The impact of carbon credits on New Zealand Radiata pine forestry profitability

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Introduction

The Emissions Trading Scheme (ETS) was implemented by the New Zealand Government on January 1, 2008, with forestry as the first (and to date, only) industry participating. It is therefore timely to examine potential financial impacts of the ETS on Radiata pine forestry in New Zealand.

The government's intentions in introducing the ETS are clear: "…The government wants…forestry to help mitigate climate change by removing carbon dioxide from the atmosphere...We believe…[the ETS]…provides the most flexible, fairest [sic] and comprehensive approach to addressing the many challenges that climate change presents…It also allows foresters to capitalise on the business opportunities climate change provides…" (MAF, 2007).

The ETS, and therefore this analysis, applies to "post-1989 forests", also called "Kyoto-compliant" (i.e. those planted from bare land after 1989). However the analysis also provides an insight into the opportunity costs of the arbitrary distinction between "post-1989" and "pre-1990" forests. As at 1 April 2006 there was a total net stocked area of 1.8 million hectares (MAF 2007a), of which about 680 000 hectares are classified as "post-1989" forest.

Method

This analysis uses a simple discounted cash flow analysis (single hectare, single rotation) to explore the following questions:

1. How will the ETS affect profitability of Radiata pine forestry in New Zealand?
2. What is the implication of changing carbon prices during the investment cycle?

Data and Assumptions

The carbon sequestration profile was modelled using a typical current annual increment curve for a direct sawlog regime (using the RadiataPine Calculator 3.0), which yielded an average of 33 tonnes per hectare of CO_2 fixed over a 30 year rotation.

The ETS (MAF, 2007) states that "…participants will be entitled to receive one NZU for each tonne of carbon dioxide stored in their forests…", and that "…NZUs will be generally interchangeable with Kyoto Protocol Assigned Amount Units (MAF 2007). This analysis initially assumes a price of $30 for each NZU, This price is consistent with that used by the Sustainability Council in a recent study (Bertram and Terry, 2008) and somewhat lower than the price ($40) used in NZIER (2008).

This analysis also assumes that the forest owner exchanges NZUs for cash as they are earned, generating additional revenue throughout the rotation, and that all NZUs are repaid at time of harvest. A rotation age of 30 years, and discount rate of 7% were assumed. Carbon dioxide yields in (T/ha) were calculated using the Radiata Pine Calculator 3.0, for a typical direct sawlog regime.

The analysis does not include the costs to the forest owner of participating in the scheme, i.e.

1. the "direct costs of administering the voluntary participation of post-1989 forests will be recovered from their owners" (MAF, 2007b)
2. costs of annual assessment of the carbon stock

Results

1. NZU price of $NZ30/T, constant throughout the investment cycle

Under the base case scenario a positive NPV of approximately $6,422 per ha is generated by the ETS. This will significantly increase the profitability of Radiata pine forestry in New Zealand.

2. Increasing carbon prices

The impact of annual increases in harvest price of between 1% and 7% annually were investigated (Table 2).

Table 2: Impact of increasing carbon price on NPV

Increase in carbon price (annual)	NPV
0%	$6,422
1%	$6,612
2%	$6,636
3%	$6,408
4%	$5,815
5%	$4,699
6%	$2,853
7%	$0

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Table 1: Cash flows, base case ($30T carbon price, constant for rotation)

		Undiscounted		Discounted	
Year	**Carbon dioxide (tonnes/ha)**	**Cost ($/ha)**	**Revenue ($/ha)**	**Cost ($/ha)**	**Revenue ($/ha)**
1	0.00		$0.00	$0.00	$0.00
2	1.72		$51.59	$0.00	$45.06
3	3.59		$107.72	$0.00	$87.93
4	16.85		$505.40	$0.00	$385.57
5	30.33		$909.89	$0.00	$648.74
6	38.34		$1,150.09	$0.00	$766.35
7	56.49		$1,694.58	$0.00	$1,055.30
8	59.64		$1,789.32	$0.00	$1,041.40
9	-7.47		-$224.01	$0.00	-$121.85
10	10.63		$318.78	$0.00	$162.05
11	23.98		$719.40	$0.00	$341.78
12	29.06		$871.80	$0.00	$387.09
13	35.09		$1,052.76	$0.00	$436.86
14	38.99		$1,169.67	$0.00	$453.62
15	42.43		$1,272.80	$0.00	$461.32
16	44.60		$1,338.09	$0.00	$453.26
17	46.00		$1,379.98	$0.00	$436.87
18	46.55		$1,396.59	$0.00	$413.20
19	46.53		$1,395.76	$0.00	$385.94
20	46.00		$1,379.91	$0.00	$356.59
21	45.09		$1,352.78	$0.00	$326.71
22	43.88		$1,316.32	$0.00	$297.11
23	42.42		$1,272.66	$0.00	$268.46
24	40.78		$1,223.35	$0.00	$241.18
25	39.03		$1,170.94	$0.00	$215.75
26	37.79		$1,133.75	$0.00	$195.23
27	36.98		$1,109.51	$0.00	$178.55
28	36.11		$1,083.24	$0.00	$162.92
29	35.28		$1,058.53	$0.00	$148.79
30	34.46	$30,035.12	$1,033.92	$3,945.63	$135.82
Sum	**1001.17**			**$3,945.63**	**$10,367.61**

NPV remains relatively constant up to a 4% annual increase in carbon price. Note that a 4% annual increase in carbon price implies that carbon price would have approximately tripled over the rotation.

3. One-off price increase at time of harvest

A "one-off" increase in prices immediately before harvest was also investigated. Breakeven (the point where the discounted cost of the carbon liability at harvest is equal to the discounted revenue from NZUs earnt during the rotation) is approximately 170% increase in price in one year - itself a rather improbable scenario - to just over $81. It may be that short term hedging strategies would be useful to manage the risk of this type of occurrence - either via financial markets, or by the forest owner retaining (i.e. not cashing in) some credits earned close to rotation age

Conclusions

The establishment of an active market for carbon in New Zealand (the ETS), with prices approximating current international prices, would radically change the economics of radiata pine forestry, and provide significant revenue to the forest owner.

The analysis highlights that the positive financial impact of the ETS is simply due to the favourable timing of revenues and costs. Under the assumptions of this analysis, positive cash flow is provided early in the rotation, and the time value of money creates positive NPV overall. This result is quite robust to the different scenarios of NZU price increases, and the benefit will also accrue to the forest owner in second and subsequent rotations.

The annual costs of administration and participation in the scheme (currently not quantified), and the prospect of a lack of an active market which has the confidence of market participants are probably the biggest threats to the profitability of carbon forestry.

The impacts on silvicultural regime selection and rotation age are not covered in this paper, however there is likely to be an impact in both cases, with longer rotations being the likely outcome (see for example Hoen and Solberg, 1997). This may have significant implications for:

- Harvesting piece size and specifications of processing equipment
- Harvesting impacts (soils, biota and landscape)
- Wood quality

The costs of the arbitrary distinction between "pre-1990" and "post-1989" forests is also highlighted. The opportunity cost of owning a forest that is not permitted to participate in the ETS is large. The other expected benefits of the ETS - greater standing volume (and therefore carbon sequestered), longer rotations (therefore lower impacts due to harvesting), and better wood quality, will also not be derived from pre-1990 forests.

Further work is required to analyse possible hedging strategies, and the impact on regime selection and rotation age. Owners of post-1989 forests should carry out analysis, based on their specific forest description, to determine the impacts specific to their resource and requirements.

References

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