Dairy Industry under New Zealand's Emissions Trading Scheme:

Analysis of farmers' attitudes towards climate change; the expense created by the NZETS and the point that farmers will begin to reduce emissions

By

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Content

Abstract

Adaptation to actual climate change and contingency planning to reduce vulnerability from likely climate change effects is crucial for the New Zealand dairy industry. Thus in alignment with international treaties and growing international pressure and speculation, the New Zealand Government in October 2007 announced an Emissions Trading Scheme (ETS) adaptable specifically to the New Zealand scene. This ETS passed into law in September 2008 through the enactment of the Climate Change Response (Emissions Trading) Amendment Act 2008.

This thesis specifically looks at agriculture related emissions and calculates the liability faced by the dairy industry come 2013 when the industry is completely involved in the ETS. The purpose of this is to further aid the industry so that it can best align itself with the ETS in order to minimise this liability. This is not simply an aid to help the industry save money, as the minimisation of liability should come as a benefit to the environment through reduced emissions. There is also a second issue associated with this – as to whether the liability faced by the industry will be material enough in order for the farmers to actually mitigate their environmental impacts or will they simply bear the expense and ignore the opportunities to reduce their emissions against a baseline (and potentially generate carbon credits for sale) and/or offset any residual emissions through purchasing carbon credits? This therefore analysed the threshold of farmer's incomes whereby they will choose to abate their emissions rather than simply paying for their carbon emissions liability. This threshold obviously varied greatly through the dairying industry with differing factors – this was taken into account and discussed in detail. Other aspects influence this threshold also, factors such as the opportunity for the industry to market a niche product if they do achieve a low carbon or carbon neutral status for their products, cost competitiveness of available abatement technologies, geographical issues pertaining to each abatement method and so on.

In order to gain an insight into farmers' perceptions 23 Taranaki dairy farmers were interviewed. This 23 was selected randomly from a list of farmers who reside in the geographical area of Taranaki. This randomisation allowed for an analysis of a variety of size of farmers which eliminated a bias of perceptions from dominating farming sizes within this region.

Utilising the theoretical framework surrounding stabilisation triangles, riparian management and nitrification inhibitors were the basis of this examination for emissions reduction management due to their major co-benefit of improved water quality alongside the ultimate goal of emissions reductions. The extent of potential mitigation through the implementation of riparian management and nitrification inhibitors equates to two of the wedges required for the overall reduction in emissions under the ETS. Also, as explained earlier, the co-benefit of improved water quality associated with riparian management and nitrification inhibitors make their implementation even more attractive.

The theory behind riparian management and nitrification inhibitors has mostly been done, therefore for the purpose of this thesis, farmers' perceptions of the abatement options were examined. These perceptions included the associated opportunities as well as the challenges that will be faced by those participating farmers.

Introduction

The Earth's climate is changing at an increasingly rapid rate, largely due to ongoing high rates of greenhouse gas emissions caused by human activity. Even with concerted global effort to reduce greenhouse gas emissions there are likely to be changes in temperature and rainfall patterns, increases in the number of significant wind and storm events, and an increased risk of flooding and coastal erosion. These impacts have flow-on effects for air and water quality, the retention of nutrients in soils, and preserving biodiversity.

Source: Emissions Trading Scheme (2007)

In alignment with international treaties and growing international pressure and speculation, the New Zealand Government in October 2007 announced an Emissions Trading Scheme (ETS) adaptable specifically to the New Zealand scene. This ETS design targeted specific sectors of society within the New Zealand economy to reduce their associated emissions. The Government decided to use this economic instrument as it provides strong incentives to reduce emissions (ETS, 2007). The Climate Change Response (Emissions Trading) Amendment Act (the Act) was subsequently passed in September 2008 and received Royal Assent on 25 September 2008 enacting the New Zealand Emissions Trading Scheme. Following a change in government in November 2008 the Act was re-examined by the incoming administration.

The purpose of the legislation was to:

(a) Enable New Zealand to meet its international obligations under the Convention and the Protocol;
(b) Provide for the implementation, operation, and administration of a greenhouse gas emissions trading scheme in New Zealand that supports and encourages global efforts to reduce greenhouse gas emissions by assisting New Zealand to meet its international obligations under the Convention and the Protocol, and by reducing New Zealand's net emissions below business-as-usual levels. Source (ETS, 2007)

The agriculture specific parties liable under the Act for agriculture had not been decided but arguments exist for this to be applied at the farm level or for it to be applied to the Fonterra or fertiliser company level.

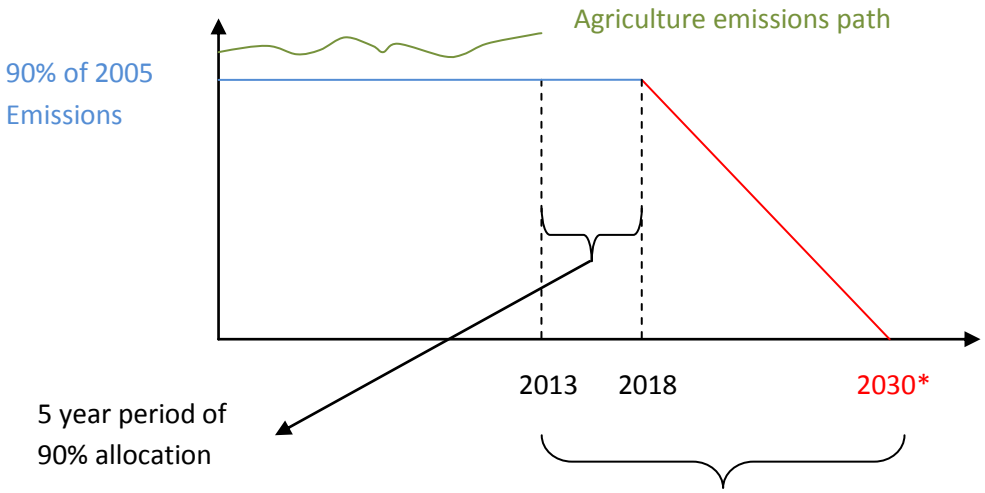
Although New Zealand's emissions are low in relation to global emissions (approximately 0.2 to 0.3% (ibid)), we have the 11th highest in the developed world (ibid). A significant factor with New Zealand's emissions is that of the composition of what we are emitting. Nearly half of our emissions come from our major exporting industry – agriculture, which emits 49% of our total emissions, this is extravagant considering the developed world's average is 12% (ibid).

The purpose of this study was to examine the likely impacts of the NZ ETS (as designed by the government in 2008) on dairy farmers, and determine the extent to which the price signal it encompassed would likely be sufficient to incentivise a change of farm management behaviour among dairy farmers in the Taranaki Region. However, since this study was designed in early 2008 the ETS legislation has transformed from a proposal, to a Bill, to an Act, to a re-examined Act. The option of an ETS instrument being used for agricultural emissions reduction is therefore now in review.

In spite of the fact that the policy context for this research has changed, the value of the research as an aid to policy development remains valid, and even more so given that the government is yet to decide on how it will approach agricultural emissions reduction. Indeed, given that the NZETS instrument is now under review, the original purpose of the thesis remains valid. In particular, this research explores the extent to which the liability faced by the industry will be material enough in order for the farmers to actually mitigate their emissions or will they simply bear the expense and ignore the opportunities to reduce their emissions?

This study therefore, analysed the threshold of dairy farmers' incomes whereby they will choose to abate their emissions rather than simply paying for their carbon emissions liability. This threshold will obviously vary greatly through the dairying industry which was taken into account and discussed in detail. Other factors also influenced this threshold, such as the opportunity for the industry to market a niche product if they do achieve a low carbon or carbon neutral status for their products. An analysis of commercially available abatement options facing farmers relating to all agriculture related emissions was conducted. Several options face farmers currently for abating CO_2 and NO_X whereas abatement technologies for methane are yet to be developed and commercialised. Stabilisation triangles, riparian management and nitrification inhibitors formed the conceptual framework basis of this examination for emissions reduction management options due to their major co-benefit of improved water quality alongside the ultimate goal of emissions reductions. The original ETS design presents two phases to this issue - pre-liability (2013) and post-liability (after 2013) which links in with the end of the first commitment period under the Kyoto Protocol, due to the nature of allocation of NZ units to the agricultural industry under the 2008 ETS design.

Figure 1: Allocation of units under the current ETS:



This is where the opportunity and liability to the industry lies – this is where the crux of the success of the ETS for agriculture.

*2030 is the date at which the ETS prescribes that the industry's free allocation of units will cease on a linear pattern from 2018 after a five year period of 90% allocation.

Projected Agricultural Emissions

The following emissions projections are based on modelling done by the Ministry of Agriculture and Forestry (2006). Projections are calculated from total animal numbers, species balance changes, increasing animal performance and future application rates of nitrogenous fertilisers (MfE, 2006). MfE projected out to 2010 for emissions based on the fact that this is the halfway point towards the end of the first commitment period for the Kyoto Protocol (2012) from the date of publication. Total emissions from the agriculture sector were projected to range between 180.3 Mt CO_2-e (Million tonnes carbon dioxide equivalent) and 222.2 Mt CO_2-e (with a 'most likely' projection of 198.8 Mt CO_2-e) over the first commitment period (ibid). Average annual emissions over this first commitment period were projected to range between 36.1 Mt CO_2-e and 44.4 Mt CO_2-e (with a 'most likely' projection of 39.8 Mt CO_2-e illustrated in figure 1a (ibid).

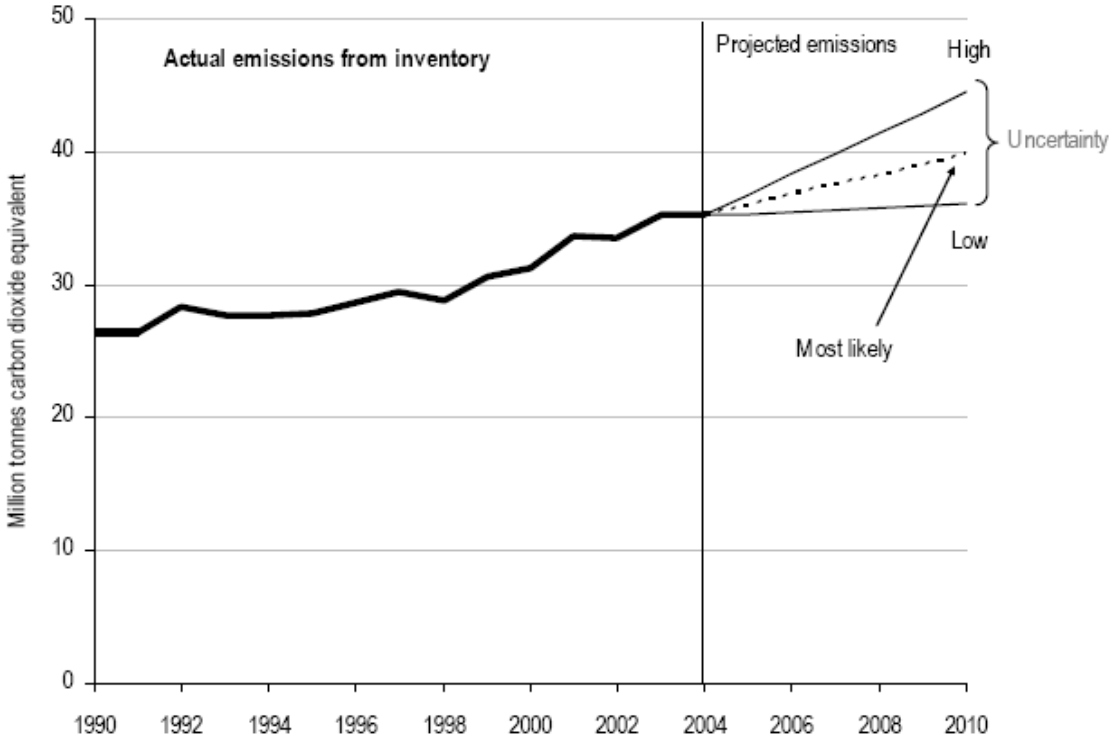


Figure 1a Agricultural emissions projected for 2010 and emissions from the agriculture sector as reported in the national inventory
Source: MfE, 2006

Aim and Research Questions

Under the New Zealand Emissions Trading Scheme, of the commercially available abatement technologies, what is the level of farmers' knowledge and likelihood of uptake in order to reduce emissions and any associated liability? Subsequently, will this liability be sufficient in order to induce on farm abatement and how does this abatement tie into the realm of sustainability?

Objectives

Objective 1) *What is the range of the liability faced by the agricultural industry under the ETS come 2013?*

Objective 2) *How can the above liability be reduced, specifically concentrating on the emissions avoided, relating to the implementation of riparian zones and nitrification inhibitors?*

Objective 3) *What is the attitude of farmers towards these abatement methodologies and will the liability simply be overlooked due to immateriality?*

Objective 4) *How does this emissions abatement tie into themes of sustainability, social responsibility and sustainable development reporting?*

The thesis will therefore analyse the threshold of farmers' incomes whereby they will choose to abate their emissions rather than simply paying for their carbon emissions liability. This threshold will obviously vary greatly through the dairying industry with differing factors – this was taken into account and discussed in detail. Other aspects could influence this threshold also, factors such as the opportunity for the industry to market a niche product if they do achieve a low carbon or carbon neutral status for their products.

Several options for abating CO_2 and NO_X are available to farmers currently but as is further revealed and discussed, the abatement technologies for methane are seriously lacking the scientific backing that others have received and is thus a major downfall of the current ETS.

Methodology

Abatement Option Selection Method

This thesis focuses on two methods of reducing dairying related emissions rather than looking at the broad spectrum of emissions associated with agriculture. It appears prudent to concentrate on the benefits received from the implementation of riparian margins where benefits are experienced in water quality of the streams that these margins are bordering. The other method that was concentrated on that is available to the agricultural industry in order to minimise their effects on the environment is that of nitrification inhibitors. These are applied in conjunction with the application of nitrogen based fertilisers and work to minimise the impacts associated with a variety of side effects. Both comprise benefits of improved water quality thus providing a rationale for selecting these two abatement options over others available to the industry.

Interview Methods

Due to the nature of the efforts to abate emissions being via individual farmers at the ground level, 'on-farm' analysis was undertaken, in order to gain an insight as to the possibility and likelihood of emissions abatement knowledge and uptake. This took the nature of an analysis of farmers' attitudes towards the liability, as due to the nature of the liability, certain farmers may bear the brunt of the costs and ignore the potential other benefits to the environment because of their efforts to offset their liability. In order to gain a greater insight into farmer's attitudes the ETS was presented to the farmers in the form of a simplified personal representation specifically relating to the dairy industry (see appendix iii). This enabled a more informed sample of answers and eliminated the opportunity for farmers to act as though they were unaware of the ETS and its effects and opportunities. The analysis of farmers' attitudes and actions towards meeting the obligations imposed by the ETS was via face-to-face interviews. This formed the analysis of the threshold of farmers' incomes that initiated environmental mitigation rather than simply paying the expense. This required the construction of an interview and approval was sought from the Victoria University Ethics Committee to conduct this (Memorandum of Ethics Approval supplied as appendix iv to this Thesis).

Dairy farms from the region of Taranaki were the target for these interviews. This therefore enabled a greater analysis of these farmers' attitudes because they are under the jurisdiction of one Regional Council. If the farmers were to be chosen at random from different regions, different Regional Council's attitudes, awareness and commitment to dairying related emissions abatement would have to come into consideration.

A list of Taranaki dairy farmers and their contact details were obtained and entries were numbered. 100 farmers were then chosen at random, these farmers were contacted via a letter and a summary of the ETS was provided. In order to obtain the right to interview, farmers were contacted from this list of 100 in order of the random selection that occurred above until the 20 required were scheduled. 23 interviews took place over a two week period for the purpose of this thesis. The semi-structured interview questions are supplied as an appendix to this thesis.

Liability Calculation Method

In order to best illustrate the full picture faced by the industry, a scenarios based approach outlines the differing liabilities associated with differing levels of adherence and uptake by the industry to the ETS. Scenario development also ties in to the use of the stabilisation triangle framework as will be seen later.

A multitude of previous emissions reduction liability calculations and methods was examined and utilised in order to illustrate the likely liability faced by the dairy industry. These calculations and methodology vary so greatly because of the fluctuating nature of carbon prices and the incubative stage that the ETS is at. This was answered by deriving information from peer reviewed articles (where possible) and data that has emerged from similar initiatives internationally. These calculations were also vary considerably due to the fact that several scenarios were needed to be represented as these calculations are forecasts and emissions trajectories are not known.

Price/Cost Ambiguities

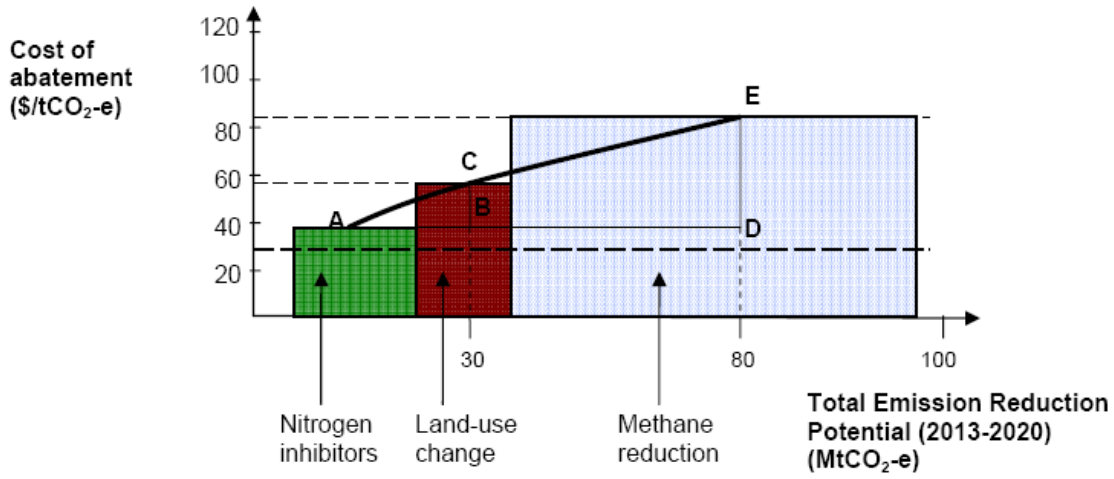


Figure 2 Indicative Abatement Cost Curve for Agriculture
Source: Sustainability Council (2008)

In order to illustrate the abatement options facing an individual farmer, Treasury developed a hypothetical abatement cost curve (indicative through the line AE) in figure 2 (Treasury, 2007). With the world price for carbon dioxide equivalent at NZ$30 (lowest dotted line) Treasury believed there are no abatement options available below this line – thus abatement comes at a cost to the emitter. But as the total world price for carbon dioxide equivalent increases, so too does the total emissions reduction potential as cheaper methods of abatement become attractive in terms of price. At what the Treasury deems as a 'mid-range' price of NZ$55 of CO_2e there would be 30Mt of abatement and at NZ$85 the abatement would increase to 80Mt consisting of some land-use change and some methane reduction uptake (ibid). The benefit to society at 30Mt of reduction pertains to the triangle ABC and at 80Mt of reduction the triangle ADE – Treasury describes this benefit to society as increases in net national wealth (ibid). In terms of actual costs compared to the costs depicted above, the improvements experienced in water quality and other benefits make each abatement option that bit more cost effective and efficient.

Conceptual Framework

Background behind co-benefits of emission mitigation and improved water quality

This section will lay the conceptual framework for the co-benefit of improved water quality inherent within the implementation of riparian management and nitrification inhibitors outside of the emissions abatement under the ETS. The two abatement options of riparian management and nitrification inhibitors could have been replaced with other options available to farmers for mitigating their emissions, but the bonus of receiving a co-benefit of improved water quality made these two a more attractive proposition for the purpose of this research.

In order to satisfy the requirements of the ETS, riparian zones must be 15 metres (Wilcock et al 2008) either side of a watercourse which creates a significant zone in order to sequester carbon emissions and the water quality benefits about to be discussed below.

Riparian Management

> *Riparian management can take several forms, from simple fencing and exclusion of stock to a multi-tier system involving grass buffer strips, production forest, and native forest plantings nearest the stream edge. The riparian buffer zones of most benefit to carbon sequestration would be those of forest tree species. However, periodic biomass removal/replanting of components of the buffer are expected to enhance the long-term maintenance of the nutrient removal capacity of buffer systems (ibid, p30).*

Riparian zones have a diverse range of immediate benefits to the state of a waterway's ecosystem. Apart from the obvious benefits of shade induced temperature change, riparian zones also aid in inhibiting runoff entering waterways, through enhanced infiltration and interception, directly from agricultural processes which can cause eutrophication or contamination of the waterway. These zones also provide habitats for certain birds and insects which enhance the state of the overall ecosystem.

Riparian zones have to be established on 90% of New Zealand dairy farms under contract from dairying co-operative Fonterra by 2012 through their 'Clean Streams Accord' (Fonterra, 2006). This level of commitment gives an initial indication of how influential riparian zones can be upon their immediate environment in the agricultural sector.

A riparian margin is defined as being

"the land beside the stream that interacts with (1) runoff from hillslopes and (2) streamwater when this overflows into the floodplain. The vegetated riparian zone can affect the stream by intercepting runoff, and thereby improving water quality, by providing shade, leaf matter and wood, and stabilising stream banks" (MAF, 2004).

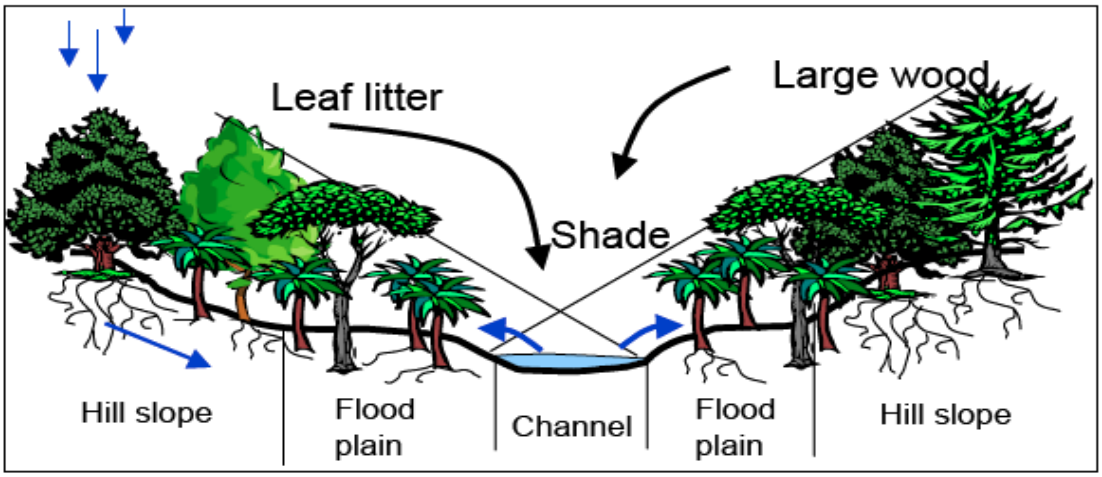


Figure 3 Illustration of a typical riparian zone

Source: MAF Technical Paper 2004-05

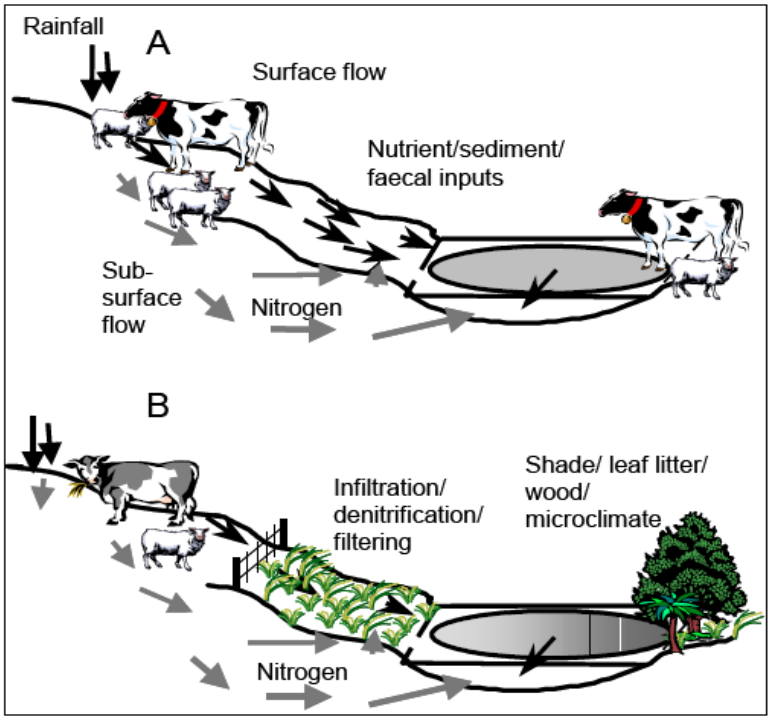


Figure 4: (A) Inputs of direct and diffuse sources of contaminants to pasture streams; (B) implementation of riparian management through fencing allows infiltration, denitrification and filtering of contaminants from flows (except for deep sub-surface

Source: MAF Technical Paper 2004-05

Figure 4 gives a good diagrammatic representation of how a riparian margin acts upon improving the quality of water within a defined waterway. The following will explore some of the physiochemical benefits of implementing riparian management.

Physiochemical Benefits from Riparian Margins

Faecal Coliforms

Once implemented riparian margins will immediately bring benefits to the waterways quality. This can be through the action of prohibiting stock gaining access to the stream or river, whereby fencing off the plantation and thus the entire margin prohibits stock from entering the stream bank.

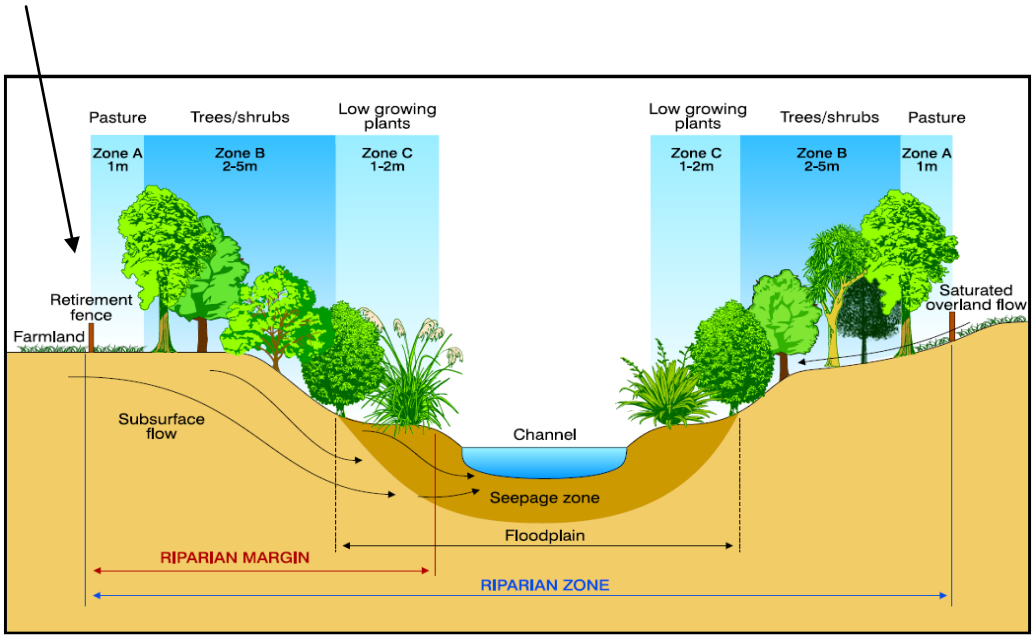


Figure 5 Typical riparian zone cross-section on New Zealand Dairy Farm
Source: Taranaki Regional Council 2001

The prohibition of stock directly entering the waterway eliminates any chance of direct faecal contamination into the channel of the waterway. Direct contamination is the most potent source of pollution and is of the most common form of contamination. Cow faeces are said to be a reservoir for *Escherichia coli (E. coli)* (Hussein, 2000) which is of most concern when sampling for quality within the requirements of the drinking-water standards for New Zealand.

A study compiled by the Ministry for Agriculture and Forestry found the following results when observing several herds of dairy cows:

Table 1 Average number of defecations per cow per day
Source: MAF Technical Paper 2002

Defecations in the water	0.11
Defecations on the bank	0.09
Defecations in the riparian zone	0.2

With the alarming results showing that, on average, 0.11 defecations would be made per day per cow directly into the waterway and 0.2 defecations directly into the riparian zone (ibid).

This equated to the following percentages of defecations within riparian zone to outside zone defecations (ibid):

Table 2 The average percentage of cattle defecation in the water, on the bank, and in the riparian zone.
Source: ibid

	Average percentage
Defecations in the water	8.3
Defecations on the bank	6.3
Defecations in the riparian zone	14.6

Also with the alarming result that, on average, a cow would defecate 8.3% of the time directly into the waterway, and 14.6% of the time within the riparian zone [2m demarcated the riparian zone for the purpose of this study] (ibid).

The Ministry for Agriculture and Forestry ran controlled tests whereby known potencies of *E. coli* were released onto pasture and outflow and *E. coli* levels were recorded at certain time intervals, as illustrated in figure 6 below (Ministry of Agriculture and Forestry Technical Paper 2002/16):

It becomes apparent that the influence of riparian margins restricts the initial flush of surface flow by hindering its path, thus the journey of the water to get to the waterway is longer.

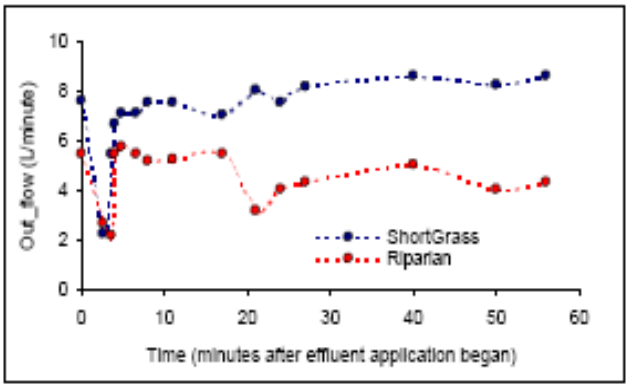


Figure 6 Outflow levels after certain time intervals
Source: ibid

The initial surge of *E. coli* is almost as high with and without riparian vegetation but the difference occurs after 40 minutes whereby *E. coli* levels increase again with no riparian vegetation but continue to decrease under riparian conditions.

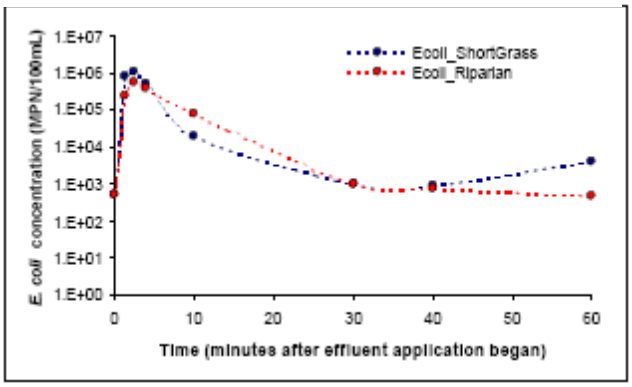


Figure 7 E. coli levels after certain time intervals
Source: ibid

Temperature

The following refers to a study completed by Parkyn et al (2003) whereby the study evaluated nine riparian schemes in the North Island of New Zealand ranging from 2 to 24 years post implementation. Figure 7 illustrates the results from temperature loggers within eight of these nine schemes with additional data collected from a 'control' site located upstream of the 'buffer' site. Within each substratum category there appeared to be a decrease in temperature with increase in age of the riparian buffer zone scheme – as illustrated by – – – on the figure 8:

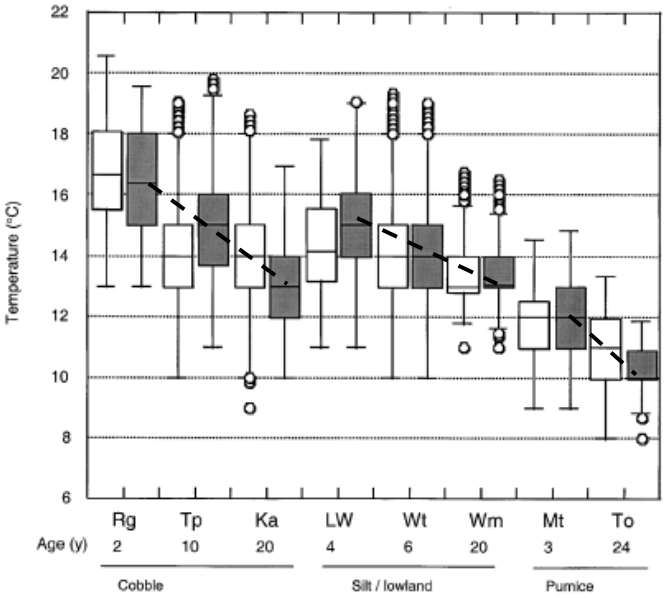


Figure 8 Temperature data for up to 3 weeks of continuous monitoring at the control (open) and buffer (shaded) reaches of each site.
Source: Parkyn et al, 2003

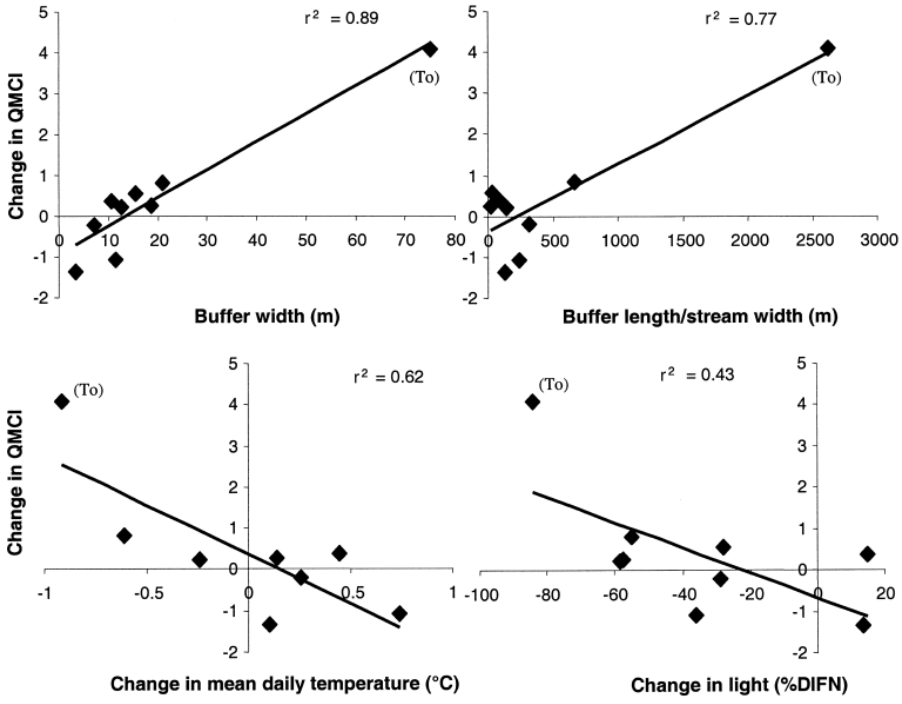


Figure 9 Change in quantitative macroinvertebrate community index (QMCI) scores between buffer and control reaches versus changes in temperature, light, buffer width, and length of the buffer (normalized by stream width).
Source: ibid

Figure 9 above illustrates how stream health is affected by four variables. The measure of stream health is the quantitative macroinvertebrate community index (QMCI) (Stark, 1999). This index combines sensitivity to pollution scores for individual taxa with their densities from each sample (Parkyn et al, 2003). All four variables improved markedly with change in the variable measured. The most significant was the observed change in temperature, lowered with riparian buffering, affecting QMCI.

In regard to the Parkyn et al (2003) study, it was found and is illustrated in figure 10, that the benthic invertebrate community composition showed constant change between the 'control' sites to the 'buffer' (riparian planted) sites (Parkyn et al, 2003) where pollution sensitive taxa (top left corner of ordination plot) were more abundant than less sensitive taxa (bottom right corner). This leads to the fact that improvements seen with riparian buffer zones can only improve with length and continuity of the riparian zone. This was found in two studies by Storey and Cowley (1997) and Scarsbrook and Halliday (1999) which recorded improvements in EPT (*Ephemeroptera*, *Plecoptera* and *Trichoptera* - pollution sensitive taxa), MCI and QMCI indicies with distance into forest remnants.

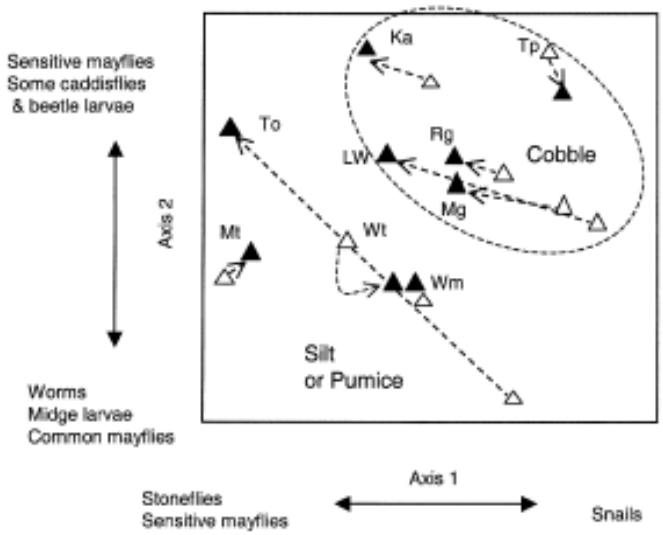


Figure 10 An ordination plot of invertebrate community composition at the control (open symbols) and buffer (shaded symbols) reaches. Arrows indicate the direction of change between each paired site. ***Source: ibid***

Parkyn et al (2003) postulated several factors necessary for improvements in stream ecological health – temperature; development of shade; age of buffers; and buffer lengths (Parkyn et al, 2003). Shade emerged as the crucial element resulting from riparian buffers whereby 75% cover equates to a 5°C change in stream temperature (Parkyn et al, 2003) with length of the buffer exacerbating this change.

Evapotranspiration

Riparian margins have an important influence upon evapotranspiration (ET) and the flow on effects onto catchment water quality and water losses (Petrone et al, 2006).

Petrone et al (2006) postulate several crucial factors that riparian ET can influence, the most influential being soil water storage potential and thus total catchment discharge/runoff (Petrone et al, 2006), thus affecting total catchment hydrology including available water sources downstream and water availability for abstraction purposes (whether for agricultural or anthropogenic uses). Riparian zones exert stream water quantity and quality regulation functions within agricultural catchments (MacNish et al, 2000).

Riparian zone ET affects water quality through the function of drying out surface soils intermittently between precipitation events (Petrone et al, 2006). This drying of the soils enables the soil profile to absorb large volumes of precipitation during rainfall events preventing direct surface runoff into the waterway. This is particularly important in agricultural catchments whereby overland flow usually contains contamination, and without riparian zones, this contamination enters the waterway directly with no interception. The hydrologic cycle is determined by ET levels within catchments and thus nutrient cycling, nutrient retention and/or transport depends on this hydrologic balance dominated by ET (Lafleur, 1990).

ET effects are dependent upon antecedent conditions, thus vary between catchments, but have general benefits applicable to the implementation of riparian management. But several studies tend to suggest that the influences from riparian ET levels remain constant between riparian sites (Petrone et al, 2006). Petrone et al (2006) postulate that in management and modelling applications it is safe to consider riparian zones as homogeneous landscape units in terms of generating ET estimates (Petrone et al, 2006).

Other Benefits

There are a range of other benefits associated with the implementation of riparian zones. One of those is the benefit of widening the streambed (Davies-Colley, 1997). This widening of the streambed means that less stored sediment remains on the banks of the stream lessening the capacity of *E. coli* to remain in these silt deposits and being released during future disturbance events, as illustrated below in figure 11.

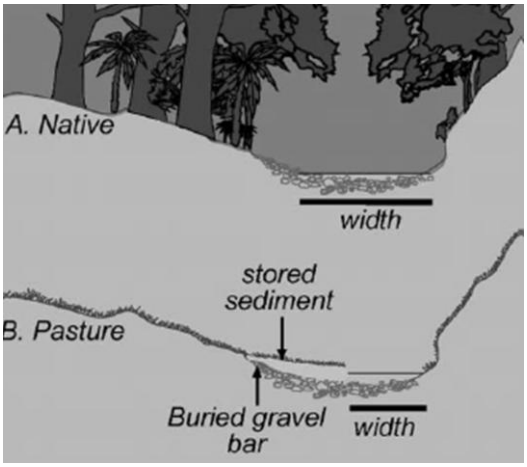


Figure 11 Change in stream channel width from native forest (A) to pasture (B)
Source: MAF Technical Paper , 2004

Associated Disadvantages with Riparian Zones

Riparian margin implementation, along with most pollution mitigation efforts, generates some unavoidable associated disadvantages or costs, as follows.

Associated with shade induced reduction in stream temperature is the disadvantage of losing possible in-stream plant growth that 'processes' the nitrogen and phosphorus within the water column from upstream sources. Riparian shade limits the primary production of macrophytes and algae that have the capacity to assimilate dissolved nutrients from the waterway (Rutherford et al, 1999). Thus, upstream compliance is essential. Limiting the nutrients entering the headwaters of any waterway will eliminate this problem.

The idea of full-catchment compliance is crucial because detrimental activity occurring upstream in any catchment will continually result in annulment of any mitigating efforts. Another problem that has been discovered is that *E. coli* tends to be 'stored' in silt deposits on the bed of waterways. These 'stored' faecal coliforms are then carried downstream during disturbance events (Nagels et al, 2002) and again void any attempts made downstream.

It has also been noted how riparian zones can act as habitat corridors for certain species including pest species. This is a particular problem where the waterway exits a national park onto farmland and thus 'unwanted' species can enter the national park via these riparian corridors seemingly unnoticed and avoid exclusion measures.

Nitrification Inhibitors

Nitrification inhibitors (NI) are applied in conjunction with the application of nitrogen based fertilisers. NIs main impact is that of reducing the greenhouse gas nitrous oxide (N_20) by slowing the actions of soil bacteria (Terry, 2007). The version of NI researched in Terry (2007) is that of dicyandiamide (DCD). NIs also reduce the production of nitrates in agricultural soils which in turn reduces leaching and denitrification (PGGRC, 2006). This impediment of leaching has obvious benefits of decreased eutrofication of waterways and lakes with effectiveness ranging from 60% to 70% (PGGRC, 2006).

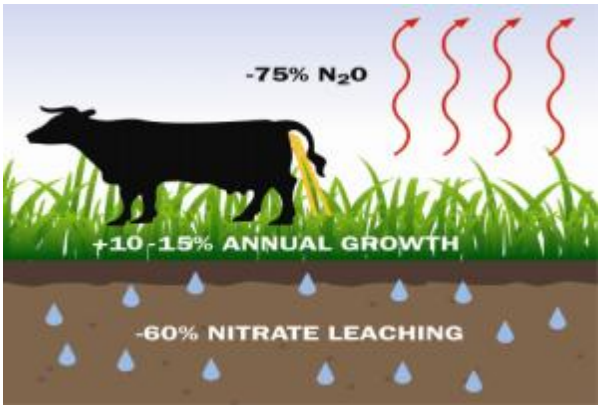


Figure 12 Effect of Nitrification Inhibitors
Source: PGGRC, 2006 (cited in Terry, 2007)

NIs also have the benefit of increasing pasture production through retaining higher levels of nutrients in the soil and thus requiring less frequent applications of fertiliser to achieve the same pasture gains (ibid). Terry reports gains in pasture production ranging between 10% to 15% (ibid). Early studies show that the application of 'eco-n' – a Ravensdown product, costs $124 per hectare per year, but farmers can count on $140 per hectare in reduced fertiliser costs - a $16 per hectare initiative whilst achieving the same level of pasture production through a substitute applicant (ibid).

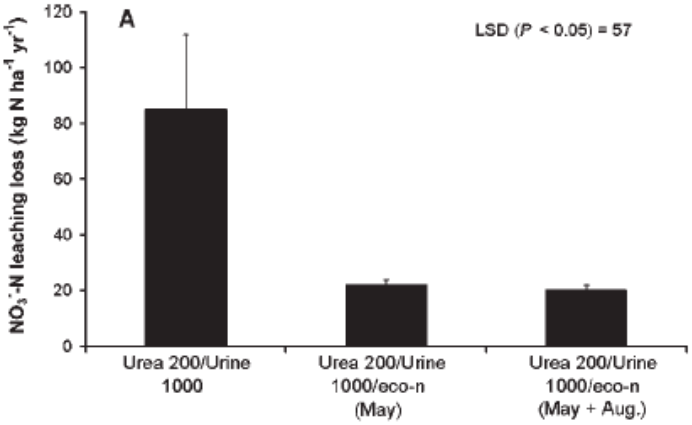
Terry (ibid) asserts a reduction of 3.7 megatonnes of carbon dioxide equivalent in the year 2010, or 9.3% of the expected total agricultural emissions through the use of the inhibitor DCD on all dairy farms in New Zealand (ibid). This calculation is based on the New Zealand Government's 2006 reporting of its 2010 Kyoto Protocol liability projection (ibid).

Table 3 illustrates differing scenarios, incorporating the use of maize feeding and stand-off pads and the resultant emissions abatement effectiveness. Terry (2007) emphasises that adding the combination of techniques below to the use of NIs should not alter its economics or proportionate effectiveness – that is the primary interaction to be allowed for is that the NI will have less nitrogen loaded urine to act on and so the quantity it can abate will be less.

Table 3 Differing Scenarios and Resultant Emissions Abatement Effectiveness
Source: Terry, 2007

Scenario description	Annual N2O emissions abated in first period (Mt CO2e)	Proportion of sub-sector emissions abated %	Proportion of agricultural emissions abated %	Proportion of national emissions abated %
Baseline Scenario				
1. Inhibitor 70% effective	3.7	57	9.3	4.6
Low Inhibitor Effectiveness Scenarios				
2. Inhibitor 50% effective	2.8	44	7.1	3.6
3. Inhibitor 50% effective, standoff pad 10%	3.1	48	7.7	3.9
4. Inhibitor 60% effective, standoff pad 10%	3.5	54	8.7	4.3
Expected Inhibitor Effectiveness Scenarios				
5. Inhibitor 70% effective, standoff pad 10%	3.9	60	9.7	4.8
6. Inhibitor 70% effective, maize feeding 22%	4.1	63	10.2	5.1
Enhanced Scenarios				
7. Inhibitor 70% effective, standoff pad 19%	4	62	10.1	5.0
8. Inhibitor 70% effective, maize feeding 29%	4.2	65	10.5	5.2
9. Inhibitor 70%, standoff pad 10%, maize feeding 22%	5.2	67	13.2	6.6
10. Maize feeding 29%, standoff pad 19%	1.8	28	4.5	2.3

The 3.7 Mt of emissions abated above equates to a value of about $440 million over the next four years to the end of 2012 towards the commitment date for agriculture (based on the current 2008 carbon price of $30/tonne, based on international carbon credits which are priced at about $38 per tonne of CO_2 equivalent) (ibid).



In terms of applying this to water quality improvements, a 2004 study by Di and Cameron reports some remarkable results. This study looked at a deep sandy soil and experienced reductions in nitrous oxide leaching from 8.5 to 20-22 kg N ha^{-1} y^{-1} which equates to a 74-76% reduction by treating the soil with eco-n (ibid). Di and Cameron also reported an increase in dry matter yield by 15-33%. This was due to increased nitrogen availability to plants through decreased nitrous oxide leaching loses (ibid). These can be seen in figure 13 where total leaching losses dramatically decrease with the application of eco-n and the pasture yield increased.

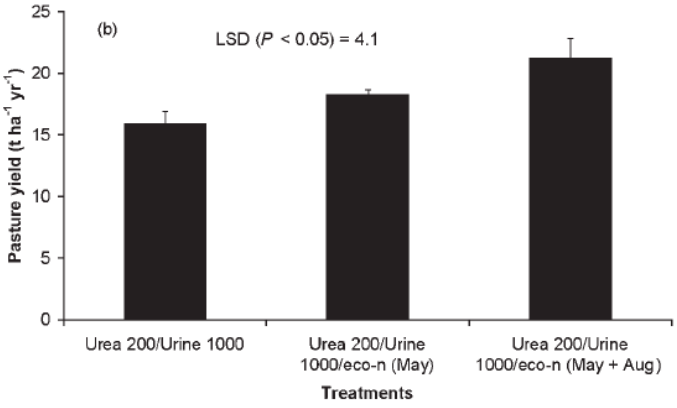


Figure 13 A Total leaching losses of NO3- and B Total annual herbage yield. Vertical bars are the standard error of the mean.
Source: Di and Cameron, 2004

Marginal Abatement Theory

A marginal abatement curve (MAC) plots the "shadow prices corresponding to constraints of increasing severity at time T against the quantity abated" (Ellerman et al, 1998, p3). Figure 14 shows one point (q, p) - the marginal cost for 'region R' of abating an additional unit of carbon emissions. The hatched area under the curve represents the total abatement cost to 'region R' for the reduction of q at time T (ibid).

An emissions reduction target for any farmer is represented as a point along the MAC. "If several [farmers] commit to achieve emissions reductions concurrently and if the marginal costs associated with those reductions differ, the aggregate cost of meeting that commitment will be less, to the extent that a [farmer] with higher marginal costs can induce a [farmer] with lower marginal costs to abate more on its behalf. By abating more, the lower cost [farmer] creates 'rights to emit', or emissions permits [NZ units], which it can sell to the higher cost [farmer]" (ibid).

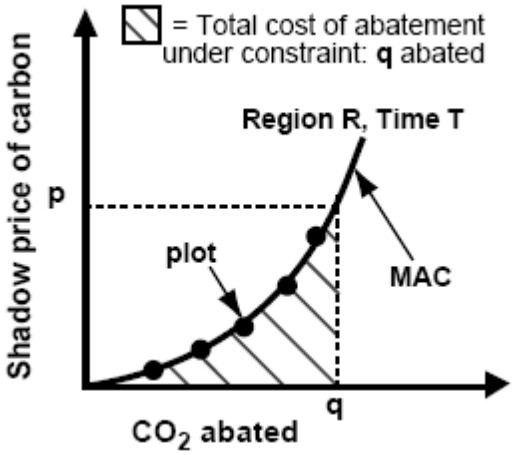


Figure 14 Marginal Abatement Curves
Source: Ellerman et al, 1998

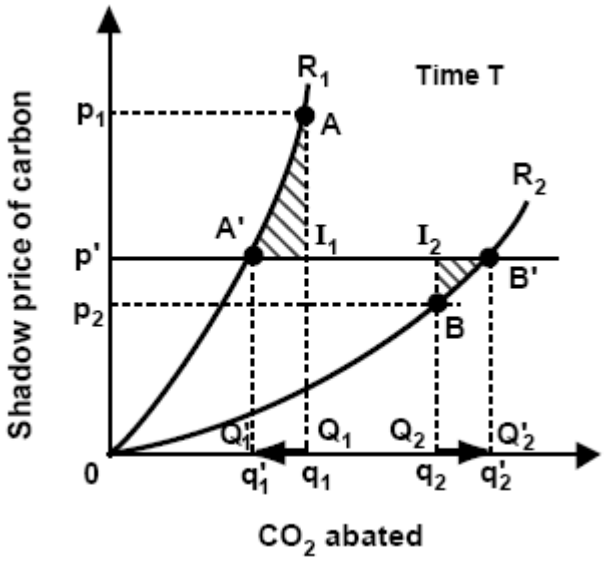


Figure 15 Marginal Abatement Curves Used for Trade
Source: ibid

Table 4 Accompanying Table to Figure 2
Source: ibid

	No Trade	Trade between R_1 and R_2
Constraints	R_1: q_1 abated R_2: q_2 abated	R_1 and R_2: $q_1 + q_2$ abated
Marginal Cost / Market Price	R_1: p_1 R_2: p_2	R_1 and R_2: p' such that $p'_1(q'_1) = p'_2(q'_2) = p'$ and $q'_1 + q'_2 = q_1 + q_2$
Abatement Cost	R_1: area AOQ_1 R_2: area BOQ_2	R_1: area $(A'OQ'_1)$ R_2: area $(B'OQ'_2)$
Emission Permits Trading	NA	R_1: buys right to emit $q_1 - q'_1$ R_2: sells right to emit $q'_2 - q_2 = q_1 - q'_1$
Imports (+) / Exports (–) Flows	NA	R_1: pays $p' \times (q_1 - q'_1)$ = area $(A'I_1Q_1Q'_1)$ to R_2 R_2: receives $p' \times (q'_2 - q_2)$ = area $(B'I_2Q_2Q'_2)$ from R_1
Total Cost	R_1: area AOQ_1 R_2: area BOQ_2	R_1: area $(A'OQ'_1)$ + area $(A'I_1Q_1Q'_1)$ < area (AOQ_1) R_2: area $(B'OQ'_2)$ – area $(B'I_2Q_2Q'_2)$ < area (BOQ_2)
Savings from Trading	NA	R_1: area (AI_1A') (hatched) R_2: area (BI_2B') (hatched)

Stabilisation Triangle Theory

Socolow and Pacala (2004) propose that stabilisation triangles can address the overall climate change problem. As can be seen in figure 16 they plotted time against fossil fuel emissions and the gap between the 'business as usual' line and the line representing desired emissions for stabilisation represents a rough stabilisation triangle. Stabilisation triangles therefore assess the potential of various mitigation strategies (ibid).

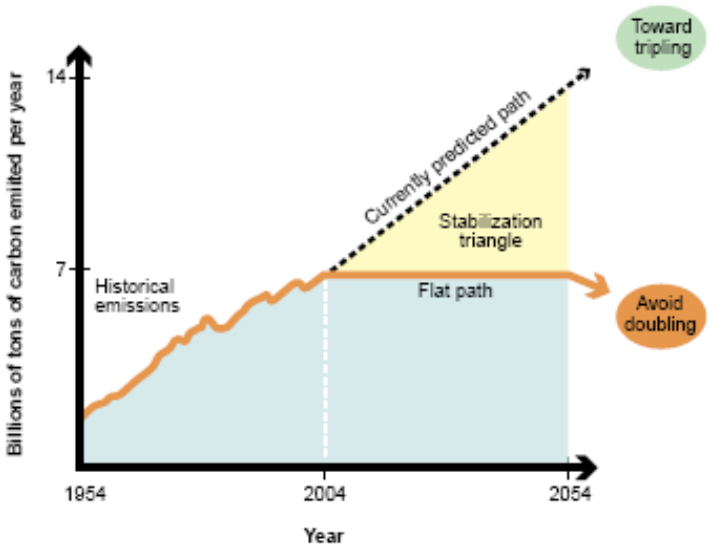


Figure 16 Historical carbon emissions with two potential pathways for the future
Source: Socolow et al 2004

This monumental triangle can be broken down into smaller more manageable requirements known as stabilisation wedges as shown in figure 17 below.

This can be applied to the dairy sectors mitigation requirements under the ETS whereby each wedge of the entire stabilisation triangle is a different abatement option.

Mitigation Wedges

The extent of potential mitigation through the implementation of riparian management and nitrification inhibitors equates to two of the wedges required for the overall reduction in emissions under the ETS. Also, as explained earlier, the co-benefit of improved water quality associated with riparian management and nitrification inhibitors make their implementation even more attractive.

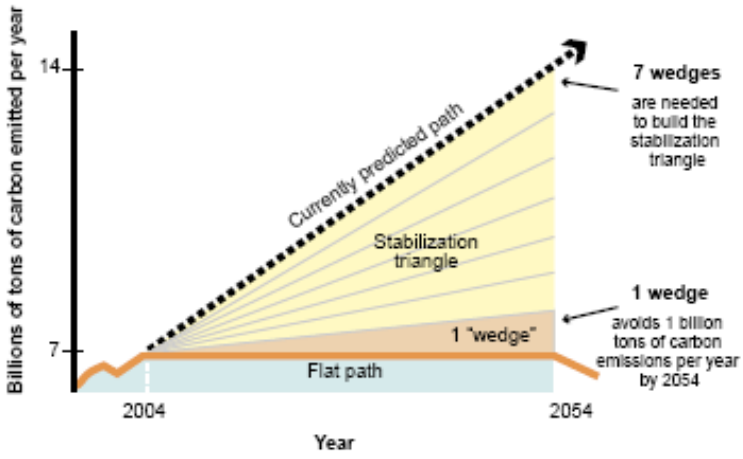


Figure 17 Stabilisation wedges
Source: Socolow et al 2004

EMISSIONS REDUCTION WEDGE – RIPARIAN MANAGEMENT

Riparian margins bring several benefits to stream health including temperature, enhanced shade, reduced eutrophication through enhanced filtration and interception, which all improve the state of ecosystem health and biodiversity strength. It is now widely recognised that agricultural non-point source pollution of waterways is a major cause of water quality degradation (Monaghan et al, 2006). Intensive agriculture emits significant amounts of nutrients, especially nitrogen and phosphorus, faecal contamination and sediment (Gillingham et al, 2000). Crawford (2001) reports that this is particularly evident in secondary streams where nutrient and faecal contamination often exceeded guidelines for surface water quality and contact recreation. Dairy cows are not the sole contributor to water quality impairment, it is inappropriate management of the dairy system which is causing pollution to our waterways (Monaghan et al, 2006) and it is the management tendencies and inaction that needs modification in order to mitigate against current practices that induce climate change. The benefits that are derived from implementing and managing riparian margins can be deployed into mitigating against climate change and towards meeting certain standards required under the ETS. These benefits can only be obtained through sufficient and proactive ex ante management processes and also through catchment-wide cohesion. Any efforts made downstream are void by non-compliance in the upper reaches of the catchment. Therefore it is not only up to farmer cohesion but is equally reliant upon a management structure with sufficient enforcement.

EMISSIONS REDUCTION WEDGE – NITRIFICATION INHIBITORS

Nitrification inhibitors (NI) are applied in conjunction with the application of nitrogen based fertilisers. NIs main impact is that of reducing the greenhouse gas nitrous oxide. NIs also reduce the production of nitrates in agricultural soils which in turn reduces leaching and denitrification (PGGRC, 06). This impediment of leaching has obvious benefits of decreased eutrofication of waterways and lakes with effectiveness ranging from 60% to 70% (Terry, 2007). NIs also have the benefit of increasing pasture production through retaining higher levels of nutrients in the soil and thus requiring less frequent applications (ibid). Terry reports gains ranging between 10% to 15% (ibid).

EMISSIONS REDUCTION WEDGE – OTHER COMBINED OPTIONS

Terry (2007) provides several other options available to industry in order to mitigate against emissions:

- ✓ Standoff pads
- ✓ Maize feed substitution
- ✓ Improving soil drainage
- ✓ Liming
- ✓ New grasses

Leslie et al (2003) postulate that *the target is to have safe, cost-effective greenhouse gas abatement technologies, which will lower total New Zealand ruminant methane and nitrous oxide emissions by at least 20 percent as compared with the 'business as usual' emissions level, by the end of the first commitment period [of the Kyoto Protocol - 2012].*

Terry (2007) reports that farmers will benefit most by applying several techniques that are best suited to their individual situation.

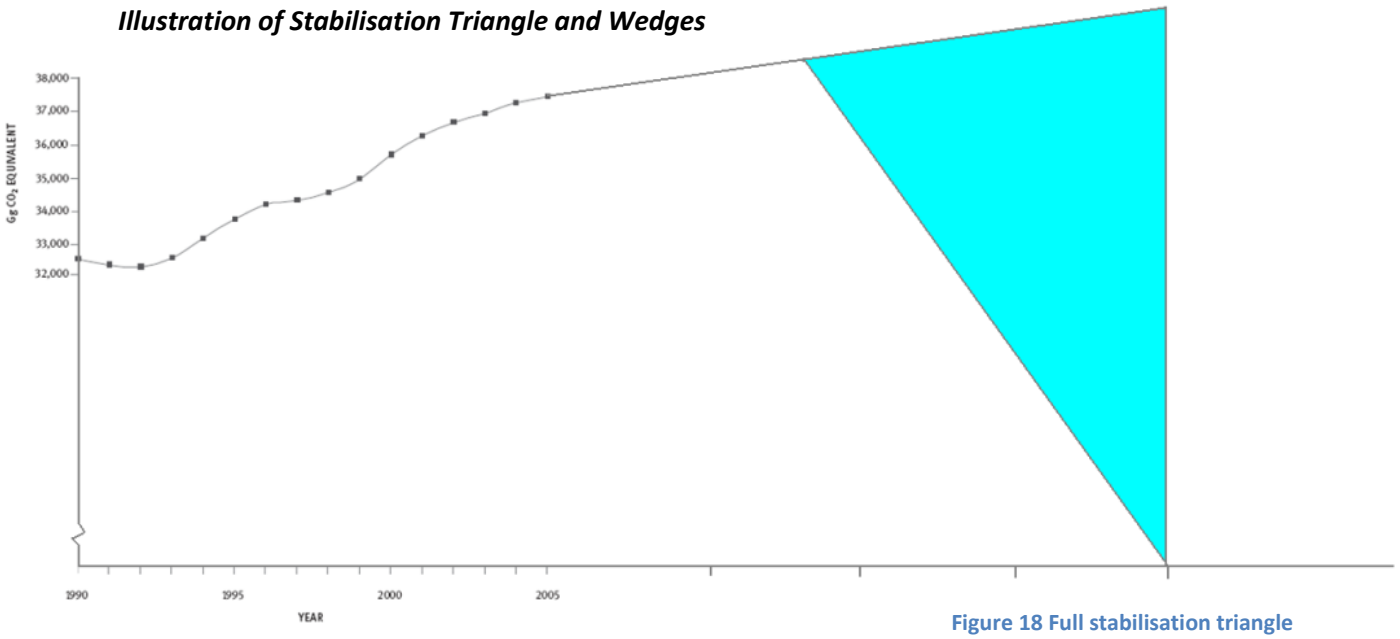


Figure 18 Full stabilisation triangle

Figure 18 illustrates a simple projected emissions path and the resultant stabilisation triangle which also illustrates the path of New Zealand Units allocation to farmers reaching zero at 2030. This follows the prescribed path that the ETS sets out for agriculture. This triangle is significantly reduced if at 2013 the emissions path has reduced to 90% of the 2005 level of emissions (figure 19).

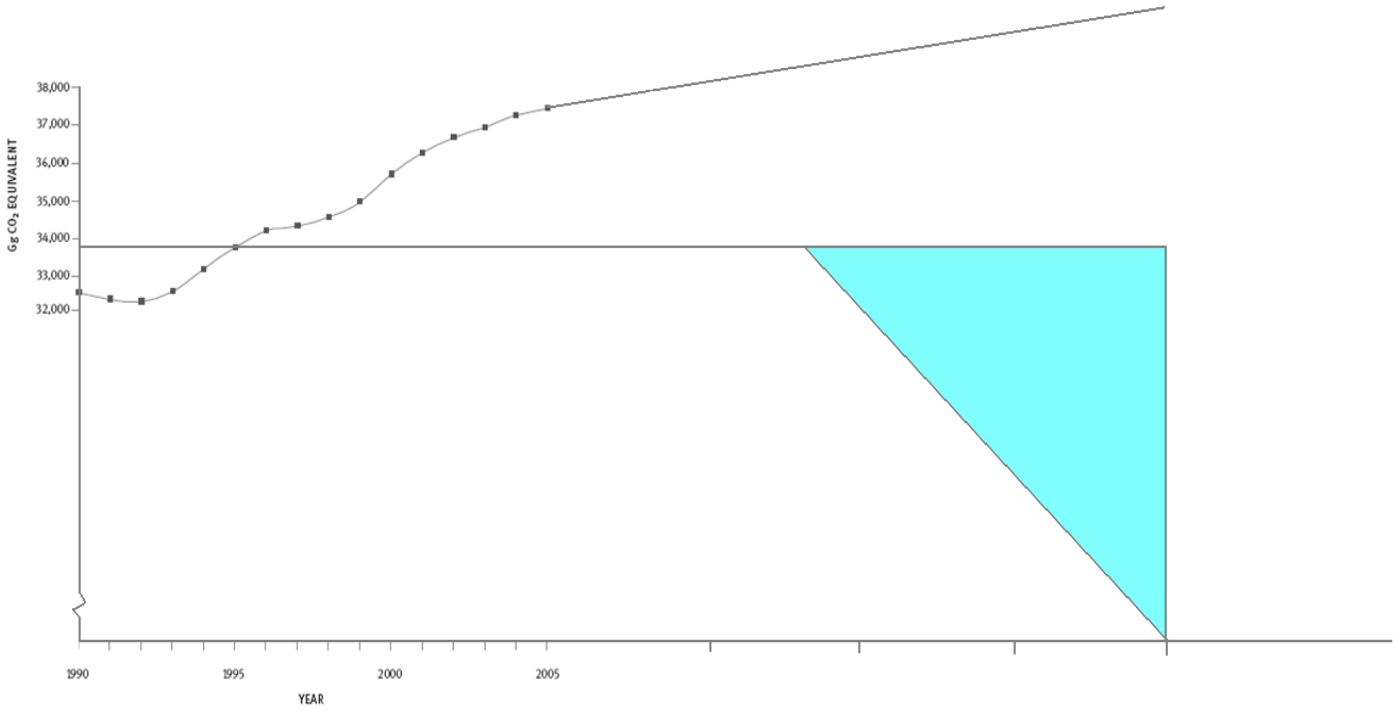


Figure 19 Stabilisation triangle with 90% allocation

The reduction in the stabilisation triangle seen above has come from early adoption by the industry of which accompanying emissions reduction is represented as the triangle in figure 20.

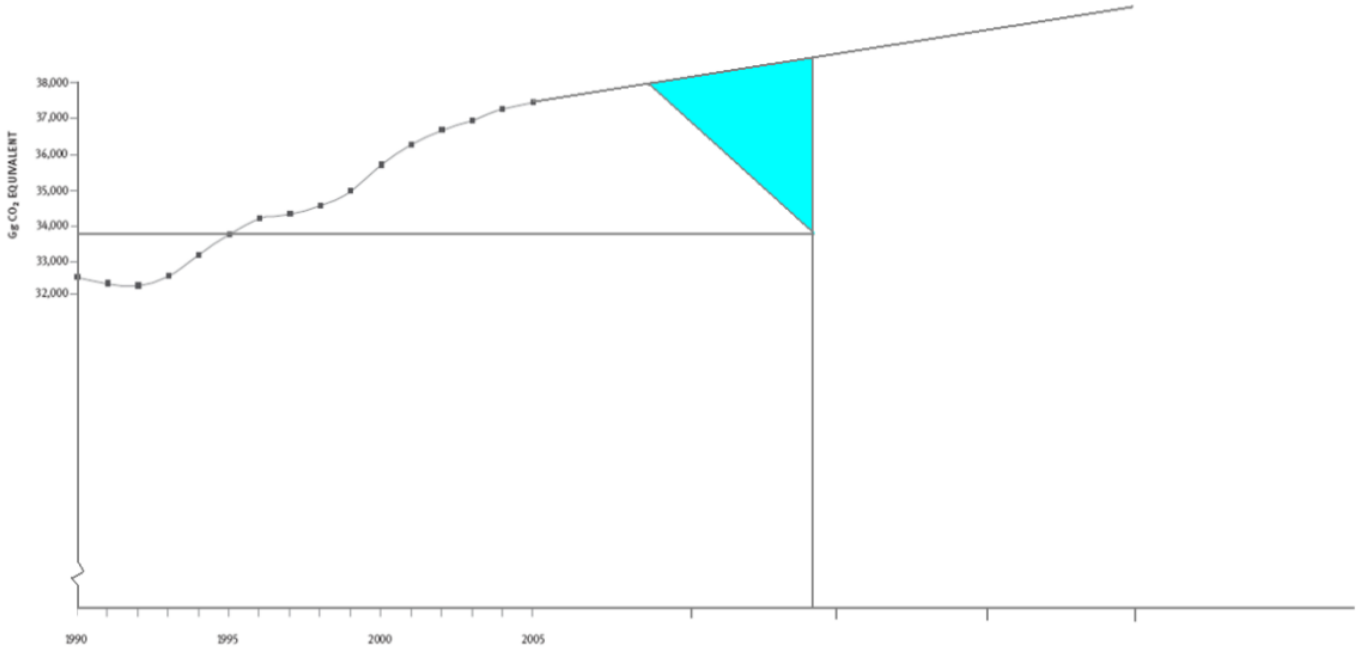


Figure 20 Stabilisation triangle assuming early action

The reduction in the stabilisation triangle seen above which has eventuated from early action and abatement of emissions from the dairying industry can also be illustrated using the stabilisation wedges concept. The size of each wedge is significantly reduced due to the early nature of the action taken. Therefore the earlier we act in regards to climate change and the earlier agriculture acts in terms of their commitments, the task becomes ever so slightly easier.

Figure 21 illustrates the wedges required with no early action from the dairying sector.

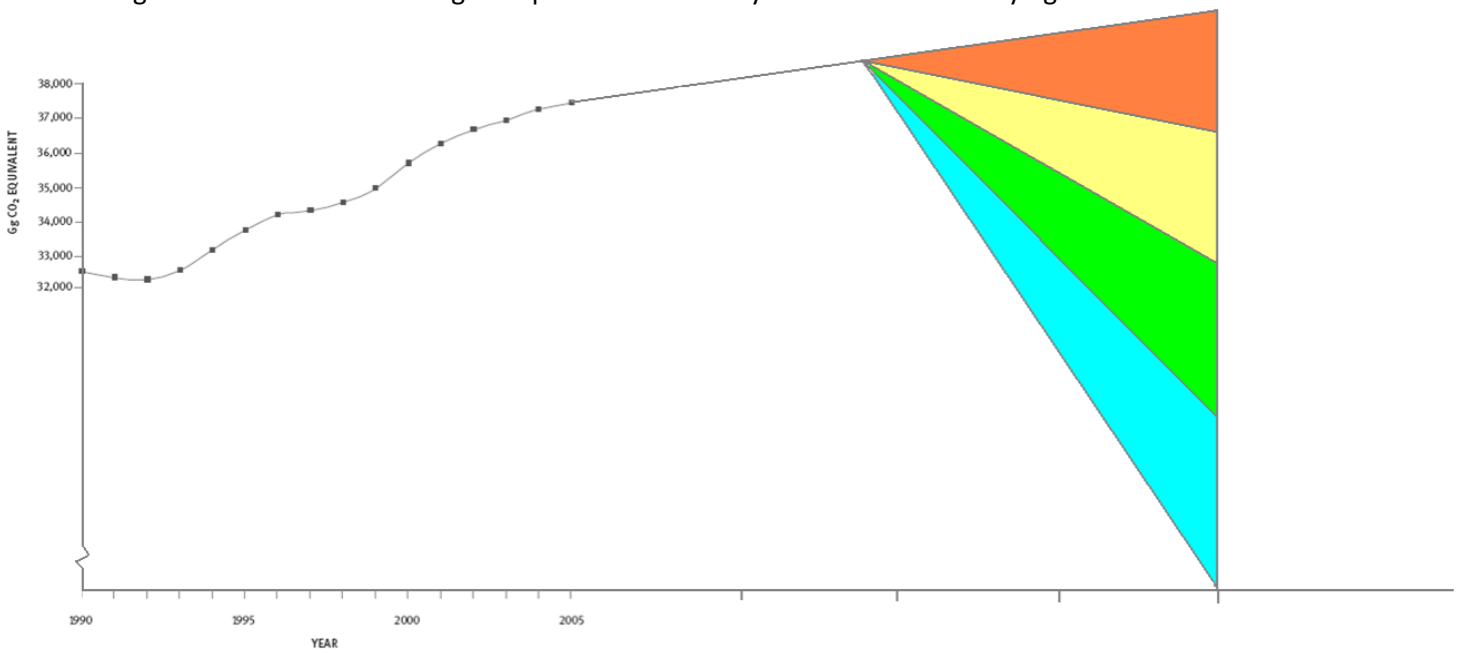


Figure 21 Full stabilisation wedges

Figure 22 then shows how these wedges become significantly easier with this early action.

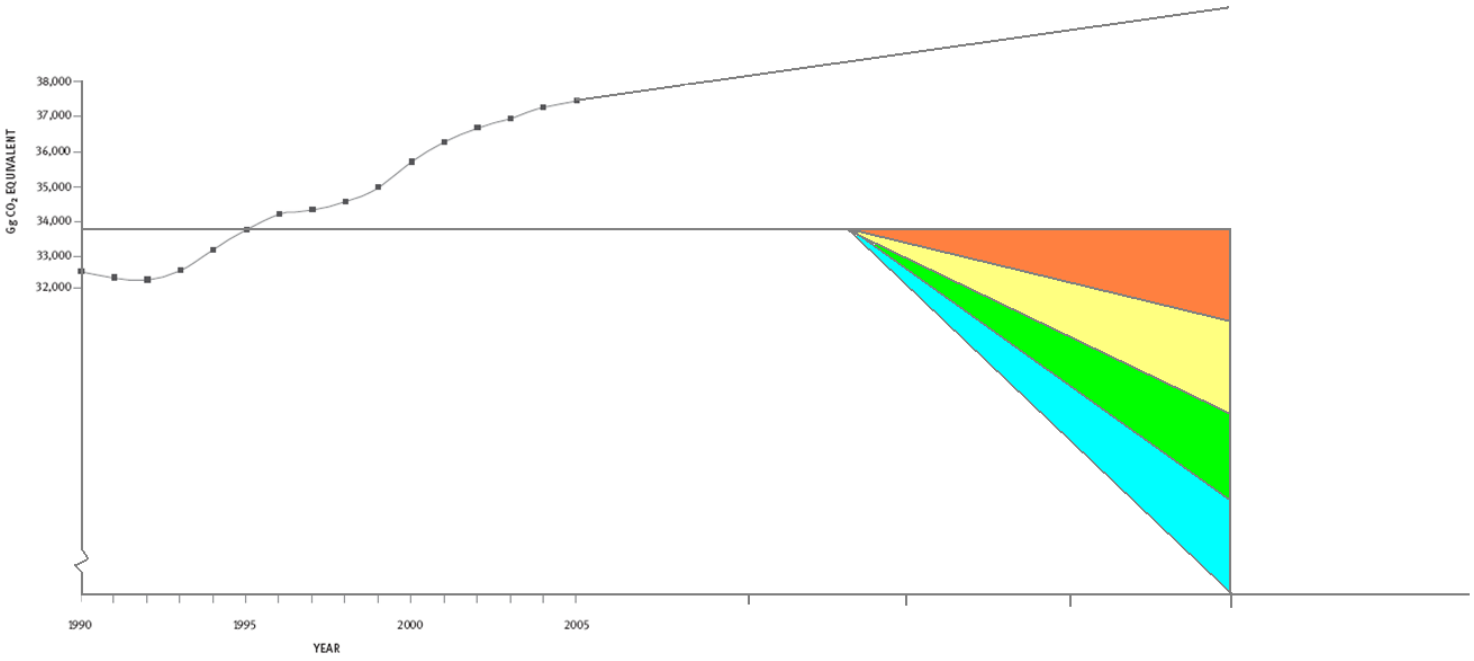


Figure 22 Stabilisation wedges after early action

The theory behind riparian management and nitrification inhibitors has mostly been done, therefore for the purpose of this thesis, farmer's perceptions of the abatement options will be examined. These perceptions will include the associated opportunities as well as the challenges that will be faced by those participating farmers.

Results

The following chapter will go through the results from my interviews with 23 Taranaki dairy farmers by question type and will draw on those patterns evident within and between questions also.

Farm Questions

These questions surrounded simple questions regarding the farm in order to gain an insight as to the scale of the property and herd size in order to satisfy my methodology requirements of a range of farm sizes.

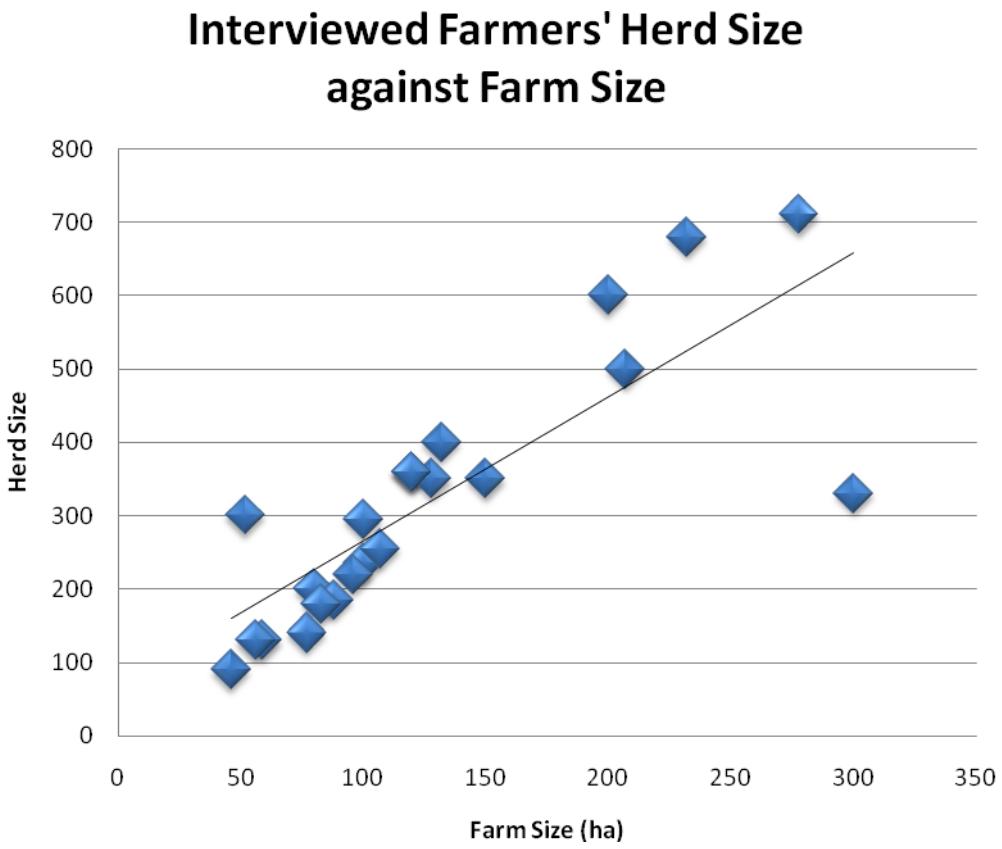


Figure 23 Interviewed farmers' herd size against farm size

Figure 24 below illustrates the random nature of the location of farmers who agreed to participate in my interview. The random nature of the location of farmers who had agreed to participate in the interviews met with expectations from the approach used, whereby letters were sent to farmers at random and then a further random selection through contacting by telephone was made for the interview sessions. Figure 23 illustrates these farms' herd sizes against property size which showed a very tight correlation barring a few outliers with one very low intensive farm milking 330 cows on a 300 hectare property. A good range of farm sizes was obtained within the interview through the smallest farm milking 90 cows and the largest farm milking 710 cows. One farm was extremely intensive milking 300 cows on 52 hectares which can also be seen in figure 23. The smallest farm

was a certified organic property with very low inputs and generally small scale. No farms had undergone extensive increases in herd sizes over the 5 years preceding my interview.

The interview had to be strategic in the fact that most farmers had stated to me that they knew very little about the ETS – thus general farm questions were asked initially on nitrous oxide, methane and carbon dioxide abatement methods. It was then a chance for me to reinforce the main points from my ETS summary and highlight the likely costs under the scheme. Questions were then asked on climate change, climate change policy, resource efficiency, the ETS itself, carbon offsetting and on whether Fonterra acting early in terms of the ETS would change their attitudes towards the scheme.

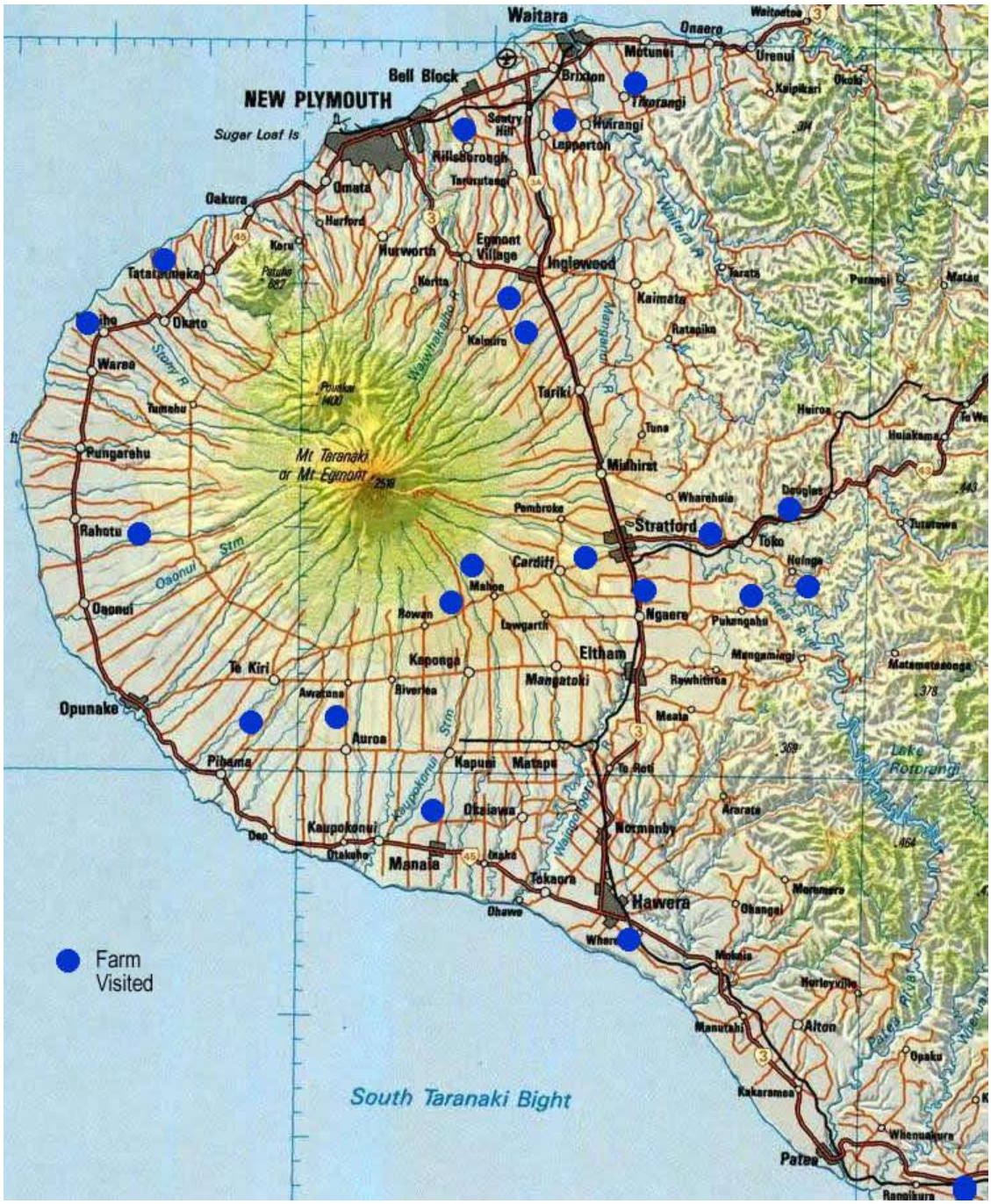


Figure 24 Farms visited for interview

Nitrous Oxide Questions

Specific questions pertaining to on farm nitrous oxide were aimed at gaining an insight into farmers' knowledge and perspectives of NOx and the methods of abatement commercially available to them. The areas explored hereafter relevant to on farm NOx were nitrification inhibitors, riparian management, cropping and in terms of soil NOx - drainage, feed pads and soil liming. These questions aimed to obtain information on farm uptake of each abatement methodology and the barriers to non-implementation.

Nitrification Inhibitors

The growing importance and requirement for mainstreaming NIs had been illustrated earlier. It was therefore crucial to gain farmers' insights as to the uptake and barriers to uptake for the use of NIs.

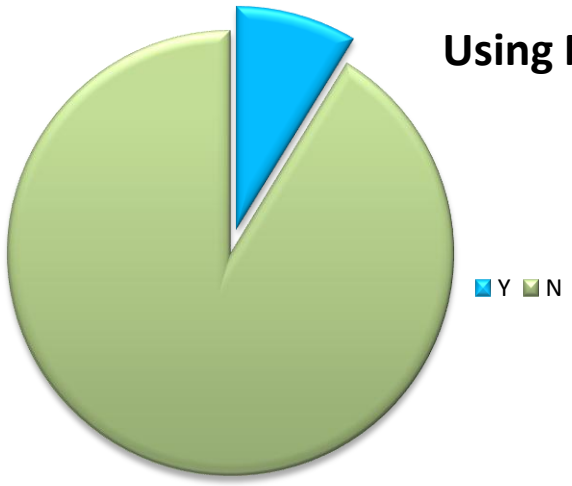


Figure 25 NI usage

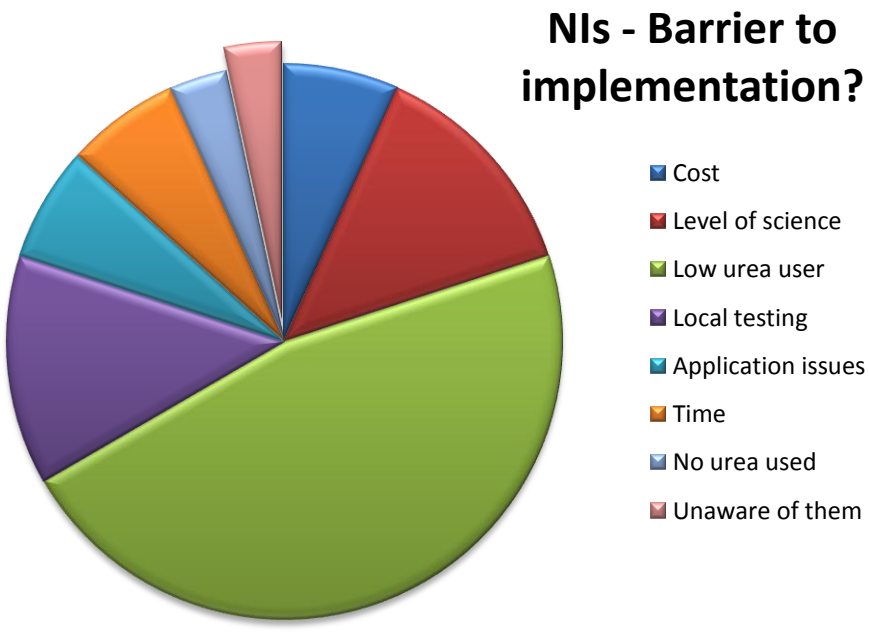


Figure 26 NIs - barrier to implementation?

NIs

It was found that 2 (9%) farmers were using NIs – one was using *SustaiN* and the other was using *EcoN*. Of these two farmers one had experienced application problems with having to follow the cows through their rotation with the *EcoN* and the timing of the second application having to be very specific timing made successful applications particularly difficult. Of those farmers who were not using NIs, the prevailing barrier (47%) for implementation was that they believed they were low urea users - this inhibited the scope for these farmers to gain the full benefits out of NIs and farmers believed this should play a part in the equitable application of the ETS if the obligation is to lie at the farm level. They perceived that because they had very little room to manoeuvre within their current levels of urea usage that those very high input farm systems that could use NIs to great advantage would scope huge benefits for those emissions abated but would leave the low input systems at a competitive disadvantage. The next highest barriers were the level of science and extent of local testing of NIs (13%) – this was a big issue for farmers with a lack of local transparent testing to base their decisions on. Other factors influencing the implementation of NIs were cost, issues pertaining to application, time (7%) and 4% of farmers interviewed were unaware of NIs. Farmers believed it would be prudent for money to be spent in order to incentivise research and development of NIs.

Riparian Management Questions

Riparian management is seen in a very bright light within the region of Taranaki because of the efforts from the regional council. The approach therefore wanted to stay away from their individual perceptions of RM and wanted to concentrate on the levels of farm-by-farm implementation and the barriers inhibiting farmers from furthering this implementation or why they are only at the levels acknowledged in the first question. The positive light that RM is perceived in Taranaki was reassured with some farmers stating they had achieved full implementation and some even stating that they had enjoyed the process and wished that GHG abatement would be as a pleasurable and rewarding journey.

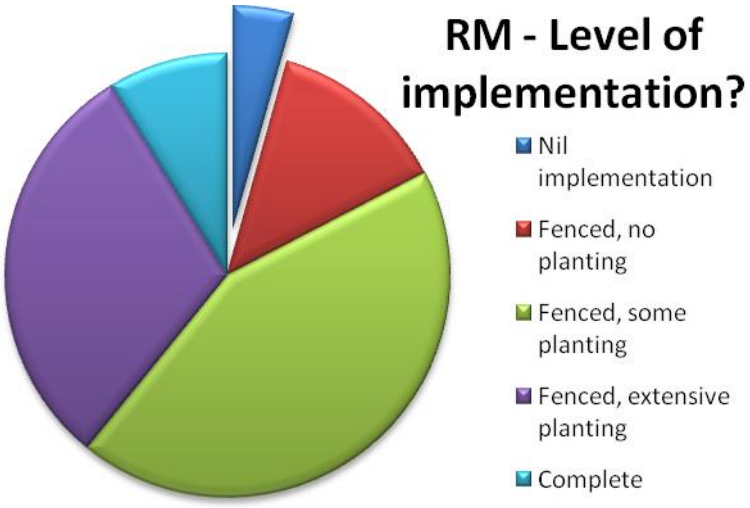


Figure 27 RM - level of implementation

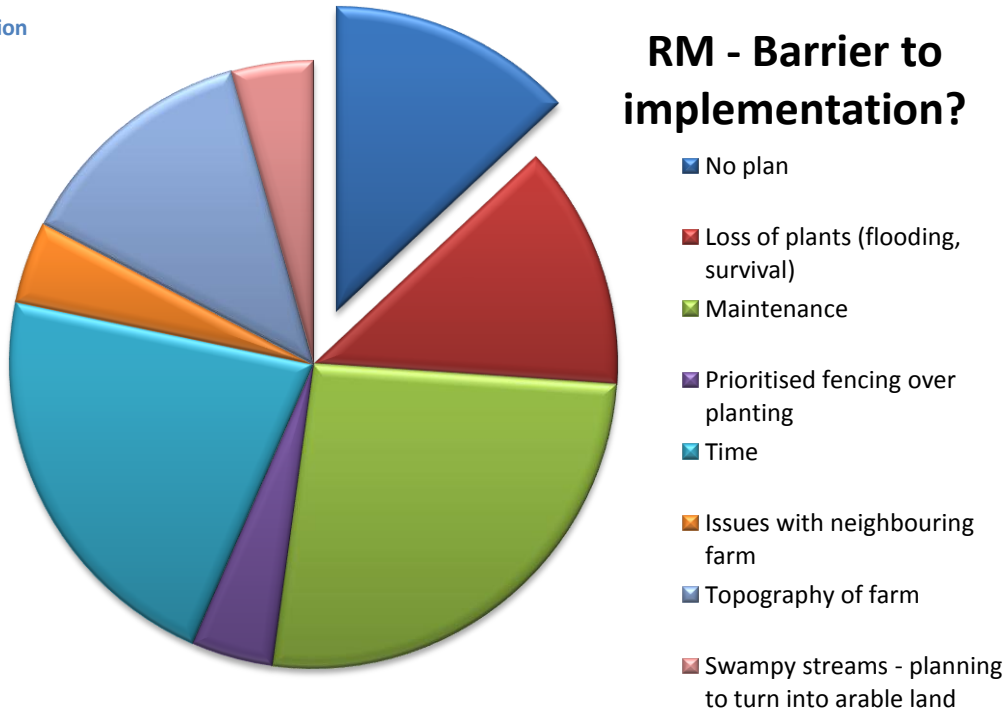


Figure 28 RM - barrier for further implementation

RM

The level of implementation of riparian management within Taranaki sample set is especially pleasing. Just one farmer (4%) reported no implementation at all; 13% reported that the property was fenced but no planting; 43% reported the property was fenced with some planting; 30% stated fully fenced with extensive planting and 9% stated that their plans had been fully implemented. In terms of the barriers towards achieving full implementation the highest encountered was that of the maintenance aspect of riparian management (26%) followed by time constraints (22%). Others consisted of actually having no official riparian management plan to follow, loss of plants through survival rates and flood events and the topography of individual farms making full implementation difficult (all 13%); some farmers had prioritised fencing over planting (4%); some stated they had issues with neighbouring properties' non-compliance and thus had no motivation to implement riparian management in those neighbouring areas (4%) and some farmers had stated that some swampy areas that were to be planted under their plans they had plans to convert into arable land (4%).

Cropping Questions

Cropping is very much influenced by farm-by-farm preference and applicability factors. Alternative crops are always developing (for example the recent use of externally grown palm kernel which was not encouraged due to the unsustainable growing of the palm) and will play a major role in GHG abatement in the future with high energy and low levels of embedded nitrogen emerging as an ambition. Therefore the following questions were aimed at gaining an insight as to the occurrence of cropping and as to what those farmers were growing and as to the barriers for those farmers not cropping.

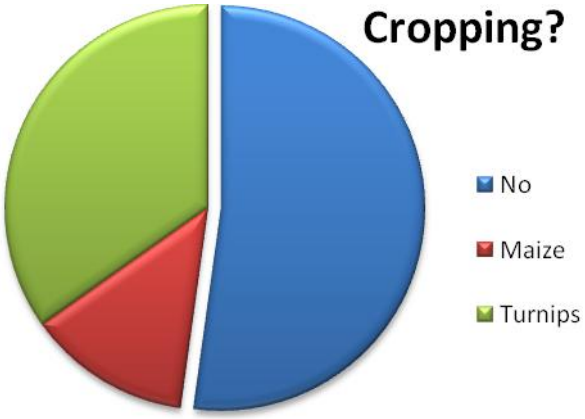


Figure 29 Farm cropping?

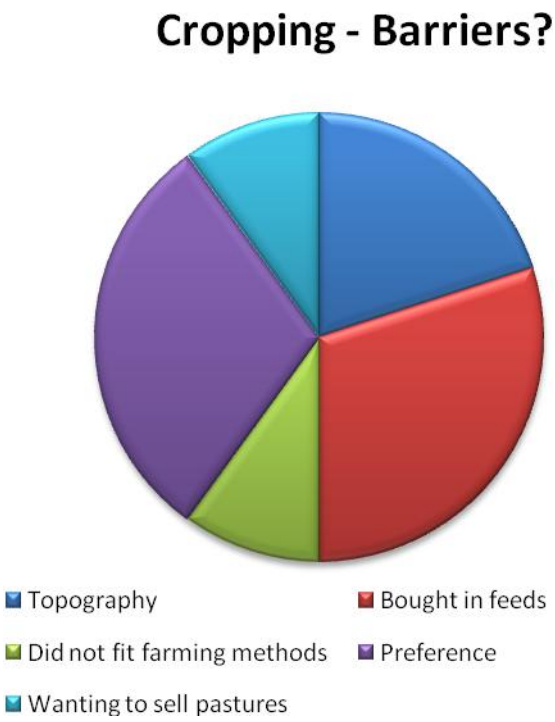


Figure 30 Barriers for cropping?

CROPPING

The level of cropping on the farms interviewed was not high with only 48% of farmers actively cropping on their properties. Of this 48%, 35% were growing turnips and 13% growing maize. The barriers influencing this level consisted of farmers stating this was simply a personal preference of feeding regimes and the farm system was receiving bought in feeds (30%); 20% of farmers stated that the topography of their property affected their ability to crop efficiently and 10% stated cropping did not fit their farming methods and 10% also stated that they were actually planning to sell those pastures grown on farm.

Soil NOx questions

Questions pertaining to the specific mitigation of soil nitrous oxide through the use of feed pads, improved drainage and soil liming were put to farmers in order to gain an insight as to the nitrous oxide abatement methods being used already. The outcome from the use of feeding pads has a direct bearing on the feeding regime of each individual farm and thus does not truly reflect deliberate NOx abatement, nor does improving drainage where the topography of the farm and preceding drainage works dictates the efforts needed to improve drainage currently.

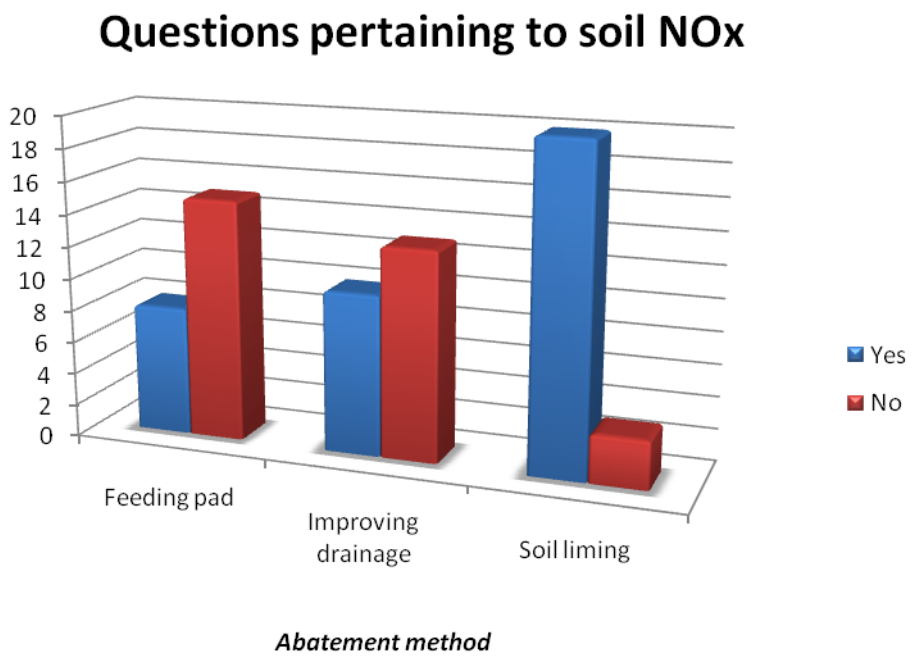


Figure 31 Differing abatement methods for soil NOx

SOIL NOx

Several questions pertained to soil NOx. When asked about feeding pads, which was influenced by the previous question of cropping habits, only 35% of farmers stated they had a feeding pad on their property. Of these 35%, two thirds stated that it was used all of the time and the other third stated that it was only used during winter. Of those farms without a feeding pad (65%) 53% stated that it did not fit their feeding system, 20% stated that they were considering a feeding pad and 26% stated that the cost associated with the installation of a feeding pad was outside of their scope at present.

In terms of on-farm drainage and the continual improvement of this, only 43% of farmers stated this was an ongoing cost. The remaining 57% stated that due to the free-draining nature of Taranaki soils that this was irrelevant. The aspect of soil liming was surprisingly high with 87% of farms actively liming their soils. It was evident that this occurred cyclically or was influenced by soil testing and subsequent advice from the farmer's fertiliser representative.

CO_2 questions

Questions on mitigating carbon dioxide were aimed to gain an insight as to the individual farmers' attitude toward the possibility of harnessing renewable energy sources, which were applicable to their individual farms and what were the barriers impeding implementation. These asked whether installing renewable energy generation was an option, as to which of wind, solar or hydro was best suited to their individual farm system, and as to what were the barriers to current implementation.

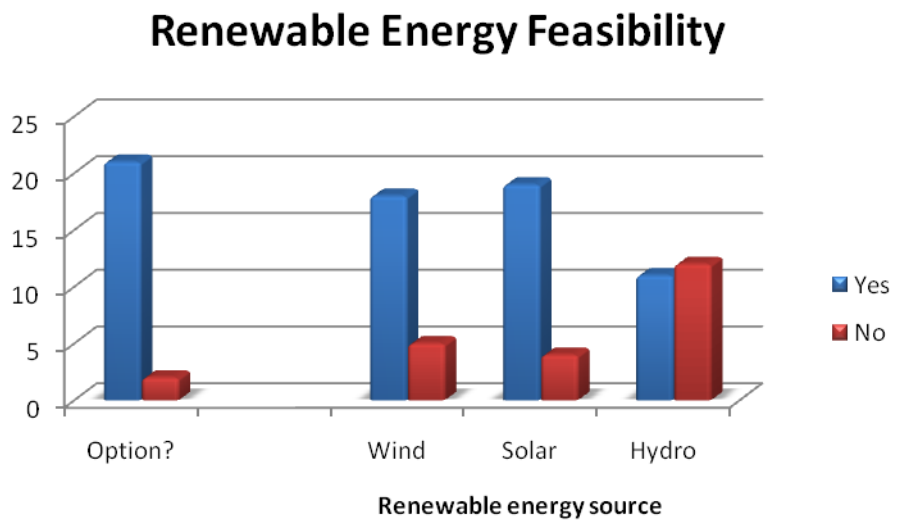


Figure 32 Renewable energy feasibility in general and by type

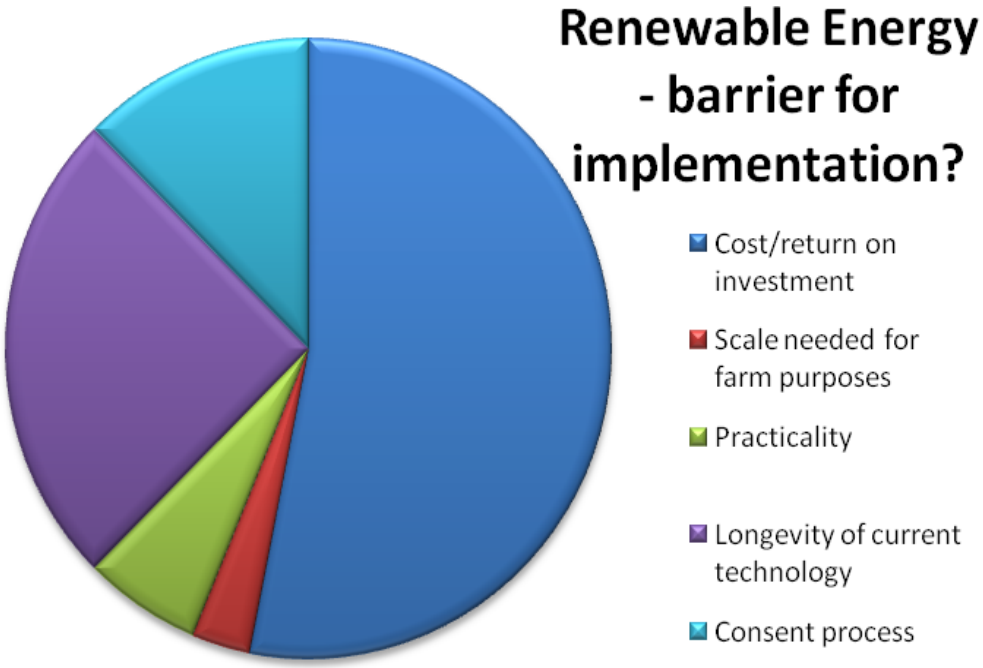


Figure 33 Renewable energy – barrier for implementation?

CARBON DIOXIDE

Not one farmer perceived a diesel or fuel budget being realistic at the farm level –farmers stated that the usage of fuel on the farm was that of required usage and that they were individually mindful of their usage which tended to be low anyway. This mindfulness stemmed from a cost aspect and also farmers were well voiced on the fact that fuel had become very expensive over the past few months, especially coinciding with other price increases for associated farm inputs. Some farmers did observe a need for Fonterra to utilise the rail infrastructure for transporting raw material and finished goods which would ultimately get trucks off the roads and contribute towards their overarching sustainability goals.

Renewable energy definitely came across as a feasible option with farmers. The vast majority (91%) of farmers stated that a renewable energy source was an option for their farm looking into the medium-term of about five years. 78% and 83% declared that wind turbines and solar panels respectively would be an option, and 48% stated that hydro generation would be an option. The barriers for farmers implementing these sources of energy included cost or return on investment (53%); longevity of current technology (25%); need for consent under the Resource Management Act (13%); practicality (6%) and concerns over the scale needed for on-farm purposes (3%).

Climate Change Questions

The following specifically looks at farmers' perceptions and insights into climate change in order to gauge the extent to which climate science had filtered down to dairy farmers and in what form. Questions asked directly related to investigating what direct effects farmers perceived eventuating from climate change; what these effects would constitute in terms of impacts on the dairy industry and as to how they (on the ground-level) perceived climate change policy to affect them. The interesting thing about these results is that it seems to confirm that this selection of people is remarkably misinformed about basic climate science. Accordingly, the useful information gathered from these questions relates to the political issues surrounding farmer perceptions of the nature of the risks associated with climate change and the extent to which this risk perception translates into a willingness to participate in a community set of solutions. Farmers expressed their single most significant effect.

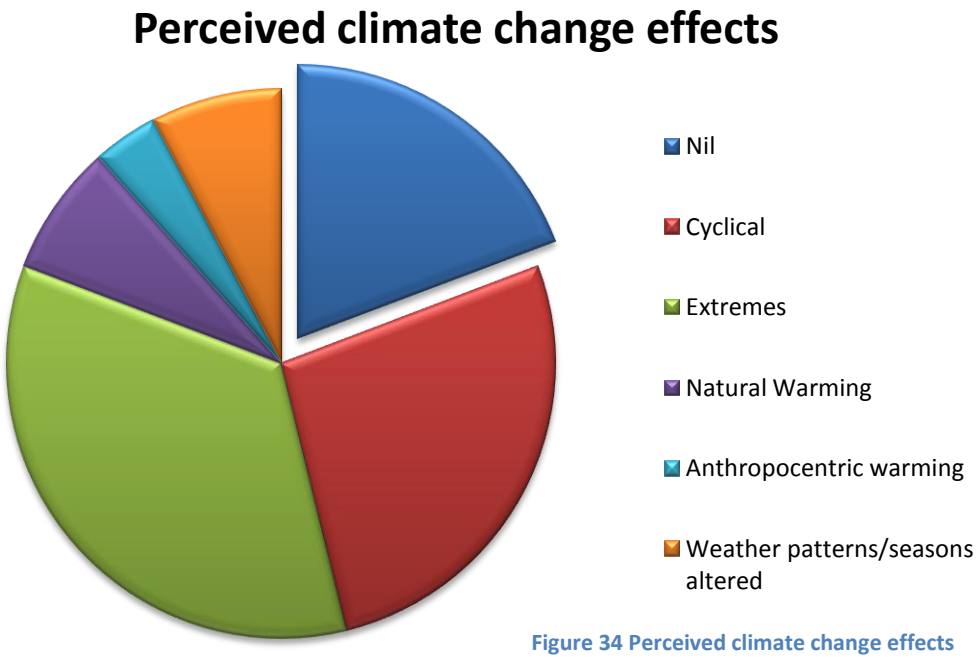


Figure 34 Perceived climate change effects

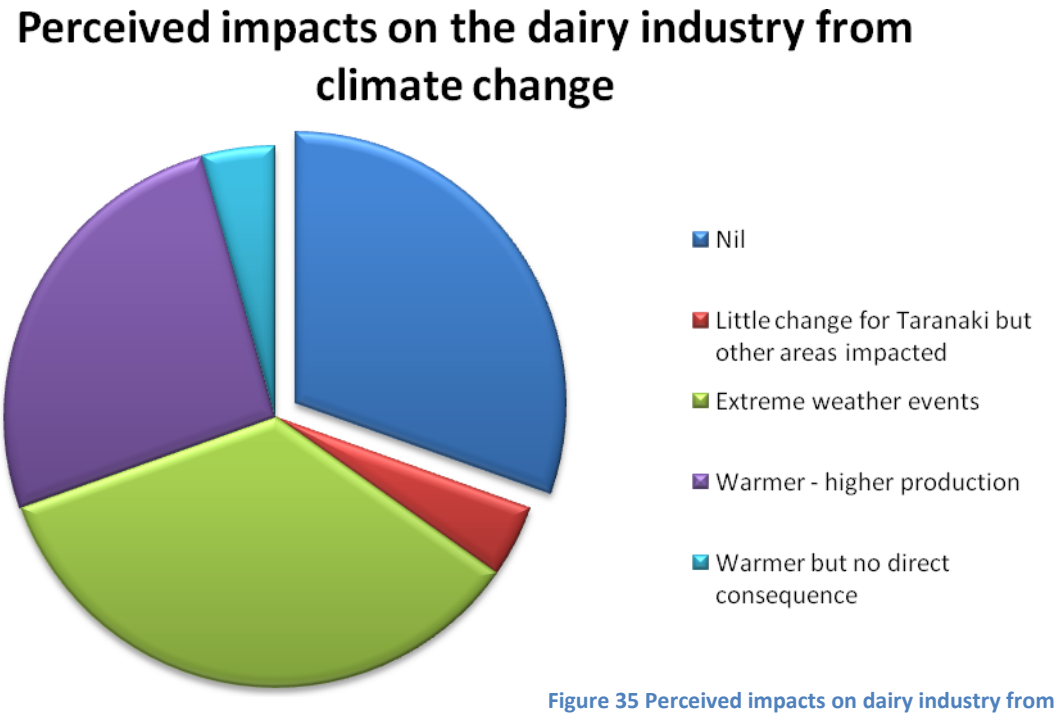


Figure 35 Perceived impacts on dairy industry from climate change

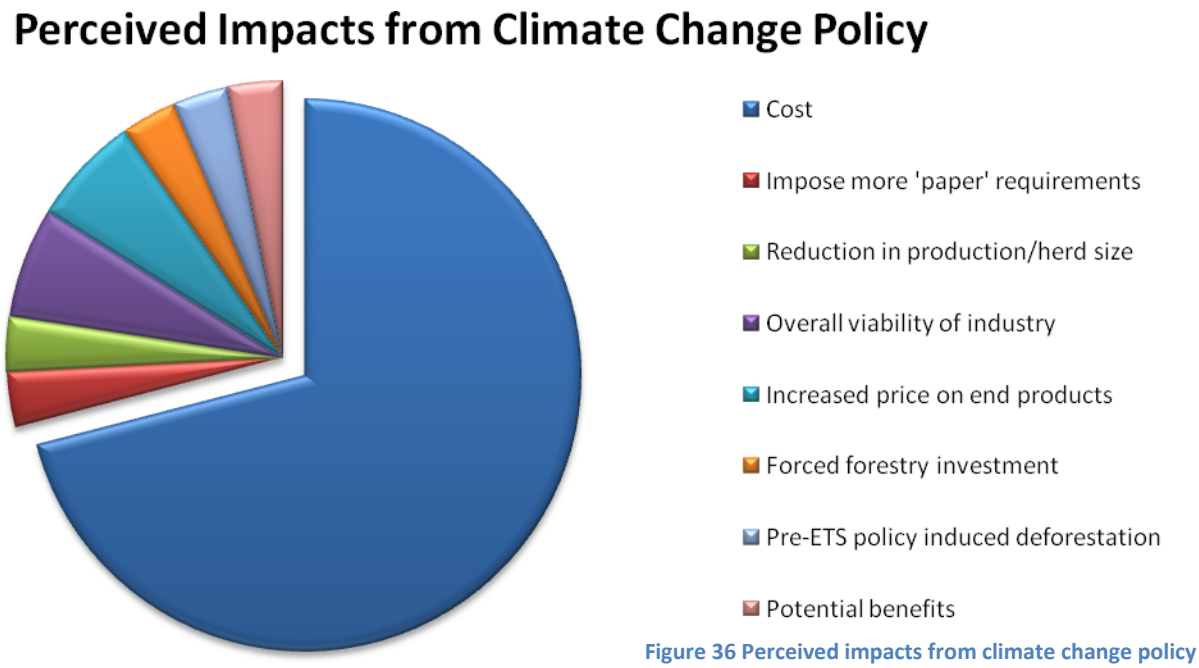


Figure 36 Perceived impacts from climate change policy

CLIMATE CHANGE

The idea of climate change was open to farmers to comment on – 52% stated they did not believe in the concept of climate change leaving a slight minority that did perceive it. In terms of climate change effects, 19% of farmers stated they saw no effects at all. Of those farmers that did see some effects eventuating from climate change 27% stated that if any change was to occur that this was simply cyclical and that the climate would self-regulate. Thirty-five percent stated that the main effects would be worsening extreme weather events. Eight percent stated they perceived natural warming occurring without a direct relationship to human induced climate change and four percent also stated they had perceived a change in the seasons and weather patterns. Four percent stated they perceived that there was anthropocentric warming occurring.

When farmers were asked to concentrate on the direct effects from climate change impacting on the dairy industry, 30% stated they saw no impact at all. 35% did state that they would perceive impacts from extreme weather events induced from a climatic change whether locally, regionally or nationally as an industry. 26% perceived that a direct impact would be climate change induced increases in production levels through warmer temperatures. 4% stated that they perceived it to get warmer with no direct consequence and that little change would be experienced in Taranaki but expected other areas to be impacted largely. This stems from a lack of practicality surrounding the media illustrated science that these farmers are basing their decisions upon. Some farmers even stated that they could not see that climate change was occurring but were quite open to the fact that this issue had the potential to impact the dairy industry. In a similar study Holloway (1999) reports:

what are being demonstrated here are flows of thinking along different lines and between different knowledges, moving around the different components of what is important to the individual farmer and his or her farming context, making links and connections, rather than being tied to scientised conceptualisation of the effects of climate change (p2029). He goes on to say that *farmers understand climate as an externality, but this is experienced in relation to all aspects of farming rather than as a discrete aspect of a wider environment (ibid).*

Farmers understood the notion of climate change policy as a measure for Central Government to mitigate the impacts of climate change with most being strongly against our signing of the Kyoto Protocol. When asked how they perceived impacts on the industry from climate change policy the overwhelming response was simply cost (71%). The general statement was that they viewed the ETS simply as taxation and were blindfolded as to seeing the options for decreasing this ETS induced cost through the abatement options discussed with them earlier. This is a serious issue that the development of the ETS needs to address in order to get farmers out of this mindset and get them looking forward as to the various options facing them in order to reduce this cost. Of the other impacts from climate change policy 6% stated that the viability of the industry was in serious jeopardy with the continuous development of these policies and 6% also stated that it was inevitable that an unethical price increase would occur on the end products of the industry. One farmer (3% of all farmers) stated that it would simply impose further reporting requirements; that it would eventuate in a reduction of herd sizes and thus production; that it would force them into forestry investment; that there were some potential benefits of climate change policy (for example induced emissions abatement); and that pre-ETS policy had induced severe deforestation and that this was a good example of climate change policy going wrong.

Herein lies the success or failure of climate change policy and communication of its effects at the ground level of New Zealand's biggest primary producer. These farmers interviewed illustrate the misinformation and ill-communication that is occurring pertaining to climate change policy and climate change itself. The associated effects to the dairying community and the economy as a whole are worsened because of this and therefore farmers deserve better engagement and nohow in order to get this consequential step in human history right.

Emissions trading scheme questions

The following specifically look at farmers' perceptions of the current New Zealand Emissions Trading Scheme. This question pertained to farmers' understanding of the ETS; as to which aspect of the ETS they deemed the most and least effective; as to whether their knowledge of the likely expense from the introduction of the ETS would inhibit early mitigation; whether an initial cost of $5,000 to the average farmer would provoke change and as to whether planting as a final method of offsetting was an option for their individual farm set up.

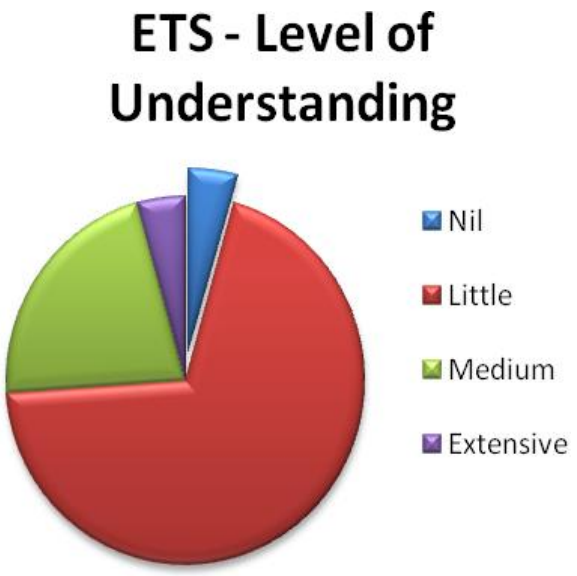


Figure 37 ETS - level of understanding

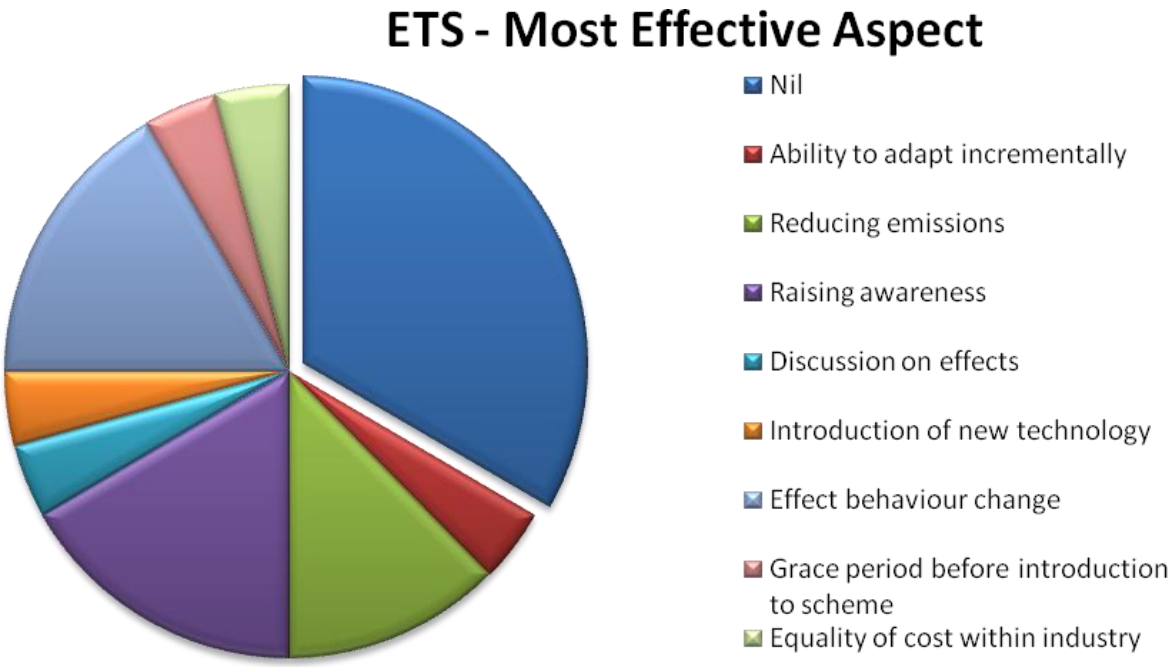


Figure 38 ETS - most effective aspect

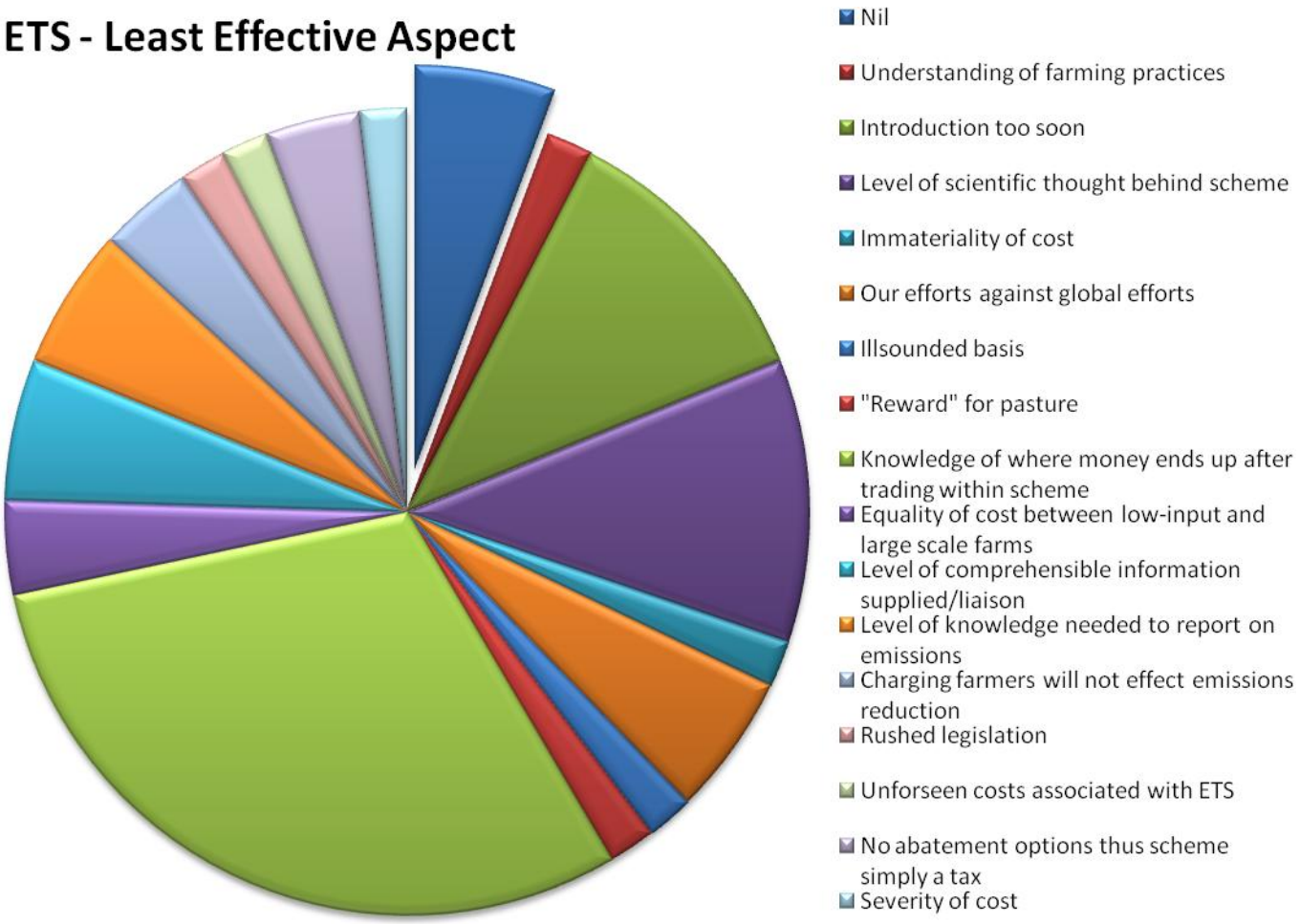


Figure 39 ETS - least effective aspect

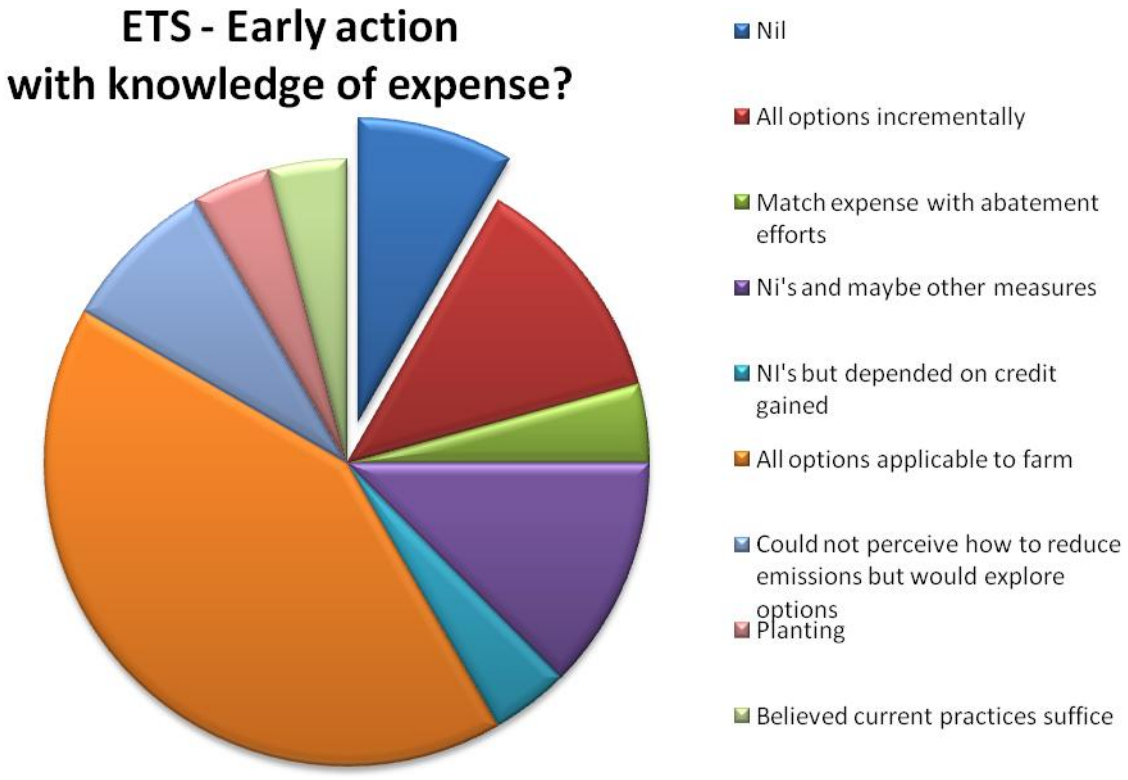


Figure 40 ETS - early action with knowledge of expense

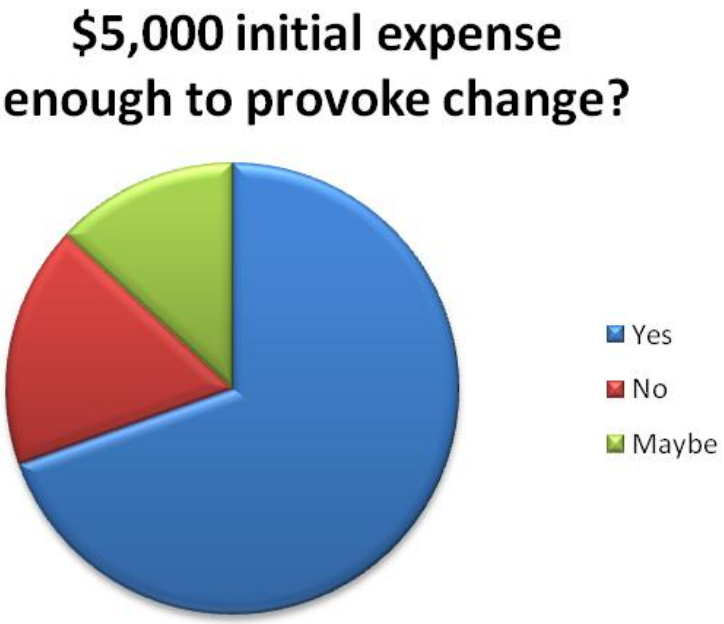


Figure 41 $5,000 material to provoke change?

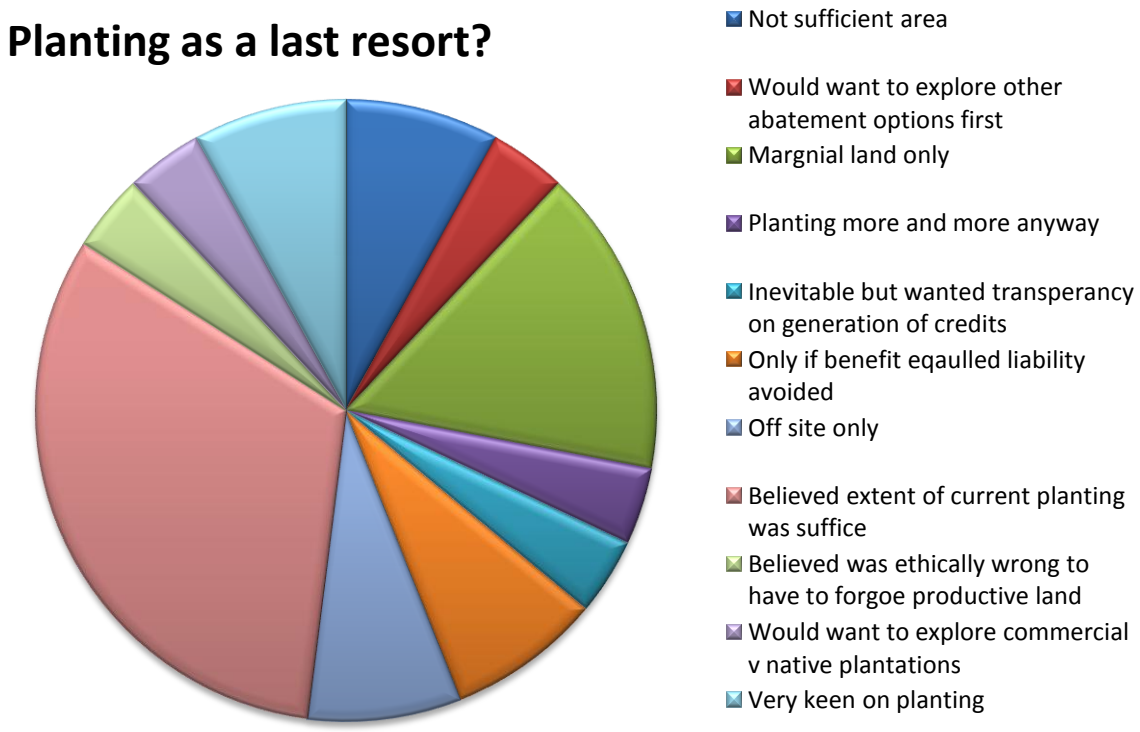


Figure 42 Would farmers consider planting as a last resort?

ETS

In order to get a feeling for the amount that farmers knew about the ETS it was asked of them as to their personal feeling of how aware they were of the scheme. 4% stated they had no knowledge of the ETS at all. 70% stated that they had a little understanding of the scheme. 22% stated they had a medium level of understanding and 4% stated that they had extensive knowledge. This farmer who had extensive knowledge had done a lot of reading on the scheme and had attended all of the farmers consultation meetings run by Federated Farmers.

From this it was asked as to whether they perceived certain attributes of the ETS to be most and least effective. 33% stated that they did not perceive any aspect of the scheme to be that of most effective. 17% stated that the aspect of raising awareness was truly beneficial and 17% also stated that the introduction of the scheme was beneficial towards effecting behaviour change within the farming industry. 13% stated that the abatement of emissions was the most beneficial. The rest of farmers (4%) each stated respectively that the following were their best aspects of the scheme: the ability to adapt incrementally; the discussion of effects on the environment from the development of the ETS; the introduction of new technologies to abate emissions; the grace period before the industry was involved in the scheme and the equality of cost within the industry.

In terms of the factors that were deemed to be of least effectiveness the highest response (30%) was that of the level of knowledge around where the money paid ends up after trading within the scheme. The next (11%) were that the scheme was being introduced too early and that the level of science behind the scheme was insufficient. 6% stated that there were nil least effective aspects; that out efforts were nulla void compared to global emission levels and abatement efforts; that the level of comprehensible information and liaison supplied was insufficient and that the level of knowledge needed to report on emissions and abatement was passed that of the average farmer's know-how. 4% stated that the equality of cost between low-input and large scale farmers was not fair; that charging farmers will not effect emissions reduction and that no abatement options were readily available thus scheme was simply a tax. 2% stated that those who had drawn up the ETS for dairying purposes did not have a full comprehension of farming practices; that the cost imposed under the scheme would eventuate to be immaterial; that the scheme had be drawn up on an ill sounded basis; that farmers were not being rewarded for the extensive growth of pastures; that the legislation had been rushed; that there would be extensive unforeseen flow-on costs from the introduction of the scheme and simply the severity of the costs imposed.

The next stage of the interview was aimed at establishing farmers' attitudes towards utilising the next four years before the industry is involved in the scheme. The summary of the ETS that was supplied with the letter that the farmers received was highlighted during this section as this outlined to them various studies that have taken place which indicate the level of expense likely to occur under the ETS. Of the expense that was put in front of farmers it was assumed that a fair assumption was an initial expense of approximately $5,000 to the average farmer in the first year. 70% of farmers agreed that this would be material to initiate some change; 17% stated that no it would not and 13% were undecided. From this it was asked whether they would act early on knowing this level of expense in order to best position themselves before 2013 when they would be fully involved and as to what these actions would involve. 8% of farmers stated they would not act early at all. 42% of farmers stated they would apply all options applicable to their individual farm. 13% stated that all options would be applied but incrementally. 13% also stated that they would

start with the use of NIs and perhaps other measures if needed. 8% also stated that they could not perceive how to physically reduce their emission but agreed that they would have to explore different options facing them. 4% of farmers each stated they would match the ETS expense with abatement methods/efforts; that they would utilise NIs but this would depend on the level of credit gained; that they would initiate further planting immediately and that their current practices should be sufficient under the requirements for the scheme.

The notion of carbon neutrality was explained to farmers and thus it was asked whether they would consider planting as a last resort abatement method. 32% of farmers stated that they believed the current level of planting on their property should be sufficient and thus would not require further planting. 16% stated that they would only plant on marginal land on their current property. 8% stated that they believed they had insufficient area that could be planted; that they would only plant if the benefit derived equalled the liability avoided including costs associated with reduced pastoral areas; that they would only plant off-site because their properties only contained effective land; and that they were actually very keen on extending planting. 4% stated that they would want to fully explore all other abatement options first; that they were planting more and more anyway; that the need for planting was inevitable but wanted transparency on the generation of credits; that they believed it was ethically wrong to have to forgo productive land and that they would want to explore the full benefits of commercial forestry against native plantings.

It was also proposed to farmers that if Fonterra used the next four years to utilise these abatement efforts by farmers to market their products as carbon neutral (if the abatement and offsetting levels were to get this far) with farmers reaping some of the associated benefits - that whether this would set a more positive light on the effort needed to meet the cost imposed by the ETS. Only 4% of farmers could not see Fonterra directly benefiting from achieving and marketing carbon neutrality. 9% stated that they could not perceive a higher payout through this action in order to meet the expense. 4% were slightly dubious about the proposal and thus did not support it. 4% stated that they believed farmers would still incur an expense or reduction in payout from Fonterra somewhere with the introduction of this sort of thing. 9% stated that they believed ethical concerns around the supply of basic goods would inhibit this. Thus 30% of farmers did not really support this idea – but 70% did stating the following: 17% each stated that they would fully support this Fonterra movement and that farmers would support anything if the benefits were apparent, and that it depended on the equality and transparency of the benefits to farmers; 9% stated that Fonterra and farmers alike should be down this avenue already; and 4% both stated that Fonterra was the governing body thus would have to follow their movements anyhow and that this would only be able to occur in the long-term thus could not perceive it within the four years before the industry is involved in the scheme. Farmers also believed Fonterra need to be very strategic in their developments on this in that the viability of the industry is at stake and thus they should potentially be assisting farmers where possible.

It was also asked whether through all of this action on climate change and the development of climate change policy whether they thought a new generation of farmer would emerge that was far more resource efficient and aware of resource efficacy. Only 9% stated that they did not with one farmer saying that the dollar meant everything to younger farmers and that younger farmers tend to be less aware of issues and their farms tend to be much more intensive. 91% of farmers stated that they believed it was already happening within the current generation of farmer.

Fonterra Question

It was put to farmers that perhaps Fonterra should explore the possibility of the industry obtaining carbon neutral status with farmers' compliance under the emissions trading scheme and other mitigatory efforts towards abating climate change and environmental impacts. This carbon neutral status would potentially earn the industry rewards (with higher payouts to those farmers complying) through the marketing of niche products and obtaining premium prices.

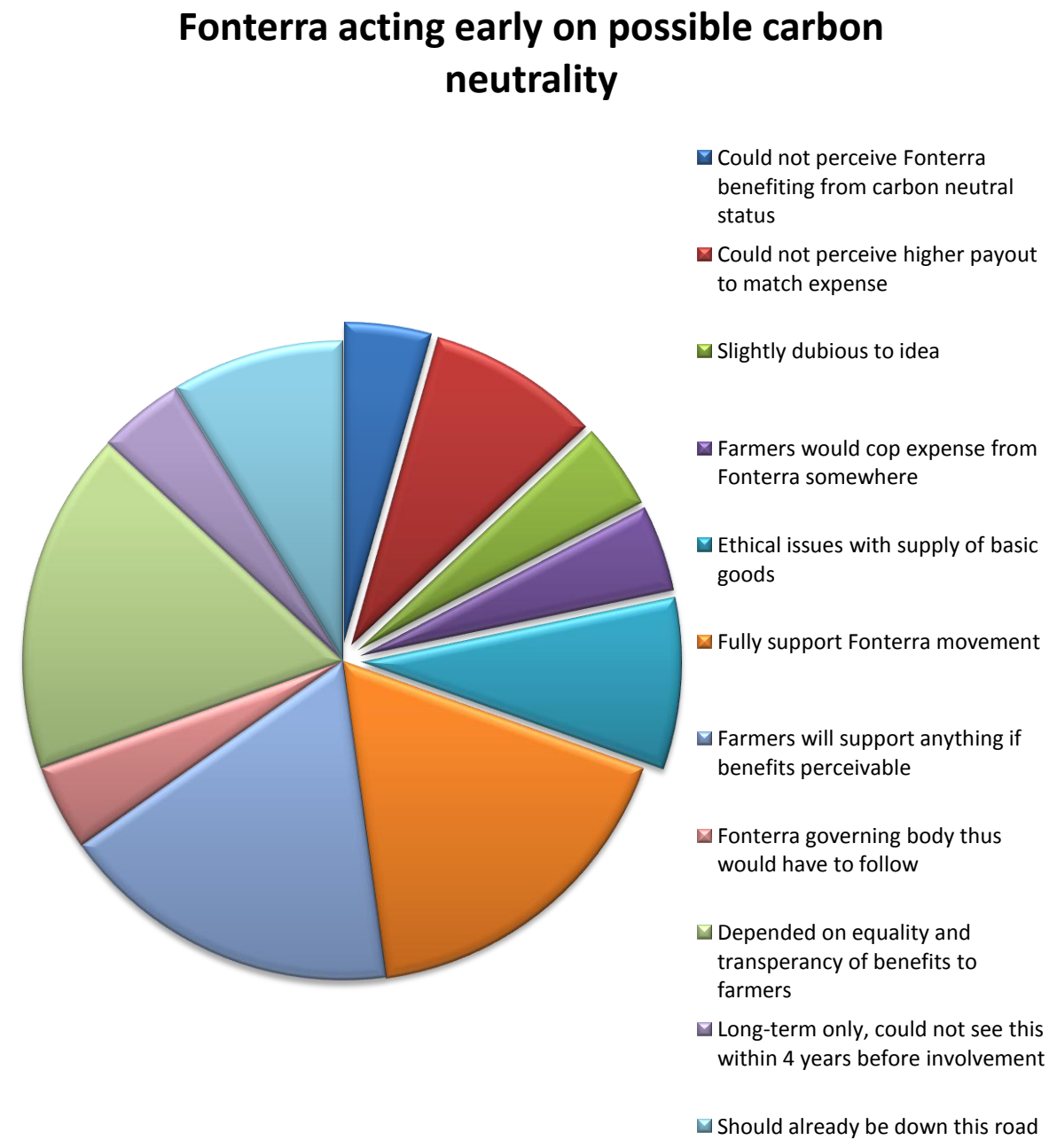


Figure 43 Would farmers support ETS more if Fonterra played the carbon neutral game?

Results – *Liability Calculation*

The breadth of methods that can be deployed for the calculation of the liability faced by the industry is almost incomprehensible. Following the scenarios based approach introduced earlier the following section will explore some of the methods of calculation and illustrate the range of liability that the dairy industry is faced with. MAF (2008) approached this using the 2006/2007 production year as a baseline for their calculations, and as would be expected, "the potential impacts increase along with the price of carbon and as the allocation of free units is decreased". It must be noted that the most important underlying factor of this study is that 2006/2007 was a particularly low production year with low profitability and therefore the relative impacts are elevated than might be the case in other years (ibid).

Table 5 illustrates the impact on the price of milk solids from the point of allocation through to the full liability faced at the time of full liability (full liability for the carbon does not necessarily equate with carbon neutrality. The goal of the ETS and any domestic compliance arrangement is to get New Zealand into a position of compliance with Kyoto, which is not a carbon neutral condition but 1990 emission levels over KPCP1.).

Table 5 Impact on price of milk solids from ETS
Source: MAF, 2008

		Allocation of 90% of 2005 emissions from each species[7]			Full Liability		
Carbon Price>		$15	$25	$50	$15	$25	$50
Milk Solids	c/kg	-5.1	-8.5	-17.1	-16.1	-26.7	-53.4

[7] Assumes that 90% of 2005 pastoral emissions of N_2O and CH_4 related to each species are freely allocated (e.g. through processors) in a way that benefits each pastoral species in direct proportion to its emissions of these gases. Other allocations are possible; e.g. lump sum allocations to farmers to ensure that incentives to reduce actual emissions are retained

Based on the average figures of the 06/07 production year of 360 milking cows producing 127,176kg of milk solids at a payout of $4.14/kg ms, the farmers' mean net profit before tax equalled $71,690. Taking the above range of carbon prices table 6 illustrates the reduction in incomes and net profits ceteris paribus as a consequence of the introduction of the NZ ETS.

Table 6 Income reduction pertinent to differing carbon prices

Carbon Price ($/t)	15	25	50
Milk solids reduction (c/kg)	-16.1	-26.7	-53.4
Income reduction ($)	20,447	33,928	67,884

The calculations above obviously only take into account the impacts on income through the implementation of the ETS. With the introduction of costs on inputs such as fertilisers, fuels, electricity and so on the outcome is a little worse. For example table 7 illustrates the impact on three energy sources with diesel increasing an alarming 14% at $50/t of carbon:

Carbon Price>		$15		$25		$50	
Petrol	c/litre (% if 1.48/l)	3.7	(2.50%)	6.1	(4.00%)	12.2	(8.00%)
Diesel	c/litre (% if 1.00/l)	4	(4.00%)	6.7	(7.00%)	13.3	(14.00%)
Electricity	c/kwh (% if 20c/kwh)	1	(5.00%)	2	(10.00%)	4	(20.00%)

Table 7 Energy price changes
Source MAF, 2008

MAF (2008) continues to explore how the increase in payouts received by farmers affects the impacts felt through the implementation of the ETS. Figure 44 illustrates this with the baseline year used above the second plot from the left:

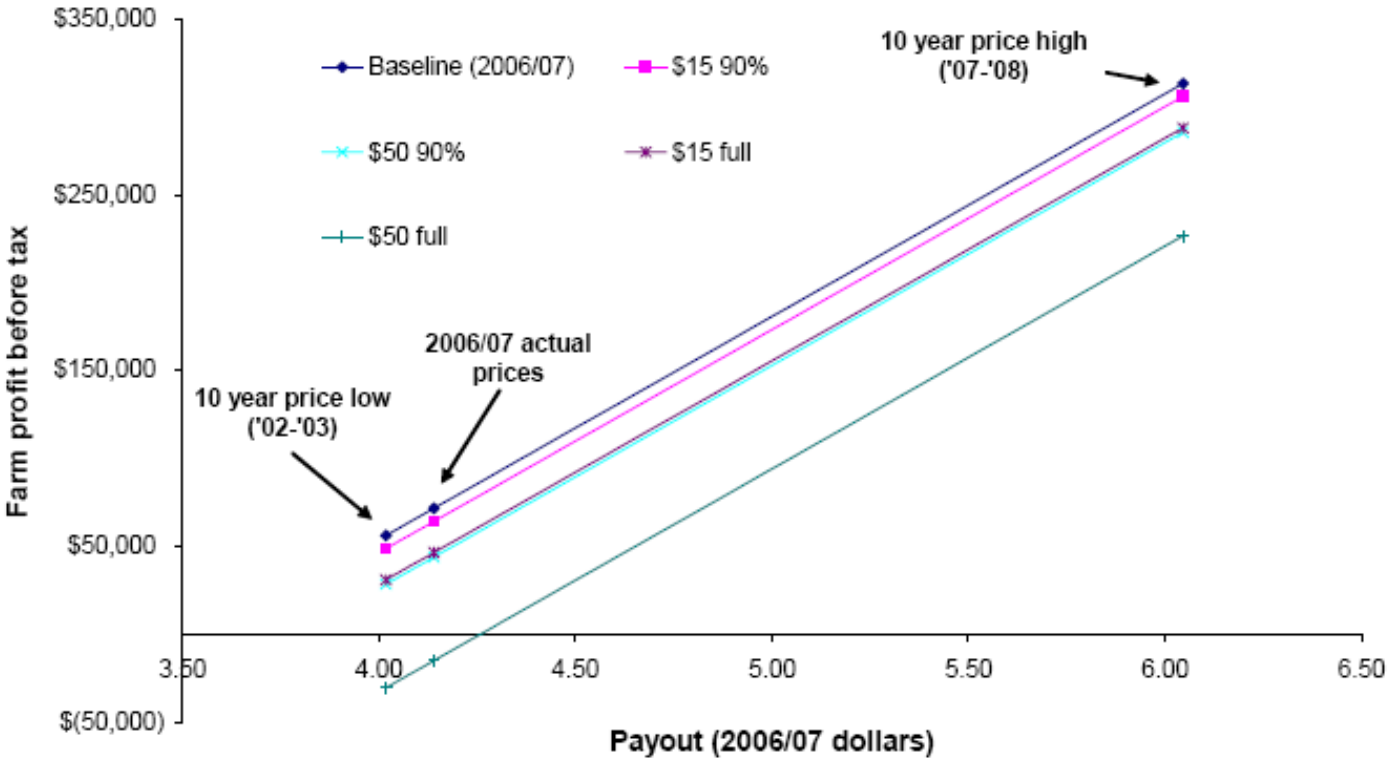


Figure 44 Dairying price sensitivity
Source MAF, 2008

Therefore with high payout increases over the twelve months preceding the introduction of the ETS during 2008 dairy farmers seem to be able to cope with this reduction in income. MAF (ibid) state "a key advantage of a market-based instrument is that it leaves participants to make their own decisions on how to manage emissions" and therefore this reduction in income can be offset with the use of current technologies and technological advances as they materialize. Farmers have three levels at which they can influence the impact the ETS has on their incomes:

I. The level of production of outputs that involve high emissions
II. The emissions intensity of output (emissions per unit of production)
III. Taking advantage of opportunities created by the ETS (for example the emission units derived from afforestation). *Source: ibid*

Table 8 Effect of nitrification inhibitors on change in income from ETS
Source MAF, 2008

		Baseline (06/07)	Free allocation 90% of 2005 emissions			Full price of emissions		
Carbon price $/t			$15	$25	$50	$15	$25	$50
1. No inhibitors	Farm profit before tax	71690	63095	57060	42482	45282	27550	-16550
	Percentage change		-12.0%	-20.4%	-40.7%	-36.8%	-61.6%	-123.1%
2. Inhibitor + no increase in output	Farm profit before tax		89792	84530	71895	73532	57446	17728
	Percentage change		25.3%	17.9%	0.3%	2.6%	-19.9%	-75.3%
3. Inhibitor + 10% output increase	Farm profit before tax		93245	87408	73341	75071	57135	12796
	Percentage change		30.1%	21.9%	2.3%	4.7%	-20.3%	-82.2%

For example table 8 illustrates the income that can be recaptured through the use of nitrification inhibitors as earlier discussed. The use of the inhibitor with output remaining constant the farmer experiences a 47.8% improvement on the reduction of income:

Other methods of calculation exist including some work done by the Taranaki Regional Council [TRC] (Bedford, pers. comm. 2008) and by the Carbon Farming Group [CFG] (CFG, 2008). The TRC used the assumptions of an average herd size of 237 cows and an emissions liability of $160 per cow equating to $37,920 a year per farmer. This calculation also assumed a world price of $40/t of carbon with each cow producing 4t of CO_2e annually. This calculation also took into account a 2-3% increase in production annually which is in alignment with Fonterra's expectations of around 4% annually (Bedford, pers. comm. 2008).

The CFG's calculations of emissions per cow equate to 2.47 CO_2e annually compared to the 4t from the TRC above. Thus at a world price of $50/t of carbon then the average farm of 237 cows would be liable for $29,270 (CFG, 2008). Or to the extreme at a cost of $100/t of carbon the cost to farmers would equate to $58,540 (ibid). Once again we start to see the variability within these calculations with no best practice guidelines established.

Discussion

It seems prudent to clarify that the country as a whole (via the government) is liable for the emission costs arising from all sectors covered by Kyoto accounting. The role of the government is to come up with a domestic strategy to cover these costs or find a way to reduce them (usually both). Such a strategy will need to determine the extent to which the sectors that generate the emissions are liable for those emissions, and then how to develop an instrument of revenue gathering as a means of accumulating the financial resources needed to meet these costs. Several options exist from total devolution of costs onto farmers, through to higher level responsibilities (e.g. making Fonterra responsible) and also exempting agriculture from responsibility thereby requiring that tax payers from all sectors cover the agricultural liability. I think it is important in your discussion to make clear what the financial realities are for the government and then the implications for different models for how to address it.

ETS

There was a general consensus within farmers that the level of science surrounding the reduction of methane emissions is insufficient. Farmers stated that with the introduction of the ETS that they were pinning their hopes on extensive future research especially in order to introduce methods of reducing methane emissions. Of the methane abatement methods that were used in the interview only the methane capturing technology method had been heard of by all farmers. Even then farmers were very dubious because of cost and thus were not interested. It would therefore be prudent here to propose that for the ETS to be applied at the farm level today then methane cannot be brought into the scheme until abatement methodologies are available at a point whereby they have undergone extensive transparent testing and are introduced to the industry at an attainable price.

Other points to come out of the interview included a general concern for the well-being of the dairy industry as a whole. All farmers were well versed on the fact that the industry is supplying the world with basic goods and that the Government had to be very cautious in creating new legislation such as the ETS. Farmers proposed a need to protect the primary industry and particularly a globally competitive company such as Fonterra.

The biggest undecided issue surrounding the development of the ETS for the dairy industry is the level of obligation within the industry. As introduced earlier the application at the farm level would induce the greatest behaviour change but for ease of administrative/reporting/auditing purposes it would be prudent for the ETS to be applied at the Fonterra or fertiliser company level. The complexity of the issue is summarised by Small et al (2007):

> *Animal farmers are required to maintain good stock records for tax purposes, so it is feasible to oblige them to hold stock-related emission permits. That may be adequate for meat and wool producers. However for dairying, emissions are more closely associated with milk production than cow numbers, so dairy processors may provide better targeting. The mostly clearly targeted system for methane emissions would require both stock number and productivity data so will require data from farmers. For nitrous oxide emissions many on farm options are possible which makes farm level monitoring attractive. This may however be offset in the short run by the high*

costs of making such a large number of farmers' points of obligation and by challenges in the science behind the models used to monitor nitrous oxides.

Nitrogenous fertilizers are supplied by a small number of companies that would provide the best monitoring point. However the associated emissions depend on farm-specific factors (soil type, time and concentration of application) that require specialised modelling such as with Overseer. More carefully tailored use of nitrogenous fertilizer is highly desirable, and incentives for that can be provided through the ETS. Fertiliser companies are obvious partners.

Fonterra has had success with agreements of this nature in the past – for example the Dairying and Clean Streams Accord which set out to fully fence all streams running through dairying properties. This was a voluntary accord from Fonterra which has arguably worked very well toward their aspirations. Farmers indicated to me that the nature of the accord (whereby they could comply incrementally) enabled them to get used to the idea and deploy their time and resources to the scheme as they deemed appropriate. Farmers believed that this incremental compliance was a huge factor in the success of the accord and thus the ETS should incorporate some incremental compliance aspects especially for some of the big farm systems who will take a lot of time to adapt. Farmers also stated that the compliance monitoring through the respective Regional Councils has worked very well and especially in Taranaki with the Regional Council subsidising plants for farmers to buy. Thus perhaps the monitoring of the ETS could perhaps fall to the Territorial Authorities within our local Government system.

Concern was illustrated by several farmers over likely conflict between complying farmers and non-complying farmers under the ETS and this has been the case with the Clean Streams Accord also. Farmers are disheartened and de-motivated to further implement voluntary and compulsory schemes when neighbouring properties do not comply. Farmers also brought this to mind within the dairy industry as a whole with farms in differing regions comprised of vastly different topography and plantations thus leading to conflict arising over the generation and balance of carbon credits between these farms and regions. Low input farmers were predominant within Taranaki and did express concern to the extent they could abate emissions and decrease inputs compared to large scale/large input systems with a greater scope to alter their farming methods.

General concern was also held over our commitments as a nation compared to international efforts. Farmers also expressed concern over the level of transparency over where the money they trade under the ETS ends up. This ties in to the amount of farmers who expressed grave concern over their individual level of knowledge of the scheme, abatement methods, reporting requirements, level of verification and so on. Thus far the factor influencing their level of knowledge was their involvement with Federated Farmers and their commitment toward attending meetings and discussion sessions organised by Federated Farmers. Several farmers had been to these events and they were the farmers with the greatest level of knowledge and insight into the ETS. Farmers believed that information should have been put in front of them in order for them to grasp something as influential and important as the passing of the ETS. Fonterra have attempted this through the publication of their Guide to Climate Change but once again it is up to the farmer to read these documents.

The following from carboNZero fittingly sums this up:

> *The market for carbon and likely other resources is growing in scale and influence, along with higher world prices for food and fibre. Farmers and their advisors face significant challenges in obtaining credible, high quality information for their decision making. There is a lack of research based evidence on the greenhouse gas emissions of key aspects of New Zealand production systems and agribusiness supply chains. These, along with the policy of uncertainty and inconsistent communication in the farming media, can all add up to farmers feeling confused, and unsure about where they can obtain trustworthy information.* (carboNZero, 2008).

The biggest issue pertaining to dairying under the ETS is that of emissions measurement and reporting which also relates back to the arguments around the point of obligation for the industry. Measurements have been conducted in order to report our agricultural N_2O emissions on a national level (Bertram & Terry, 2008) in order to meet the requirements of Kyoto. AgResearch has used an online tool of OVERSEER in order to aid farmers to obtain nutrient budgets and it is hoped that this will be developed further to cover the requirements under the ETS (ibid). Vast amounts of work need to be done in order to get these tools to incorporate NIs and it is not certain that these methodologies will be accepted by the UNFCCC under the current Kyoto regime (ibid).

Abatement Methodologies/Attitudes

The attitudes towards differing abatement options faced by farmers seem to be determined by two over-riding aspects – cost and to what level they have been tested. A similar study (Parminter & Wilson, 2003) of New Zealand farmers asked as to what practices farmers associated with greenhouse gases or climate change. Table 9 shows some of the responses in terms of how farmers can increase and decrease the rate of climate change:

Table 9 Farming practices associated with GHG or climate change Source: Parminter & Wilson (2003)

How farmers can increase the rate of climate change	How farmers can decrease the rate of climate change
Over use of fertilisers and farm chemicals	Plant trees
Animals producing gas emissions	Protect the environment (including organics)
Intensive farming systems	Use low GHG producing grasses
Greater use of vehicles	Minimise fertiliser and chemical use
Burning rubbish and crop residues	Very little that they can do
Removing trees and wetlands	More efficient use of vehicles
Increased use of fossil fuels	Increased research for greater understanding
Very little influence	Reduced animal intensity
Trapped without options	Protect waterways more
Mismanaging waterways	Reduced crop cultivation
Lack of understanding	Learn more about the issues
Runoff into streams	Improved waste management and recycling
Poor feed options	Become politically active
Inadequate research	Reduce animal emissions of GHG
	Improve effluent disposal
	Reduce burning-off

Similarities can be drawn from this study to the farmers in this thesis's that those factors prominent in farmers' thoughts regarding abatement options facing them include afforestation, reducing fertiliser reliance, efficient use of vehicles, greater research, protecting waterways, improved waste management and improving the levels of scientific research.

Along with the findings earlier that 71% of farmers were mainly concerned with the cost induced effect from climate change policy, the above study also found that 34% of landowners considered that the main future consequence for them of GHG's or climate change was an increase in Government intervention (for example some responses included "legislation may force different farm practices, affecting the productivity of crops and pasture production") (Parminter & Wilson, 2003, p19). This response was higher in this study than any other direct effect from climate change.

Figure 45 below reflects the responses from landowners quantification of how much their own practices could be changed to reduce GHG's or climate change. It is evident that landowners perceive that they comprise little power to influence GHG's or climate change with their on farm practices.

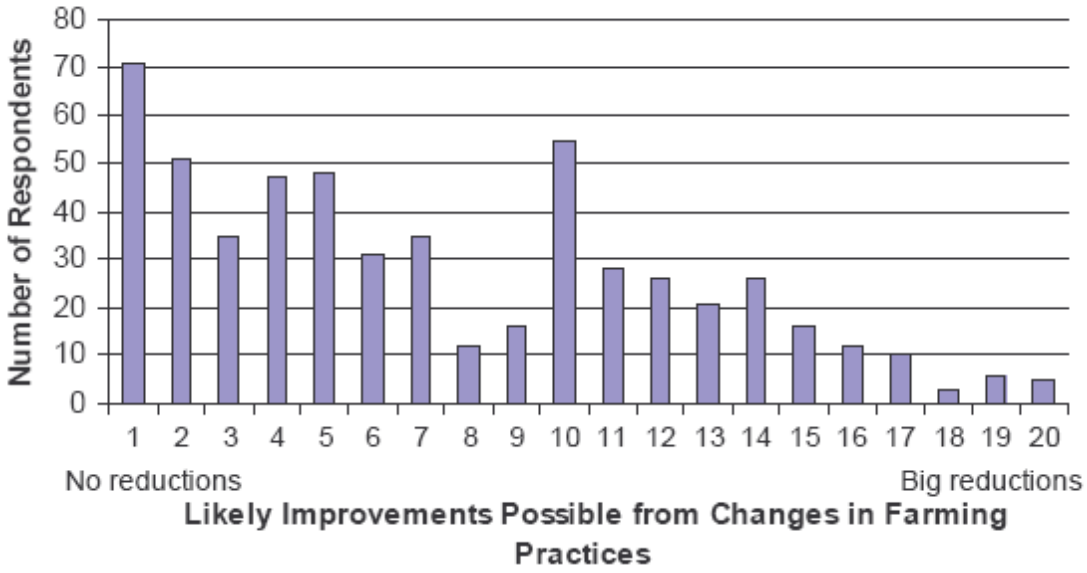


Figure 45 Reductions in GHG or Climate Change that could be possible from changing farming practices
Source: Parminter & Wilson (2003)

This is also reflected through the need for more transparent levels of scientific information fed and available to farmers in order to increase their knowledge base. Their beliefs that their behaviours will not influence climate change of levels of GHG's would be enhanced if they could see past their individual farm level and toward their contribution to the dairy industry as a whole. This would then flow on to the industry's efforts being complemented nationally with other industries efforts and so on. This was reflected earlier with results showing that farmers were concerned with the dairy industry's efforts against national efforts and New Zealand's abatement efforts against global efforts.

When discussing the aspects of the ETS and climate change with farmers it was strikingly evident that the level of comprehensible information was significantly lacking. This was also the case surrounding the information pertaining to abatement methodologies and certain farming practices. The study by Holloway also looked at these aspects with some interesting results illustrated in figures 46 and 47 below:

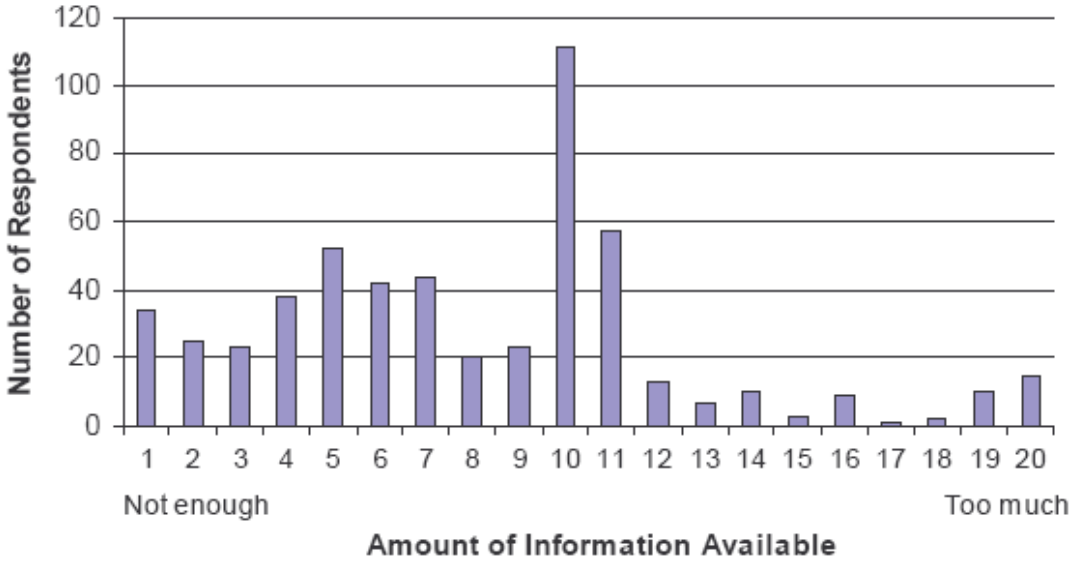


Figure 46 Landowners' assessment of the amount of available information on GHG's and climate change
Source: Parminter & Wilson (2003)

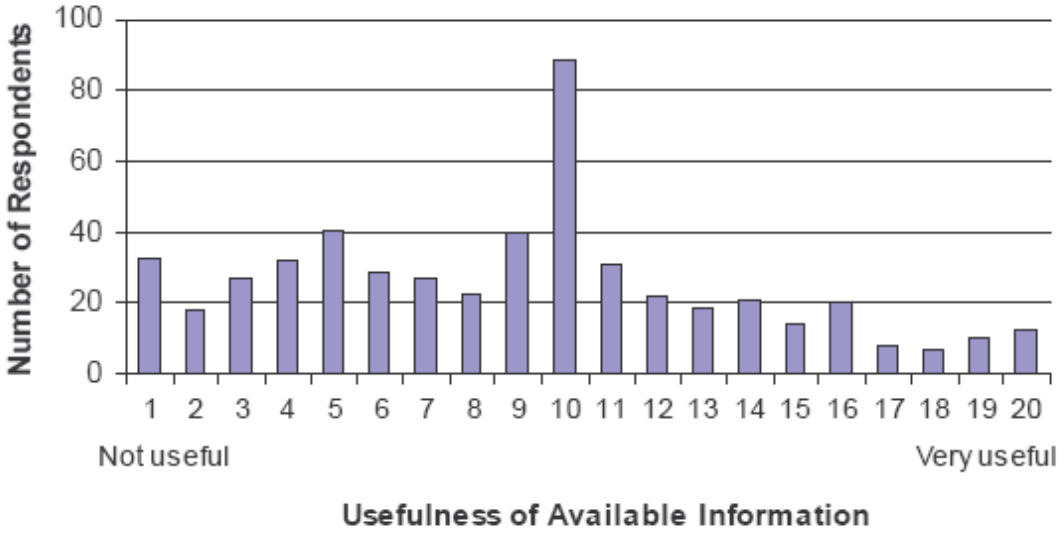


Figure 47 Landowners' assessment of the usefulness of available information on GHG's and climate change
Source: Parminter & Wilson (2003)

This confirms the statements made earlier that more information should have been made available to farmers and that this information had to be constructed in a way to capture farmers' attention and be in a format that they could easily understand and easily apply to their farm or their individual situations. This information needs to be easily available else it will be ignored and they will continue to argue that they have failed to be properly informed as to the direct consequences of the policy developments.

Liability Calculation/Emissions Measurement/Reporting

Farmers exhibited a real concern over the lack of clarity and understanding surrounding the calculation of costs likely to be incurred under the ETS. Stern (2006) emphasised the difficulties surrounding the measurement of agricultural related emissions where he states *since the sources tend to be distributed, there would be high transaction costs associated with actual measurement of GHG at the point of emission* (ibid, p389). This would be a sound basis for those arguing for the level of obligation to be applied at the Fonterra or fertiliser company level of the industry rather than at the farm level as proposed. Stern furthers this through proposing the use of pricing mechanisms placed on GHG emission proxies where, for example, fertiliser itself is targeted by a pricing mechanism in order to reduce emissions (ibid). He also leads on to the pricing of complementary inputs – for example imposing prices on the currently inadequate pricing regime around access to water whereby fertiliser usage is greatly enhanced through irrigation techniques. Thus if water was priced to an extent where the marginal cost was greater than the marginal benefit received through extensive fertiliser use then a reduction in fertiliser reliance would be experienced and other techniques explored.

Considerable uncertainty exists as to how and who will be required to report upon their emissions under the ETS. The formal process that participants must adhere to is registering as a participant, opening a holding account with the emission unit registry, collect and keep data, calculate emissions, file an annual emissions return, surrender emission units and respond to inquiries regarding audit and or verification initiated by the Crown (Emissions Trading Group, 2008). Thus it would be presumed that the calculation and reporting must be done at the farm level. As illustrated earlier with the vast range of liability calculation under differing parameters this farm level reporting appears impractical. In order to guarantee transparency, accuracy and timeliness it would seem appropriate to allocate this responsibility to the Regional Councils administering consent compliance on individual farms anyhow. Consent parameters could be designed to cover emissions at the farm level accurately and compliance reported on annually.

The ETS framework states *high-quality emissions monitoring and reporting are essential to assure effective compliance and trading* (ETS, 2008, p52). The scheme then goes on to state that *to the extent possible, without challenging the integrity of the scheme, monitoring and reporting requirements should take advantage of existing information flow and documentation* (ibid). Thus with the compliance monitoring that regional councils already undertake then this would complement the extra compliance requirement under the ETS. A provision could be made to audit the procedures of each regional council in order to assure accuracy across the board. Fonterra have answered this stating that they will gather the on-farm emissions data from suppliers, submit total emissions' returns annually and trade units on behalf of our farmers (Fonterra, 2008). Fonterra further stated that they will be liable for processing the information provided by each farm, but farmers, would be liable for any financial costs associated with the emissions generated on farm (ibid). This leaves the onus at the farm level for emissions to be measured and reported which still lacks the required emphasis on simplicity and accuracy from the farmers' side of things.

Fonterra states that they believe emissions trading is the best scheme under the Government's plans to abate GHG emissions (ibid). Fonterra believe emissions trading to be more flexible than a pure control mechanism over emissions through the Resource Management Act and that it has potential

to link to international measures (ibid). In terms of the level of obligation within the ETS Fonterra states:

> *However, we have indicated to Government that New Zealand farmers should not be exposed to a price on emissions until there are methods available to report and reduce on-farm emissions, or our competitors have been exposed to an equal carbon cost…If we do apply a carbon charge to agricultural GHG's first [internationally], our industry's competitiveness may end up significantly compromised, allowing other less efficient producers in other countries to fill the gap in global supply* (ibid, p6).

This risk to the competitiveness of Fonterra and its farmers is a big concern to the economy and was picked up by many farmers and an area of concern with the ETS in its current form. Under the ETS a corporate welfare regime exists whereby eight companies are likely to qualify for this corporate welfare and are likely to receive $1.4 billion over the first commitment period and 6 years post-Kyoto also (Bertram, 2008). This 'subsidy' will cover 90% of direct 2005 emission costs and 90% of the increase in cost of electricity expected due to the introduction of the ETS (ibid). Of this total subsidy Fonterra is one of the eight companies likely to receive assistance with conservative assumptions suggesting an $86m initial subsidy to cover the first commitment period and another $108m to cover the subsequent 6 years (ibid). This assistance is to avoid any negative effects on trade exposed companies in order to cement current competitiveness in the global economy.

It is about now where it seems necessary to outline a slight disclosure as to the developments of the ETS during the journey of writing this thesis. The ETS was mooted in September 2007 and was passed into law September 2008 just after the interviews for this thesis were conducted. In November 2008 the National Party came to power, and promised to maintain the ETS but in an altered form that aligned economic needs with environmental needs. Since the election the new government has outlined that a select committee will be formed to review the ETS and that a carbon tax would be *more predictable for a period of time as a transitional mechanism* (Dominion Post, 19.11.2008, C1). This select committee is to report back to parliament by September 2009 and thus a wait exists for the ETS to be finalised or scrapped and another form of climate change policy created. Prime Minister John Key had always stated that an ETS for New Zealand should follow that of our closest trading partners and with Australia proposing to include agriculture in 2015 it is evident that we will probably follow in these footsteps. This carbon tax idea could contain merit building on Sterns ideas from above where emissions proxies are charged a tax deliberately targeting problems area within industry, but the disadvantage of shifting to a tax stems from the inconsistency of government to set a clear direction for climate policy that can survive the electoral cycle. Such consistency is necessary for the investment community to realign investment decisions toward a low carbon economy. In turn, progress toward a low carbon economy is required globally if the international community is to succeed in stabilising atmospheric GHG concentrations to a level that will avoid dangerous anthropogenic interference in the climate system.

It is also important to point out that some abatement methods such as nitrification inhibitors, feed pads and small plantations do not count towards offsets under current international framework. For forestry to be included under Kyoto the area must be at least one hectare which is at least 30 meters wide and was planted post 1990 (Fonterra, 2008). Unfortunately good argument exists whereby riparian margins failing to meet this threshold should be excluded under a flexible post-Kyoto

agreement due to stringent regulations and requirements through the Marrakesh Accords and Land-Use, Land-Use Change and Forestry Good Practice Guidelines set out by the UNFCCC. Farmers would surely refuse the regulation of having to plant 15m either side of a watercourse in order to meet ETS regulations.

Social Responsibility/Sustainability

Sustainable development reporting extends from the area of corporate social responsibility (CSR). CSR can be viewed as the act of discharging any voluntary social accountability of an organisation (Gray et al, 1996). This social accountability arises when and if the organisation actually has (or perceives to have) a social responsibility (Gray et al, 1996). The process of CSR seeks to improve or develop the organisation's level of accountability, democracy and transparency (Gray et al, 1996). Strong arguments exist surrounding those for CSR and those against any CSR at all. A strong advocate of not applying CSR is the late Milton Friedman who postulates that:

"in a free society there is one and only one social responsibility of business – to use its resources and engage in activities designed to increase its profits so long as it stays within the rules of the game, which is to say, engages in open and free competition without deception or fraud"

Source: Friedman, 1970

Friedman's opinion stems from his belief that "there are no 'social' values, no 'social' responsibilities in any sense other than the shared values and responsibilities of individuals" (Friedman, 1970). Thus individuals are responsible for business decisions and action and that any exercise of social responsibility by a corporate executive is:

- Unfair - as it constitutes taxation without representation,
- Undemocratic – as it invests governmental power in a person who has no general mandate to govern,
- Unwise – as there are no checks or balances,
- A violation of trust – as the executive is employed by the owners "as an agent serving the interests of his principal",
- Futile – as (s)he [the executive] imposes costs on (her)his stockholders.

Source: Mulligan (1986) in a critique of Friedman (1970)

Friedman in his argument assumes the corporate executive is acting without counsel and participation from other stakeholders (Mulligan, 1986).

Mulligan is a strong advocate for CSR where he uses the precautionary principle to support his stance:

"since, to act with perfect certainty, we would need to know all the events which will be in any way affected by our action throughout an infinite future. Human life, however, requires action in the absence of certainty, and business people in particular have a bias toward action".

Source: Mulligan, 1986

Thus it is assumed here that sustainable development reporting is an act of discharging any CSR an organisation may comprise. But it is only an act of CSR if there is no regulation requiring it. If we are dealing with a public policy design there is every opportunity to impose regulatory requirements that generate outcomes that happen to be socially and environmentally responsible. This is a key role of government in the design of remedial measures associated with market failure. Climate change is a big example of market failure on a global scale. SD reporting is an act of CSR if it is undertaken voluntarily and aligned with a standard of behaviour above and beyond compliance with regulations. Thus companies reporting under the jurisdiction of the NZ ETS cannot claim to be discharging an act of corporate social responsibility.

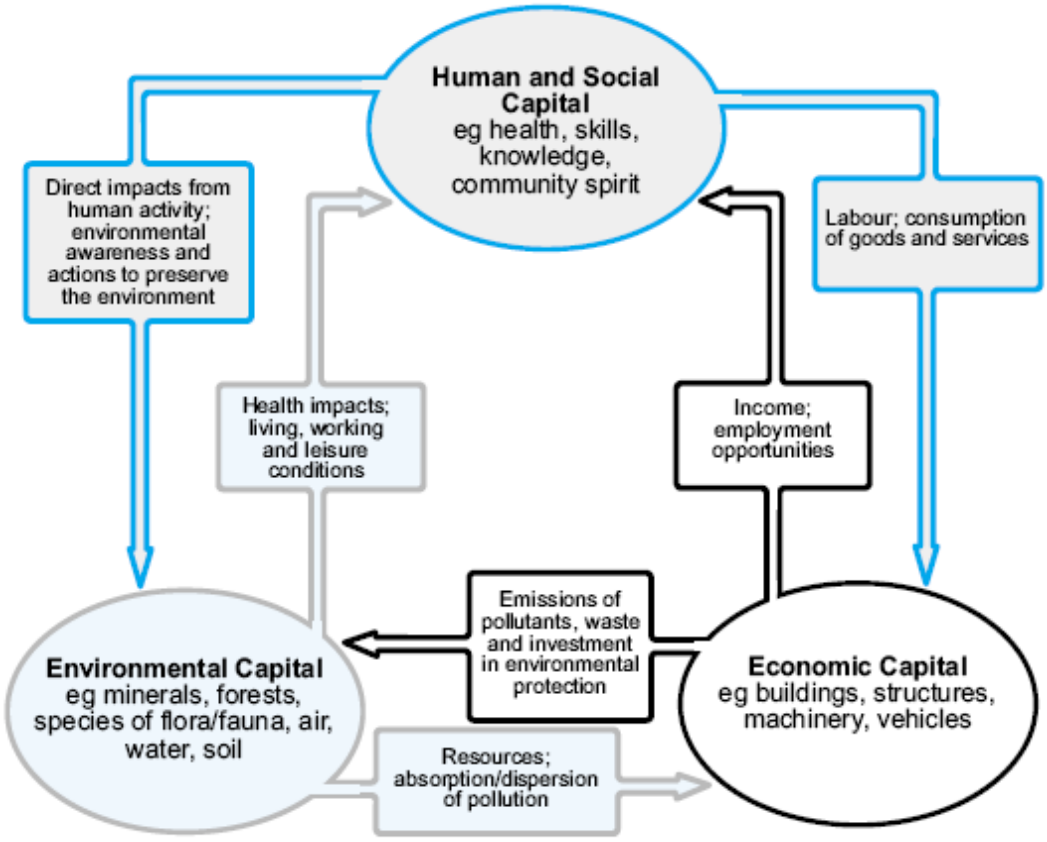


Figure 48 Interactions between the dimensions of sustainable development

Source: UK Department of the Environment, Transport and the Regions

Figure 48 gives illustrates the different aspects involved with sustainable development and the interactions therein. "Sustainable development takes into account all the different economic, social and environmental aspects to choose the best long-term path to maintain and improve our quality of life" (Statistics NZ, 2002). Figure 48 also gives an account of the feedback systems implicit within sustainable development also, for example, from economic capital the human and social capital sphere receives income and employment where, in return, it supplies the economic capital with labour and consumption of goods and services. When scrutinising the environmental sphere we

start to notice the detrimental side of the equation where, for example, resources are depleted, humans receive health impacts, and ecosystem services are degraded.

Farmers outlined to me their concern over the ever increasing level of bureaucracy within the industry and this highlights the issue of property rights over private and public goods. We could envisage the farmer's resources as the environmental source and the atmosphere as the environmental sink. This sink receives the waste products from the farming system and attempts to regenerate this waste. Daly and Farley (2004) propose to directly control sources would involve greater interference with existing property rights than controlling sinks. The formation of the ETS has put a value on the public good of the atmosphere as the only known sink for greenhouse gas emissions (with artificial sequestration science currently at an embryonic stage). It would be deemed far more socialistic to charge for emitting source pollutants with a resultant value on the public sink than to directly control the access to the source (ibid). The ETS as a form of climate change policy is explained through the creation of property rights to the atmosphere. Although not excludable the introduction of a cost to trade the right to emit would be excludable and a private good once traded. It would therefore be deemed as socially responsible for a farming entity to enter the ETS and abate emissions as an effort towards combating climate change and respecting the human right to a clean environment, incorporating the important issue of inter-generational equity. This reduces the total social cost and would continue to do so as abatement levels increase and total net emissions decline nationally.

The issue of non-compliance by New Zealand organisations boils down to the fact that sustainability reporting remains a voluntary act, except for points of obligation in the ETS. Whilst some companies are attempting SDR those who are not have no legal obligation to do so. Thus while SDR remains a voluntary act the uptake of SDR in New Zealand will remain stagnant. Alongside the issues of regulation are the implications around the complexity of SDR and the resources required to efficiently uptake any form of SDR. Guidelines do exist for companies to simply pick up and produce reports upon, but currently a game of follow the leader exists whereby a few companies report upon their sustainability and the rest will free-ride upon their efforts and learn from their mistakes. Therefore farms as an entity are fulfilling their reporting requirements under the ETS is expedient towards exercising this social requirement of reporting their actions in terms of emission measurement and abatement efforts.

If farmers or other industries did not have any impact on the broader system that generates liabilities for the tax payer then there would be little need for reporting associated with compliance with environmental regulations. All industries generate externalities that need to be managed by governments and the farming industry is not exempt from this. Examples include the extensive damage certain farming practices can and do have on water quality and GHG emissions. It is healthy to be up front about the facts of the matter and these issues can be addressed in a way that take account of the needs and interests of farmers, so that an environmental management outcome (farmer responsibilities) is able to align with the protection of farmers rights.

Through the period of writing this thesis the New Zealand Emissions Trading Scheme has gone through many alterations for the worse and for the good. The country was considered world leaders in attempting to include agriculture in to such a scheme which many applauded our efforts. It now looks as though, under new leadership, the country will head down a carbon tax path until the

intricacies of an ETS are ironed out. To not include agriculture in either of these methods of meeting our Kyoto Protocol commitments would equate to an enormous subsidy to the industry with tax payers having to cover half of the country's emissions from one single industry.

Unfortunately not all greenhouse gas abatement options facing the dairy industry are available "off-the-shelf" and this has been reflected through farmers' attitudes towards abating these emissions. The current legislation (Climate Change Response (Emissions Trading) Amendment Act 2008) cannot be applied to the dairy industry at the farm level without excluding the need to abate methane emissions until abatement methods become mainstreamed with extensive testing and made available at a competitive price to farmers. The science is progressing around methane but is not at a point where, for example, it is surrounding nitrification inhibitors and the resultant market for NIs where these are available to farmers to use on farm, and as studies are showing, at a profit to those farmers and of course the environment. For the new National led Government to implement the Climate Change Response (Emissions Trading) Amendment Act 2008, a clause would need to be made that enables the Government to introduce methane into the ETS when it is accepted that the research and testing is transparent and proved to a point where its inclusion will be accepted by the industry. At the time of writing this thesis the point of obligation for the agriculture industry is still to be decided with many saying that it should be at the farm level, but many arguing that it should be at either the fertiliser company level or Fonterra level. The arguments for the ETS being applied to individual farmers propose that greater behavioural change (in terms of on farm management and emissions abatement) will occur with the cost being borne by individual farmers. Whereas the arguments for the ETS being applied to fertiliser companies or Fonterra propose that for ease of administrative requirements (for example monitoring, reporting and auditing) that applying it to 40,000 individual farming businesses would simply be astronomically complex. If the ETS is applied at the farm level most farmers agreed with a proposal that was put to them that Fonterra should act early on their shareholders mitigatory efforts and start to look down the path of being carbon neutral and looking to capitalise on this through the marketing of niche products on the global market. To most farmers the likely initial expense of approximately $5,000 is enough to spur them in to early action and early abatement efforts before the industry is fully involved in the ETS. Although farmers stated that 2013 was too early to be involved, this 4 year lead in period does provide time to trial certain abatement methodologies and techniques in order to meet their individual costs under the scheme and also to trial measurement and reporting requirements.

Taranaki dairy farmers interviewed for this thesis agree with those commentators arguing for the exclusion of methane and for the scheme to be applied at a higher level within the industry than themselves. Very few farmers were fluent with the workings of the ETS let alone getting over the mindset that this was simply another tax. Farmers were blind to the fact that the cost imposed on them by the ETS was reducible through varying abatement options and that they could offset it completely through on and off-site afforestation schemes. Very few had even heard of the availability of nitrification inhibitors let alone actually using them (9% were actively using NIs) nor had the knowledge of their true benefits. Riparian management is seen in an ever growing green light, especially in Taranaki, and the need for riparian margins to be included would ever increase and enhance the viability of the ETS.

Conclusion and Gaps Identified

How the introduction of an Emissions Trading Scheme in the New Zealand dairy industry would affect farmers and their individual attitudes towards the greater goal of abating climate change was the aim of this thesis. The objectives addressed were surrounding the intricacies of the range of the liability faced by the agricultural industry under the ETS come 2013; how can this liability be reduced specifically concentrating on the emissions avoided relating to the implementation of riparian zones and nitrification inhibitors; what is the attitude of farmers towards these abatement methodologies and will the liability simply be overlooked due to immateriality; and finally how does this emissions abatement tie into themes of sustainability, social responsibility and sustainable development reporting?

The analysis through face-to-face interviews illustrated here that Taranaki dairy farmers are mostly willing to comply with what the Government of the day passes in terms of meeting climate change commitments with certain reservations. These farmers need to be convinced (along with part of the population) that climate change is out there and that our ratification of and commitments towards meeting Kyoto are worthwhile and equitably attainable. Research and development surrounding some abatement methodologies require vast improvement and once this is achieved then these gases and abatement methods can be brought under such an emissions trading scheme – until then we must move forward with the current technologies and meet what we can efficiently now. Farmers are certainly open to trialling new technologies and methods of doing things but an overriding factor will always be cost and the Government needs to place careful consideration around cost regardless of where the scheme is applied to the agriculture industry – they need to protect the competitiveness of Fonterra but also pay special attention to the needs and capabilities of individual farmers if it is to be applied here. The industry are capable of following market and environment movements which has been seen through the implementation of the Clean Streams Accord. The industry has maintained competitive payouts through global market turmoil thus they will find the best path to get through the implementation of the ETS without farmers being struck by the ETS stick too harshly.

Unfortunately the scepticism surrounding climate change will always be illustrated by the media and particularly those sources of media that farmers find it easiest to obtain and comprehend. The farmers interviewed here showed a near on 50:50 split between accepting anthropogenic warming and not accepting climate change (through the observation of nil effects, cyclical climate and natural warming). Most farmers did accept that if climate change is occurring that varying effects would be felt throughout the country within the dairy industry. In terms of the mitigatory efforts towards abating climate change an astonishing majority of farmers perceived that this would simply impose a cost to them. Ignoring the climate change debate it was asked of farmers as to their thoughts and attitudes surrounding the capture and use of renewable energy. The interesting general response to these questions was that 91% of farmers stated that renewable energy was an option to them within their medium term outlook. The barrier to current implementation was basically cost and longevity of current technologies so with improvement hopefully we will see a vast uptake of renewables on farm over the next decade.

Farmers realised the need for the country to meet our Kyoto liability although most were against the country having ratified Kyoto. New Zealand's political journey has taken us through the first phase

of global climate change commitments and is looking to continue ratification through post Kyoto commitments. The Emissions Trading Scheme is an embryonic step towards us as a country meeting this current commitment and will hopefully develop through to be robust enough to meet future commitments. In order for the country to meet these commitments it is vital that agriculture is covered in some way or another else any efforts made as a country will be null and void.

This research has highlighted the need for extra engagement with the dairying industry in terms of the high level goals of the ETS; day-to-day benefits and costs of imposing such a scheme on the industry; tangible examples and know-how of the requirements and science behind different abatement methodologies; comprehensive reporting and the true transparent costs of imposing such a scheme on the dairy industry and the resultant wider economy implications and what this means for New Zealand to be treading the carbon trading path - especially in terms of meeting global efforts towards achieving a low carbon-reliant system.

Glossary of Terms

CFG	Carbon Farming Group
CH_4	Methane
CO_2	Carbon Dioxide
CO_2e	Carbon Dioxide Equivalent
CSR	Corporate Social Responsibility
ETG	Emissions Trading Group
ETS	New Zealand Emissions Trading Scheme
EU ETS	European Union Emissions Trading Scheme
GHG	Greenhouse Gases
IPCC	Intergovernmental Panel on Climate Change
MAF	Ministry of Agriculture and Forestry
MfE	Ministry for the Environment
Mt	Million Tonnes (of greenhouse gases)
NIs	Nitrification Inhibitors
NO_x	Nitrous Oxide
NZU	New Zealand Unit
PCE	Parliamentary Commissioner for the Environment
PGGRC	Pastoral Greenhouse Gas Research Consortium
RM	Riparian Management
RMA	Resource Management Act (1991)
UNFCCC	United Nations Framework Convention on Climate Change

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APPENDICES

Appendix I – Copy of Interview Questions

Appendix II – Copy of letter that went to farmers instigating interview

Appendix III – Copy of ETS summary that accompanied letter

Appendix IV – Ethics Approval

Interview Questions

1. What is the size of your farm?

2. What is the size of your herd?

2a. Has this changed over the last 5 years?

NOx

3. What current practices do you have in place in order to reduce nitrous oxide emissions (NI, RM etc)?

No RM

3a. Does your farm have a nutrient budget and to what level have you implemented this?

3b. What would it take for you to trial:
- a nitrification inhibitor?
- reduced N feed?
- feeding pads?
- improving drainage?
- soil liming?

Voluntary marginal abatement measures – before what level of regulation are these 'low hanging fruits' utilised?

Eg: NI applied at a profit – negative cost on the MAC curve – farmers utilise these before 'go live' date to best align themselves

3c. *If no current riparian management*

3.1a. Do you have a riparian management plan?

3.1.1a. If yes – what barriers are prohibiting your motivation to implement this?

3.1.1b. If no – why not and what would overcome the barriers and encourage you to have a RM plan?

CH_4

4. What current practices do you have in place in order to reduce methane emissions?

4b. What would it take for you to trial:
- bulls with reduced residual feed intake?
- better managed intensive grazing?
- propionate precursors?
- legumes containing condensed tannins?
- methane capturing technology?

CO_2

5. What current practices do you have in place in order to reduce carbon dioxide emissions?

5b. What would it take for you to trial:
- diesel/fuel budgets?
- small-scale renewable energy sources for power?
- offsetting by planting trees?

6. How do you perceive the potential impacts on the dairying industry from climate change (long-term)?

7. Relevant to the dairying industry how do you perceive the potential impacts of climate change policy on your medium-term business strategy? [nil - minimal – enough to provoke some changes – change a lot of strategies – extreme rethink of approach]

8. Before this interview, to what level were you aware of the ETS and its associated implications?

9. What aspects of the ETS (as it stands) do you deem to be the *most* effective for the dairy industry?

10. What aspects of the ETS (as it stands) do you deem to be the *least* effective for the dairy industry?

11. Given that international carbon prices are set to rise and given the likelihood of the ETS and delaying any action simply makes it more expensive, which early voluntary actions would you consider?

12. Also given the imminent carbon price increases and ETS as a 'last resort' would you consider land-use changes – even minor amounts in order to offset your emissions and ETS liabilities?

12a. If yes – what area? (paddocks, ha's)

13. Of the cost that the ETS will impose on you (assuming enactment), to what level will you bear this cost and start to consider mitigation efforts/options? [$5k - $10k - $15k - $20k - $25k etc]

14. Are there any other factors that would influence the level of income at which you would start to abate against emissions?

15. If this reduction in emissions meant that you/Fonterra could promote your product as 'clean / green / carbon neutral' (ie playing the marketing game and recovering costs from the consumer) would this encourage early voluntary action?

16. Do you believe this development of climate change and evident emissions trading, that a new generation of farmer will emerge that has a strong attitude toward resource efficacy – ie: how will climate change and emissions trading influence the next generation of farmers?

TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI
VICTORIA
UNIVERSITY OF WELLINGTON

Research: Dairy Farming and the New Zealand Emissions Trading Scheme

Proposed Interview

Dear Farmer,

I am undertaking research on the current and future impact of the NZ ETS on dairy farming practices. In particular I am interested in learning about farmer attitudes and insights associated with climate change policy and its potential influence on farming practices.

I attach a brief summary of the way the New Zealand Emissions Trading Scheme (ETS) is likely to influence dairying. This summary also explains the specific issue of interest for this research.

I will be randomly selecting 30 farmers from a total of 100 dairy farmers in Taranaki for interviews. Accordingly, I may be in touch with you regarding an interview (approximately 30 minutes).

Any information you provide will be kept confidential to me (the researcher), my supervisor and the person who transcribes the tape recordings of our interview. The thesis and any potential publication or conference presentation arising from this research will not use your name, and no opinions will be attributed to you in any way that will identify you.

All raw data will be kept confidential and destroyed on completion of this thesis. Results directly pertaining to my research will be available upon request.

I thank you for your time in reading this and you may hear from me regarding a possible interview. Your cooperation is much appreciated but if an interview is inconvenient for you then I completely understand.

Kind regards,

Craig Fowles

Masters of Environmental Studies

Victoria University of Wellington

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New Zealand Emissions Trading Scheme Summary

BACKGROUND

The Earth's climate is changing at an increasingly rapid rate, largely due to ongoing high rates of greenhouse gas emissions caused by human activity. Even with concerted global effort to reduce greenhouse gas emissions there are likely to be changes in temperature and rainfall patterns, increases in the number of significant wind and storm events, and an increased risk of flooding and coastal erosion. These impacts have flow-on effects for air and water quality, the retention of nutrients in soils, and preserving biodiversity.

Source: Emissions Trading Scheme (2007)

In alignment with international treaties and growing international pressure and speculation, the New Zealand Government in October 2007 announced an Emissions Trading Scheme (ETS) adaptable specifically to the New Zealand scene. This ETS targets specific sectors of society within our economy in order to reduce their associated emissions. The Government has decided to take this financial path as it provides strong incentives to reduce emissions (ETS, 2007). Agriculture will be involved with the ETS come 1 January 2013. Therefore a unique opportunity exists whereby emissions (and the associated expense) can be minimised over a five year period leading up to this initiation date, in other words now!

Although New Zealand's emissions are low in relation to global emissions (approximately 0.2 to 0.3%), we have the 12th highest in the developed world (ibid). The significant factor with New Zealand's emissions is that of the composition of what we are emitting. The majority of our emissions come from our major exporting industry – agriculture, which emits 49% of our total emissions, this is extravagant considering the developed world's average is 12% (ibid). Agricultural emissions consist of methane from livestock and nitrous oxide from livestock excrement and the extensive use of nitrogen based fertilisers.

LIKELY COST

The breadth of methods that can be deployed for the calculation of the liability faced by the industry is almost incomprehensible. MAF (2008) approached this using the 2006/2007 production year as a baseline for their calculations, and as would be expected, "the potential impacts increase along with the price of carbon and as the allocation of free units is decreased". It must be noted that the most important underlying factor of this study is that 2006/2007 was a particularly low production year with low profitability and therefore the relative impacts are elevated than might be the case in other years (ibid). Based on the average figures of the 06/07 production year of 360 milking cows producing 127,176kg of milk solids at a payout of $4.14/kg ms the farmers net profit before tax equalled $71,690. Taking a range of carbon prices the table below illustrates the reduction in income (all other things remaining equal).

Carbon Price ($/t)	15	25	50
Milk solids reduction (c/kg)	-16.1	-26.7	-53.4
Income reduction ($)	20,447	33,928	67,884

These calculations obviously only take into account the impacts on income through the implementation of the ETS. With the introduction of costs on inputs such as fertilisers, fuels, electricity and so on the outcome is a little worse.

Other methods of calculation exist including some work done by the Taranaki Regional Council [TRC] (Bedford, pers. comm. 2008) and by the Carbon Farming Group [CFG] (CFG, 2008). The TRC used the assumptions of an average herd size of 237 cows and an emissions liability of $160 per cow equating to $37,920 a year per farmer. This calculation also assumed a world price of $40/t of carbon with each cow producing 4t of CO_2e annually. This calculation also took into account a 2-3% increase in production annually which is in alignment with Fonterra's expectations of around 4% annually (Bedford, pers. comm. 2008). The CFG's calculations of emissions per cow equate to 2.47 CO_2e annually compared to the 4t from the TRC above. Thus at a world price of $50/t of carbon then the average farm of 237 cows would be liable for $29,270 (CFG, 2008). Once again we start to see the variability within these calculations with no best practice guidelines available.

MITIGATION

Amongst many more the following are some of the abatement methods with peer reviewed science behind them that you as dairy farmers can start to act now toward reducing emissions and reducing your liability that is likely to eventuate.

- Riparian Management
- Standoff pads
- New grasses
- Maize feed substitution
- Improving soil drainage
- Nitrification inhibitors
- Liming

I expect that most of this is not new to you but perhaps builds a little on what you knew already or maybe it will spark you off on to some personal research surrounding this very important and inevitable issue surrounding the New Zealand economy and environment. As my letter stated I may be in contact with you regarding an interview but if this is at all inconvenient then that is fine. Thank you for your time.

TE WHARE WĀNANGA O TE ŪPOKO O TE IKA A MĀUI
VICTORIA
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MEMORANDUM

Phone 0-4-463 5676

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TO	Craig Fowles
COPY TO	Dr Sean Weaver, Supervisor
FROM	Dr Allison Kirkman, Convener, Human Ethics Committee
DATE	August 20, 2008
PAGES	1
SUBJECT	**Ethics Approval: No 15785, Agricultural sector under New Zealand's Emissions Trading Scheme.**

Thank you for your application for ethical approval, which has now been considered by the Standing Committee of the Human Ethics Committee.

Your application has been approved from the above date and this approval continues until 30 March 2009. If your data collection is not completed by this date you should apply to the Human Ethics Committee for an extension to this approval.

Best wishes with the research.

Allison Kirkman

Convener