Can Carbon support resilient Northland farms?

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A summary of the carbon balance for Millbrook Station, Pakiri, and how forestry may contribute to future physical and economic resilience for this example Northland farm. For publication in agricultural media.

Introduction

Millbrook Station is part of the Meat and Wool Monitor Farm Programme. Valuable knowledge has been gained about the property that can be used to investigate a range of future farm management options. The impact of the Emissions Trading Scheme on the farm can be explored using the high level of detail available for the farm. A farm carbon balance, including forestry, was prepared for Millbrook Station. This work was completed for the NZ Landcare Trust under a MAF Sustainable Farming Fund project focused on farm resilience in Northland. The results were presented to approximately 50 farmers as part of the final field day for the three year programme for this monitor farm

Background

New Zealand ratified the Kyoto Protocol in 2002 and agreed to limit greenhouse gas emissions at 1990 levels. NZ must achieve this target by 2012 or take responsibility for emissions above this level. New Zealand has introduced several schemes to address its Kyoto Protocol requirements under the Climate Change Response Act, 2002 which passed into law in September 2008 and was amended by the incoming National Government in November 2009. This legislation establishes the Emissions Trading Scheme (ETS). Under the ETS, agriculture will be required to purchase carbon credits to offset emissions. Activities such as forestry generate carbon credits which can be entered into the ETS and used to offset emissions, or traded for cash. Forestry has been in the ETS since 2008 with carbon credits available for forests planted after 1990 on land not previously in forest. Other sectors of the economy including energy, liquid fossil fuels and industry are scheduled to enter the ETS from July this year. This will provide a market for carbon credits in New Zealand as these sectors will be liable for 50% of their greenhouse gas emissions and will have to "surrender" an equivalent amount of carbon credits. Agriculture will be included in the scheme from 2015 with mandatory reporting of emissions due from January 2012.

Farm carbon balance

Livestock grazing on pasture are considered net emitters of greenhouse gases, due mostly to methane emitted from the rumen and nitrous oxide from soils. Millbrook Station is a sheep and beef farm which had around 4,100 stock units in May 2010, less than usual due to drought conditions. The effective grazing area is 478 hectares and current livestock base is 628 ewes plus 702 cattle including 134 beef cows. Total annual greenhouse gas emissions for Millbrook

Station are described in the table below. A New Zealand Unit (NZU), the standard measure used for carbon accounting, is equivalent to one tonne of carbon dioxide (CO_2). The Carbon Farming Group calculator was used to prepare this table. This produces a comparable result to Overseer® with a tenth of the inputs and can be found at http://www.carbonfarming.org.nz/calculators.php. Livestock are the source of 97% of emissions (1,357 of the total 1,402 units)from this farm. This is typical for a traditional sheep and beef farm. In comparison to other examples diesel use was high as a water pump was driven by a diesel motor and electricity was low as household electricity was excluded from the calculations.

Table 1 Total annual greenhouse gas emissions as tonnes carbon dioxide equivalents for a sheep and beef farm

Greenhouse gas source	Annual use	Tonnes CO_2 (NZU)
Petrol	2446 litres	6
Diesel	6110 litres	16
Electricity	4500 kWh	1
Nitrogen	3.8 tonne	21
Sheep	869 ewe equivalents[1]	287
Cattle	626 cattle equivalents[1]	1070
Total annual emissions		1401

1 – includes breeding and young stock

Impact of ETS on farm

Initially, as for other consumers, the ETS will result in some increase in costs as suppliers of diesel, electricity, fertiliser etc pass on their costs of purchasing carbon credits. These industries start with a 50% free allocation so in effect will be liable for half of their emissions. In 2015 agricultural emissions from livestock will be taken into account. It is expected these will be paid for by the processor on behalf of farmers via a levy on produce – i.e the point of obligation will be at the processor level. This may change over time to the farmer being directly responsible.

In 2015 there will initially be a 90% free allocation of credits to agriculture which means that farmers will be liable for 10% of their livestock emissions. At $25/NZU this will amount to a levy about 3c/kg beef and 6c per kg sheepmeat or 140 NZUs per year in 2015 for this farm. The free allocation of credits will reduce by 1.3% year on year from 2016 onwards. Agriculture will be liable for 43% of emissions by 2050. Figure 1 shows total emission liabilities over time. At $25/NZU, under the ETS, this could amount to about $10,000 per year by 2030.

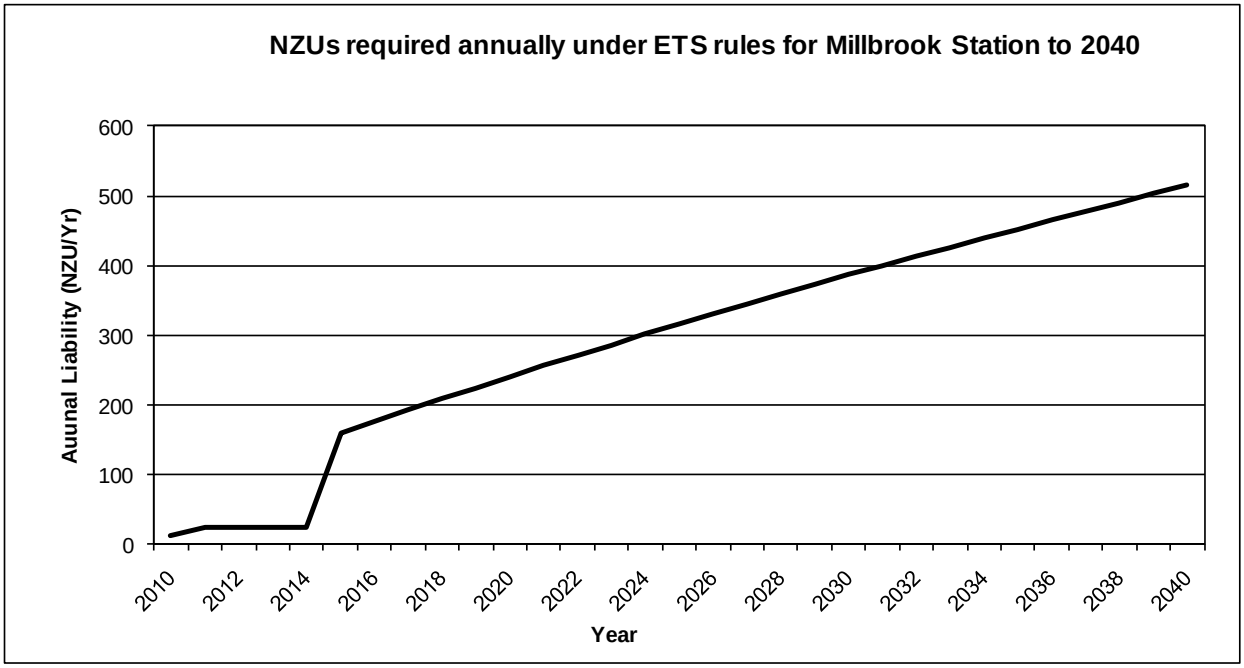

Figure 1 Effect of ETS and time on total annual emissions liabilities for Millbrook Station.

Forestry & the ETS

Given that 97% of farm emissions are from livestock and that little can be done about these emissions apart from destocking, farmers will need to look at strategies to mitigate this cost. Planting trees offers an opportunity to generate carbon credits as trees use the sun's energy to convert carbon dioxide into organic compounds (photosynthesis) - storing carbon. Three schemes have been set in place in New Zealand to capitalise on this, one of which is the ETS. Other schemes include the Permanent Forest Sink Initiative (PFSI), which requires a covenant over the land, and the Afforestation Grant Scheme (AGS). This provides a grant to establish a new forest in return for the rights to the carbon accumulated by the forest for the first ten years. For all schemes, standardised tables describe accumulated carbon based on species, age and in some cases region. These are used to calculate carbon credits during forest growth and liabilities at harvest time. These schemes are operating now and are being used by forest and landowners to account for carbon credits.

How can credits from a forest be used?

Given that the point of obligation will initially be at the processor level, credits from forestry will not directly offset emissions liabilities from livestock. A farmer could plant trees and generate credits from forestry and sell these to offset the cost of emissions. This will in effect be a cashflow or terms of trade effect. As the levy on product (meat) is related to NZU price, which will be related to international price carbon and value of forestry credit, this strategy has potential to reduce business risk as levies and credits are linked through the market price for carbon.

Existing forestry

Fortunately Millbrook Station is eligible to claim carbon credits from existing forest under the ETS. This is because some forest was established on non-forest land after 1989. Existing forest comprises of 20 ha of radiata pine planted in 1995 and 166 ha which has been retired to native forest restoration or "reversion". In 1990 the land was being grazed by goats and sheep and had some gorse but no significant cover of forest species. Critically, less than 30% of the area was covered with forest species and prevailing grazing management would have prevented this area becoming a forest. Had there been 30% or more cover of forest species such as manuka or kanuka, the land would be classed as forest and would not be eligible to enter the ETS to claim annual carbon credits (NZUs).

Carbon storage by trees – some units

Forest carbon management and carbon farming are new areas of expertise so it is important to understand some basics such as the units used. A cubic metre of stemwood from a radiata pine tree approximates a tonne of carbon dioxide (CO_2) and equals an NZ Unit (NZU) which makes calculations easy. A pine tree can accumulate about 2.5 tonne of CO_2 in a 30 year period.

Calculating carbon credits from forests at Millbrook

Standardised "look-up" tables are available to calculate the quantity of carbon accumulated by a forest. These tables are available from MAF (http://www.maf.govt.nz/sustainable-forestry/ets/guide/lookup-table-guide.pdf). At present carbon credits can be claimed from January 2008 onwards. Annual accumulation varies with age, species and location. Radiata pine accumulates approximately 22 tonnes/CO_2/ha/year if left to grow for 50 years. At present a straight line accumulation of 3 tonne/ha/yr is used for native reversion although a newly proposed rate for native reversion amounts to approximately twice that rate.

Forest areas on the Station are currently accumulating a total of approximately 1268 NZUs per year. When agriculture first enters the ETS in 2015 it must meet 10% of its emissions. 10% of Millbrook's emissions will amount to 140 NZUs. This is more than offset by its annual credits from forestry. It is also important to note that over the period between 2008 and 2015 Millbrook will potentially be able to claim 8666 NZUs – these may be sold, or could be retained.

Matching landuse capability with productive land use

A wide range of land types occur in the 1087 ha of Millbrook Station. A landuse capability survey detailed the productivity of the land resource for Millbrook Station. Five distinct Land Management Units were identified. Thanks to Summit-Quinphos, detailed pasture growth, cover and quality has been closely monitored on Millbrook over the last two years. Results for three broad land type categories are shown in Table 2 below. The flat/easy land had annual production of almost three times that of the steep hills. This low productivity steep land was also receiving gorse control from spraying every 3 years at a cost of $600/ha. This combination of low productivity and increased cost results in a negative gross margin on this land type. From this

land use analysis 100 ha was identified for establishment of new forest with proposed planting a range of species including radiata pine, poplars, eucalyptus, Japanese cedar and redwoods.

Table 2 Annual pasture production for three land types at Millbrook (average data from June 2008 to May 2010)

Land Type	Annual Production (kgDM/ha)
Flat/Easy Land	12,950
Rolling Hills	8,776
Steep Hills	4,947

Proposed new forest and farm productivity

Farmax® was used to assess the impact on the productivity and profitability of the livestock operation of changing 100ha of grazing land to forestry. Table 3 shows that average productivity and gross margin is significantly improved by this change. There is less than a five percent reduction in overall farm productivity from a 20% reduction in grazed land area while profitability was improved. Note that the current farm base scenario was developed on the basis of the pasture, livestock and profitability monitoring carried out during the 3 year Meat and Wool monitor farm programme rather than current stock numbers which are lower than usual due to the effects of the drought.

Table 3 Effect of proposed new forest on Millbrook Station productivity

	Current farm	After 100 ha New Forest
Area	478 ha	378 ha
kg Meat per ha	204	261
kg Wool per ha	25	15
kg Total per ha	229	276
$ Gross Margin per kg product	2.07	2.51
kg Total Farm Production	109,468	104,469
$ Gross Margin per hectare	474	693

Given the range of species and areas of the proposed planting and assuming the 100 ha is planted in 2011 accumulation of 23,893 NZUs is possible during the first ten years. At a current market value of $20/NZU this equates to a gross return of $480/ha/year, similar to current returns. Cashflow is required for the initial forest investment which is usually the sticking point for forestry investment given the traditional long wait for returns. However, assuming an average establishment cost of $2000/ha and NZU price of $20, Millbrook Station will have sufficient surplus carbon credits to sell from existing forestry and will be able fund the proposed new forest from carbon income anticipated in the next six years. Furthermore there will be sufficient credits available to address the expected harvest liabilities from the 20ha of pine in 2025.

Millbrook Station is ideally placed to capitalise on the potential returns from carbon while minimising the risks. Establishment of the new forest could be done over several years funded directly from carbon sales so that no extra capital would be required.

There are a range of other benefits from establishing forestry which can also add value to the farm. These include protection of waterways, reduction in soil erosion, provision of shade and

shelter for livestock, an increase in biodiversity, diversity of income from carbon and timber and improvement of the amenity or aesthetic values of a property.

Conclusion

Under current legislation, doing nothing about ETS costs will reduce future farm incomes and potentially the overall value of the farm business. The Millbrook Station example shows how this cost can be mitigated using existing post-1989 forestry. Having access to carbon credits insulates the farm business from the cost of liabilities by neutralising carbon price effects. This could be especially valuable where future carbon prices are high. Average gross margin and productivity is predicted to improve at Millbrook Station from retiring less productive areas of the farm to forestry and focussing inputs on the more productive areas. Given that the bulk of agricultural emissions are difficult to mitigate, forestry offers an opportunity to reduce emission liabilities (and costs) over the medium term (30 to 50 years) while solutions to livestock emissions are developed and implemented.

Forestry provides multiple benefits and forms part of a sustainable land management strategy with positive environmental and economic outcomes. Farming operations which have already integrated forestry established after 1989 are not only more resilient to climatic changes (droughts and floods) but will ideally placed to address the increased costs imposed by the ETS.