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Manatū Ahu Matua

Coordination and Cooperation for Effective Climate Policy Design and Implementation

Synthesis of research

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Purposes of programme and overall achievement

Each landowner's economic decisions to mitigate and adapt to climate change depend on and affect others' decisions. Policy must induce cooperation and coordination. We provide empirical evidence and a clear conceptual framework to encourage cooperation, enabling the Emissions Trading System (ETS) to be applied effectively in agriculture, and to facilitate the coordination required for the rapid uptake of new adaptation and mitigation technology.

As a result of our programme, central and local government, agricultural decision makers and Maori have improved understanding of the operation of the agricultural and forestry components of an emissions trading system and climate change mitigation policy more generally. They better understand the impacts and opportunities it will bring for them and others. They have defined new strategies for developing and implementing climate mitigation and adaptation policies. These involve clarifying ownership of and potentially reallocating newly valuable resources and coordinating action among large numbers of actors.

The critical political issue for mitigation policy in agriculture is the impact on farm profitability and rural land values. Current analyses have explored the direct impacts of an emissions trading system on farmers and farming communities but not their ability to reduce that impact through mitigation responses. Only limited modelling has been done of the offsetting impacts of free allocation of units. We have previously had no firm evidence on the relationship between farm profitability and asset values. We have begun to address these gaps.

The success of any set of institutions will depend on transactions costs, social attitudes, and the preparedness of agents within the society to enforce rules. We have explored ways that non-mandatory or voluntary programmes can be used in conjunction with other approaches to facilitate innovation in response to climate change. We have identified some constructive solutions to correct the wedge between public and private benefits of actions designed to respond to climate change, enabling a rapid uptake of new technologies.

We ran a bi-monthly dialogue group so technical people understand the real world constraints that must be addressed, making their technical knowledge more applicable, and stakeholders understand the science and economics relevant to addressing allocation and institutional issues. This was an unofficial body and was professionally designed and facilitated. We also extended our existing emissions trading game, which had already been used effectively with school students through to regional councillors, and extended it to a wider range of scenarios specifically relevant to agriculture and as an interactive game that can be used as a broad-based training and education tool on climate policy issues. We have created a short film reflecting perspectives of farmers, the farming industry, scientists and policy makers on key issues for agricultural mitigation. From these, we are developing a set of educational resources and a strategy to disseminate them.

Our team involved economists from Motu, GNS-Science, Landcare Research, Lincoln University, Canterbury University and Victoria University and a social science facilitator. It also drew on outstanding academic expertise in a range of disciplines (through NIWA, AgResearch and Scion) and deep policy experience from number of agencies (including MPI, MfE, MFAT).

Key Results

RESEARCH RESULTS

Our research explored both what can be done about agricultural emissions, who will be affected by change that mitigate emissions and how we as a society can coordinate and cooperate to achieve effective, efficient mitigation action. Details of the twenty one papers produced (some still being finalised) are given under specific outputs. Some presentations associated with each piece of work are also listed. Most material has links to the Motu website.

What behaviour is needed and who will be affected?

We explored the potential for on-farm mitigation in three ways. Duncan Smeaton and others simulated a range of options on a 'typical' dairy and sheep-beef farm; this work suggested that lower emissions systems that are not significantly less profitable or productive are possible. We surveyed the literature on mitigation costs and found that it was difficult to compare studies or draw robust conclusions from existing studies. None took explicit account of uncertainty in either weather or prices, and little attention was paid to the real costs of transition from one system to another or the limits on access to capital or skills. Taking a different approach to assess on-farm mitigation potential, we used data provided by MPI on heterogeneity in emissions intensity (emissions per unit output) on MAF monitor farms, controlled for exogenous geophysical factors and application of specific mitigation methods (e.g. nitrification inhibitors and feed pads), and interpreted the residuals as mitigation potential demonstrated within the existing distribution of farming systems.

With additional support from the Ministry of Science and Innovation (MSI), we continued to develop our Land Use in Rural New Zealand model. We recalibrated the price responsiveness and adjustment paths of each land use at the national level based on new econometric estimates. We revised our spatial allocation algorithm and parameterised it with spatial probabilities for each land use from a spatial econometrics model. We re-designed our simulation model and created new simulations of land use change under several policy scenarios. The model is now considerably more efficient and more clearly coded and documented. This confirmed that we can expect significant emission reductions over time through land use change induced by taking account of emissions; these changes are likely, however, to occur either very slowly or at very high cost.

Our second key focus was understanding how the costs of mitigation would affect the agricultural sector. We explored New Zealand's ability to affect the international prices we face and largely confirmed the hypothesis that we are price takers though we do seem to face lower prices in our expanding markets which suggests that the value to New Zealand of current average product might be higher than the value of additional production. Within our Agricultural Emissions Dialogue we discussed ways in which processors (and farmers) could get higher value for the products we produce through niche marketing. We concluded that there are potential gains in this area but they require high levels of trust between farmers and processors, something that seems an issue in the sheep and beef sector.

We then looked at who would actually bear costs of mitigation, and any regulation. We estimated the relationship between commodity prices (which can be considered analagous to a regulatory shock that raises costs) and residential housing values. We found that the

commodity price shocks affect urban areas indicating that some costs are passed through. The effect on rural house prices was harder to identify but not necessarily smaller. We are currently exploring the effects of commodity price changes on farming land values using the very detailed sales data from Quotable Value but this is work in progress.

Using a more direct approach, we modelled the location of the direct costs of mitigation and imposition of liabilities / awarding of credits. We made our LURNZ model emissions component spatial using regional data for dairy and carrying capacity maps to allocate sheep and beef animals in a credible way. We created forest age maps so we could model the evolution of carbon sequestration across regions. This enhanced version of LURNZ allows us to model land use responses to regulation and then estimate costs of land use change and GHG charges and the benefits from carbon sequestration. This work is still being finalised.

The potential impacts on farms, rural communities and the wider community from the cost of agricultural mitigation and regulation occurs within a wider context of increasing population and global climate change. We found that New Zealand is likely to benefit from the higher international commodity prices that will result but it is less clear what the net effect of climate change will be once the variable regional impact and the impact of extreme events is taken into account. Certainly some farmers will be hurt.

We extended work by Reisinger and Stroombergen on the effects of different greenhouse gas 'metrics' on New Zealand to explore the impacts on farmers. We found that while the overall picture is similar, the impacts of different international scenarios are amplified and results depend critically on the form of policy – especially the extent to which farmers must bear the costs of their emissions.

Finally, through a connection with a separate work programme on water quality (MSI funded), we explored the inter-relationships between water quality and GHG mitigation and regulation. We created a clear theoretical model that shows the potential for complementarity and conflict among objectives, showed how with complementarity the GHG policy reduces the price in a nutrient trading market and lowers the cost of water quality policy. This suggests that regional councils with water quality issues might work to ensure that the existing forestry component of the ETS works effectively in their catchments, and support agricultural emissions mitigation efforts more generally. This would reduce the cost to them of buying nitrate reductions and the political resistence from farmers to water quality regulations. In some catchments with mild water quality issues, it could avoid the need for water quality regulation.

Action: Coordination and Cooperation

Before we could consider policy design issues we went back to fundamentals to explore the potential objectives of policy. Clear objectives are critical for good policy design. We considered the potential objectives of all New Zealanders, and objectives in both the short and longer term. The policy needs to promote welfare of all New Zealanders and needs their support both to allow it to be implemented and to make it effective. We separated motivations into intrinsic concern about climate change, response to international pressure (diplomatically or through markets), and support for complementary goals. The balance among goals affects the optimal form of our policy.

We explored the issue of emissions monitoring in our Dialogue group but did no formal research. We reinforced the conclusion that GHGs cannot be measured in meaningful verifiable way at the farm scale in isolation from the system as a whole. The group also

emphasised the importance of farmers understanding the drivers of emissions in their systems and their inverse relationship with productivity.

In work that was partly funded by a separate MSI project, we explored the effecvtiveness of the forestry component of the emissions trading system. A critical issue identified was the problem of investment certainty when investments depend on the carbon cost or credit and the future price of carbon is driven by policy and uncertain politics at the national and international levels. We began to explore options to address the difference between policy-maker price expectations and those within the market as well as inability of current markets to fully manage carbon price risks over long periods. As part of this, two junior researchers studied the Afforestation Grant Scheme as one option. This work identified some problems in the specific scheme but also reinforced the value of something similar.

The problem of optimal investment under uncertainty is very visible in forestry but equally arises in agricultural investments and infrastructure investments. This uncertainty can lead to apparently conservative or slow uptake of new ideas and technology. We explored how the desire to maintain options optimally affects investment with the specific example of a sea-wall. In the context of a farmer considering adoption of a new environmentally friendly production technology we presented a framework for understanding the drivers behind adoption patterns and identifying points at which adoption could efficiently be facilitated. We emphasise that faster adoption is not always better.

In the course of this research, and our dialogue group, we found large gaps in knowledge in unexpected places such as the small amount of empirical research around branding of NZ products overseas and how we interact with international markets, empirical evidence around the process of agricultural technology uptake, solid modelling and evidence on the cost of mitigation options. We identified a need for better understanding of how the banking sector, capital markets more generally and the tax system affect agricultural emissions and could be part of a solution. If we are to move to a low carbon agricultural economy we need to develop tools to stimulate efficient experimentation and learning about new technology on farm and to provide efficient levels of investment certainty. While we have made progress on understanding the distributional impacts of agricultural emissions policy, this is also an area where more work is needed.

SUMMARY AND REVIEW OF THE AGDIALOGUE PROCESS

The original purpose behind the AgDialogue group was to find and document effective, efficient and fair solutions to the challenge of agricultural GHG (greenhouse gas) emissions. For this purpose just over 20 participants from a range of groups around New Zealand were selected to participate in a professionally facilitated 18 month process. This section document some of thinking behind the design of the AgDialogue. It also looks at what was successful, and the range of constructive feedback we received from participants.

Purpose of the dialogue

AgDialogue was set up with a stated purpose of finding and documenting effective, efficient and fair solutions to the challenge of agricultural emissions. A document on the original motivations and schedule underpinning the AgDialogue group can be found here. The aims of AgDialogue were achieved by covering a wide range of relevant topics, through discussion with experts and among participants. The experts, from Motu and other reputable organisations, aimed to inform participants of necessary background material and the latest research, and in turn the AgDialogue participants helped inform the researchers of gaps in their research. This arrangement is represented in Figure 1.

Selection of participants

Participants were selected on the basis of their experience from a particular perspective, as well as personal characteristics. While we did not aim to have a representative selection from the New Zealand population, the participants were purposely selected from a range of relevant groups. These groups included farmers, farm industry groups, Maori, Non-Governmental Organisations (NGOs) and government. Relevant personal characteristics included being a good thinker, knowledgeable and interested in relevant topics, open-minded, and amenable to working as part of a group. Total number of participants was kept low (rarely more than 20) to allow in depth discussion to occur.

Officials from MPI and MfE became extremely positive and useful participants over time both bringing personal ideas and also ensuring that we benefitted from existing thinking within government, though initially we found both departments were nervous about participating. The officials are not responsible for any conclusions the group came to, or for any errors we made despite their input.

Facilitation

The meetings were professionally facilitated by Glen Lauder from Common Ground. The small number of participants, and the consistent attendance of members over a lengthy period of time, allowed a strong group rapport to be built. This rapport, and the length of time given to cover the various topics, especially at the retreats, allowed the issues to be discussed in depth in an honest way. This meant the group discussion and thinking could progress and converge, rather than be subject to a debate that solidified existing views and positions. The success of this group was in no small part due to the in depth planning and careful selection of participants that was done before the first meeting.

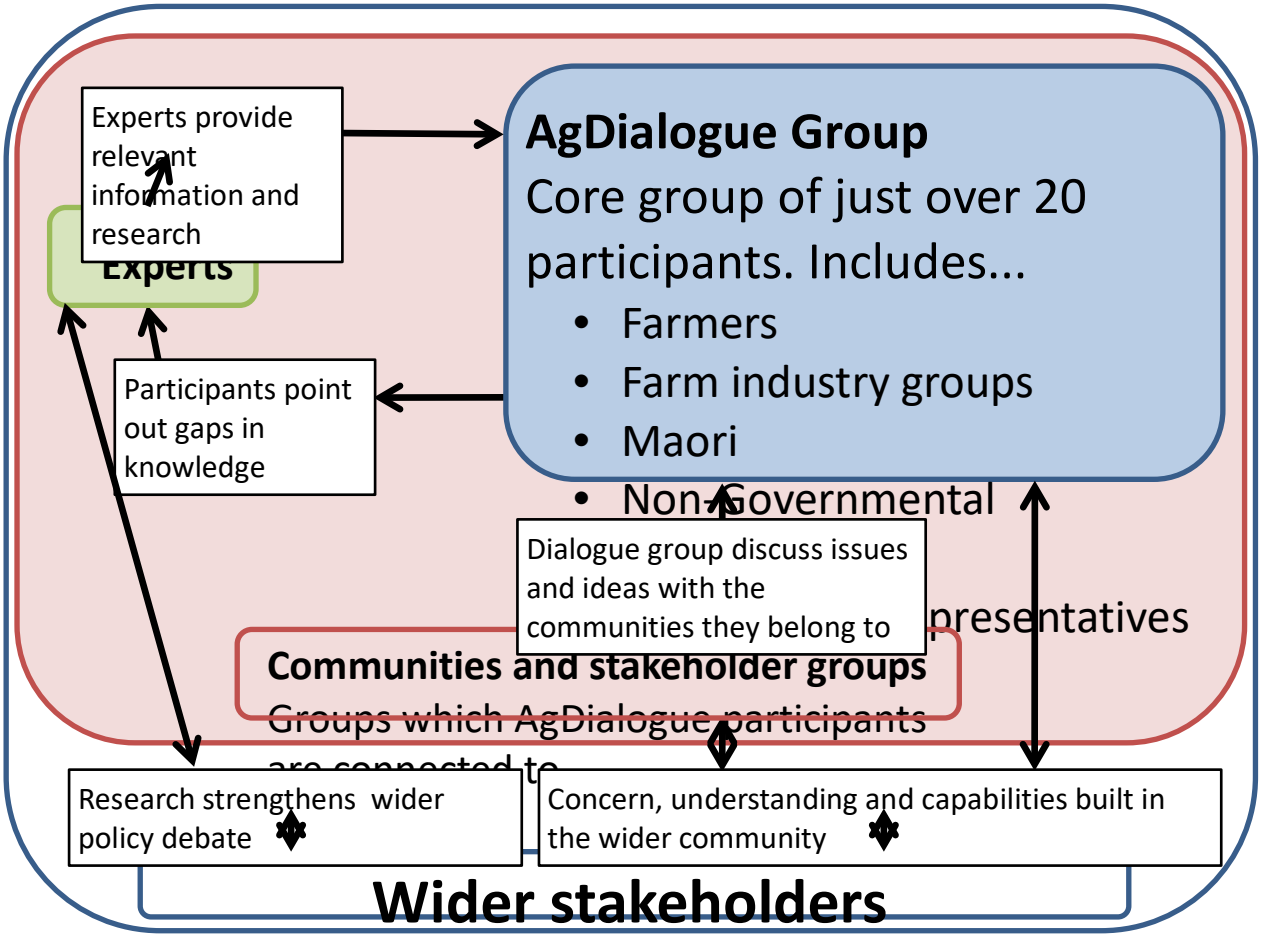


Figure 1 Schematic representation of AgDialogue

Format

The Dialogue included seven half-day meetings in Wellington, and three two-day retreats at different locations around the North Island. The half-day meetings were mainly technical in nature, and the retreats focussed on deeper discussion by the participants. Material covered by the meetings included climate science, mitigation options for agriculture, monitoring, Emissions Trading and other policy options, wider economic considerations for the agricultural sector, farmer behaviour and behaviour change, cooperation, technology uptake, and fairness considerations.

The second retreat, in February 2012 in Otaki, had a strong focus on getting the participants to come up with solutions to some of the issues we had been discussing. The two subsequent half-day meetings and the final retreat near Huntly had a large focus on developing and refining these ideas, and synthesising them into a package.

The design of the dialogue group process was shared between Motu as project owner and CommonGround who convened and conducted the dialogue component. The dialogue design (or collaborative practice) was based on experience with previous Motu dialogue groups on climate and water issues and other regional and local NZ experience including work with iwi, community development and catchment groups; partnership in design and coaching of the (New Zealand, national) Land and Water Forum; and work overseas especially with SOL (Society of Organizational Learning) partners.

The design focussed on creating (or developing) five necessary conditions:

1. A diversity of participant experience, with an orientation towards practical (cf policy) experience.
2. Technical (scientific and economic) learning and social learning.
3. A "high-trust container" for exploring alternative thinking together, that develops strong individual ownership of challenge and the shared learning
4. The readiness and invitation to innovate
5. The configuration and infrastructure to support prototyping of emergent initiatives.

To have the design work, the challenge of the practice is to cultivate the following qualities that bring life to the design:

- Acknowledgement of what each participant brings, and listening.
- Respect, and the willingness and timing to invite participants to take on a new challenge.
- Trust and ownership, by cultivating generosity amongst participants.
- A willingness to welcome and contain dissent, as a necessary pre-cursor to innovation.
- Commitment and the energy to explore new pathways and prototypes.
- The courage to enquire further, beyond the AgDialogue group.

In general, these are developmental qualities in that they grow sequentially from one another.

Dialogue (as distinct from debate) is a pattern of exchange that is cultivated. It requires a focus on growing the self-convening capacity of the group and its participants; it is distinct from facilitation (where the facilitator may play a central guiding role) or chairmanship (who might be the "referee" of the conversation). Convening conversation so the group develops a capacity to engage in dialogue takes patience and attention.

The group operated under the Chatham House rule. All proceedings were recorded via audio, and sometimes video for the benefit of the researchers and facilitators. Any published outputs acknowledge the members AgDialogue's participation (if they choose) but are the sole responsibility of and represent the opinions of Motu researchers alone. We did not aim to produce a consensus view, but successfully produced a focused and informed policy environment within the group and beyond.

Evaluation of the process using views of the participants

Feedback from the participants of AgDialogue – including all those who were involved throughout the process – was requested via email in May 2012, with another chance for comment via email being given mid-August 2012. Twelve pieces of feedback from 11 different participants was received, ten pieces of which were from the May round of feedback. The participants who sent in feedback have been given a number from 1 to 11 for this document.

Participation

In terms of the process, the experiences of participants were generally positive. Facilitation, planning and the range of views that were brought to the table all received positive comments. Participant 1 said "The format is great, the facilitation helps considerably and the group selection was inspired." Participant 2 expressed the views of many of the other participants by saying the best thing about AgDialogue was "Time to hear different perspectives, get beneath the surface of people taking 'positions' and develop joint long term goals."

In terms of participants there was one perspective that a number of participants commented was missing, due to "disengagement of the green lobby folks from the process" (Participant 3). This displayed a willingness of the participants to hear all relevant perspectives, and perhaps the low attendance from this perspective needs to be considered. Why they did not participate or were perceived not to participate to the same extent as the other participants needs to be explored.

The only other negative related to participation that was also frequently seen in the feedback was "bringing too many new people into the group at a late stage" (Participant 1). Participant 7 noted it was difficult to come into the process half way through. Though not many people were brought in at a late stage, one or two additional people in the latter meetings brought in as replacements or with particular skills was enough to elicit this reaction.

Broadly though, it can be said that the choice of participants early on was excellent, which was reflected in the feedback. Furthermore, all those chosen accepted the invitation, and very few people dropped out of the process, even though it lasted almost 18 months. This alone can be seen as testament to the success of the project.

Format of the meetings

The range of the types of participants involved in terms of locations around the country and type of employment, showed up in the feedback around format of meetings. A number of participants found that the half day meetings in Wellington were too short to get into deep discussion, and to seem worth the travel. Participants 1, 5, 8, 9 and 10 expressed something along these lines, with 10 for example saying "Retreats the best format - more progress and less travel."

Participant 4 though found the retreats too long to be able to commit to attending them. "For me personally the retreats were a real issue having to commit extended periods of time. ... [the organisers need] to reflect on the tradeoff between the attractiveness of retreats with the risk

of losing participation." Especially for the second and third retreats, the low attendance or partial attendance from a number of people showed that Participant 4 was not the only one who found this an issue.

Participants 2 and 6 expressed support for the mix of half day meetings and retreats. Some of the participants commented on the importance of strong administration and communication between the meetings. A comment of note is from Participant 5, who commented that "Having key messages at end of day and follow on from there at next meeting for me was missing."

Two other participants gave positive feedback on the organisation. "Attention to detail in the setup of meetings has meant that we have never given a thought to what happens behind the scenes," (Participant 6). Participant 11, who was not a regular part of the group, said "I have actually simply appreciated being reminded of the process from your recent follow up. That doesn't always happen, but is great to see."

Topics and goals

Though the topics for discussion were worked out in general terms in the planning stage, the process, its goals and motivations were also co-developed by the participants in the initial meetings. As the process went along the direction of discussion evolved, and the tangible outputs were unclear until the end. The feedback from participants acknowledged that this was part of the process, but it also brought with it its challenges.

Though many participants enjoyed the ability to discuss these challenging issues with informed thinkers from a range of perspectives, some also found the lack of clarity around the goals behind the process difficult. Naturally with a diversity of world views, some found the topics for discussion did not cover what they felt should be covered, and that there was bias in the way some of the topics were presented. However, Participant 2 found that the discussions sometimes were not focussed enough. Overall though, the value in the being able to discuss a range of relevant topics with a range of people was seen as a strong positive. This fits with the ideas expressed in Figure 1.

Below are a range of quotes from the participants on the process as a whole.

Participant 2: "[Least useful from the process was] people getting off topic. Lateral thinking is interesting, and has its place early on in the process, but this group cannot solve all the world's problems."

Participant 9: "There was however a sense of inevitability about the market based solutions that emerged. "

Participant 10: "[I found there was an] apparent predetermination that ETS [the New Zealand Emission Trading Scheme] for agriculture is a given. Fundamental science glossed over. A focus on the costs confined to first stage of implementation."

Participant 4 found what many found in that "Most important for me was the fact that the group itself exists bringing together vastly perspectives from a range of different perspectives on the complex and contemporary issue of climate change." However, in the August round of feedback, Participant 4 expressed that "I guess when the AgDialogue debate began, I had possibly (naively) hoped that the dialogue would develop and mature towards this more holistic discussion than we have. It didn't and won't is my assessment. And therefore for me the AgDialogue is flawed and indeed unsustainable where it assumes that agriculture (farming) will always be the best and only landuse." Why the Participant, and participants with similar viewpoints might not have felt comfortable bringing up these issues may need to be explored.

Future prospects

We also asked the participants to comment on whether AgDialogue or a similar project had a future. Here are some of the comments.

Participant 1: "Would like to see the group continue-primarily to implement some of the 10 [prototype] ideas [that we developed] –move from talking - to doing."
Participant 5: "For the AgDialogue group to be extended I would like to have a clearer focus on what we aim to achieve and work towards."
Participant 4 (May): "If it does continue I would like to see a wider discussion (than just farming) that discusses the broad impacts and challenges of climate change towards integrated responses i.e. across sectors, communities, and values (economic, social, conservation, cultural)."

Conclusion

In summary, the feedback from participants was mainly positive on the format and facilitation. Participants found that one of the key things they got out of the process was being able to comfortably explore ideas with a range of people from other perspectives in a positive environment. The relationships that formed within the group were strong. However, if a similar process was to continue, there was a tension between the breadth of discussion and the ability for the group to help develop and implement new ideas.

Qualities of the outputs

A number of intangible outputs came from the dialogue. As shown in Figure 1, the AgDialogue helped inform a range of experts, both inside and outside of Motu, in their research. It also helped created an informed policy discussion in a group from a range of backgrounds. These participants will hopefully bring their increased knowledge and fluency of the complex issues around agricultural GHG emissions into their sectors and communities. Further to the specific Motu research projects which were greatly enhanced through discussion within AgDialogue, Motu has also developed a greater understanding of how to deal with New Zealand's agricultural GHGs. The process has allowed us to develop a synthesis of thinking and ideas, especially around how to create greater behaviour change in the agricultural sector. This includes a package of 10 prototypes developed by AgDialogue participants, which could stand alone, or help to implement future regulation such as the ETS.

The package was already well received by participants of a roundtable run by the Institute of Governance and Policy Studies from Victoria University of Wellington. Suzi Kerr of Motu, and several of the AgDialogue participants including two farmers, presented it to around 40 stakeholders at the beginning of August 2012. The ideas presented by the group also appeared to help bridge some differences in view among the roundtable attendees, or at least encourage discussion among people of differing views. Suzi also presented it to an agricultural science audience in Christchurch on 22 August.

Motu has just completed a film, with the help of a professional filmmaker Jess Feast, synthesising some of these ideas. We also hope to create a package of educational materials aimed at a wide audience, developed from our increased understanding of the issues through AgDialogue. These include games designed to increase understanding of how the ETS could work for Agriculture. The AgDialogue group also started a blog about Agricultural Emissions, where various related issues continue to be discussed.

Through the many outputs from the project, no doubt we achieved our original goal of creating a more informed policy environment in a range of areas on the issue of agricultural

GHGs. From the experience of running this dialogue hopefully we can improve this method of research and policy discussion.

Conclusion

The process overall has been very fruitful. This is demonstrated in its contribution to the research and understanding on a range of topics relevant to agricultural GHGs. Furthermore, a strong group of people have greatly increased their understanding of the issues around agricultural GHGs in New Zealand, which they can bring back to their sectors and communities. The strength of the process lay in the selection of participants, the length of time given to exploring a range of research and ideas, and the commitment of the participants throughout.

Key strengths include:

1. Selection of participants for their experience and personal characteristics
2. The length of the process and the ability for participants to explore topics in depth with people from a range of perspectives that they trust, with enough time for positions to evolve over the process
3. The level of understanding, consensus, innovation and quality of research from the process

Key things to work on for a similar future process are:

1. Greater focus on what technical material to present so that it is relevant and not too extensive.
2. Clearer split between the meetings with technical material presented (half day Wellington meetings), and the meetings for dialogue (the two day retreats). This could include responsibility for running the technical meetings lying with Motu, while the dialogue meetings lie with the professional facilitator.
3. Better flow, connection and follow up between meetings, with more focus on this at a senior level.
4. Ensuring that the "green" lobby groups, and any other important groups, are represented and feel able to express their views even if those views come from a significantly different worldview to the other participants.

EMERGENT ACTION PACKAGE

As a result of our agricultural emissions dialogue group and our research we reinforced three broad messages: we need to be explicit about the different objectives we could be seeking through actions to address emissions; a wider range of actors need to be engaged; and they need to be engaged to address three goals: concern, capability and contracting, - with more emphasis on the first two while New Zealand's response evolves.

We might address emissions through an intrinsic motivation to address climate change. This leads us to place emphasis on actions that can make New Zealand a credible leader in policy and science innovation in the agricultural emissions space. If we want people to follow us we must make the path attractive. This requires that we try to control and mitigate adverse consequences in terms of global food security, impacts on farmers and rural communities (we don't want to repeat some aspects of impacts of the 1980s reforms), sudden impacts on the agricultural sector and hence the New Zealand economy, high costs to tax payers, and leakage of production and hence emissions to other countries. We need to be clear however when we are smoothing a transition to a new state of the world and when we are trying to stop change.

New Zealand is doing a lot of work on global leadership but can be even more effective. We need to act as though we will solve the challenges in the long term, have a strong vision and work toward that in a way that will politically and economically seem attractive to others who might follow. We need to actively engage with those who face similar issues but are earlier on the path to address them.

These actions will be complementary to those addressing another motivation: responding to international pressure from governments and markets. Leadership and proactive responses to actual or anticipated pressures both require meaningful verifiable actions that have integrity and need good communication to be effective. Finally, policies to address other environmental issues, particularly water quality policy, will generally both assist and be assisted by efforts on agricultural emissions as long as the rural community is positively engaged in each.

Public debate tends to focus around the actions of central government, yet they can influence only a small number of the multitude of levers that can gradually transform individual behaviour, farm practice, our consumption habits and the rural sector. Universities, Crown Research Institutes, Iwi, Sectoral organisations such as Federated Farmers and Dairy NZ, Companies such as Fonterra and fertiliser suppliers, Regional Councils, right down to communities, farm discussion groups and individual farmers all have a role to play. Many are acting to different extents already but actions would benefit from coordination, mutual reinforcement, shared vision and more resources. Many farmers are willing to contribute their share of the costs as long as they believe it is valuable.

This leads to a question of what is the farmers' fair share of costs. This is not a question with a technical answer but we try to clarify the discussion. We identify three principles for sharing costs equitably. The first is a 'child's view' that is supported by many psychology experiments. Most people believe in the general principles that 'Everyone should have their turn' and 'tasks and goodies should be equally shared'. Application of these ideas however begs the question of what is shared and among whom. If this were interpreted as equal sharing per capita of costs to New Zealand from Kyoto compliance, a back of the envelope calculation suggests that the cost, estimated at around 1% of RGNDI, could be met by each person contributing 1% of everyone's income or perhaps an equal cost per capita: around $333 per year. Others interpret equal sharing as that every sector should face the 'same' cost – but sectors don't bear costs, people do. 'Equal treatment' has an pervasive appeal but can lead to outcomes where compensation is poorly targetted to cost – for example the allocation of a fixed number of NZ to each hectare of forestry land to compensate for the high cost of deforestation – despite the fact that most forest land would never be deforested.

A second commonly invoked principle is 'polluter pays'. This also has appeal but begs the question of who the 'polluter' is. If the polluter must be 'responsible' for his actions, he must understand that he is causing damage and have the ability to do something about it. Is the farmer or the consumer responsible for agricultural emissions? The principle of responsibility suggests that those who do bad things unintentionally should not be punished but also that those who do good things unintentionally should not earn rewards. Potentially, those who have benefited from high emissions even if unintentionally could expect to have some of the gains that came from this taken away from them but this is hard to achieve in practice. In the long term, those who continue to cause emissions, either farmers who can mitigate cost-effectively but choose not to, or consumers who continue to purchase products associated with emissions, should bear the costs; this is both equitable and efficient.

The third principle is that those who are more able to bear costs should bear higher costs – i.e. those with high incomes or wealth relative to others. We live in a highly unequal world and need to take all opportunities to reduce those inequalities or at least avoid exacerbating them.

Equitable sharing of costs is also only one motivation behind support for farmers (or in an ETS context, free allocation of NZ units). Other motivations are: addressing leakage of production outside New Zealand (a problem of uncertain magnitude – our research suggests it is probably small in the livestock sector); smoothing the transition into a new economy with low emissions (to address stranded asset issues for individuals, farms and communities and allow time for learning, experimentation and financial and psychological adjustment); and encouraging participation and compliance in a situation where change requires action by around forty thousand farmers. These latter three motivations are important in the short to medium term – in the long term, allocation should be all about perceptions of equity.

In an attempt to think more creatively about ways to address emissions we divided possible actions into those that affect:

1. Concern - changing attitudes and encouraging action
2. Capability – knowledge and access to resources
3. Contracting - legal agreements or regulation

At a more community level, drawing on the work of Elinor Ostrom, these could be reinterpted as trust, technical support and transparency. Her Nobel Prize winning work found these were critical to achieving cooperation.

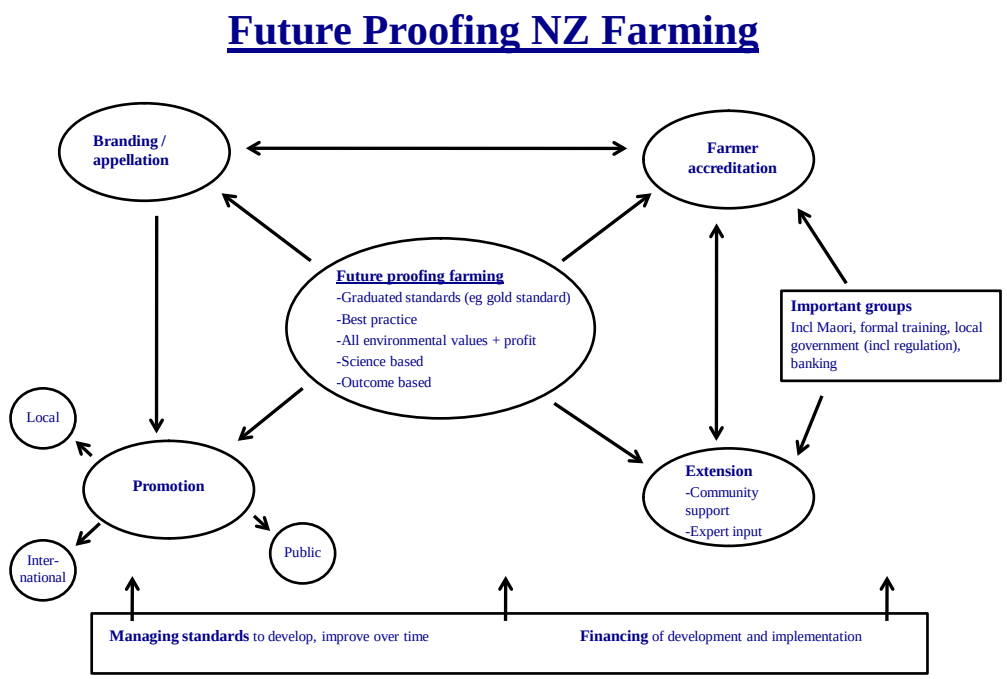
At an individual level we need farmers to have agency (a feeling that they can contribute and do have some control over the issue); to have the ability to act; and to take action. Combined with the broad set of actors discussed above, this gave us the matrix below. The emissions trading system could be thought of as occupying the top right-hand box. This should be seen as the final piece of a much wider picture rather than as a starting place and complete policy.

Matrix of actions

Action / Group	Concern Trust Agency	Capability Abilities	Regulation Transparency Action
National			
Regional			
Community			
Individual			

Our Dialogue group discussed ways to address each of these spaces to complement actions that are already being taken; this needs to be a much longer and wider process. They came up with a package of actions that could be done in the short term to move the process forward. Many of these are summarised in the ‘future-proofing farming’ prototype presented in the

figure below. This was seen as a package with mutually reinforcing components. This was not intended to be a complete or even fully developed set of ideas but something that can engage a broader group in a wider conversation and get around fixed ideas and polarisation.



It was recognised that the farm standards that would be encouraged would need to be qualitative not numerical (i.e. not explicit farm level GHG footprinting or life-cycle analysis of products) at the farm scale and would recognise actions that farmers could control.

Complementing this were ideas around creating a user-friendly tool for farmers to understand the GHG emission implications of their management decisions; recognition of the need to engage the banking sector in proactive lending decisions to support lower emissions agriculture; a desire to engage urban communities and consumers through a kiwi farming game and a sustainable cooking television show; infusing climate friendly thinking into New Zealand's culture through for example a kapa haka competition with climate change as a theme; and infusing our education syllabus at all levels with understanding of farming and greenhouse gas emissions.

In the long-term, we envisage an international environment with a complete and stable (sufficiently stringent – though not necessarily meeting the two degree target) international agreement. We imagine that New Zealand policies and mitigation practices are understood and used where appropriate. We have developed them with integrity and have demonstrated their effectiveness and application (where appropriate). Other countries have stable regulation. This may well not involve emissions pricing but it will either involve other forms of regulation that are equally stringent or maybe not. Even if they never internalise the emissions charges, as long as leakage is not a major issue, we should not continue to protect production within New Zealand – the cost to tax payers and the economy would be unsustainable.

Within New Zealand we imagine that the full climate cost is imposed on marginal emissions giving farmers efficient incentives. Fair compensation has been agreed for changes in land values– or to the extent that this was not possible, historical grievances are accepted. Communities and workers have fully adjusted to the changed patterns of production and shifts in work opportunities. Farmers are knowledgeable about existing mitigation options and

apply them with confidence. There is ongoing research and dissemination of ideas. Other key environmental resources are well managed. For New Zealand, this probably involves a farm-scale emissions trading system. This may seem an unduly optimistic vision, but if we do not have a clear idea of where we want to go and do not believe that we can solve the issues we are unlikely to achieve much. New Zealanders have a history of innovation; once the challenge is clearly defined we pride on ourselves on being able to meet it.

In the short term the problem is much more complex. We don't know exactly where international agreements, technology or society is going or at what speed. There are costs and risks associated with acting early – but also benefits. With this in mind we suggest that we don't delay in taking action but don't rush and make irreversible decisions with long lasting consequences we may regret. We must keep the long term in mind, create and maintain options and focus on long-term efficiency. As we move ahead we need to focus on operating fair processes to encourage participation and cooperation. We need to encourage experimentation and learning and reward those who take risks. We need to act with integrity, and always demand the highest quality of information and science. We need to promote and coordinate a broad set of actions by players at all levels on all three aspects (3Cs - 3Ts - 3As) concern/trust/agency; capability/ technical support/ability; and contracting/transparency/ action.

Specific outputs

WHAT BEHAVIOUR IS NEEDED AND WHO WILL BE AFFECTED?

Agricultural Mitigation Potential

1. Anastasiadis, Simon and Suzi Kerr. 2012. "Mitigation and Heterogeneity in Management Practices on New Zealand Dairy Farms" Paper prepared for NZARE Conference, August 2012

   We consider two approaches to quantify New Zealand farmers' ability to mitigate their farm's environmental impact: The construction of marginal abatement cost curves and improvements in farm management practices. Marginal abatement cost curves can be constructed by combining information on the effectiveness of mitigation with cost data. However, we find that the available data is not sufficient to support this approach. We consider improvements in management practices using a distribution of farm production efficiency with regard to nitrogen and greenhouse gas (kg production per unit of emissions). Where differences in production efficiency are due to factors that can be managed by farmers, targeting less efficient farmers to encourage the adoption of management practices similar to those of the more efficient farmers is a potential mitigation strategy.

Anastasiadis, Simon. 2012 'Mitigation and Heterogeneity in Management Practices: New Zealand Dairy Farms' Presented at the New Zealand Agricultural and Resource Economics Society Conference, Nelson, August.

2. Smeaton, Duncan C., Tim Cox, Suzi Kerr and Robin Dynes. 2011. "Relationships between Farm Productivity, Profitability, N Leaching and GHG Emissions: A Modelling Approach," Proceedings of the New Zealand Grassland Association 73, pp. 57–62.

   The financial and environmental performance of a typical dairy and sheep/beef farm under contrasting inputs and systems were modelled to test associations between productivity, profitability, nitrogen (N) leaching and green house gas (GHG) emissions. GHG emissions and N leaching were found to be closely correlated ($R2 > 0.90$) but the correlation between these two emissions items and production and/or profit was less so, suggesting that systems that are both profitable and have a modest emissions output should be possible. The reasons why farmers have not already adopted these systems are complex but could include any of: requirement of higher level of managerial skill, incompatibility with farm soil type or contour, increased risk and capital cost to convert to the new system. Any system that involves improvements in animal efficiency is associated with a reduction in emissions per kg of saleable product.

Greenhouse Gas and Nutrient Mitigation Cost Researchers' Workshop, Hamilton, 5 May 2011.

Around 20 researchers, consultants, regional council staff and farmers attended a one day workshop to compare modelling approaches and results and explore productive ways to move forward in this space. Feedback suggested that while the meeting was unable to reach firm conclusions, it was useful, and we planned to meet again.

Baisden, Troy. 2011. “How does the science process filter environmental mitigation options?” Motu Agricultural Emissions Dialogue Group, Wellington, NZ, 17 May 2011.

Kerr, Suzi. 2011. “Modelling mitigation options,” Motu Agricultural Emissions Dialogue Group, Wellington, NZ, 17 May 2011.

Kerr, Suzi. 2011. “Mitigation options,” Motu Agricultural Emissions Dialogue Group, Karekare, Auckland, NZ, 3 July 2011.

Land use change potential

3. Kerr, Suzi, Simon Anastasiadis, Alex Olssen, William Power, Levente Timar, and Wei Zhang (2012) ‘Spatial and temporal responses to an emissions trading system covering agriculture and forestry: simulation results from New Zealand’ Motu Working Paper 12-10

   We perform simulations using the integrated Land Use in Rural New Zealand (LURNZ) model to analyse the effect of various New Zealand emissions trading scheme (ETS) scenarios on land-use, emissions, and output in a temporally and spatially explicit manner. We compare the impact of afforestation to the impact of other land-use change on net greenhouse gas emissions, and evaluate the importance of the forestry component of the ETS relative to the agricultural component. We also examine the effect of land-use change on the time profile of net emissions from the forestry sector. Our projections for the mid-2020s suggest that under a comprehensive ETS, sequestration associated with new planting could be significant; it may approach 20 percent of national inventory agricultural emissions in 2008. Most of this is driven by the reward for forestry rather than a liability for agricultural emissions. Finally, we present projections of future agricultural output under various policy scenarios.

Kerr, Suzi. 2011. "Land Use and Climate Change in New Zealand," speaking notes and slides from presentation at the 7th Australia-New Zealand Climate Change and Business Conference, Wellington, 1-2 August 2011. Invited Speaker.

Kerr, Suzi. 2011. “Land use change and options in New Zealand,” Motu Agricultural Emissions Dialogue Group, Wellington, NZ, 31 August 2011.

Kerr, Suzi. 2010. “Emissions trading for forestry and agriculture: policy design and integrated simulations in New Zealand,” UC Berkeley Agricultural and Resource Economics seminar, Feb 18, 2010.

4. Kerr, Suzi, and Alex Olssen. 2012. "Gradual Land-use Change in New Zealand: Results from a Dynamic Econometric Model", Motu Working Paper 12-06, Motu Economic and Public Policy Research, Wellington.

   Rural land use is important for New Zealand’s economic and environmental outcomes. Using a dynamic econometric model and recent New Zealand data, we estimate the response of land use to changing economic returns as proxied by relevant commodity prices. Because New Zealand is small, export prices are credibly exogenous. We show that land use responses can be slow. Our result implies that policy-induced land-use change is likely to be slow or costly.

Timar, Levente. 2011. "Modelling Rural Land Use in New Zealand: A Discrete Choice Perspective," Australian Agricultural and Resource Economics Society Conference, Melbourne, 8–11 February 2011.

Timar, Levente. 2011. "Māori Land and Rural Land Use in New Zealand," New Zealand Association of Economists Annual Conference, Wellington, 29 June–1 July 2011.

Land Use in Rural New Zealand (LURNZ) development

5. Zhang, Wei. 2012. "Creating New Zealand Forestry Age Maps in 2002 and 2008 and Estimating and Projecting Plantation Forest Removals and Emissions in LURNZ" Motu manuscript

We have: 1. Developed forestry age maps from 2002 to 2008 building on previous work by Tom Adams at Scion. 2. Applied the age maps in estimate net forestry emissions. 3. Checked that the estimated emissions match well with observed emissions. 4. Updated the forestry and scrub parts of greenhouse gas module in LURNZ.

6. Turner, James 'Optimal Forest Rotations in LURNZ' Report to Motu, AgResearch

This paper proposes a method for implementation in LURNZ for identifying and applying optimal forest rotations to the estimation of area of production forest harvested in a period.

Who mitigates and bears mitigation costs?

7. Woods, Darian, with Andrew Coleman. 2012. "Price, Quality, and International Agricultural Trade", Motu Working Paper 12-08, Motu Economic and Public Policy Research, Wellington.

The average value of a particular class of agricultural exports varies widely across different destinations. This raises the question: in the event of a supply shock, such as the implementation of the Emissions Trading Scheme, can farmers offset higher costs by raising their average prices by contracting exports to lower value destinations? If the difference in value reflects different prices because producers have market power, the answer will be "yes". If the difference in value reflects differences in the quality of goods exported to different destinations, the answer is "no." This paper use a variety of trade data and techniques to examine which explanation is most likely to be relevant. While the answers are not definitive, there is little support for the hypothesis that exports are curtailed to lower value destinations when supply costs increase.

Woods, Darien and Andrew Coleman. 2011. "Price, Quality, and International Agricultural Trade," Wellington, NZ, 31 August 2011.
NZARES conference in August 2012 in Nelson.

8. Saunders, Caroline; Hugh McDonald and Tim Driver. 2011. "Enhancing Value for New Zealand Farmers by Improving the Value Chain," *Agribusiness and Economics Research Unit Research Report No. 324*, Agribusiness and Economics Research Unit, Lincoln University, Christchurch.

This report explores the opportunities for New Zealand farmers to increase their returns through higher value added for their products. The paper explores the international context in which New Zealand trades its agricultural products. Historically, market access has been a major issue for New Zealand agricultural exports. This is still an issue, but there has been a relaxing to trade restrictions allowing greater access to some markets as well as growing opportunities in the emerging markets.

Saunders, Caroline. 2011. "Value added production," Motu Agricultural Emissions Dialogue Group, Karekare, Auckland, NZ, 3 July 2011.

Rural land values

9. Grimes, Arthur and Sean Hyland 'Passing the Buck: Impacts of Commodity Price Shocks on Rural Outcomes' Paper presented at the NZARES conference, Nelson, August 2012

Producers of agricultural commodities treat world commodity prices as exogenous. Prices facing regional producers can also be considered exogenous when we aggregate producers over small districts, and even across New Zealand. Through estimation of a vector autoregressive (VAR) model, under a minimal set of restrictions and through institutional knowledge, we estimate the causal impact of exogenous commodity price innovations on a set of community outcomes. We find the conventional approach of restricting the focus to national effects is insufficient to understand such dynamics, and future analysis and policy should consider sub-national responses. By extending the framework to a VAR on panel data covering all, or a sub-sample, of New Zealand TLSs over 1991-2011, we find that an increase in commodity prices leads to a permanent increase in housing investment and house prices across the country. However there is a significant degree of spatial distribution in effects. Contrary to our hypothesis, we find that rural communities are in fact the most insulated from commodity price shocks, with small and insignificant effects in both outcomes. Instead, due to constrained short-run rural employment and indirect redistribution through increased expenditure, it is urban areas that experience the most significant increases in housing investment, and the lion's share of house price appreciation.

Hyland, Sean. 2012 'Passing the Buck: Impacts of Commodity Price Shocks on Rural Outcomes' Presented at New Zealand Agricultural and Resource Economics Society Conference, Nelson, August.

Work in progress
Maré, David, Sean Hyland and Alex Olssen: Panel analysis using the responsiveness of rural land values to commodity price changes as an indicator of the attractiveness of potential land uses. This will complement the above work by using detailed information from Quotable Value on agricultural land values.

Incidence of mitigation and ETS costs

Timar, Levente. 2012. "Whose mitigation is it anyway?" Motu Agricultural Emissions Dialogue Group, Wellington, NZ, 8 May.
Kerr, Suzi. 2012. "Addressing Agricultural GHGs 'fairly'," Motu Agricultural Emissions Dialogue Group, Huntly, NZ, 25 June.

Kerr, Suzi. 2012 'Allocation and cost sharing: Nutrient trading and greenhouse gas markets' New Zealand Agricultural and Resource Economics Society Conference, Nelson, 31 August

Work in Progress

10. Timar, Levente. 2012. "Land-use Intensity and Greenhouse Gas Emissions" Motu Manuscript

This document describes the development of the new Land-use Intensity and Greenhouse Gas Emissions modules of the Land Use in Rural New Zealand (LURNZ) model. The previous versions of these modules (Hendy & Kerr, 2006; Hendy & Kerr, 2005) yielded outputs that were, within each land use, largely homogenous across New Zealand; the main reason for undertaking this new work was to introduce spatial heterogeneity into LURNZ's projections of net emissions. The updated intensity and emissions modules enable us to analyse the regional environmental and socio-economic impacts of agricultural emissions mitigation policy, including an ETS.

11. Timar, Levente and Suzi Kerr. 2012. "Whose Mitigation is it Anyway? Climate Change Policy and Agricultural Greenhouse Gas Emissions in New Zealand" Motu manuscript.

Impacts of climate change on farmers

12. Stroombergen, Adolf. 2010. "The International Effects of Climate Change on Agricultural Commodity Prices, and the Wider Effects on New Zealand," *Motu Working Paper* 10-14, Motu Economic and Public Policy Research, Wellington.

This research takes a closer look at the effects of climate change on New Zealand agriculture and on the wider economy, including indirect international effects such as changes in the prices of goods exported from and imported to New Zealand, as well as carbon prices and policies. Economic loss from short term catastrophic events such floods and landslides is not investigated. Infometrics (2007) presented an initial quantitative analysis of some of the above issues. In this paper they update the part of that report that looked at the effect of climate change on agricultural commodity prices, by considering some new scenarios based on international research since 2007, and expand the time-period from 2025 to 2070.

Stroombergen, Adolf. 2011. "The International Effects of Climate Change on Agricultural Commodity Prices, and the Wider Effects on New Zealand," Motu Agricultural Emissions Dialogue Group, Wellington, NZ, 23 March 2011.

Renwick, James. 2011. "Direct impacts of climate change for New Zealand Primary Sector," Motu Agricultural Emissions Dialogue Group, Wellington, NZ, 23 March 2011.

Methane and metrics

13. Dorner, Zack; Hugh McDonald and Suzi Kerr. 2012. "Methane and the implications for New Zealand farmers of international climate change policy including metrics," Motu Manuscript.

Reisinger and Stroombergen's (2012) modelling suggests pricing all global GHG (greenhouse gas) emissions, including agricultural emissions, would be beneficial for the New Zealand economy, with higher GHG prices leading to greater economic benefit. Though this inference may seem counter-intuitive for a country in which agriculture is

economically important, when the effects of GHG charges flow on to global commodity prices, the rise in global prices more than compensates New Zealand for the costs of our GHG emissions. In this paper we investigate the implications of Reisinger and Stroombergen's (2012) results for a model New Zealand dairy and model New Zealand sheep and beef farm. We consider three international policy scenarios that differ by whether agricultural emissions are priced globally, and in New Zealand. We find that New Zealand farmer preferences generally align with New Zealand's economic preferences, though farmers are more greatly affected by differing international policy scenarios compared with the New Zealand economy as a whole. We find that the impact of the choice of metric is minor, especially when compared with the differences between international policy scenarios. Our results suggest that long term, the best scenario for New Zealand and our farmers is to fully price global agricultural emissions within an international climate change agreement.

Reisinger, Andy. 2011. "Apples and oranges: What can science tell us about how to compare emissions of different GHGs? How might different choices affect NZ?" Motu Agricultural Emissions Dialogue Group, Wellington, NZ, 30 November 2012.

Dorner, Zack, Suzi Kerr and Hugh McDonald. 2012. "Methane matters: From international climate change policy to the New Zealand farm," Motu Agricultural Emissions Dialogue Group, Otaki, NZ, 12 February 2012.

Greenhouse gas emissions and water quality

14. Yeo, Boon-Ling, Oliver Browne, Simon Anastasiadis and Suzi Kerr. 2012. "Synergies between Nutrient Trading Scheme and the New Zealand Greenhouse Gas (GHG) Emissions Trading Scheme (ETS) in the Lake Rotorua Catchment", draft paper prepared for the NZARES conference, Motu Economic and Public Policy Research, Wellington.

The intensity of agricultural production affects both the nutrient discharges from farms and their GHG emissions. Regulation that reduces emissions of one type may have a complementary effect on emissions of the other type. This paper explores this issue in the Lake Rotorua catchment of New Zealand using the NManager model. We model the complementary environmental outcomes and cost savings of implementing a greenhouse gas and nutrient regulation concurrently. We find that nitrogen and greenhouse gas mitigation are complementary in the Rotorua catchment, and that this leads to both nitrogen and emissions reductions when either regulation is implemented independently, and cost savings when the policies are enforced concurrently.

Yeo, Boon-ling. 2012 'Synergies between a nutrient trading scheme (NTS) and the New Zealand emissions trading scheme (ETS) in the Lake Rotorua Catchment' Presentation at New Zealand Association of Resource Economists, Nelson, 31 August (Winner of Best First Time Presenter Award)

ACTION: COORDINATION AND COOPERATION

15. McDonald, Hugh, and Suzi Kerr. 2011. "Why do New Zealanders Care about Agricultural Emissions?" Motu Note #9, Motu Economic and Public Policy Research, Wellington. Slightly different version published as McDonald, Hugh, and Suzi Kerr

(2012). "Why do New Zealanders Care about Agricultural Emissions?" *Policy Quarterly*, 8(2), Wellington.

Agricultural emissions account for more than 46.5% of New Zealand's total greenhouse gas (GHG) emissions and 13.5% of global GHG emissions. Excluding agriculture from global mitigation commitments has been shown to increase the cost of containing warming to 2°C by as much as 15–50%. Clearly, the question of what response will effectively address these emissions is critically important to New Zealand and the world. However, as the above quotations illustrate, current views on what shape that response should take are polarised. This polarisation may have been exacerbated by the government's initial framing of the emissions trading scheme as a response to a specific international obligation under Kyoto, a motivation that seems less salient since the Durban conference. Designing agricultural emissions policy will require balancing these views, and the views of all other New Zealanders, whose aims for agricultural emissions policy may bring in further dimensions. Implicitly, this involves optimising a social welfare function that considers the aims and motivations of all New Zealanders. This article contributes to the agricultural emissions policy discussion by stepping back and considering these underlying motivations: why do individuals, communities, companies and government in New Zealand care about how agricultural emissions are addressed?

This paper was presented at the New Zealand Agricultural and Resource Economics Annual Conference, Nelson, NZ, 25-26 August 2011.
Kerr, Suzi. 2011. " Why agricultural emissions matter – going forward," Motu Agricultural Emissions Dialogue Group, Wellington, NZ, 23 March 2011.
Kerr, Suzi. 2011. "Motivations and responses," Motu Agricultural Emissions Dialogue Group, Wellington, NZ, 17 May 2011.
Kerr, Suzi. 2012. "Why and how we can act," Motu Agricultural Emissions Dialogue Group, Otaki, NZ, 12 February 2012.

Other presentations on international context for action on agricultural emissions.
Lee, Steph and Charlotte Darlow. 2011. "Climate Change International Dimensions," Motu Agricultural Emissions Dialogue Group, Wellington, NZ, 23 March 2011.

Saunders, Caroline. 2011. "Food miles, carbon footprinting and other factors affecting trade," Motu Agricultural Emissions Dialogue Group, Wellington, NZ, 23 March 2011.

Monitoring emissions

Kerr, Suzi. 2011. "Knowing and telling about our emissions," Motu Agricultural Emissions Dialogue Group, Wellington, NZ, 6 October 2011.

Valuing carbon in forests

Identify problem of investment uncertainty

16. Karpas, Eric and Suzi Kerr. 2011. "Preliminary Evidence on Responses to the New Zealand Forestry Emissions Trading Scheme," *Motu Working Paper* 11-09, Motu Economic and Public Policy Research, Wellington.

This paper aims to provide useful documentation of the ETS as it stood in 2010. The paper first provides a brief outline of the role of forestry in New Zealand's ETS, including the reasons for its inclusion in the greater system and the rules by which forestry operates

within the system. It then analyses these rules, indicating the reasons behind the inclusion of certain provisions where the reasoning may not be immediately clear. Finally, the paper provides both quantitative and qualitative data on how well the system is working so far, whether the system is operating as predicted, and why any discrepancies between predicted and actual outcomes arise.

The paper was presented at NZARES in July 2010 and at the EcoClimate Economic Researchers Workshop, 21-22 February 2011, Motu Research, Wellington.

Begin to identify solutions

17. Coleman, Andrew. 2011. "Financial Contracts and the Management of Carbon Emissions in Small Scale Plantation Forests," *Motu Working Paper* 11-04. Motu Economic and Public Policy Research, Wellington

Under the New Zealand Emissions Trading Scheme, foresters can obtain carbon units as their forests sequester carbon. If they sell these units as they are earned, the units must be repurchased when the forest is harvested, exposing foresters to price risk. This paper examines the way forward markets, futures markets, and carbon lending markets could be used to manage this risk. It argues that carbon lending markets are likely to be the most convenient form for foresters, as they allow the total returns from forestry investments to be increased with minimal risk. The carbon units can be lent to industrial firms or developers of new forests to minimise the carbon risk they face if they make carbon reducing investments.

The paper was presented at the EcoClimate Economic Researchers Workshop, 21–22 February 2011, Motu Research, Wellington. It was also **presented at a public seminar on March 16 2011** to the New Zealand Institute for the Study of Competition and Regulation (ISCR). The audience was comprised of about 45 representatives from the forestry, banking, academic and government sectors.

18. Coleman, Andrew and Suzi Kerr. 2011. "Managing Risks in Emissions Trading Markets," Motu Research Update 20, pp. 1-2.

Uncertainty about the longevity of the New Zealand Emissions Trading Scheme, and about the future price of carbon, means that companies and foresters have been hesitant to fully commit to the ETS. The recent work of Motu Senior Fellows Andrew Coleman and Suzi Kerr has discussed some ways to create more confidence in the ETS and increase the efficiency of investments.

19. Kerr, Suzi. 2011. "Submission to the Emissions Trading System Review Panel," comments on the Emissions Trading System Review.

This submission on the Emissions Trading System Review's major suggestion is that the government buy NZUs ahead to limit the government's long term liability and induce more efficient short-term investments, particularly by foresters. It also contains Dr. Kerr's comments on some of the consultation questions posed by the Review Panel in their Issues Statement and Call for Written Submissions.

20. Olssen, Alex and Suzi Kerr. 2012. "Policy uncertainty, the Afforestation Grant Scheme, and the Emissions Trading Scheme," Motu manuscript.

Between 2008 and 2012 New Zealand land owners could be paid money for planting new forests under the Afforestation Grant Scheme (AGS). This grant scheme was introduced despite the fact that New Zealand already had an Emissions Trading Scheme (ETS) that rewarded forest owners with carbon credits as their forests grew. Many justifications have been proposed for such a scheme, the most prominent is that a grant scheme allows land owners to plant despite large establishment costs, however these have typically not been scrutinised using a formal model. In a simple model we show that policy uncertainty can provide a justification for a grant scheme even when a trading scheme exists. Furthermore, we can look at other reasons for a grant scheme and see if they make sense within our framework. For example, we show that establishment costs do not justify a grant in and of themselves. But, they can justify such a scheme in certain circumstances. We then use data on the population of AGS proposals, where we observe acceptances, rejections, as well as the tender rate, the proposed forest species, and several other characteristics of the proposals to look at various aspects of the grants implementation.

Investment and technology adoption

21. Grimes, Arthur. 2012. 'Optimal Infrastructure Adaptation to Climate Change' Motu Note 11.

The paper examines some of the key issues that should be taken into account when designing and implementing climate change adaptation policies with regard to infrastructure investments. To make the analysis concrete, we refer to the case of adaptation to the prospect of coastal flooding in which case a seawall can be considered as an infrastructure investment; however the analysis is general. The two key lessons of the analysis for infrastructure investments are: (a) to spread the nature of adaptation responses to climate change across margins that reduce the probability of flood, the exposure given a flood, and the loss given the exposure; and (b) to be cautious in committing to irreversible infrastructure investments that may no longer be optimal as our understandings of the severity and frequency of climate change outcomes are revised.

Presented to Motu Climate Change Economics Research workshop, March 2012

22. Coleman, Andrew and Isabelle Sin. 2012. "The Adoption of Environmentally Friendly Technologies in Agriculture," Motu Note #12, Motu Economic and Public Policy Research, Wellington.

This research note considers the decision faced by farmers who have the option of adopting a new environmentally friendly production technology. It discusses why the rate of adoption is likely to deviate from the rate that is socially optimal, and outlines the roles for intervention in reducing the difference between the two.

A farmer's decision to adopt a new technology is largely based on balancing the economic costs against the economic benefits. The technology will be adopted if it yields an expected profit that is high enough to compensate for any higher risk it offers relative to current technology. When there is an irreversible cost of adopting and returns are uncertain, there is an option value to waiting to adopt. This option value means adoption may not occur until the expected benefits are considerably larger than the costs.

The socially desirable adoption rate occurs when each farmer adopts if the present social benefits of adoption exceed the present social costs. However, the actual rate of adoption may differ from the optimal rate because private benefits differ from social benefits, or because there are other market imperfections.

In the absence of intervention, private and social benefits will differ because most of the benefits of reducing pollution accrue to society as a whole, not to the farmer performing the mitigation. They will also differ for early adopters because, by adopting, these farmers generate information about the new technology that is valuable to other farmers, but this benefit does not enter their adoption decision. Suboptimal adoption may also occur because information about the new technology that would inform the adoption decision is a public good, and thus is under-provided by the market.

An intervention designed to efficiently increase the adoption of an environmentally friendly agricultural technology should address one of these three problems. That is, it should reward farmers from environmentally beneficial choices, subsidise early adoption of the technology and thus encourage the generation of knowledge about it, or directly enhance the generation and dissemination of credible information about the new technology.

However, any intervention should keep in mind that faster adoption of a new technology is not always better. Too-fast adoption can't take advantage of the benefits of learning, and risks lock-in to an inferior technology at a social cost that could potentially be very high.

Sin, Isabelle and Andrew Coleman. 2012. "The adoption of green technologies in agriculture," Motu Agricultural Emissions Dialogue Group, Wellington, NZ, 8 May 2012.

Other presentations on cooperation

Coleman, Andrew. 2011. "The Evolution of Institutions for Collective Action," Motu Agricultural Emissions Dialogue Group, Wellington, NZ, 31 August 2011.

Olssen, Alex. 2011. "The Clean Streams Accord: Cooperation in agriculture," Motu Agricultural Emissions Dialogue Group, Wellington, NZ, 31 August 2011.

Emergent solutions action package

Kerr, Suzi. 2012. "Preliminary synthesis," Motu Agricultural Emissions Dialogue Group, Huntly, NZ, 24 June 2012.

Kerr, Suzi. 2012 'The who, why and how of acting on agricultural emissions'; 'Mitigation through land use and behavioural change'; and 'Emerging Solutions' Joint forum Institute of Governance and Policy Studies and Motu, 7 August, 2012

Kerr, Suzi. 2012 'Emerging solutions: The who, why and how of acting on agricultural emissions' Institute of Agricultural and Horticultural Science, Lincoln, 22 August, 2012

BROADER COMMUNICATION AND EDUCATION

Agricultural Emissions Dialogue blog.

agriculturalemissions.blogspot.co.nz

This blog has been set up as a forum for discussing agriculture and greenhouse gas emissions, with a New Zealand focus. Contributors from a variety of relevant backgrounds - farming, industry, public policy, and science - post regularly on a broad range of topics relevant to agricultural emissions.

ClimateSIM – interactive game

Hugh McDonald developed a paper-based trading game around the options for agricultural emissions trading. Participants take on the roles of dairy and sheep/beef farmers and play several rounds, each with different regulatory conditions. The outcomes for both farms and the government are reported after each round. The game has been played in Wellington with the AgDialogue group, a group of stakeholders discussing agriculture and agricultural emissions in New Zealand. One government participant noted that it was the clearest explanation of the different options he had seen.

Simon Anastasiadis has developed a computer simulation platform for running trading games. Guidance and feedback on the platform was provided by Jim Sinner (Cawthron) and Andrew Fenemor, (Landcare Research).

As part of a Cawthron / Landcare Research-led project the platform was used to run scenarios that included allowance trading, trading zones, charges, uncertainty, initial allocation, auctions, market power, short vs. long term trades, and changes in commodity prices. In the game some participants are responsible for dairy, sheep/beef, arable, viticulture or forestry properties, while others take the roles of local council or businesses.
The platform has performed well across six workshops, three held in Waipukurau, Hawkes Bay; and three held in Tokoroa, Waikato. Where it identifies key information for users, produces summaries of each scenario, and stores participants' decisions for later review. Though not developed or calibrated explicitly for greenhouse gas emissions trading, the platform is flexible and would be straightforward to adapt for this purpose.

Anastasiadis, Simon. 2012. Hawkes Bay Platform Users' Manual.

Film on agricultural greenhouse gases

Motu commissioned a professional independent filmmaker, Jess Feast, to make a short film on New Zealand agricultural GHGs. An 18 minute film has just been completed and will be made available through the Motu website as well as on DVD.

The film covers a wide range of issues relating to agricultural GHG emissions. It is aimed at a general audience. It combines interviews with a range of experts, plus two farmers who participated in the AgDialogue group.

Motu, and other contributors (including AGRC, Dairy NZ and the NZ Climate Change Center at Victoria University) will have access to the full interview footage; this may be useful for creating short video clips on specific topics.

Future directions on communication

Now our analysis and dialogue group are complete (at least this stage) we are planning an extended dissemination phase in collaboration with dialogue participants and some key organisations. Zack Dorner will be working on this active dissemination through the end of 2012.