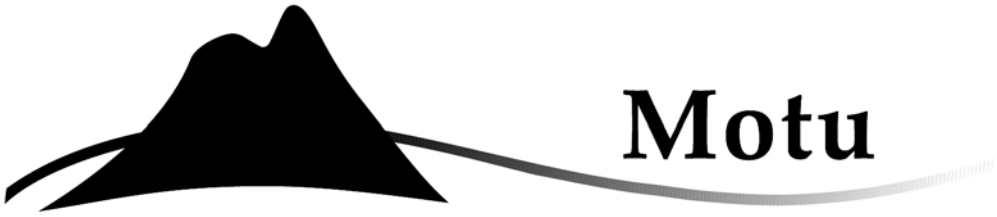

Inclusion of Agriculture and Forestry in a Domestic Emissions Trading Scheme: New Zealand's Experience to Date

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Abstract

No country has previously attempted to include either agriculture or forestry in an emissions trading system. The New Zealand government is planning to include both. This paper describes how they plan to do it, what some of the critical issues have been and some of the outstanding challenges. If New Zealand can resolve these issues and so can create a strong system, this could create a precedent for many others.

Policy development is actively progressing as this paper is written. This paper does not definitively cover the issues but records our thinking at a moment in time and provides a framework for more in-depth analysis.

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Emissions trading, New Zealand, agriculture, public policy

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1 History and context

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1.1 The history and status of greenhouse gas pricing mechanisms in New Zealand

In 2003, the Government agreed "not to implement a legislated levy on the agricultural sector for the purposes of provision of research into agricultural non-carbon dioxide abatement as long as this Memorandum of Understanding is in effect". This was in return for an agreement by the industry to fund mitigation research with the target of reducing total ruminant methane and nitrous oxide emissions by at least 20% relative to business as usual. This research is being implemented through the Pastoral Greenhouse Gas Research Consortium. The memorandum formally expired on 30 June 2007.

This agreement was reached after the ill-fated 2003 attempt to put a levy on greenhouse gas emissions (the so called ‘fart tax’), which led to massive public demonstrations. Farmers at the time did not accept any responsibility for greenhouse gas emissions (or for that matter water quality issues) and also saw the levy as the thin end of a wedge. The engagement of the farming sector (especially dairy) with environmental issues has moved considerably since then though there is still likely to be significant opposition and resistance – it has only just begun to be tapped.

The 'Projects to reduce emissions' initiative run by the Ministry for the Environment was a mechanism that allowed Joint Implementation type projects but these were primarily limited to energy and landfill gases.[1] Some of these affected agriculture but not methane or nitrous oxide emissions from agriculture.

Forestry has experienced a similarly difficult history. Until September this year, the government was very clear that it would not devolve credit for sequestration in post-1989 forests. In addition they clearly stated in 2003 that the deforestation liability for pre 1990 forests would be devolved to the industry above a 'deforestation cap' of 21 MT CO_2-e. This 21 Mt cap was initially expected to be sufficient to cover all deforestation in the first commitment period, but is now expected to be insufficient as simultaneously confidence in forestry has fallen and the returns to pastoral agriculture and particularly dairy have risen. The combination of these two policies generated significant opposition within the forestry sector who saw themselves as having contributed significantly to climate mitigation and who considered that at least in part, their planting decisions had been motivated by carbon sequestration. Forestry landowners refused to grant government representatives access to their land to collect data for the forest carbon inventory. They were extremely vocal right up until the recent government proposal was announced. They have now lifted the ban on access to private forestry properties. They still have some concerns with the policy – these are discussed later.

The previously proposed carbon taxes did not cover agricultural or forestry emissions. The first was threatened in the late 1990s if voluntary emission controls were insufficient – it did not eventuate. The second was announced in 2002 to start in 2007 but was abandoned in 2005. Both collapsed at least in part because of strong industry opposition and, in the later case, because of the extensive negotiated exemptions that gradually undermined the environmental efficacy of the tax.

The Permanent Forest Sink Initiative run by the Ministry of Agriculture and Forestry, which became operational on 1 December 2007, offers

[1] http://www.mfe.govt.nz/issues/climate/policies-initiatives/projects/index.html

internationally tradable Kyoto units to land kept under continuous forest cover, but due to its relatively restrictive conditions is expected to have limited applicability to plantation forestry.[2] It is a voluntary programme and levels of uptake are uncertain given its limited applicability and the recent introduction of forestry into the ETS.

Initial overall industry response to the Emissions Trading System (ETS) has appeared positive but as people delve further into the details and as ordinary firms and farmers become more familiar with the proposals and their likely implications, concern and opposition to at least some elements seem likely to grow. Some detail about how the ETS will operate in agriculture and forestry are given in section 1.5. More detail is available in government documents.[3] Concerns with the ETS as a whole are focusing particularly around liquidity in and access to international carbon markets, leakage of production and emissions from trade-exposed emissions-intensive sectors, and the likely overall economic impact of the system.

The proposal for agriculture is still very open and discussions with industry groups have been active. This means that concerns have not really crystallised yet. At least some agricultural and forestry industry representatives have expressed discomfort with the idea of processors or industry organisations being made points of obligation for farm-based mitigation activities. Others, such as some fertiliser companies, are willing to assist in the process of farm based monitoring but not take formal legal responsibility. Some individual farmers have expressed strong concern that the system could lead to downward pressure on food production (especially in the face of global food shortages). The government has set up a 'Peak' group with technical advisory groups to explore the agricultural issues in depth.

The forestry sector has responded very positively to the inclusion of agriculture in the system. They have outstanding concerns about the remaining deforestation liability and the way that the free allocation of New Zealand Units

[2] http://www.maf.govt.nz/forestry/pfsi/
[3] http://www.climatechange.govt.nz/nz-solutions/reducing-our-footprint.shtml

(NZUs) to compensate for this liability is being distributed. This is a particularly intense issue for some Iwi, e.g. Ngai Tahu who received forestry land – but not the forest on them – as part of Treaty settlements and now face liabilities. There are also some concerns about the complexity of the proposed monitoring for small forest blocks. There is an ongoing concern with the Kyoto rules which do not take account of the carbon in harvested wood products and which create an artificial distinction between pre-1990 and post 1989 forests. The proposed late entry of agriculture reduces the potential response in forestry because of the competition for marginal land.

1.2 Key features of the New Zealand Emissions Trading System (ETS)

The first critical feature that distinguishes the NZ system from those currently proposed in Australia or the United States is that New Zealand is part of the Kyoto system and is using the ETS as a tool to assist it meet its international obligations. The proposed ETS rules therefore largely mirror those in the Kyoto Protocol. This also means that our 'cap' is not an absolute cap as New Zealand companies will be free to purchase and sell units internationally. NZUs will be backed by Assigned Amount Units (AAUs) and be able to be converted and sold internationally.[4] Similarly the ETS will allow parties to purchase and surrender international credits from the Clean Development Mechanism and Joint Implementation (but not temporary Certified Emission Reductions from afforestation projects) as well as AAUs.[5] This connection to international markets means that international markets will largely determine the New Zealand Unit price. It also means that the timing of entry of sectors, and hence the need to purchase NZUs, and the release of freely allocated NZUs, or sale of government controlled ones do not need to be synchronised so that supply and demand are roughly balanced. This has raised some concerns about access to international markets and the uncertainty and likely volatility of these markets in the short term.

[4] Assigned amount units are the basic currency of Kyoto. Each country that ratifies is given an amount of AAUs equal to their agreed target. For New Zealand this is the 1990 level of emissions.
[5] The latter means that New Zealand is allowed to buy so called 'hot air' which are assigned amount units held by some Former Soviet Union countries (particularly Russia and Ukraine) that are in excess of their current emissions. These could be sold without any emission reduction

A second key and unusual feature is that the intention is that the system is comprehensive: all sectors and all gases will be included. The proposal for free allocation for the agriculture, forestry and industrial sectors uses a simple formula based on 2005 emissions that is consistently applied. The liquid fuels and electricity generation sectors will not receive a free allocation because companies can pass costs on. It is proposed that all free allocation will be phased out consistently in a linear fashion between 2013 and 2025. This consistent treatment across sectors (at least on one visible basis) avoids most lobbying across sectors except in terms of the timing of entry. The lobbying over how the free allocation will be allocated within sectors and how the free allocation will be phased out is beginning to be intense.

Third, those who are points of obligation in the system will not necessarily be the same party that receives free allocations; the points of obligation are being chosen on the basis of primarily technical considerations.

These three key features have heavily shaped the nature of the debates on the critical issues of measurement and initial allocation of free units.

1.2.1 What is the likely timing of ETS implementation?

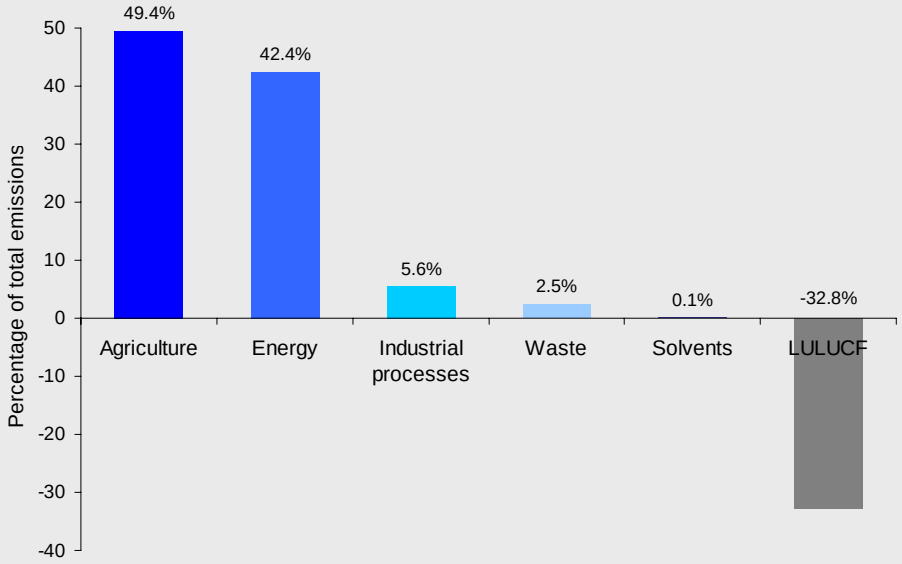
The government has decided that individual sectors will enter into the ETS through a staged process based on sectors' preparedness for trading, administrative feasibility and consideration of price effects through the economy. Critical issues are the ability to measure emissions at the chosen level of point of obligation, the ability to resolve allocation decisions and previous commitments the government has made to specific groups.

New Zealand presents a unique context for phasing the introduction of an ETS. Its stationary energy sector contributes approximately 23 per cent of total greenhouse gas emissions, liquid fuels contribute approximately 20%, and the industrial processes (non-energy) sector contributes approximately 5.6 per cent. The ETS would directly involve about 80 major firms in these sectors. In contrast

within those countries. The European Union Emissions trading system does not allow purchase of

to the EU and other developed nations, approximately 49 per cent of New Zealand's emissions derive from agriculture, while forestry offsets the equivalent of approximately 32 per cent of total emissions in the first commitment period.

Figure 1 Contribution to total net New Zealand CO_2-e emissions by sector, 2004



Contribution to total net New Zealand CO_2-equivalent emissions by sector, 2004.

Source: Ministry for the Environment. 2006. *New Zealand's Greenhouse Gas Inventory 1990-2004*. Wellington.

Given the significant contribution of the non-energy sectors to New Zealand's emissions balance, the Government considered it important that they be included in the scheme as early as possible. The forestry sector will be the first to enter the scheme. This reflects the fact that forest owners have a degree of flexibility to bring forward deforestation if there are incentives to do so. Further, reduction of deforestation is likely to be one of the lower-cost options for reducing New Zealand's greenhouse gas emissions in the first commitment period of the Kyoto Protocol.

The government has decided in principle to formally bring all agricultural emissions into the ETS on 1 January 2013, and not to introduce any other price-based measures in the interim. However, the government intends to

these units.

require participants to monitor their emissions prior to 2013 to ensure the relevant monitoring and reporting systems are functioning properly. This in-principle decision reflects the operational challenges faced in bringing the agricultural sector into the ETS and previous undertakings by the government.

The proposed dates of entry of the different sectors into the NZ ETS are set out in Table 1.

Table 1: Staged entry of sectors into the NZ ETS

	Sector Commencement of obligations	**End of initial compliance period**
Forestry (includes deforestation of pre-1990 forest land and afforestation post-1989 forest)	1 January 2008	31 December 2009 (first compliance period is two years)
Liquid fossil fuels (mainly transport)	1 January 2009	31 December 2009
Stationary energy (includes coal, natural gas and geothermal)	1 January 2010	31 December 2010
Industrial process (non-energy) emissions[9]	1 January 2010	31 December 2010
Agriculture (includes pastoral and arable farming and horticulture)	1 January 2013	31 December 2013
Waste	1 January 2013	31 December 2013

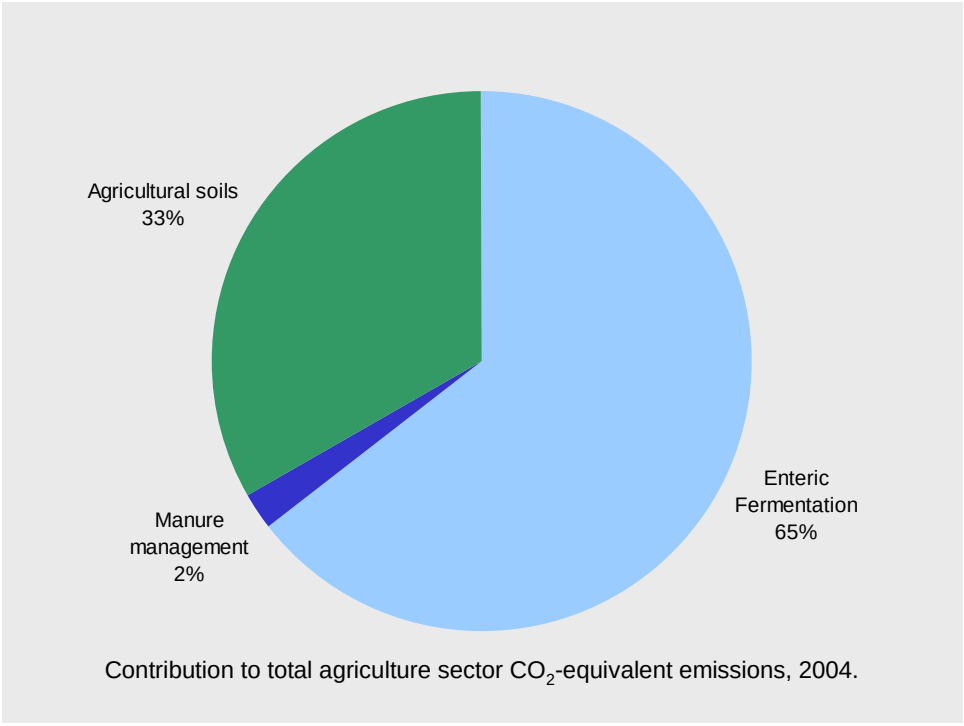
1.3 Why should agriculture and forestry be included in an ETS?

New Zealand is in a unique position as a developed country because of our unusual emissions profile. Agricultural, non-CO_2, emissions make up around half of New Zealand's gross emissions. On the forestry side, emissions from deforestation have been significant in recent years and the timing of deforestation decisions is very flexible. The expected harvests of post-1989 forest after 2020 will lead to significant net emissions from forests and an associated carbon liability. On the positive side, in the long term, New Zealand has considerable potential to expand its forest estate and on average sequester considerable additional carbon. New Zealand policy needs to affect agriculture and forestry decisions to contribute effectively to global mitigation.

1.3.1 How can agriculture and forestry contribute to climate mitigation?

New Zealand agriculture is primarily pastoral (dairy and sheep/beef) so this paper will address only emissions from these activities.

Figure 2 Contributions to agricultural GHG emissions (CO_2-e)



Contribution to total agriculture sector CO_2-equivalent emissions, 2004.

Source: Ministry for the Environment. 2006. *New Zealand's Greenhouse Gas Inventory 1990-2004*. Wellington.

Methane emissions (primarily enteric fermentation) are fundamentally driven by dry matter intake. The efficiency with which it is processed is important but currently New Zealand has not developed methods to affect this systematically – this is a direction of intense current research. Dry matter intake depends on the number and size of animals. Each animal uses a certain amount of energy just to sustain itself – maintenance energy. Larger, more productive animals use more energy. Productivity improvements mean that the same amount of final output can be produced with fewer animals. For example fattening lambs faster so they can be slaughtered at 6 months rather than 1 year reduces the emissions per kilo of lamb produced. This lowers methane emissions. Productivity in the dairy industry is currently growing at around 1% per year – it could possibly be accelerated. The other obvious way to reduce methane emissions is reduce the volume of product produced.

More options are available to control nitrous oxide emissions (primarily from agricultural soils). Nitrous oxide comes partly from fertiliser and partly from livestock depositions (urine and dung). Fertiliser use is growing extremely fast in New Zealand. Both the amount and timing of use can be altered. The

amount of fertilizer and depositions relate directly to stock numbers and the level of production. Productivity improvements lower emissions per unit of output; lower output means lower emissions.

Manure and runoff management can also reduce the impact of a given level of depositions. For example, feeding pads concentrate urine and manure so it can be collected and disposed of with lower emissions. Nitrification inhibitors can, on some soils, reduce the percentage of urine and dung that is converted into nitrous oxide. They are already being applied to some farms particularly in the South Island and the science behind measuring their impact is rapidly advancing. All these options also have benefits for water quality.

For forestry many options enhance the total stock of standing carbon. For pre-1990 forests, the only Kyoto-recognised option (under 3.3) is to not deforest.[6] For post 1989 forests, foresters can increase the area of forest through lower deforestation and higher rates of replanting, increase average age of the forest by either extending rotations or not harvesting at all; and increase the carbon density for a given age class by increasing stocking density or changing pruning regimes or species (including indigenous forest). All of these are relatively easy to monitor, and their impacts on carbon assessed though on-site assessments.

There are some risks associated with mitigation through forestry because of the Albedo effect (forests are dark so absorb rather than reflect heat). This makes sequestration in mid-latitude forests potentially less valuable for controlling climate change. The science on this is still advancing but it could alter the role of temperate forestry in future climate agreements.

[6] Countries have two options for accounting for forestry. Article 3.4 provides an option for full carbon accounting in forests. Under 3.3 accounting is partial. Forests are separated into pre-1990 and post-1989. Pre 1990 forests do not need to be monitored, reporting is required only if they are deforested (change land use to a non-forest use). Above-ground carbon in post 1989 forests is fully accounted for so forests gain credit as they grow and face liabilities on harvest. Soil carbon is not included.

1.3.2 Why use trading as the policy instrument?

The cost and value of mitigation options varies considerably across farms and areas of forest. This makes it hard to regulate efficiently using traditional methods. Price-based measures provide farmers and foresters strong incentives and flexibility to choose their response. Agriculture and forestry compete for land so the incentives provided can be complementary. Including them in the system also creates consistency with the pressure for other climate mitigation efforts within New Zealand, and to a lesser extent abroad, which has both efficiency and equity benefits.

1.4 The value of New Zealand's effort

If New Zealand can learn how to effectively abate agricultural (especially livestock) emissions and enhance forests this will be internationally valuable, particularly for developing countries. New Zealand is already investing in research into mitigation options in these sectors. The introduction of the ETS will lead to more publicly funded research but also induce private sector innovation and adoption of new technology and management practices.

New Zealand has already learned a lot about how to design a policy that includes agriculture and forestry. Monitoring technology and models are being intensively investigated over the next year, as the details of the ETS policy are refined. New Zealand will continue to learn as it implements the policy and researchers plan to evaluate the system once it is operating. This will provide valuable knowledge to other countries that consider implementing similar programmes.

1.5 Overview of Treatment of Agriculture and Forestry in NZ ETS

1.5.1 Agriculture

All energy-related emissions in agriculture are covered indirectly through the liquid fuels and stationary energy sectors. The system will also cover emissions from synthetic fertiliser use and enteric fermentation and manure management, which produce nitrous oxide and methane. Coverage of these gases is the focus of this paper.

The government proposes that coverage for sources of agricultural gases be limited to those that are currently accounted for under New Zealand's nominated activities for the Kyoto Protocol. This is to ensure that the scheme coverage reflects New Zealand's current obligations under Kyoto, and is because of the limited technical feasibility of including additional sources. Broadly speaking, the ETS has been developed to cover the bulk of emissions from pastoral agriculture (sheep, beef, deer and related production such as wool and velvet), horticulture and arable production. This means that other minor sources may be included in the scheme where it is practical to do so, but a pragmatic approach will be taken and there is likely to be a range of minor emission sources to which the de minimus principle will apply.

The government's preferred point of obligation for emissions from fertiliser use is on the importers and producers of nitrogenous fertiliser. However, it has indicated a willingness to consider placing the obligation on farmers or sector bodies. For emissions from enteric fermentation and manure management the government's preferred point of obligation is on the processors of the relevant agricultural products (such as meat and diary processors), but again the option of placing the obligation on farmers or sector bodies has been retained.

The government plans to freely allocate units equal to 90% of 2005 emission levels when agriculture enters the ETS. This free allocation will decline linearly to zero in 2025. Free units could be allocated to farmers, processors or sector bodies and will not necessarily go to the party that is made the point of obligation. It is possible that agriculture could face a progressive obligation (i.e. responsible for surrendering units to match only a share of emissions). All decisions on allocation, including the decision to delay entry of agriculture until 2013 are still subject to negotiation.

1.5.2 Forestry

In contrast, the rules for forestry are more clearly defined. The treatment of forestry in the NZ ETS relatively closely mirrors New Zealand's obligations under the Kyoto Protocol. As a result, the scheme treats forests first

established before 1 January 1990 (‘pre 1990’ forests) differently from those first established after 1 January 1990 (‘post 1989’ forests).

Owners of pre-1990 exotic forest who decide to deforest (that is, convert to another land use) after 1 January 2008 will be liable for the carbon emitted as a result of deforestation. Any fluctuations in carbon stocks while those forests remain in place, such as due to harvesting and replanting, will not be captured by the scheme. The core obligations of those deforesting pre-1990 forestland will be to:

- Report annually to the administering agency about any area deforested;
- Calculate, using specified methodology, the emissions associated with this deforestation;
- Surrender a number of New Zealand Units (NZUs) or other acceptable units equal to the calculated emissions.

Deforestation is defined as “the conversion of forested land to non-forest uses, such as farmland, roads, or housing developments”. Where there is any doubt over whether a change in land use has occurred, deforestation will be deemed to have taken place if a sufficient covering of a forest species that is capable of reaching at least five metres in height is not in place after a specified period of time.

Owners of post-1989 forestland have been given the choice to enter the ETS. Owners who enter the scheme will be obliged to take responsibility for the ongoing net changes in the carbon stocks of their forests. They will receive NZUs if those stocks increase as a result of tree growth and will be required to surrender NZUs if those stocks decrease as a result of activities or events such as harvesting or fire. The Government will retain responsibility for changes in the carbon stocks of post-1989 forests that have not entered the ETS, keeping any credits earned and remaining responsible for any future liabilities. Those who opt to join the ETS will have core rights and/or obligations to:

- Report to the administering agency the relevant carbon stock changes;

- Calculate the increased stock of carbon removed from the atmosphere and/or decrease in carbon emissions associated with the forest, using methodologies approved in regulations;
- Receive a number of NZUs equal to the calculated sequestration; or
- Surrender a number of NZUs or other acceptable units equal to the calculated emission liabilities, should emissions exceed sequestration;
- Pay direct costs associated with administration of the scheme.

1.5.3 How agriculture and forestry fit into the more general ETS – interactions with other sectors.

The inclusion of agriculture is directly relevant for forestry because they compete for marginal land. Once agriculture is included, the response in the forestry sector to its own signals will be stronger.

The interactions between agriculture and other sectors are primarily in terms of perceived equity. If agriculture is not included or is included very late, or if it is protected in some way, the burden of compliance falls more heavily on other sectors because the government will have fewer surplus Assigned Amount Units to sell (or more to buy). These concerns about special treatment of agriculture have been muted in part because of recognition of the sector's trade exposure and of the complexities of including it.

Forestry is the first sector to enter the system (from 1 January 2008) although they will not be required to report activity and surrender or receive credits until the end of 2009. Because forestry is likely to generate net credits in the first years of the system, they are expected to be key domestic sellers of NZ units and therefore provide some liquidity in the New Zealand market (others who receive free allocations and are not points of obligation will also sell as their sectors enter). However, it is likely that forest owners will bank some of their NZ units in order to protect against future harvest liabilities.

2 Key challenges and ETS design features

2.1 Measurement/modelling – monitoring and verification

New Zealand generates a 'National Inventory' each year, which measures all greenhouse gas emissions and sequestration. This is generated based on IPCC Guidelines (Ministry for the Environment 2007). It has been produced, with gradual improvements for several years already. New Zealand must surrender enough assigned amount units to match net emissions as measured in this inventory.

A domestic emissions trading system issues emission units to the private sector by sale or gift. It makes private actors responsible for reporting information that can be used to model greenhouse gas emissions from their chain of production; surrendering emission units that match the inferred emissions; claiming emission units to match sequestration.

The methods used to measure/model emissions associated with each point of obligation in each chain of production may not be exactly those used to generate the national inventory. However, the total emissions implied by both process (central and devolved) need to be consistent so that in an all-sources, all-gases system, the total units surrendered by private actors will match the national inventory and New Zealand compliance will be assured. The New Zealand government must cover any difference.

2.1.1 Agriculture

The two main greenhouse gases emitted in the agricultural sector are methane (CH4) and nitrous oxide (N2O). Methane is emitted from enteric fermentation in domestic livestock and from the breakdown of animal excreta in some situations; nitrous oxide is emitted directly from agricultural soils and animal excreta on agricultural soils, and indirectly from nitrogen used in agricultural fertiliser.

New Zealand's National Inventory methodology uses a detailed livestock population characterisation and livestock productivity data to calculate feed intake for the four largest categories in the New Zealand ruminant population

(dairy cattle, beef cattle, sheep and deer).[7] Roughly speaking, the amount of methane and nitrous oxide emitted is calculated using emission factors per unit of feed intake.

For each livestock category, the best available productivity data are used to compile the inventory. These data are from Statistics New Zealand and industry statistics. To ensure consistency, the same data sources are used each year. This ensures that the data provide a time-series that reflects changing farming practices, even if there is uncertainty surrounding the absolute values.

Animal numbers are provided by Statistics New Zealand from census and survey data conducted in June each year. For sheep, dairy cattle, non-dairy cattle and deer, the populations within a year are adjusted on a monthly basis to take account of births, deaths and transfers between age groups.

Obtaining data on the productivity of ruminant livestock in New Zealand, and how it has changed over time, is a difficult task. Some of the information collected is robust e.g., the slaughter weight of all livestock exported from New Zealand are collected by the Ministry of Agriculture and Forestry from all slaughter plants in New Zealand and this information is used as a surrogate for changes in animal liveweight over time. Other information, for instance liveweight of dairy cattle and liveweight of breeding bulls is collected at irregular intervals, from small survey populations, or is not available at all. The data include average liveweights, milk yields and milk composition of dairy cows, average liveweights of beef cattle (beef cows, heifers, bulls and steers), average liveweights of sheep (ewes and lambs), average liveweights of deer (breeding and growing hinds and stags).

Nitrous oxide emissions from fertiliser directly applied are calculated using nationally consistent emissions factors and data from the New Zealand Fertiliser Manufacturers' Research Association (FertResearch).

[7] Detailed information on the inventory methodology for agriculture is given at http://www.mfe.govt.nz/publications/climate/nir-jul07/html/page16.html.

These data aim to estimate consistent national level estimates. They do not take account of spatial variation. They will not necessarily be consistent with the sum of estimates based on data from specific farms or even processors.

An alternative is to estimate emissions based on farm level data. These would in principle be more accurate (as long as the data quality is high). The primary option for this approach to measurement would be based on the OVERSEER model.

2.1.1.a Farm-based measurement: the 'OVERSEER' model

OVERSEER is a model developed by AgResearch for use nationally to calculate annual average nutrient budgets for individual farms. Its original aim was to help farmers optimise farm production. Almost coincidentally it calculates nutrient loss and methane and nitrous oxide emissions to the environment, and the nutrient loss aspect has made it attractive to regional councils. It provides a potential tool for estimating annual average methane and nitrous oxide emissions from farms. The model and detailed descriptions about it can be downloaded from the AgResearch website (http://www.agresearch.co.nz/overseerweb/). It is reasonably straightforward to run.

It can be operated in two modes – simple and detailed. The former considers the whole farm as a single unit, while the latter sub-divides the farm into blocks. The data inputs for OVERSEER include: farm type (e.g., sheep/beef), productivity (e.g., t/y milk solids for dairy), soil type, soil drainage class, slope, rainfall, stocking rate, dry matter production, fertiliser use, supplementary feed, area for effluent irrigation.

If OVERSEER is run for each individual property and the estimates are summed, they will not necessarily add up to the current national methane and nitrous oxide estimates. If the farm-level measurement option is chosen, New Zealand may need to use data from a year before agriculture enters the ETS to calibrate OVERSEER so the government does not subsidise and is not subsidised by the agricultural sector unintentionally. Gradually OVERSEER and the national inventory may be able to be adjusted so they are consistent.

The use of OVERSEER as the basis for regulation is currently facing a legal challenge – it is being proposed for use in water quality management. There is however no competing model currently so the scientists and others expect that the challenge will be unsuccessful.

2.1.2 Forestry

2.1.2.a Forest Modelling

Emissions and removals from forestry (and more generally land use, land-use change and forestry) are estimated in the National Inventory using the Land Use and Carbon Analysis System (LUCAS).[8] Under this system carbon stocks are assessed at randomly selected points in New Zealand's forest estate and then grossed up to derive a national estimate. Timber volumes are assessed on-site at each selected point, and then converted into carbon estimates through agreed models.

The Government has not provided detailed information on how it intends to assess emissions and sequestrations from forests under the ETS. In relation to pre 1990 forest emissions, owners will be required to report annually any area that has been deforested. The options for determining emissions discussed include:

- standardised tables based on species, region and age
- specific modelling based on pre-harvest inventory
- verifiable harvest data.

For post 1989 forest, the government has said that participants will be required to submit a carbon stock assessment at the end of the 2008–12 period, but may elect to report more frequently at intervals of not less than one year. The options for carbon estimation methodologies will range from relatively simple to more accurate and sophisticated methods. The number of units issued will reflect the sophistication of the sampling methodology chosen, that is, the more accurate

[8] 1.1 Basic information on forestry in the most recent inventory is found at www.mfe.govt.nz/publications/climate/nir-jul07/html/page9.html and more detailed information on the methodology is found on page 16 of the same document under the title A3.2 Additional information for the LULUCF sector: the Land Use and Carbon Analysis System (LUCAS).

and therefore expensive the methodology, the higher the potential allocation of units.

The approach taken to estimation methodologies has a number of implications. Allowing private agents to choose the form of modelling and reporting raises the risk of adverse selection, and could lead to a divergence between national estimates under LUCAS and the sum of forest-specific emission estimates. Forest owners may know that one form of modelling will benefit them relative to others and choose on that basis. This could induce bias in the monitoring system. However, requiring all owners to use the same approach would impose high costs on owners of small forests, and could reduce incentives if the methodology chosen was not sufficiently accurate to capture the carbon impact of some changes to owners' forest management practices.

It may be preferable to require larger forest blocks to adopt the same (relatively accurate) estimation methodology used by the government under LUCAS, where the costs will be low per unit of carbon, and simultaneously reduce the relative penalty for simple modelling on small blocks.

2.1.2.b Enforcement

The ETS will work on a self-assessment basis much like most OECD countries' income tax regimes. The scheme administrator will have the right to assess the accuracy of any reports provided, and penalties will apply if they are not correct.

Random audits will be undertaken by the administration agency. Information from aerial and satellite imagery collected under the LUCAS (to enable the Government to comply with its obligations under the Kyoto Protocol) will be used to help detect forest harvesting and deforestation that has not been reported.

In addition, the government has proposed that returns provided for post 1989 forests will require certification by a 'Registered Carbon Certifier' before they can be accepted. This reflects the fact that once completed, carbon stock assessments will sometimes be difficult to check through an ex post audit. The

certifiers will have to maintain relevant competencies to carry out and/or sign off various tasks, including:

- assessment of carbon stock changes;
- verification of deforested areas; and
- on-site audits.

2.1.2.c Administration

The scheme administrator will record and retain up-to-date information on all forestland that is part of the ETS.

Any person will have the ability to request information on the designation and potential liabilities of a specific piece of land. When a scheme participant transfers or sells his or her interest in a forest covered by the scheme, the new owner will become the new participant. All future liabilities will become the responsibility of the new owner, and any NZUs issued prior to the transfer and any actual liabilities that existed prior to the transfer will remain with the original owner(s). It will therefore be important for potential vendors and purchasers of forests covered by the scheme to be able to determine the status of different parcels of land to ascertain whether any future potential liabilities are attached to the forestland in question.

There will be an onus on the existing participant or vendor to notify the administering agency upon any sale or transfer of that forestland and/or forestry right. There will be an onus on the transferee/purchaser to notify the administering agency of the change in ownership in order to be eligible to receive NZUs. Prior to the date of transfer of the land, it will be necessary for a final carbon stock assessment to be submitted to the administering agency.

2.2 Point of obligation and assessment

In any industry, there is a vertical chain of production and consumption, with several ‘layers’ from initial production to final consumption. For example, in the dairy sector milk solids are produced on farms and sold to processing plants; these process the milk solids into products; they export these or sell them domestically to further processors or to retailers; the products are finally sold to households who consume the products.

The ‘points of obligation’ in an emissions trading system are the entities in each industry that are required to report a defined set of information. This information is used to model the GHG emissions relating to each chain of production and consumption. The points of obligation must then surrender sufficient emission units to match those GHG emissions.

Three considerations affect the choice of point of obligation. First, the government wants to obtain comprehensive coverage so that all emissions in the economy are included in the emissions trading system and hence controlled under the cap. Second, the government wants to minimise transaction costs for both the private sector and the government. Third, the government wants to provide the most clearly targeted incentives to reduce emissions. For agriculture, not all activities that affect emissions can be easily measured at a small number of points – e.g. processing plants; similarly for forestry. There is a tradeoff between transactions costs and accuracy of targeting. Only mitigation activities that affect emissions as assessed at a point of obligation will be encouraged by the system. Others could be added through offsets but this creates new problems.

One key consideration that does not affect the choice of point of obligation is equity. The point in the chain at which emissions are assessed and the point at which any free allocation is provided are completely separate decisions in a liquid market. The first is a technical decision; the second is a political one.

The point of obligation does not affect incentives to abate (except to the extent that the assessment of emissions must be inaccurate) or how the economic burden is borne through the economy. Wherever obligations are placed, prices will change throughout the value chain. Since economic burdens are shared through the vertical chain of production and consumption, parties with no legal obligation also have incentives to respond.

In particular a commonly heard argument that people will respond more if they face the need to buy permits directly and that this means the point of obligation should be at the point of direct emissions, does not hold water. If the argument is based on an assumption that the mechanics of compliance are a good

educational tool, this seems unlikely to be the best educational process. If it is based on an assumption that corporate and firm structures put inefficiently low weight on price signals, this seems a more systemic problem that the private sector should address internally rather than using the form of government regulation to improve the efficiency of their own internal processes. If the private sector responds inefficiently to the price signal, they bear the cost – there is no externality.

2.2.1 Agriculture

The choice of point of obligation is a trade-off between accuracy of measurement, and hence targeting of incentives for reduction, relative to minimisation of measurement and transaction costs, and the political costs that direct involvement of large numbers of farmers would involve.

To capture the major sources of agricultural greenhouse gas emissions in an ETS, the government has identified a range of options for the point of obligation to surrender units, including the farm level, processor/company level, and sector body level. In terms of providing incentives for behaviour change, the farm-level obligation represents the best option not because directly reporting their activities changes their incentives but because the activities that can be reported at the farm level are a wider set than those that can be reported at a processor level. For example, the application of N inhibitors can only be monitored on farm. They will not be encouraged with a processor level obligation. Emissions estimates will be more accurate and farmers will have more options in how they respond to the price signal. A farm-level obligation is unlikely to be feasible for all agricultural emissions in the short term, however, for a range of reasons including administrative complexity and the difficulty of measuring and verifying emissions.

The government's initial preference is to bring the agricultural sector into the ETS with a company/processor level point of obligation. This would include emissions from:

- nitrogen fertilisers at the fertiliser company level;
- the dairy sector at the dairy processor level; and

- other animal agriculture at the primary (meat) processor level.

This approach would create incentives for land use change toward lower emitting land uses and reductions in marginal production (or reduction in growth).

It would not however increase incentives on farmers to improve productivity (for example fattening lambs for slaughter more rapidly or producing more milk-solids per dairy cow), which directly lowers emissions per unit of production. Productivity in dairy has been rising at around 1% per year and this rise could potentially be accelerated. No data on farm animal numbers or age classes is available at the processor level though some could be collected.

Animal farmers are required to maintain good stock records for tax purposes. Processors collect data on production (e.g. milk solids, meat) from each farmer. By combining these data at the processor level, most of the controllable variation in methane emissions and a large amount of the variation in nitrous oxide emissions from livestock deposition could relatively easily be captured.

Also, there would be no pressure for emissions reduction per animal through changed farm management practices such as nitrification inhibitors and feeding pads. This is particularly relevant for nitrous oxide at present and this problem will be exacerbated in the future as potential mitigation innovations become (or should become) available.

The government is open to considering sector body or farm level options for emissions from both nitrogen fertiliser and livestock. This will be a subject for further engagement with the sector.

Dairy farms are already moving toward producing nutrient budgets using OVERSEER under the ‘Dairying and Clean Streams Accord’ (by 2007). Therefore it would be relatively cheap to apply this for greenhouse gases as well. Sheep/beef farms could use this model with the help of fertiliser companies (around 30,000 properties). This could however impose relatively high costs on very small properties. Properties that are small in area or production (possibly

measured as potential production rather than current production, which may change) may need to be exempt under a de minimus rule.

Nitrogenous fertilisers are supplied by a small number of companies that would provide the easiest 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 to facilitate this. They may however be unwilling to be the legal point of obligation for emissions if those are measured based on farm level data and hence the fertiliser company becomes responsible for the quality of the farm level data.

Two other options could offer a compromise between a full farm-level point of obligation with high accuracy and cost and a processor and fertiliser company level of obligation with lower accuracy and low cost: farm level monitoring for specific sub-groups in the agriculture sector with all other emissions at the processor level; or voluntary farm level monitoring (e.g. through offset projects).

Farm level obligations could be brought in only for dairy farms (defined as properties with more than a certain number of dairy animals or farms that own a share in a cooperative). These farms are highly emissions intensive and will soon be implementing OVERSEER anyway.

Farm level obligations could also be mandatory for catchments where Regional Councils are using OVERSEER as the basis for managing water quality. This could include Taupo, Lake Rotorua, and parts of the Manawatu and later the Waikato River catchment and parts of Southland. The additional costs of reporting greenhouse gases would be low.

Requiring some farmers to report at farm level while others are covered at a processor level raises two related issues. First, how consistency can be maintained with the National Inventory as the regulation moves between levels and hence methods of measurement. Any reduction in obligation on a farmer must be matched by a change in the National Inventory and hence New Zealand's

obligation if the taxpayer is to be protected. Second, is it equitable to treat similar farmers differently? This paper will not address the first issue, which is purely technical.

The equity issue cuts two ways. Farmers that report at the farm level are probably not that disadvantaged by having high compliance costs given that they are included precisely because they have relatively low costs of inclusion. They may not perceive it this way however, particularly because the pass-through of costs from processors to farmers may not be transparent.

Farmers reporting at farm level have the advantage of increased flexibility. They can benefit from on-farm mitigation options, which could reduce their average emissions obligation considerably relative to what they would face under a processor-level obligation. Other farmers may feel they are unfairly excluded. However, although farmer who are included may gain as a group, some individual farmers will have much higher emissions than average because of factors beyond their control (e.g. soil type or topography). They will suffer from mandatory farm level reporting. They may feel that this is inequitable relative to similar farmers who are not included.

Partial coverage of farms at the farm scale could lead to perverse behaviour such as moving dairy animals from farms covered at farm scale to those covered at the processor level during non-milking periods to reduce monitored farm emissions.

2.2.2 Use of offsets

2.2.2.a To improve targeting of incentives at farm level

If the point of obligation in agriculture is at the processor level, farmers could be enabled to create offsets where they would compare their farm level measurements of emissions with the average emissions implied by the processor-level measurement. They would receive NZUs for the difference. This idea creates two challenges. First, the farm level measurements would need to be consistent with, or more conservative than, the processor level so the offsets would not create a liability for government if all farmers chose this option.

Second, and more challenging is the problem of 'adverse selection'. Only those farmers whose farm level emissions are lower than the national average for their animal numbers and production will choose to participate in the offsets programme. This means that every offset will lower farmer obligations more than it lowers national emissions as measured in the Inventory. This could be addressed by raising the obligations at the processor level in an iterative way (e.g. each year as more offsets are claimed). This however obviously disadvantages those who do not measure at farm level and thus face a rising obligation. This will encourage them to apply for offsets but it also disadvantages those who find the compliance costs of the offset programme high (e.g. small farmers or farmers on communally owned Maori land) and those who face higher than average farm level emissions for geophysical reasons.

One final problem with offsets is that they tend to create a precedent that farmers are paid for all emission reductions. This would be politically awkward in a situation where all other sectors are facing costs but could potentially be handled within the pool of freely allocated allowances in the agriculture sector.

The government has noted that there is the potential for an offsets mechanism to be used in the NZ ETS, but stopped short of agreeing to introduce one due to concerns around the technical and administrative challenges involved. There is often a complex administration system for offsets, and determining "additionality" can be problematic. Furthermore, any reductions leading to the issuance of domestic offsets must also be reflected in New Zealand's national inventory of greenhouse gas emissions under the UNFCCC to ensure New Zealand gains credit for the reduction at the national level.

If offsets were to be included, it would be preferable to have them be defined as voluntary opt-ins to the longer-term farm level ETS rather than create a separate set of rules. This would require defining rules for any farm-level free allocation at least for the voluntary period. To protect against extreme adverse selection, the short-term free allocation should be lower than current emissions and if possible the group of farmers eligible should be restricted as far as possible

– e.g. to those for whom short term action is considered to have significant long-term consequences.

Alternative short-term policies may be preferable. If the motivation is developing and demonstrating new technology and practices, grants could be made available but not explicitly linked to measurements of emission reductions. In this case any grant funding should be linked to a responsibility to allow the farm practice to be evaluated to maximise the learning benefits.

If some farm practices are considered to be universally appropriate and not too costly they could simply be required by regulation. These would vary by farming sector and could also vary by region or soil type (e.g. for N inhibitors). These could be chosen strategically to contribute to local water quality or water allocation goals as well. The challenge is defining what practices should be required. Farm conditions are so variable this is likely to be hard to define and contentious. If the practices become sophisticated, they will require complex monitoring and it might be just as easy to simply include the farms in the ETS with monitoring of the desired practices included in the measurement rules.

2.2.3 Forestry

In contrast to the agricultural sector, the government has ruled out placing the point of obligation for forest emissions and removals at the port and wood processing level by measuring log volumes as a proxy for carbon. Placing the point of obligation at this level would have substantially reduced the number of entities involved. However, the administrative difficulties and reduced incentives would have been too acute. It would be impossible to separate timber from pre-1990 and post-1989 forests and there would be reduced incentives to change forest management or for planting new post-1989 forests. For pre 1990 forests, some form of rebate would be needed for parties that replanted. However, new planting data is generally of poor quality – and may be even more poorly correlated with standing forest a few years later. If new planting was rewarded at the nursery level (where data is usually collected), plants may be propagated and even planted but not cared for sufficiently to ensure they are well established.

Proposed rules around the point of obligation for forestry differ slightly for pre 1990 and post 1989 forest. This reflects the fact that for pre 1990 forest, it is only the decision to change land use that will trigger obligations under the scheme, while for post 1989 forest a broad range of forest management decisions, such as silvicultural treatment and rotation lengths, will have an impact on carbon stocks.

For pre-1990 forests, the participants will be, by default, landowners, as they are the party who will generally have the ultimate authority to deforest. However, where a landowner can prove that a land use decision has been legally delegated to another party, such as under a long term lease with no restriction on allowable land uses, the landowner will be able to apply to the administering agency to have the obligation transferred to that third party for the duration of the legal agreement.

For post-1989 forest where the forest and landowner are separate parties, the forest owner will be the initial participant as they control decisions over species and forest management practices. However, the landowner's agreement will also be needed to join the scheme as the point of obligation will automatically revert to them when the relevant legal agreement expires, and they will then take on all remaining obligations and rights. This requirement for joint approval will provide an opportunity for the landowner and forest owner to reach an agreement on the sharing of the credits and liabilities.

Landowners operating as a group of companies under company or tax law will be treated as a single participant under the scheme. This means that forests on their land are either all covered or all excluded.

Participation for post-1989 forests is voluntary and all sequestration during the commitment period receives credit (and liabilities can never exceed credits) so this is essentially an offset programme with a simple 1990 clear land baseline rather than any attempt to assess additionality, and consistent monitoring rules. Forest owners will stay out only because of the transaction costs associated with participating.

2.2.4 Thresholds

Where the programme is compulsory, the issue of the gains from including small players relative to the administrative and regulatory compliance costs they will face is an issue. This is particularly salient in agriculture and pre-1990 forestry, where the ideal points of obligation include many very small players.

2.2.4.a Agriculture

Because the point of obligation has not been chosen, this issue has not yet been addressed. It is assumed that if the point of obligation is at the farm level the threshold would be considerably lower than for industrial processors. It would need to be based on something easily observable and preferably unchanging or slowly adjusting, for example, farm parcel area combined with a measure of potential productivity, or value added in GST returns in previous three years. Ideally lifestyle properties and very small or very low total productivity properties would be excluded. To avoid an acute change in obligation at the point of the threshold, the obligation to participate could be introduced at one threshold but the level of emissions that must be covered could be gradually increased with farm size for those above the threshold. Small farmers just over the threshold would then not be significantly disadvantaged relative to their peers. If free allocation of units is also linked to the same threshold, the disadvantage of being above the threshold will be reduced or removed.

For those who are below the threshold, any actions to encourage mitigation could be similar to those discussed in 2.2.2.

2.2.4.b Forestry

To minimise compliance and administration costs, and protect activities of social and environmental concern, a number of thresholds and exemptions have been built into the scheme.

The key exemption is for all landowners with less than 50 hectares of pre-1990 forest across all of their landholdings on 1 September 2007. Those landowners will be able to apply to the administering agency for an exemption

from the deforestation requirements of the ETS. The exemption will attach to the land whether it is retained or sold.

A further general exemption is provided for the deforestation of small areas of land. Anyone who deforests less than two hectares of their total pre-1990 forest land holding during the 2008–12 period and each subsequent phase of the ETS will not have to report it to the administering agency.

Additional exemptions are proposed for the removal of self-seeded exotic 'tree weeds' and for the construction of housing on Maori land.

2.3 Leakage

Emissions 'leakage' arises when products are exported (or import substitutable), international competitors do not face regulation, and production can move outside New Zealand. Production and emissions fall in NZ as a result of the regulation but rise in countries that do not face fixed targets as their production rises. Any rise in emissions outside the Kyoto cap causes an environmental loss globally and undermines the environmental goals of the global agreement. Emissions could rise even more if New Zealand is relatively emissions efficient.

Such leakage is not necessarily against New Zealand's economic interests, because it will make compliance with NZ's targets easier. The production that is lost is worth less in terms of profit than the cost of buying additional emission units. If emission obligations are not devolved this cost is borne by taxpayers as a fiscal cost. The potential economic gain from leakage is offset however because of the potentially temporary nature of the leakage. Any shift in production involves adjustment costs. If these are incurred and then the issue of leakage is resolved and it is efficient for production to rise again, NZ will 'regret' having borne the adjustment cost. It is also possible that a short-term loss could lead to long-term dynamic consequences through loss of market share or key capabilities in New Zealand. The short-term production loss may lead to loss of a longer-term opportunity.

This balance of considerations around leakage was explicitly recognised by the government in developing its overall objective for the ETS, which is to:

"support and encourage global efforts to reduce greenhouse gas emissions by:

- reducing New Zealand's net emissions below business-as-usual levels; and
- complying with our international obligations, including our Kyoto Protocol obligations,;

while maintaining economic flexibility, equity and environmental integrity at least cost in the long term."

The government has indicated in its engagement material that it is most concerned to avoid the loss of economic activity where: there would be long term regrets associated with firms closing or substantially reducing output levels; concentrated job losses are likely to occur; and there could be reputational issues for New Zealand.

It is difficult to define products and processes that are vulnerable to significant leakage, so any policy to address this will inevitably be crude and imperfect. That does not mean that it should not be addressed in at least some cases.

In New Zealand agriculture has been argued to be a potential target for leakage policy because NZ producers are largely price takers and the emissions intensity of New Zealand production is relatively low. Land cannot move, and good quality land is unlikely to move out of agriculture in any significant way. Also New Zealand producers are generally price takers so a reduction in NZ production will not lead to a large change elsewhere. Because of recent rapid domestic growth, which is straining the sector, climate change policy is unlikely to create an excess of capital that could be invested in agriculture or of skilled agricultural labour that will move overseas, at least in the short run. These factors reduce leakage in agriculture. The Motu 'Land Use in Rural New Zealand' model suggests that at a price of $15 per tonne, land use change could lead to losses in dairy land of around 0.5% and of 0.1% in sheep/beef land. These are a lower bound on production losses because stocking rates are also likely to fall. This is also a low carbon price. In addition, even relatively small percentage changes in land use and land use intensity could be significant to New Zealand given the critical role of agriculture in NZ's economy and especially in NZ's exports.

Only on-farm mitigation options provide real global GHG emissions gains. Emission reductions from reduction in production are simply replaced offshore. However dairy and sheep/beef farming also affect other environmental goals. For example water quality is being threatened by dairy conversions in many catchments. Biodiversity could benefit from reduced pastoral grazing, especially if some of the pasture was replaced by native regeneration. Regulation has not yet fully addressed most of these other environmental concerns so the positive side effects of reduced pastoral production on other environmental goods could offset any concerns about leakage.

Forestry does not face leakage problems – on the contrary, it benefits from less comprehensive rewards for expanding forestry in other countries. The changes in New Zealand deforestation are unlikely to have any international effect particularly as harvesting of pre-1990 forest will be unaffected. It seems unlikely however that the net growth in New Zealand will be large enough to displace forestry production elsewhere in any significant way. The forestry industry in New Zealand also faces transport and processing challenges that could limit its expansion. New Zealand forestry does face competition from illegal logging especially in the tropics, but this has been a concern even without climate change policy.

2.3.1 Addressing leakage

The first and best option for reducing emissions leakage is to get a more complete international agreement. Even if other countries that are covered by the agreement do not devolve emission liabilities to farmers, their economies will be bearing the marginal cost of those emissions. Alternatively, some countries may regulate emissions even if they do not have formal commitments under the international agreement. This could occur through domestic policies or through Clean Development Mechanism projects. New Zealand has only limited ability to affect international negotiations or the behaviour of other countries however.

If the international agreement continues to exclude some of our key agricultural competitors we need to balance three competing objectives:

environment, economic regrets, and fiscal considerations. Any ‘solution’ is likely to be inherently messy and confusing.

Leakage arises because the marginal cost (i.e. the cost of producing one more) of producing specific products and processes rises because of their embodied greenhouse gases. It is not addressed by policies that freely allocate units based on any historical measure.

Leakage can be addressed in three ways:

- border adjustments to equalise treatment of traded goods;
- output-based allocation of units instead of fixed allocations; or
- progressive obligations.

2.3.1.a Border adjustments

Border adjustments work by exempting exports of specific products from the obligation to cover their embodied emissions and simultaneously imposing obligations to cover the embodied emissions of those products when they are imported. Domestic producers are put on a level playing field with their international competitors. Border adjustments are the cleanest approach. They can discriminate among products based on the climate policy in the originating or receiving country. They can discriminate between production for the domestic and international markets. Domestic consumers can face the emission obligations of their diets.

On the down side, there may be WTO implications relating to their use as they will ‘discriminate’ against products from countries with weak climate policies even if they have ratified Kyoto. The New Zealand government is not willing to bear the cost of facing an international legal challenge on these issues. These issues were discussed at Bali in December 2007 so may be resolved at an international level. In addition, for agriculture they involve subsidising exports (or rather not receiving emission units to match inferred emissions from export production) so impose costs on taxpayers and are not an efficient long-term solution.

2.3.1.b Output-based allocation

Design issues

Output-based allocation uses free allocations that are linked to levels of output of the products so that the impact of the policy on the marginal cost of production is reduced. Each extra unit of production is associated with the free allocation of some extra NZUs so while marginal costs may rise with the policy, at least some of the cost rise will be offset. The effective marginal cost of output will be lower than if agriculture bears the full carbon price so leakage will be reduced.

This approach does not need to perfectly offset the cost rise, and the level of NZUs per unit of output does not need to be based on any measure of 'best practice', which is inherently hard to determine. It should be explicitly recognised as a simple crude way to reduce the degree of leakage rather than an attempt to get a perfect policy. It could be a percentage of historical emissions per unit of that output (e.g. milk solid production) in New Zealand as a whole.

The definition of 'output' for each sub-sector must be defined and the level of relative emissions per unit of output must be agreed because this has equity implications. For pastoral agriculture there are relatively easily available and homogenous measures of output such as kilograms of milk solids or kilograms of meat.

This policy could operate within an absolute cap on emissions. The relative output of the chosen products by individual farms could be used to share a fixed pool of free units rather than having a fixed amount of units per unit of output. This would hold fixed the total transfer of compensation to the sector thus avoiding any influence of sectoral level rent seeking on the decision-making process.

Effects on farmers and incentives to reduce emissions

All farms will have an incentive to reduce emissions intensity if the cost of emissions is passed onto them – i.e. they are the point of obligation or a processor point of obligation effectively passes on emissions reduction incentives. The most productive, low intensity farmers will have the lowest incentive to

reduce output which inefficient, high intensity farmers will probably reduce output. Thus the programme could lead to reallocation of land toward efficient farmers within New Zealand as well as improved emissions intensity. The effectiveness of the incentives depends on the choice of point of obligation and emissions monitoring system and also on the range of mitigation options available.

This form of allocation also partially (and imperfectly) compensates farmers for their loss of land value when the system is introduced. Those who have relatively low emissions intensity will benefit relative to those with high emissions intensity because low emissions intensity farmers will be allocated a high percentage of the units they need to support their current production. If the percentage is set low enough, no farm, even if their emissions intensity is really low, will be receiving an output subsidy relative to unregulated farms so there should be no trade implications.

Any policies to reduce leakage should be temporary. As our competitors apply regulations, New Zealand needs to reduce the implicit protection so that production can happen in the best countries as well as efficiently within countries. In addition, consumers should be faced with the emissions implications of their diets – with output-based allocation they are not. If it becomes apparent that other countries are not going to regulate agricultural emissions for a long time, we should accept that in the same way that we are forced to accept other agricultural subsidies and not try to correct it through domestic policy.

2.3.1.c Progressive obligations

Progressive obligations are a less efficient version of an output-based allocation approach. They require farms to cover only a share of their emissions. They do mute the incentive to reduce output (which is good where leakage is an issue); a farm that produces one more unit of output only needs to cover a share of the additional emissions so marginal costs don't rise as much. However, progressive obligations also reduce incentives to reduce emissions per unit of output. A farm that reduces its emissions intensity receives only a share of the

benefit of that reduction because they only pay for a share of their emissions. Also, total emissions are not capped; this imposes fiscal risk on government.

2.4 Allocation of allowances

The government has defined the total size of the 'allocation pie' for agriculture – though the phase-out of allocation may still be an open question. The total level of free allocation when the agricultural sector enters the ETS in 2013 is defined as 90 per cent of 2005 levels of emissions. This is the same approach as that used to define the total allocation to industry, broadly equivalent to that proposed for forestry, and is relatively close to the target that was outlined in the Memorandum of Understanding signed between the Crown and the agricultural sector in 2002. As in the industrial production sector, the level of free allocation will decline to zero at a linear rate from 2013 to 2025. The key outstanding issue is how these units are distributed within the agricultural and forestry sectors.

The allocation of allowances is primarily an issue relating to equity. There are two exceptions to this: use of allocation to address leakage; and ensuring farmers have access to emission units in a potentially illiquid market. These are relevant to agriculture but not forestry.

2.4.1 Equity of allocation in agriculture

The agricultural sector is characterised by a large number of sellers producing relatively homogeneous and perishable product. For the most part, processors are price takers on international markets and cannot influence the price of goods sold. Likewise, farmers are price takers and cannot influence the price obtained from downstream processors. As a result, costs introduced into the agriculture value chain are generally absorbed at the farm level. They cannot be passed on to consumers or absorbed by processors.

Some of these costs will be passed on to agricultural labour and suppliers but much of it is likely to be capitalised in the value of agricultural land and capital. Profit could fall by as much as the cost of the emission units required to match all emissions – up to half of profit at NZ$50 per tonne CO2 equivalent. It will however generally fall much less because the land use will change so the

value will drop to that in the next use. Where that use is forestry or native regeneration, the values of those land uses will be higher than without the ETS so the losses will be ameliorated. Where the next best use is less intensive sheep/beef farming, the value of land in that use will also have fallen. The capitalisation of emissions costs may be hard to identify because rural land values are driven by expectations of capital gains as well as potential future profit in the current use.

Land never becomes obsolete so these losses are in perpetuity. Landownership tends to be concentrated so they are likely to be borne by a relatively small group of individuals. An exception to this is the many new dairy farms that have a corporate structure.

Offsetting the fall in land value from the ETS are potential increases in returns because of higher dairy and meat prices overseas because of the impact of biofuel demand and the direct impact of climate change on international production.

If the land and capital assets fall significantly in value as a result of the ETS, they can be thought of as 'stranded assets' that could justify some compensation. If compensation for stranded assets is the major motivation for free allocation, the allocation should be done in a 'lump sum' fashion based on historical data. This would match the loss of capital value, which occurs in a lump sum fashion also.

One other motivation for free allocation of units is recognition of prior action to reduce emissions intensity. This argues against the use of emissions as a metric for free allocation of units. Alternatives could include land area in a given use at a particular date, land use capability, potential stocking rates, or even simple land area. These would have to be weighted by 'allocation factors' that are calibrated to share the total free allocation 'pie'.

2.4.2 Allocation and liquidity of emissions markets

In the early stages of an emissions trading system, when international and domestic emissions trading markets are not very well developed and liquid,

and farmers and their accountants are unaccustomed to dealing with emissions liabilities, farmers who face a severe shortfall of allowances may cut production inefficiently rather than buy allowances. If this is considered to be a real problem, it argues for a closer match between free allocation and likely final demand for emission units, at least initially.

2.4.3 Interaction of allocation with leakage

If output-based allocation is chosen to address leakage issues, it simultaneously resolves the issue of free allocation, though possibly not in the most equitable way. The advantages are that it bases allocation on readily available data; focuses incentives on reducing emissions intensity rather than production; and avoids large losses in land value. It deals with new entrants and those who exit from farming seamlessly. On the other hand, it does not effectively address stranded assets if they are associated with a fall in production on those farms. For example, a sheep/beef farm that is abandoned receives no units. It is based on current not historical data. On the other hand, that farm could receive credits for native regeneration, which provide partial compensation.

It is also likely to create some concerns because farms have quite different levels of emission intensity. Some of this is driven by the farmer's efficiency but some is driven by geophysical characteristics. Thus, the lowest intensity farms will benefit most from this option while the inefficient high-intensity farms will benefit least. These may be disproportionately poorer farms and may include a high level of Maori owned land.

2.4.4 Government proposal

The government has identified three key options for allocating free NZUs in the agricultural sector, but stressed that it wants to see the benefit of the allocation go to farmers which it expects to experience the most significant impacts:

- The government could allocate directly to farmers on the basis of historical emission levels or some other proxy for emissions. The key advantage of this option is that farmers would capture the benefits of the free allocation, offsetting lost profits and impacts on land prices.

Allocating to farmers would be challenging, however, because there is a range of ownership structures to consider.

- The second option is to allocate to processors, based on their historical levels of throughput. This allocation would be based on the fact that some major agricultural processors are co-operatives and/or operate in a highly competitive market (in terms of demand for raw product). The effects of a free allocation to processors could therefore be incorporated into their supply pricing to the benefit of farmers, or passed on through increased pay outs or improvement to the value of their shares. One advantage of this is that the net effect would be to shield farmers from exposure to the full price of emissions. In reality, however, there is currently a range of ownership structures, particularly in the meat sector, and it is uncertain whether a free allocation to processors would benefit farmers through supply prices.
- A third option would be to allocate to sector bodies, which would take responsibility for managing the units on behalf of farmers. The allocation could be based on historical production throughput, as above.

All of these options will be investigated in more detail during 2008.

2.4.5 Liability and free allocation in forestry

The live issue of free allocation for pre 1990 forests is entirely an issue of compensation for stranded assets. Current deforestation is driven by decisions made as long as 30 years ago. The deforestation liability is highly concentrated and particularly affects Maori-owned land and in particular land that was part of Treaty settlements. Thus allocation needs to address both the equity and political feasibility issues associated with concentrated losses. In addition, forestry can potentially play a significant role in New Zealand's mitigation effort. The people who will face losses are part of the same community who we need to encourage to respond to the positive forestry signals and to comply willingly with programme requirements. Without their cooperation it will be difficult to enforce compliance and responsiveness will be low.

At the same time, owners of post 1989 forests are receiving a significant increase in the value of their land that is based on political realities

and, to a lesser extent, recognition of past actions. All those with forests planted post-1989 can receive credit for all the sequestration in their forests after 2008 (and liabilities on harvest that do not exceed the credits) even though most of these forests were planted and maintained for commercial reasons and are in no way 'additional'. We will not discuss the equity of that decision.[9]

2.4.5.a Current government signals

The Government has indicated an intention to provide assistance to owners of pre-1990 forests (who have no choice but to enter the scheme). Assistance will be provided through both the allocation of units and exemptions from the scheme. The objective of this assistance is stated as being to offset some of the economic impact of the deforestation requirements in the ETS. The forestry sector has previously emphasised that requiring owners to take account of the climate change effects of deforestation would reduce their opportunities to profitably introduce new land uses, and therefore have an impact on land values.

The total amount of assistance proposed for pre-1990 exotic forest has been set at the equivalent of 55 million tonnes of emissions of CO2. This level of assistance appears to have been loosely based on historical rates of deforestation applied to the total pre 1990 estate. There is approximately 1.2 million hectares of land under pre-1990 exotic forest, and in the 10 years prior to the announcement of the deforestation cap long-term deforestation averages have been less than five percent. Assuming an average of 800 tonnes of CO2 per hectare of exotic forest, deforestation of five percent of the pre 1990 forest estate would lead to emissions of 48Mt.

The government is proposing to divide these units equally across all non-exempt pre-1990 forest on the basis of land area as at 1 January 2008. It has publicly recognised that in doing so it will under-compensate those owning land that is suited to alternative uses, and possibly over-compensate some other landowners. This proposal has met some resistance from both the forestry sector and Maori landowners.

[9] Reilly and Asadoorian

2.4.5.b Alternative approaches

The government could pursue a number of other allocation approaches.

1. Targeting on basis of land suitability

In its engagement material the government discusses the possibility of targeting the units on the basis of the land's suitability for alternative uses. It states that this approach would in principle be more equitable than a simple pro rata allocation, providing more compensation to those facing the largest economic impacts. However, it rejected that option due to concerns around litigation and administrative complexity.

2. Exclude some from free allocation pool

Some have proposed excluding those who have bought forests since 2003 when the deforestation liability was announced (on the basis that this will have lowered the price they paid). It would also be possible to exclude large forestry companies on the grounds that they are likely to offset the losses with gains elsewhere in their estate and that their losses are shared widely. Either of these would increase the pool of units available to other forestland owners.

3. Tradable deforestation assurances

This option designs a mechanism to get landowners to reveal their true demand to deforest and hence how much they lose by being constrained. The aims are to:

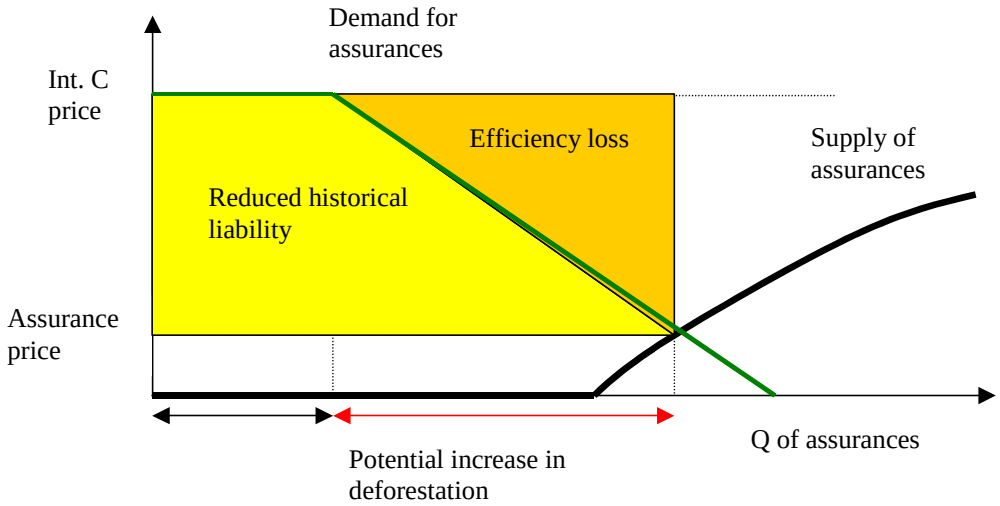
- Efficiently allocate a number of 'assurances' that imply a level of liability the government accepts
- Equitably distribute the government contribution
- Minimise risk faced by owners of forestland.
- Be revenue neutral – could be run by forestry industry

Under this option, some deforestation-specific unit, 'assurances' would be auctioned. These assurances could not be surrendered for anything except deforestation in New Zealand. The government would supply an agreed initial amount of units to the auction for free and then provide additional NZ units transformed into assurances at cost price to the market. The buyers in the auction would pay the average not marginal price of units.

This would have the effect of reducing the average cost of the assurances auctioned below the international price of carbon. An auction of this nature would ensure that the subsidised units go to the parties that value them the most. It provides certainty to those who hold the units that they can deforest at a known cost. However, it provides protection only to those who do choose to deforest; thus it provides no compensation to those with large areas of land that will now not be deforested but has lost significant value. The amount of protection afforded by this approach depends on the extent of demand to deforest at high prices and how far below the international price the deforestation assurance price falls.

A disadvantage is that the marginal private cost of deforestation will be lower than the social cost so inefficient deforestation decisions will be made. The extent of the inefficiency depends on the difference between the deforestation assurance price and the international price, and on the elasticity of demand for deforestation. If the demand curve is steep between the two prices, the efficiency loss is small. Reducing the number of deforestation assurances reduces the protection but also reduces the inefficiency. An illustrative example is shown below (based on an international price of $30 per tonne of CO2 and a inclusion of 20m free units in the auction). The demand curve is entirely made up.

Figure 3 Deforestation assurance market



4. Partial obligation or cash rebate

Rather than targeting the free allocation of units to landowners prior to their needing them, it would also be possible to wait until they had deforested and then provide assistance after the event. So long as those deforesting knew that they would always be required to meet at least some of the relevant cost of emissions, this sort of 'ex post' subsidy would also ensure that assistance only went to those landowners with real alternative uses. This sort of approach could take a number of forms. One obvious possibility would be to require participants to surrender units to cover only a portion of the deforestation loss. An alternative example would be for participants to have a certain portion of the cost of their permits rebated after surrendering them. This rebate would need to be based on an agreed domestic or international benchmark price. These approaches would have similar protective and inefficiency effect to the auction but the total quantity of free allocation would not be fixed and unless the proportion of emissions / cost were fixed in advance it would generate significant uncertainty.

5. Define emissions from deforestation differently

One other approach that would reduce this problem would be to define the 'emissions' from deforestation as the average stock of carbon over a rotation, rather than the carbon at the time of deforestation. This would be environmentally sensible but would create a Kyoto liability for government because of the current Kyoto rules. Government could agree to take on this liability in lieu of some of the emissions it has agreed to cover. Again the liability would be open-ended leaving the government with some risk.

Determining levels and patterns of free allocation under an ETS will always be problematic. And it will never be possible to design an approach that satisfies all stakeholders. Each of the possible allocation mechanisms outlined here has strengths and weaknesses. In choosing between them, governments need to consider their underlying objectives, and in particular the parties they are most concerned to target assistance to.

2.5 Sub-sectoral coverage, variation and treatment;

Pastoral agriculture is the main contributor of agricultural greenhouse gas emissions in New Zealand and the part of agriculture we have focused most

on here. There is no intention to treat subsectors of pastoral agriculture differently except to the extent that they are differentially affected by de minimus rules defining thresholds or by the point of obligation and hence method of accounting chosen for each sector. Similarly the Government intends to cover horticulture, where the main emissions are from fertiliser use. The points of obligation and accounting methods are still very much matters for further work and discussion so it is impossible to know how these will play out. The intention however is to cover the vast majority of emissions either directly (with point of obligation at the farm) or indirectly (point of obligation at the input company - e.g. fertiliser company – or processor).

3 Conclusion

New Zealand believes that agriculture can be brought into emissions trading. Significant challenges remain in defining appropriate points of obligation and emissions accounting systems and there is likely to be an acute trade-off between the cost of farm scale monitoring and the benefits it brings in terms of close targeting of mitigation opportunities.

Forestry can be brought into an emissions trading system at relatively low cost using generous allowances to post-1989 forests and a voluntary system but probably with some inefficient deforestation incentives to avoid large concentrated losses.

If New Zealand can develop and implement these proposed policies effectively it can also help others learn about mitigation and policy design.

4 Brief Bibliography

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Also see a series of short background articles on emissions trading in New Zealand at www.motu.org.nz/climate