owners (given their lower level of collateral and lower per customer value).⁸²

Averaging should increase the benefit to forest owners – as such, if the government provides an averaging mechanism, there is little reason to subsidise it. The government could attempt to replicate what would be offered by a perfect set of financial products provided by the private sector to reduce fiscal costs and risk. The government should attempt to recoup any associated fiscal costs (e.g. administration, monitoring, counterparty risks).⁸³

Should there be a size limit on eligible forests?

⁸¹ For example, if carbon payments are based on an assumed harvesting age of 30 years and a forester harvests at 28 years, then they will receive more credits than the long-term average carbon stock of their forest.

⁸² Though if private actors are unwilling to do this, there would need to be a clear justification for government taking on equivalent risks.

⁸³ The government already takes on the counterparty risk of giving a forest owner 27–30 years' worth of carbon credits, which could be defaulted on.

The 2011 NZ ETS review recommended that the government consider whether “a ceiling on the maximum size of a forest” was required (Emissions Trading Scheme Review Panel 2011). The main concern was that larger forests present a bigger potential fiscal risk. However, as larger forests are owned by larger companies, it’s not clear that the counterparty risk is higher. Even large forest companies are unlikely to have uniform harvesting distributions. Thus, averaging may still incentivise them to engage in afforestation in response to the NZ ETS.

Should there be an age limit on eligible forests?

If land that is already planted receives higher value from averaging than it would have under the NZ ETS, this will have no effect on afforestation, and because averaging offers no incentive to increase rotation ages or change forest density, there will be no benefits to New Zealand. Thus, only “new” forests should be able to gain benefit from averaging at a cost to government. Averaging could be offered to existing post-1989 forests (either inside or outside the NZ ETS), but on strictly commercial terms.

Unit supply

Averaging (whether offered by the government or the private market) could lead to a significant one-off increase in the supply of NZUs not tied to a liability if it is available to existing post-1989 forests. This would have an impact on the timing of NZU supply to the NZ ETS market. It could also affect the liabilities managed by the New Zealand government.

4.1.2 Harvested Wood Products (HWPs)

Currently, “emissions from wood products are accounted for as soon as a forest is harvested”. Accounting for the carbon stored in HWPs “defer[s] the emissions liability for harvested trees over the lifetime of the wood products”. Devolving this deferred liability to post-1989 forest owners (through the NZ ETS) could “increase the economic returns of” forestry participants (Ministry for the Environment 2016c). It could also better align the true environmental benefits from forests with the rewards available to foresters in the ETS. The 2011 NZ ETS review panel recommended accounting for carbon stored in HWPs; however, as the 2016 forestry technical note points out, this will introduce yet more complexity to the NZ ETS for forestry.

Considerations

How to devolve the deferred liability for HWPs?

Ideally, this would be done in the simplest way possible.⁸⁴ Establishing a national average for what products harvested trees are turned into and using this to adjust NZ ETS liabilities would be relatively straightforward. If this is introduced with averaging, HWPs could be incorporated into a forest’s long-term average carbon stock. Another option is to incorporate emissions from

⁸⁴ Some proposals would add a large amount of complexity to the system, e.g. including wood processors, sawmillers, and exporters into the NZ ETS (they would be credited for carbon stored in HWPs, and debited as the products decay and release carbon back into the atmosphere).

the decay of HWPs and on-site residuals into subsequent rotation carbon look-up tables. Foresters would surrender fewer credits at harvest, but earn fewer credits in subsequent rotations.

Either option would be relatively simple and would appropriately increase the average profitability of new forests. However, neither would provide incentives to produce long-lived grades of timber through species choice and management.

Because these options would have no real effect on existing forests, it should be introduced only when the forest is replanted.⁸⁵ Otherwise, it simply creates a windfall gain for existing forests.

Deferring full liability for emissions when land is deforested would involve significant costs and low value, as land owners would need to be tracked for many years. The NPV of future liabilities could be imposed when deforestation occurs.

4.1.3 Additionality and environmental integrity of the NZ ETS

The NZ ETS is designed to incentivise the planting of additional forests, i.e. planting that would not have occurred in the scheme's absence, in order to help New Zealand cost-effectively achieve its international targets. Despite this, the NZ ETS deliberately does not attempt to distinguish whether or not a forest planted after 1989 was additional or not. This reduces administrative costs significantly and makes participation much simpler for forests that are additional, thereby potentially increasing responses. Are there large costs from this?

There are two concerns with giving carbon credits to forestry that is potentially non-additional: first, non-additional forests receive windfall gains (at the expense of the taxpayer); and second, perception exists, particularly in Europe, that these credits may not represent genuine carbon abatement and hence may weaken New Zealand's contribution to global climate mitigation. This second concern is not a valid argument – all planting since 1989 represents carbon sequestration relative to the 1 January 1990 starting point used for United Nations reporting. New Zealand gets credit for these forests regardless of the NZ ETS design. Non-additional forests in the NZ ETS do not reduce the stringency of New Zealand's Paris commitment; this is a domestic fiscal issue.

Almost 90% of all forest land currently registered in the NZ ETS was planted between 1990 and 2004. It is hard to argue that much of this planting occurred in anticipation of the price signal provided by the NZ ETS. As such, the idea that there are non-additional forest owners receiving NZUs is not unfounded. This concern should be tempered by two caveats. First, forest land could only ever earn credits for net carbon sequestered from 1 January 2008 (and now only since 2013 – the beginning of the current MERP). Second, as a result of this and liabilities on harvest, the expected financial windfall for forests planted between 1990 and 2004 are low, and

⁸⁵ It could have small effects on timing of harvest because the timing of carbon liabilities and credits are shifted into the future.

in some cases can be achieved only from risky speculative activity (as discussed in Section 3.4.1). Small foresters who planted up until 1996 were unable to sell any “safe” credits, and even large owners in the peak planting years could sell few. Going forward, non-additionality will be an issue only if timber prices rise such that timber forestry becomes attractive again. Even then, if carbon prices are high, only a fraction of replanting and new planting will be non-additional.

The perception issues surrounding forestry in the NZ ETS are partially due to lack of understanding. New Zealand remains the only country to include forestry as a mandatory participant in its ETS – other schemes exclude forestry or include it only as an offset option (e.g. California). However, some blows to the integrity of the forestry sector’s participation in the NZ ETS have been self-inflicted (e.g. re-registration arbitrage, which allows large amounts of international credits with questionable environmental integrity to be introduced into the scheme).

4.2 Other NZ ETS issues that affect forest sequestration

The NZ ETS can be complex to engage in, especially for small forest owners. This is likely to lead to a lower response than could potentially be achieved and may create risks for some actors, with subsequent equity effects and effects on perceptions of the system as a whole.

As mentioned in Section 3.4.2, it appears likely that some small forest owners who planted in the 1990s and registered their forests in the NZ ETS misunderstood the scheme’s incentives and may not understand their carbon harvest liabilities. Ollie Belton echoed these concerns. He mentioned that many market participants rely on forestry consultants and carbon brokers for advice. He also said that most consultants and brokers were not registered with the Financial Markets Authority. Joanna Silver felt the market was “very opaque” and exposed “mum and dad [forestry] investors”. There is a chance these investors have been misinformed or even misled. Another risk for investors occurs when purchasing forestry real estate. Nigel Brunel mentioned there had been cases of agents not giving proper advice about carbon rules and obligations.

4.2.1 Market transparency

Currently, there is no central source for price and volume information. Some private players provide price information on the trades they handle (e.g. CommTrade and Carbon Match); however, volume information is not available. Both Nigel Brunel and Ollie Belton expressed concern that the volume numbers derived from the New Zealand Emission Unit Registry are overinflated. The registry often counts a single trade as multiple trades. This is because one trade may involve a forest owner selling units to their broker, who then sells them to the market platform, who then sells them to a broker on the other side who then might sell them onto their client. The registry would count this as four trades and subsequently overstate the volume of emissions units traded.

Another consideration is the transparency of information held by the government. Market participants often complain about the difficulty involved with getting basic information.⁸⁶ Some information the government has is likely to be sensitive; however, the provision of more aggregated data would help the market function more efficiently and reduce information asymmetry between participants. One example is lack of information about the stock of NZUs currently held by market participants.⁸⁷ There is limited information on who owns these credits and what portion are linked to future harvesting liabilities.⁸⁸ In the data we received from MPI, we found that the current “Post-89 unit balance total” – the sum of the number of units allocated to forestry participants net of those paid back – is 46 million units. (As at 2 May, 2016. Ministry for Primary Industries 2016b).

4.2.2 Financial regulation

A related issue is the treatment of NZUs as financial assets. Arthur Grimes (Member of the Board of Directors of the Financial Markets Authority), Joanna Silver, Nigel Brunel, and other stakeholders have mentioned that NZUs are not currently covered by standard financial regulation.⁸⁹ These same stakeholders felt that NZUs were effectively securities.⁹⁰ This lack of regulation may pose risks to market participants and perception of the scheme. Further, it could deter financial institutions from providing sophisticated products to help manage price risk and smooth flows of sequestration.

There will be compliance costs associated with more financial regulation. Which actors would have to face these costs is a major question. Brunel felt those giving advice or acting as intermediaries should have to register with the Financial Markets Authority, while forest owners trading on their own behalf could potentially be exempted.

Grimes, Silver, Brunel, and Belton all agreed that the lack of regulation contributed to the lack of willingness by financial institutions to engage with carbon credits. They did not feel it was the main deterrent, however. In their view, the more important factors were the combination of the low carbon price in 2011–15 and policy uncertainty.

⁸⁶ We ourselves had to specially request some basic data such as deforestation of pre-1990 forests. We also used the OIA to access other forestry data (which we have now made publicly available).

⁸⁷ Commonly referred to as “the bank” of units. Ormsby and Kerr (2016) estimate this at around 140 million NZUs at its peak in July 2015.

⁸⁸ Many of these NZUs will be owned by foresters and some will be needed to repay future harvesting liabilities; however, some will have been decoupled from this obligation during the arbitrage period.

⁸⁹ The 2008 legislation that introduced the NZ ETS explicitly stated that emissions units were not to be treated as securities; however, this was later repealed. Currently, emissions units are not explicitly included or excluded from the Financial Markets Conduct Act 2013 (see <http://www.legislation.govt.nz/act/public/2013/0069/latest/DLM4090578.html>).

⁹⁰ Nigel Brunel stated that emissions units are regulated as financial instruments in Australia and Europe.

4.2.3 *Political uncertainty*

Much of the previous literature on this topic has stressed the negative impact of policy uncertainty (e.g. Bertram and Terry 2010; Jiang et al. 2009; Karpas and Kerr 2011).⁹¹ Since the introduction of the NZ ETS in 2008, there have been three reviews of the policy and a number of amendments to the Climate Change Response Act 2002 (Leining 2016). Currently, future NZU supply is undefined and there is no predictable mechanism to review the current NZ\$25 per tonne of CO₂-e price ceiling on NZUs surrendered. Forestry rules that could have major implications for current and future forestry participants are yet again under discussion. Indeed, David Rhodes said that “some people have been burned by this and are very distrustful” of government policy. Ollie Belton also felt that policy uncertainty had driven some participants away. During any future reviews and policy amendments, the government needs to be mindful of the negative impacts of uncertainty.

5 Conclusions

Forest owners have responded to the financial incentives from the NZ ETS in a rational way. Both afforestation and deforestation decisions appear to have been influenced by the emissions price and/or expectations about the emissions price in the future. There is some evidence that afforestation increased in 2011–12 in response to the carbon price, and that deforestation decisions were made with current and future emissions prices in mind. We find that the plantation forest component of the scheme is being administered effectively and is relatively easy to comply with.

However, the scheme has been beset by challenges. The collapse in the global carbon price and, associated with this, the proliferation of international Kyoto credits of questionable environmental integrity, combined with the government decision to delay New Zealand’s delink from international markets until 2015, greatly reduced the price signal for forestry from the NZ ETS from 2012 to 2015. A weak price signal, coupled with ongoing policy uncertainty surrounding the NZ ETS, has limited the effectiveness of the scheme in achieving its forestry goals.

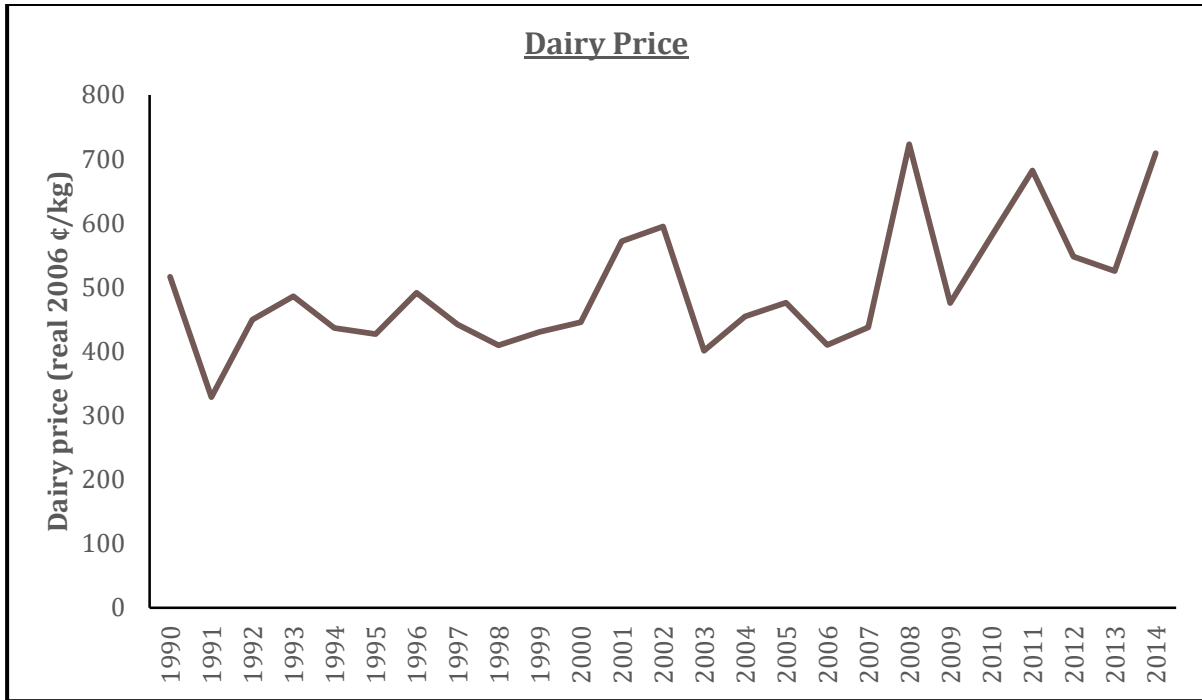
Thankfully, there are reasons to be more optimistic about the future. The Paris Climate Agreement in 2015 established a renewed global framework and vision, and the carbon price in New Zealand has rebounded to levels above NZ\$16 (since mid-2016). If the price remains high, and the current ETS review and shifts in New Zealand political processes around climate policy are able to establish a higher degree of policy predictability, owners of marginal land and forest

⁹¹ Section 5.3.1 in Karpas and Kerr (2011) provides a good explanation of the impacts of uncertainty for forestry: “Because forestry is a long-term investment with many business decisions being made 20 to 30 years in advance of the sale of the product, foresters must predict the future to undertake risk management and decision-making analysis. However, the ETS is mired in uncertainties that make decisions difficult for foresters. Very little carbon is sequestered in the first few years of growth, so the carbon prices that are critical for new planting, if timber price expectations alone do not justify it and hence the planting is ‘additional’, are more than five years ahead.”

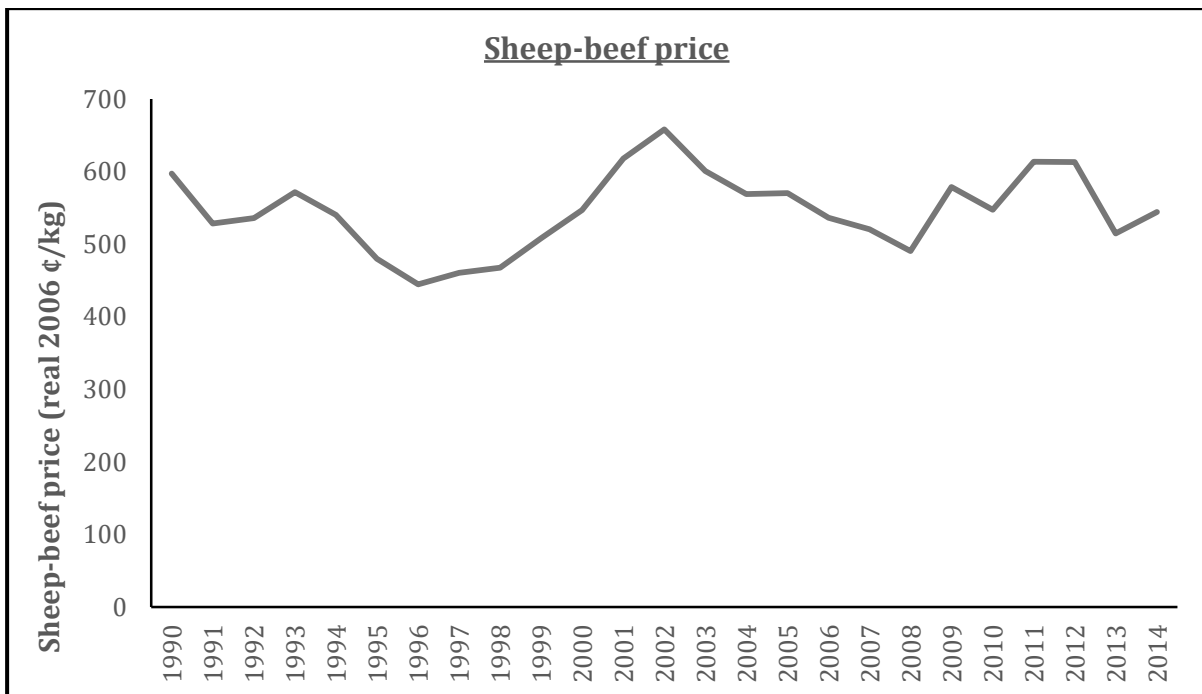
are likely to continue to respond rationally to financial incentives, but now in positive directions: avoiding deforestation, planting new trees, increasing rotation lengths and carbon density and replanting after harvest.

Appendices

Appendix 1: Commodity prices



Source: DairyNZ/Livestock Improvement Council dairy statistics (2014/15)



Source: Statistics New Zealand Infoshare

Appendix 2: Definition of deforestation in the NZ ETS

From page 26 of *A Guide to Look-up Tables for Forestry in the Emissions Trading Scheme* (Ministry for Primary Industries 2015b):

“Deforest, in relation to forest land:

- means to convert forest land to land that is not forest land; and
- includes cleared land, where the following applies:
- Four years after clearing, a given hectare has not been replanted with at least 500 stems of forest species or has not naturally established a covering of at least 500 stems of forest species;

and either:

- 10 years after clearing, predominantly exotic forest species are growing, but a given hectare does not have tree crown cover of at least 30 percent from trees that have reached five metres in height; or
- 20 years after clearing, predominantly indigenous forest species are growing, but a given hectare does not have tree crown cover of at least 30 percent from trees that have reached five metres in height.

Deforestation is generally treated as occurring on the date the hectare is cleared as part of the deforestation process. The only exceptions are where deforestation is deemed to have occurred four, 10 or 20 years after clearance in the circumstances outlined above; however, in these circumstances any liabilities associated with deforestation are calculated as at four, 10 or 20 years earlier, respectively.”

References

- Adams, Thomas, and James A. Turner. 2012. "An Investigation into the Effects of an Emissions Trading Scheme on Forest Management and Land Use in New Zealand." *Forest Policy and Economics* 15 (February): 78–90. doi:10.1016/j.forpol.2011.09.010.
- Allan, Corey, and Suzi Kerr. 2015. "Show Me the Profits: Examining the Relationship between Agricultural Profitability and Rural Land Values in New Zealand over Time." Motu Manuscript. Wellington, New Zealand: Motu Economic & Public Policy Research.
- Beef and Lamb New Zealand. 2016. "Sheep and Beef Farm Survey." *Beef and Lamb New Zealand* [website]. <http://www.beeflambnz.com/information/on-farm-data-and-industry-production/sheep-beef-farm-survey>
- Bertram, Geoffrey, and Simon Terry. 2010. *The Carbon Challenge*. Wellington: Bridget Williams Books.
- Coleman, Andrew. 2011. "Financial Contracts and the Management of Carbon Emissions in Small Scale Plantation Forests." Motu Working Paper 11-04. Motu Working Paper Series. Wellington: Motu Economic and Public Policy Research. http://www.motu.org.nz/publications/detail/financial_contracts.
- Dorner, Zack, and Dean Hyslop. 2014. "Modelling Changing Rural Land Use in New Zealand 1997 to 2008 Using a Multinomial Logit Approach." Motu Working Paper 14–12. Wellington: Motu Economic and Public Policy Research. http://www.motu.org.nz/publications/detail/modelling_changing_rural_land_use_in_new_zealand_1997_to_2008_using_a_multi.
- Emissions Trading Scheme Review Panel. 2011. "Doing New Zealand's Fair Share. Emissions Trading Scheme Review 2011, Final Report." Wellington: Ministry for the Environment.
- Environmental Protection Authority. 2014. "Frequently Asked Questions on the Annual Reports Required by the Climate Change Response Act." Environmental Protection Authority. http://www.epa.govt.nz/Publications/2013-14_Section_89_FAQs.pdf.
- . 2015. "NZ ETS 2014 – Facts and Figures." Wellington: Environmental Protection Authority. http://www.epa.govt.nz/e-m-t/reports/ets_reports/annual/Documents/2014%20NZ%20ETS%20Facts%20and%20Figures%20final.pdf.
- Financial Times. 2014. "'White Gold' Turns New Zealand into the 'Saudi Arabia of Milk' - FT.com." March 3. <http://www.ft.com/intl/cms/s/0/552bb834-a1c5-11e3-953b-00144feab7de.html#slide0>.
- Greenpeace NZ. 2010. "Deforestation for Dairy." August 4. <http://www.greenpeace.org/new-zealand/en/campaigns/climate-change/smart-farming/Deforestation-for-dairy/>.
- Groser, Tim, and Jo Goodhew. 2014. "Government Amends Climate Change Response Act 2002 to Change Forestry Surrender Obligations." *New Zealand Government Press Release*, May 16. <https://www.beehive.govt.nz/release/government-amends-climate-change-response-act-2002-change-forestry-surrender-obligations>.
- Jiang, Nan, Basil M.H. Sharp, and Mingyue Sheng. 2009. "Policy Watch: New Zealand's Emissions Trading Scheme." *New Zealand Economic Papers* 43 (1): 69–79.
- Karpas, Eric, and Suzi Kerr. 2011. "Preliminary Evidence on Responses to the New Zealand Forestry Emissions Trading System." Motu Working Paper 11-09. Motu Working Paper. Wellington, New Zealand: Motu Economic and Public Policy Research. http://www.motu.org.nz/publications/detail/preliminary_evidence_on_responses_to_the_new_zealand_forestry_emissions_tra.
- Kerr, Suzi, Simon Anastasiadis, Alex Olssen, William Power, Levente Timar, and Wei Zhang. 2012. "Spatial and Temporal Responses to an Emissions Trading Scheme Covering Agriculture and Forestry: Simulation Results from New Zealand." *Forests* 3 (December): 1133–56.
- Kerr, Suzi, and Suzie Greenhalgh. 2015. "The Taupo Nitrogen Market: The World's Only Diffuse Source Trading Programme." Motu Note #20. Motu Economic & Public Policy Research. <http://motu.nz/our-work/environment-and-resources/nutrient-trading-and-water-quality/the-taupo-nitrogen-market-the-worlds-only-diffuse-source-trading-programme/>.

- Kerr, Suzi, and Alex Olssen. 2012. "Gradual Land-Use Change in New Zealand: Results from a Dynamic Econometric Model." Motu Working Paper 12-06. Wellington: Motu Economic and Public Policy Research.
- Leining, Catherine. 2016. "A Timeline of the NZ Emissions Trading Scheme." *Motu*. <http://motu.nz/our-work/environment-and-resources/emission-mitigation/shaping-new-zealands-low-emissions-future/a-timeline-of-the-nz-emissions-trading-scheme/>.
- Leining, Catherine, and Suzi Kerr. 2016. "Lessons Learned from the New Zealand Emissions Trading Scheme." Motu Working Paper 16-06. Wellington: Motu Economic and Public Policy Research. http://motu-www.motu.org.nz/wpapers/16_06.pdf.
- Leining, Catherine, Judd Ormsby, and Suzi Kerr. 2017. "Evolution of the New Zealand Emissions Trading Scheme: Linking." Motu Working Paper 17-06. Wellington, New Zealand: Motu Economic and Policy Research.
- Manley, Bruce. 2013. "Deforestation Survey 2012." MPI Technical Paper 2013/02. Ministry for Primary Industries.
- . 2014. "Deforestation Survey 2013, Final Report." MPI Technical Paper 2014/02. Ministry for Primary Industries. <https://www.mpi.govt.nz/document-vault/4131>.
- . 2015. "Deforestation Survey 2014." MPI Technical Paper 2015/02. Ministry for Primary Industries. <https://www.mpi.govt.nz/document-vault/6355>.
- . 2016a. "Afforestation Responses to Carbon Price Changes and Market Certainties." University of Canterbury School of Forestry. <https://www.mfe.govt.nz/publications/climate-change/afforestation-responses-carbon-price-changes-and-market-certainties>.
- . 2016b. "Deforestation Intentions Survey 2015." Ministry for Primary Industries. <https://www.mpi.govt.nz/document-vault/11776>.
- Ministry for the Environment. 2013. "New Zealand's Sixth National Communication under the UNFCCC and the Kyoto Protocol." Wellington, New Zealand: New Zealand Ministry for the Environment. <http://www.mfe.govt.nz/publications/climate/nz-sixth-national-communication/index.html>.
- Ministry for Primary Industries. 2011. "Review of MAF Afforestation Schemes: Permanent Forest Sink Initiative; Afforestation Grant Scheme; East Coast Forestry Project; Sustainable Land Management (Hill Country Erosion) Programme." MAF Information Paper No: 2011/07. Wellington, New Zealand: Ministry for Primary Industries. www.mpi.govt.nz/document-vault/3729.
- . 2012. "National Dairy Farm Monitoring 2012." Wellington: Ministry for Primary Industries.
- . 2014a. "National Exotic Forest Description 2014." <https://www.mpi.govt.nz/document-vault/4948>.
- . 2014b. "Offsetting Deforestation of Pre-1990 Forest Land under the Emissions Trading Scheme." Ministry for Primary Industries. <https://www.mpi.govt.nz/news-and-resources/publications/>.
- . 2015. "An Overview of Forestry in the ETS." Ministry for Primary Industries. <https://www.mpi.govt.nz/document-vault/6991>.
- . 2016a. "New Zealand Exports by Forest Product 1981 to Most Recent." <https://www.mpi.govt.nz/news-and-resources/open-data-and-forecasting/forestry/>.
- . 2016b. "OIA16-0176: Forestry ETS Data." Response to an OIA request made by Motu. Ministry for Primary Industries. <http://motu.nz/our-work/environment-and-resources/emission-mitigation/emissions-trading/emissions-trading-scheme-forecasting-data>.
- Ministry for the Environment. 2015a. "New Zealand Emissions Trading Scheme Review 2015/16: Discussion Document and Call for Written Submissions." Wellington: Ministry for the Environment. <http://www.mfe.govt.nz/publications/climate-change/new-zealand-emissions-trading-scheme-review-2015-16-discussion-document>.
- . 2015b. "New Zealand's Greenhouse Gas Inventory 1990–2013." Wellington: Ministry for the Environment. <http://www.mfe.govt.nz/publications/climate-change/new-zealands-greenhouse-gas-inventory-1990-2013>.
- . 2016a. "New Zealand's Greenhouse Gas Inventory 1990–2014." Wellington: Ministry for the Environment. <http://www.mfe.govt.nz/publications/climate-change/new-zealands-greenhouse-gas-inventory-1990-2014>.

- . 2016b. “The New Zealand Emissions Trading Scheme Evaluation Report 2016.” Wellington: Ministry for the Environment. <http://www.mfe.govt.nz/publications/climate-change/new-zealand-emissions-trading-scheme-evaluation-report-2016>.
- . 2016c. “New Zealand Emissions Trading Scheme Review 2015/16: Forestry Technical Note.” Wellington: Ministry for the Environment. <http://www.mfe.govt.nz/publications/climate-change/forestry-technical-note>.
- Ministry of Agriculture and Forestry. 2011. *A Guide to Forestry in the Emissions Trading Scheme*. Wellington: Ministry of Agriculture and Forestry. <http://www.maf.govt.nz/news-resources/publications>.
- New Zealand Government. 2015a. “New Zealand Submission to the ADP: New Zealand’s Intended Nationally Determined Contribution.” Wellington: New Zealand Government. <http://www4.unfccc.int/submissions/INDC/Published%20Documents/New%20Zealand/1/New%20Zealand%20INDC%202015.pdf>.
- . 2015b. “New Zealand Submission to the ADP: Addendum to New Zealand’s Intended Nationally Determined Contribution.” Wellington: New Zealand Government. <http://www4.unfccc.int/submissions/INDC/Published%20Documents/New%20Zealand/1/NZ%20INDC%20Addendum%2025%2011%202015.pdf>.
- Olssen, Alex, Wei Zhang, David Evison, and Suzi Kerr. 2012. “A Forest-Profit Expectations Dataset for New Zealand, 1990-2008.” Wellington: Motu Economic and Public Policy Research. http://www.motu.org.nz/publications/detail/a_forest-profit_expectations_dataset_for_new_zealand_19902008.
- OMF, Commtrade. 2016. “New Zealand Emission Units Price 2010-2015.” OM Financial Ltd. <https://www.comtrade.co.nz/>.
- Ormsby, Judd, and Suzi Kerr. 2016. “The New Zealand Emissions Trading Scheme de-Link from Kyoto: Impacts on Banking and Prices.” Motu Working Paper 16–13. Wellington, New Zealand: Motu Economic & Public Policy Research.
- The Treasury. 2014. “Regulatory Impact Statement: Re-Registration Arbitrage by Post-1989 Forest Land Participants in the ETS.” New Zealand Government. <http://www.treasury.govt.nz/publications/informationreleases/ris/pdfs/ris-mfe-rra-may14.pdf>.
- Thirkettle, Matt, and Suzi Kerr. 2015. “Predicting Harvestability of Existing Pinus Radiata Stands: 2013-2030 Projections of Stumpage Profits from Pre-90 and Post-89 Forests.” *Motu Working Paper*. <http://motu.nz/our-work/environment-and-resources/lurnz/predicting-harvestability-of-existing-pinus-radiata-stands-2013-2030-projections-of-stumpage-profits-from-pre-90-and-post-89-forests/>.
- Waikato Regional Council. 2016a. “Let’s Talk Water.” Waikato Regional Council. <http://www.waikatoregion.govt.nz/freshwater-discussion/>.
- . 2016b. “Waikato Regional Fresh Water Discussion: A Framework for Getting the Best Use Allocation through Time.” Waikato Regional Council. <http://www.waikatoregion.govt.nz/PageFiles/40487/Freshwater%20technical%20summary.pdf>.

Recent Motu Working Papers

All papers in the Motu Working Paper Series are available on our website www.motu.nz, or by contacting us on info@motu.org.nz or +64 4 939 4250.

- 17-13 Fleming, David A., Arthur Grimes, Laurent Lebreton, David C Maré and Peter Nunns. 2017. "Valuing sunshine."
- 17-12 Hyslop, Dean and Wilbur Townsend. 2017. "The longer term impacts of job displacement on labour market outcomes."
- 17-11 Carver, Thomas, Patrick Dawson and Suzi Kerr. 2017. "Including forestry in an Emissions Trading Scheme: Lessons from New Zealand."
- 17-10 Daigneault, Adam, Sandy Elliott, Suzie Greenhalgh, Suzi Kerr, Edmund Lou, Leah Murphy, Levente Timar and Sanjay Wadhwa. 2017. "Modelling the potential impact of New Zealand's freshwater reforms on land-based Greenhouse Gas emissions"
- 17-09 Coleman, Andrew. 2017. "Housing, the 'Great Income Tax Experiment', and the intergenerational consequences of the lease"
- 17-08 Preston, Kate and Arthur Grimes. 2017. "Migration and Gender: Who Gains and in Which Ways?"
- 17-07 Grimes, Arthur, Judd Ormsby and Kate Preston. 2017. "Wages, Wellbeing and Location: Slaving Away in Sydney or Cruising on the Gold Coast."
- 17-06 Leining, Catherine, Judd Ormsby and Suzi Kerr. 2017. "Evolution of the New Zealand Emissions Trading Scheme: Linking."
- 17-05 Leining, Catherine, Corey Allan and Suzi Kerr. 2017. "Evolution of the NZ ETS: Sectoral Coverage and Points of Obligation."
- 17-04 Maré, David C., Trinh Le, Richard Fabling and Nathan Chappell. 2017. "Productivity and the Allocation of Skills."
- 17-03 Grimes, Arthur and Wilbur Townsend. 2017. "The Effect of Fibre Broadband on Student Learning."
- 17-02 Alimi, Omoniyi, David C Maré and Jacques Poot. 2017. "More pensioners, less income inequality?"
- 17-01 Carver, Thomas and Suzi Kerr. 2017. "Facilitating Carbon Offsets from Native Forests."
- 16-22 Fabling, Richard, and Arthur Grimes. 2016. "Picking Up Speed: Does Ultrafast Broadband Increase Firm Productivity?"
- 16-21 Maré, David C. 2016. "Urban Productivity Estimation with Heterogeneous Prices and Labour."
- 16-20 Allan, Corey, and Suzi Kerr. 2016. "Who's Going Green? Decomposing the Change in Household Consumption Emissions 2006–2012."
- 16-19 Hyslop, Dean, and Wilbur Townsend. 2016. "Employment Misclassification in Survey and Administrative Reports."
- 16-18 Hyslop, Dean, and Wilbur Townsend. 2016. "Earnings Dynamics and Measurement Error in Matched Survey and Administrative Data."
- 16-17 Hollis, Michele, Cecile de Klein, Dave Frame, Mike Harvey, Martin Manning, Andy Reisinger, Suzi Kerr, and Anna Robinson. 2016. "Cows, Sheep and Science: A Scientific Perspective on Biological Emissions from Agriculture."
- 16-16 Kerr, Suzi. 2016. "Agricultural Emissions Mitigation in New Zealand: Answers to Questions from the Parliamentary Commissioner for the Environment."
- 16-15 Timar, Levente. 2016. "Yield to Change: Modelling the Land-use Response to Climate Driven Changes in Pasture Production."
- 16-14 Chappell, Nathan, and Adam B. Jaffe. 2016. "Intangible Investment and Firm Performance."
- 16-13 Kerr, Suzi, and Judd Ormsby. 2016. "The New Zealand Emissions Trading Scheme De-link From Kyoto: Impacts on Banking and Prices."
- 16-12 Carver, Tom, and Arthur Grimes. 2016. "Income or Consumption: Which Better Predicts Subjective Wellbeing?"

