

MAF Policy

Bridging the gap between environmental knowledge and research,
and desired environmental outcomes to achieve sustainable land
management

Phase Three

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CORYDON
CONSULTANTS LTD

 **Massey University**

 **agresearch**

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Executive Summary

Introduction and Background (Section 1)

Bridging the Gap is a three stage research project commissioned by the Ministry of Agriculture and Forestry (MAF) Policy. The objectives of the research project were to:

- identify successful and sustainable approaches for bridging the gap between environmental knowledge and research and actual land management practices
- analyse why these particular transfer approaches work
- identify key characteristics of successful models
- present the findings to relevant organisations to help them identify ways to increase their contributions to bridging the gap.

This report covers the final stage and is an account of observations made during the process of discussing the research findings with the key stakeholders. The principle audience for this report is MAF Policy.

In exploring the relationship between science, policy and application, *Bridging the Gap* has focused on three environmental issues of particular relevance to New Zealand agriculture – soil erosion, nitrate leaching and possum control.

Information Dissemination and Identifying Priority Stakeholders (Sections 2 and 3)

The key messages from Phase One and Two of *Bridging the Gap* were summarised into information sheets suitable for distribution to agencies working with farmers. Altogether 106 information packages were sent to relevant staff at organisations with an interest in sustainable land management.

The agencies and organisations most able to influence land management practices and encourage the implementation of strategies based on the research recommendations were identified through a process of institutional analysis. This was followed by an action plan. Each organisation was analysed against a list of eight “significant inputs” for bringing about changes in land management practices.

Workshop for Regional Councils (Section 4)

A nitrogen management workshop for regional councils was held in Wellington to inform participants of the *Bridging the Gap* research findings. The workshop provided councils with an opportunity to share their experiences in dealing with the key aspects of N management and to explore the development of common standards and strategies based on best practice.

The following points came from the discussions.

Monitoring

- > Ground water monitoring is difficult and bore monitoring is limited. To be effective monitoring needs to take place at the catchment level.
- > There is a need to develop a relationship between monitoring activities and outcomes.

- > Farmer responses to nutrient and waste management on neighbouring properties were seen as a barometer for attitudes. In Taranaki for example, 50% of reports on discharge breaches come from neighbours.
- > Councils tended to see their responsibility as being limited to setting standards (bottom lines) and monitoring compliance, leaving farmers to take responsibility for how to meet the standards.
- > The community can be effective monitors of compliance when the requirements are clear and non compliance is visible.

Enforcement

- > Participants agreed that exposing culprits in public, e.g. “being named in the paper” can have a powerful effect. Farmers tend to find exposure to public scrutiny humiliating.
- > Councils must be able to support their rules by explaining to industry how to meet the specified requirements.

The role of industry

- > The horticultural industry was seen as providing a good example of an “industry led programme” to meet customer standards. Can the same approach be used for dairying?

Other points from the Council presentations

- > Further discussion included; a need for improved scientific information, calls for national water quality standards that account for local environmental variations; and the need for a regular forum to facilitate the sharing of information and solutions.

Mitigation options

- > Councils rely on science providers to assess the effectiveness of each mitigating option although effectiveness depends on how the technology is managed by individual farmers.
- > It is difficult to assess individual mitigation options in isolation. More emphasis is needed on whole-farm systems.
- > Current market signals are not strong enough to encourage industry to give priority to environmental sustainability. The role of regional councils is to set targets not provide a toolbox of technologies to achieve the targets. Regional input-based policies (such as stocking rates) are an administrative convenience and may lock farmers into inefficient systems.

Nitrogen Limits

- > It is best to monitor water quality at the bottom of the catchment. However, time lags in nitrogen reaching a water body may mean that poor performance is discovered too late for corrective action to be effective.

Communicating with Farmers

- > Communication approaches are changing in an effort to keep pace with the changes in farming generations.

- > Agribusiness professionals are not trained in sustainable land management and few consultants are lining up to up-skill on sustainable land management because there is no incentive for them to provide environmental advice.

Where to from here?

- > The establishment of a regular forum for regional council staff dealing with nitrate issues was raised and supported. It was suggested that this group should include representatives from MAF and MfE and be a forum for sharing information about approaches and solutions.
- > The idea of having national standards for water quality was challenged on the basis of variations in environmental quality, farming systems and rural communities.

Discussions with key stakeholder organisations (Section 5)

There was overall agreement with the findings of the Phase Two research and agreement on the areas of environmental performance that need improvement. There were many suggestions as to how this might be achieved but conflicting views on who should be responsible and how resources might be provided.

There was general support for a national body to provide direction on sustainable land management issues and there was a view that this role could be played by, and located within an existing organisation such as MFE or MAF. Although there was general support for some centre of national coordination there was also a view that the actual delivery and monitoring of sustainable land management should be at a catchment level.

Understandably, each stakeholder group tended to advocate for improvement in those areas that would best serve their interests. While all agreed that land managers should be concerned about balancing economic, social, and environmental outcomes, views on how they might be supported in achieving this varied. It was agreed that there was a shortage of technical expertise across both the public and private sectors and a feeling that a greater share of the costs of improved environmental outcomes should be carried by the wider community. There was also a concern that much of the invaluable land management experience built up in traditional ‘family farm’ communities was being lost (especially with the emergence of corporate farming in many regions).

Many of the stakeholder organisations commented that the fragmented centres of expertise and poorly coordinated delivery of information was a barrier to improved performance. There was however, disagreement on where the centres of information might best be located. Although the Phase 2 report recommended that regional councils should be centres of coordination and integration not all agreed.

Conclusions (section 6)

What has become clear from responses to the *Bridging the Gap* findings is that roles and responsibilities in delivering science and information to farmers are often confused and conflicting.

Given that sustainable land management is a national issue it was felt that a national agency should be providing a focus for discussion and debate. Regional council people also wanted a national forum within which to share experiences and be provided with the

latest science on nitrate management and water quality. Those involved with possum control are very well served in these regards.

Regional councils recognise the benefits of integrated management to achieve multiple benefits but are not always supported in this objective by national arrangements. Sustainable land management is not a simple objective and supporting land managers to achieve it requires well coordinated and integrated systems of delivery.

Although there is no longer a 'science centre' for erosion control there are sufficient remnants of the old soil and water network to provide reasonable technical support to farmers. By contrast, the delivery of science and technical advice on nitrate management appears patchy and confused. There is no 'centre of responsibility' for monitoring innovation and transferring the findings of the different initiatives beyond immediate communities of interest.

The responses of stakeholders suggest that there are three scales to be considered in bridging the gap between environmental knowledge and research, and desired environmental outcomes: national, regional, and local (or catchment). At each scale there is a need for policy formulation, centres of science and information advice, and the integration of all of these in the broader context of sustainable land management. Delivery systems must be designed to ensure that the right mix of information and advice comes together at a catchment level, appropriate to the needs of particular catchment communities and land managers.

Given that possum control, erosion control, and nitrate management are all critical land management issues for carbon sequestration and climate change there would seem to be an urgent need to further explore the unresolved issues our discussions with stakeholders have raised.

1. Introduction

“Bridging the gap between environmental knowledge and research, and desired environmental outcomes to achieve sustainable land management” (summarised in this report as *Bridging the Gap*) is the title of a three stage research project commissioned by the Ministry of Agriculture and Forestry (MAF) Policy.

This section sets out the background to the *Bridging the Gap* research project, the focus of the research, the way the research was conducted and the methodology adopted for Phase Three, the final phase of the project.

1.1. BACKGROUND

The *Bridging the Gap* research project has been undertaken by a consortium, led by Nimmo-Bell and Corydon Consultants Ltd, Clive Anstey, AgResearch and Massey University’s Department of Applied and International Economics.

The objectives of the research project were to:

- identify successful and sustainable approaches for bridging the gap between environmental knowledge and research and actual land management practices
- analyse why these particular transfer approaches work
- identify key characteristics of successful models and impediments to uptake
- present the findings to those agencies and organisations most able to influence land management practices and to help them identify ways to increase their contributions to bridging the gap between knowledge and outcomes.

This is the third report generated by the work carried out over the three phased research project. The principle audience for this report is MAF Policy. Other government departments, players in the agriculture industry and regional councils will also benefit from the information it contains. The purpose of all three reports is to provide direction to policy development and implementation across all aspects of sustainable land management.

1.2. THE RESEARCH FOCUS

Achieving sustainable environmental outcomes for land management requires input from science, policy and those who manage the land as well as the wider community. Achieving synergies between the various players is important in New Zealand where the wellbeing of the agricultural sector is integral to the country’s social, cultural and economic wellbeing. In exploring the relationship between science, policy and application, *Bridging the Gap* has focused on three environmental issues of particular relevance to New Zealand agriculture – soil erosion, nitrate leaching and possum control.

1.3. PROJECT STRUCTURE

Phase One of the project involved a literature review to identify key lessons on how science and environmental knowledge have been used to achieve desired environmental outcomes and what factors influence behaviour change in the context of land management. The report noted the importance of taking an holistic and participatory approach to bring about sustainable change in land management practices. In particular this report identified fifteen factors which the various theories and policy experiences

indicated were highly influential in achieving environmentally sustainable land management practices.

Phase Two tested and evaluated the conclusions reached in Phase One for relevance to the New Zealand context. Phase Two also provided the research team with further insights into the current issues facing land managers and contact with the key people working in sustainable land management. This was done principally by a comparative analysis of thirteen case studies involving groups of farmers in ten regions. In total, 114 farmers were interviewed. This research was supplemented with a nationwide telephone survey of 1,000 dairy farmers to gain an overview of farmer attitudes to nitrate leaching and nutrient management. The results were used to test and add weight to the findings of the case-studies on nitrogen. From this research the most influential factors in achieving sustainable land management practices was refined and reduced in number to nine (see Appendix 1 for the list of most influential factors).

Phase Three is the implementation phase of the project. The key messages that emerged from the analysis of behaviour and adoption theory, the analysis of overseas policy approaches and the case-study responses have provided useful insights into how to more effectively encourage sustainable land management. In Phase Three, these findings were discussed with industry, regional councils, government departments, research institutes and other influential stakeholders to help identify where existing policies, programmes and initiatives could benefit from the findings.

1.4. METHODOLOGY FOR PHASE THREE

Phase Three encompassed a range of mechanisms aimed at achieving uptake of the findings from Phase One and Two by the organisations and agencies that play key roles in bridging the gap between knowledge and land management practices. By encouraging these organisations and agencies to examine their current practices in the light of the research findings it was intended that where appropriate, they would adapt their current approaches in accordance with the findings to increase their effectiveness in achieving sustainable land management outcomes.

The methodology for Phase Three involved five stages.

- i. The preparation of information sheets for Agribusiness professionals, regional councils, research institutes and central government policy developers which summarised the issues and findings.
- ii. An institutional analysis to identify the priority stakeholders for the research team to work with, based on their actual or potential level of influence on land management practices.
- iii. A one-day workshop for the eight regional councils experiencing significant nitrate leaching problems. Notes taken at this workshop were circulated to the participants to check and then a final version circulated for their own records.
- iv. Slide-show presentations to and discussions with priority stakeholders on the findings of the research and how they might be able to pick up on those aspects of relevance to their sphere of influence.
- v. Dissemination of findings to others through a circular letter and various forums such as conference presentations

1.5. REPORT

This report presents the responses from regional councils, industry, government departments, and others to the presentations and discussions on the research findings, including any changes they intended to make to their existing practices in response to the research findings. The conclusions and recommendations (Section 6) note additional measures required, identified through the Phase Three process to increase the uptake of new land management technologies aimed at improving environmental sustainability. Since this report is primarily for the Ministry of Agriculture and Forestry, the recommendations tend to focus on activities the Ministry itself needs to undertake, either alone or in collaboration with other organisations.

2. Information sheets

The key messages from Phase One and Two of *Bridging the Gap* were compiled into information summary sheets suitable for distribution to agencies working with farmers. These included agri-business professionals and regional councils as well as environmental policy developers. Separate information sheets were developed for each of the three topic areas – nitrate leaching, erosion and possum control. Copies are contained in Appendix 2.

These information sheets were distributed to participants at the priority stakeholder presentations. They have also been posted out to agribusiness professionals, research institutes and the Parliamentary Commissioner for the Environment. All eighty six territorial local authorities were also provided with copies using Local Government New Zealand's mailing list. All together 106 information packages were sent to relevant staff at organisations with an interest in sustainable land management. These packages included research summaries and technical awareness sheets (on nitrate leaching, soil erosion and possum control).

3. Institutional analysis

The key objective of Phase Three was to disseminate the research findings to the agencies and organisations most able to influence land management practices and to encourage them to develop strategies to put the research recommendations into action. The institutions were identified through a process of institutional analysis and this was followed by an action plan.

3.1. IDENTIFYING THE STAKEHOLDER ORGANISATIONS

The first step in the process was to identify the priority stakeholders for the research team to work with. These stakeholders were selected on the basis of their actual or potential level of influence on land management practices. It was considered that the research findings would more likely be implemented if the research team worked directly (face to face) with the most influential organisations rather than dissipating their energies across the plethora of agencies and organisations that have some input to farming practices.

The team began by drawing up a list of all the organisations they were aware of who had some input to land management practices in New Zealand. A process based on institutional analysis theory¹ was then undertaken to evaluate the relative scope of each organisation and its level of influence. Each was analysed against a list of eight “significant inputs” for bringing about changes in land management practices. These inputs were based on the discrete functions encapsulated in the nine most influential factors identified in through the Phase One and Phase Two research. These functions were:

- Governance – the making of laws, regulations and standards
- Providing incentives and penalties
- Development of new knowledge and technologies
- Conveying information and technology transfer to land managers or intermediaries
- Providing resources and support such as funding and materials
- Applying the knowledge or technology through trials and demonstrations
- Monitoring and demonstrating the changes resulting from changes in land management
- Exerting pressure for changes in practice through such measures as lobbying, submissions and public statements.

Separate analyses were done for nitrate leaching, possum control and erosion.

3.2. PRIORITISING THE STAKEHOLDERS

The role of each organisation was evaluated against each of these inputs. The results of this exercise are shown in Appendix 3. Regional councils and the Landcare Trust scored highest having the greatest number of potential inputs across all three environmental areas. The research team then looked for the organisations which had scored the most highly in the specialist topic areas. The results were:

- Nitrate leaching: Fonterra
- Erosion: Department of Conservation
- Possum Control: Department of Conservation and Animal Health Board.

¹ Based on institutional analysis theory, McAdam et.al. 1996, McAdam and Scott,2002, DiMaggio and Powell, 1983

These three organisations were added to the list of Priority Stakeholders.

Those organisations which scored on five inputs were then listed according to topic areas. The results of this process were as follows:

- Nitrate leaching: Lincoln and Massey Universities, Ballance Nutrients, Ministry for Environment, MAF Policy, AgResearch, Landcare Research, Dairy NZ,
- Erosion: Lincoln and Massey Universities; AgResearch, Landcare Research, Meat and Wool NZ, Ministry for Environment
- Possum Control: MAF Policy, AgResearch, Landcare Research, Meat and Wool NZ

These organisations were then grouped as “Other Significant Stakeholders”. One organisation which did not score sufficiently high in terms of the number of inputs but which the team felt was a significant source of influence and should therefore be included in this group was the Parliamentary Commission for the Environment.

The final selection of “Priority” and “Other” stakeholders based on their functions and range of influence were therefore:

- Regional councils
- New Zealand Landcare Trust
- Fonterra
- Department of Conservation
- Animal Health Board.
- Lincoln and Massey Universities
- Ministry for Environment,
- MAF Policy,
- AgResearch,
- Landcare Research,
- Dairy NZ
- Meat and Wool NZ
- Parliamentary Commissioner for Environment

3.3. ACTION PLAN

The team then went through the list of “Priority” and “Other” stakeholders to decide what action would be most appropriate for each in terms of information dissemination and influencing current practices and strategies. The results were as follows:

| Organisation | Action |
|----------------------------------|--|
| Regional councils | Workshop for those most affected by nitrate leaching |
| New Zealand Landcare Trust | Meeting/presentation |
| Fonterra | Meeting/presentation |
| DOC (with AHB) | Meeting/presentation & possible workshop with regional councils – subject to funding |
| Meat and Wool | Meeting/presentation |
| Ministry for Environment | Meeting/presentation |
| Dairy NZ | Meeting/presentation |
| Research Institutes, and the PCE | Letter drawing attention to the research gaps identified in the Phase Two report. |

The Research Institutes and the Parliamentary Commissioner for the Environment were classed as “Other” rather than Priority stakeholders. For this group a letter was compiled

which drew attention to the research gaps identified in the Phase Two report. A copy of this letter is contained in Appendix 4. Copies of the Information Sheets (Appendix 2) were also enclosed.

To widen the audience for the Information Sheets, copies were also posted out to all local councils.

4. Workshop for Regional Councils

4.1. Structure and Focus

A workshop was held in Wellington on 26th March 2008. The objective of the workshop was defined as:

“To achieve a more consistently effective approach to the management of nitrogen across regional councils by:

- Informing the participants of the *Bridging the Gap* research findings
- Providing the councils with an opportunity to share their experiences, successes and lessons learned to date
- Facilitating discussion on some key aspects of management
- Developing some common standards and strategies based on best practice.”

4.1.1 Participants

Twenty-three staff and advisors from eight regional councils attended. These councils had been identified as the ones which have the greatest number of dairy-farms and/or have problems with nitrate-management. They were:

- Environment Waikato
- Taranaki Regional Council
- Hawkes Bay Regional Council
- Environment Bay of Plenty
- Horizons Regional Council
- Environment Canterbury
- Otago Regional Council
- Environment Southland

In addition two representatives from AgResearch, one from Fonterra and three from MAF Policy attended.

4.1.2 Format

The workshop began with an overview of the nitrate issue in New Zealand based on information from the Ministry for Environment’s *State of Environment Report 2008* and other information on the situation in Canterbury and Southland obtained from the Parliamentary Commission for the Environment. This overview was followed by a presentation on the findings of the *Bridging the Gap* research project that related specifically to nitrate leaching. Each regional council then provided a 10-15 minute overview of the nitrate problem in their region and how their Council was attempting to address this. The balance of the workshop was then spent in small group discussions followed by open forums. Each of the small groups was provided with a set of questions to guide their discussion. These questions were based on the findings from the research.

4.2. CLARIFYING THE PURPOSE OF THE WORKSHOP

During the opening discussion regional council representatives noted that they valued the opportunity the workshop provided for them to share their respective views and experiences. However, they also noted that the discussion would benefit from a Ministry for Environment (MfE) view as in their experience, this is sometimes at odds with regional council views.

Some participants were not clear on the context of the discussion, i.e. what was to be the focus of the day? The sponsor of the research, Gerald Rys (Senior Scientist, Natural Resources Policy, MAF) responded by saying that MAF was interested in nitrogen management in farming systems and the broader issues of nitrogen management, such as climate change. *Bridging the Gap* fits within the context of MAF's research as an input to climate change policy and the Water Quality Programme of Action. While *Bridging the Gap* is primarily a social research project it also needed to take into account economic factors. MAF has a heavy investment in understanding the science of nitrate management and *Bridging the Gap* is part of MAF's effort to improve its understanding of social research in this area.

Gerald Rys suggested that a useful objective for the workshop was to discuss the targets for reducing the impact of nitrogen. This discussion could lead to identification of specific targets for particular catchments and regions and a discussion on how to define the targets. He noted that while nitrogen losses from farming systems was the focus for the day, our current knowledge of phosphate (P) leaching is even less developed than our knowledge on nitrates and therefore this also needed attention.

4.3. Regional council presentations

Each council then gave a brief presentation on their particular strategies for managing nitrate leaching. The format for the presentations had been provided to participants prior to the workshop and included:

- Existing policies and rules
- Methods of communicating with farmers
- Technologies being used and trialed
- Who is involved in the trials and how the results are communicated to farmers
- The level of compliance and methods of enforcement
- Lessons learned to date.

The presentation summaries provided by each of the councils is contained in Appendix 4.

4.3.1 *General discussion from the presentations*

Points made included:

- > An interesting finding from the research is that there has been a big shift from central to regional government in the management of natural resources under the RMA. The responsibilities for maintaining environmental integrity have also shifted. Thought needs to be given to how the scientific, policy level and practical on-farm information can best be transferred from central to the regional levels.
- > Fonterra has become more proactive in the area of sustainable land management but has a scarcity of good people to work in the area of sustainable land management.
- > Modelling inputs and outputs is critical for managing the impact of nitrogen from farming systems.

The rest of the day was spent discussing specific issues raised in the *Bridging the Gap* research. A summary of the key points raised in the discussion groups follows.

4.4. GROUP DISCUSSION: MONITORING AND ENFORCEMENT METHODS

Set questions for the group to address:

- How effective are they?
- What are the problems?
- What other methods could be used?
- What is needed for more effective enforcement?

Responses

Points recorded include:

4.4.1 *Monitoring*

- > Ground water monitoring is difficult and bore monitoring is limited.
- > Catchment scale monitoring is also important. It was mentioned that monitoring has to be done before it's too late and should be used to support enforcement.
- > There was discussion about science and its role in providing levels of certainty when monitoring. Whole farm nutrients can be modelled.
- > There is a need to develop a relationship between monitoring activities and outcomes. Monitoring should enhance desired outcomes and therefore should be carried out quite consciously.
- > Farmers were seen as effective monitoring "tools". The finding in the *Bridging the Gaps* research that farmers are reluctant to pot their neighbours was challenged. Some felt that this may have changed since the fieldwork as participants had many examples of farmers reporting on their neighbours. In Taranaki it was said, 50% of complaints received are reported by neighbours. Neighbours will report what they see as non compliance but this relates only to point discharges – non point discharges don't get reported. How can non-point discharges be monitored/enforced?
- > There was some discussion about the need for councils to limit their responsibility to the setting of standards (bottom lines) and monitoring compliance with those standards and leaving farmers to take responsibility for how effects are to be managed to meet the standards. Councils need only intervene when standards are not met. Some events can't be managed. Are we talking of accidents or ignorance?
- > The community can be effective monitors where the requirements are clear and non compliance can be visually picked up. This reinforces the need to set standards in consultation with communities, preferably communities that share the same catchment or physical context.
- > Whatever modelling and monitoring is undertaken must be comprehensible to those towards whom it is directed. Ownership of outcomes is important.

4.4.2 *Enforcement*

- > The ways in which policy and /or rules are made and written are important; if not done well enforcement is very difficult, if not impossible.

- > Work is needed to promote standards / methods / approaches. Sixty percent will follow guidelines backed by rules. Enforcement will pick up the other 40%.
- > Flexibility in compliance is required and linked to ‘due care’. Fairness across all farmers is required.
- > Participants agreed that exposing culprits in public, e.g. “being named in the paper” can have a powerful effect as farmers find that humiliating.
- > Rules must be drafted to reflect farmer expectations. If not, they can’t be enforced, e.g. Councils must be able to support their rules by explaining to industry how to meet the specified requirements. Having clear, practical rules which farmers have been involved in drafting was noted as best practice.

4.4.3 *The role of industry*

- > The role of industry was discussed and a suggestion made that industry should consider taking responsibility for a self-auditing process for non-point source emissions.
- > The horticultural industry has had to meet customer standards – a chain of custody is in place to meet market requirements. Can the same approach be used for dairying?
- > There is a need to have a mix of regulatory mechanisms and advocacy. This responsibility can be shared across the land owner, the industry and the regulating authority.

4.4.4 *Need for more information*

- > There is a relationship between nitrogen in water and milk solids. There is a need to establish the relationship between rates of fertiliser application, productivity, and environmental effects (in different situations).

4.4.5 *Limits to national standards*

- > National standards can only ever be indicative. There is a need to take account of the local environment.

4.4.6 *Whole farm plans*

- > Councils should insist on whole farm plans which incorporate an agreed nutrient management system. So far there have been no consents granted for whole farm plans so they have not been tested in a statutory context.

4.4.7 *Need for special interest group to discuss compliance and enforcement*

- > There was discussion around the desirability of setting up a “Special Interest Group Compliance and Enforcement” and having them share case law / legal opinions.

4.5. GROUP DISCUSSION: CURRENT MITIGATION OPTIONS

Set questions to address:

- How effective are they, are some more effective than others and in what circumstances?
- What more is needed – knowledge, support, funding, communication etc?

- What more could the dairy industry as a whole be doing?

Responses

4.5.1 *What determines effective mitigation?*

- > Councils rely on science providers to assess the effectiveness of each mitigating option.
- > Effectiveness depends on how the technology is managed by individual farmers.
- > In Southland, feed barns, feed pads and nitrification inhibitors are proving the most effective/popular. Regional council staff believe that a reduction in nitrate leaching of 40% is feasible with the drivers for adoption being primarily financial and animal health reasons.
- > In the Manawatu, some mitigation options are being implemented with no net cost to the farm.

4.5.2 *Need for flexibility to accommodate local variations*

- > Mitigation options need flexibility to achieve targets. They also need to be backed up by regulations.
- > Nitrification inhibitors are affected by regional conditions (e.g. soil types, climate, and temperature). In this regard, locally relevant and trialled science is important for reducing the risks.
- > Communicating various options is important for adoption.
- > It is difficult to identify individual mitigating options and more emphasis is needed on considering whole-farm systems. Farmers need a toolbox of technologies and options that are economic, environmentally and socially sustainable.

4.5.3 *Need for further research*

- > More work is needed on developing mitigation options with co-benefits (e.g. reduced greenhouse gas emissions for climate change benefits). There is a danger in focusing only on nitrate leaching in farming systems.
- > Generally, Overseer is used to model the changes and predict nitrogen losses but it needs further development.

4.5.4 *Impediments to mitigation*

- > The industry needs to take a stronger lead in research, especially in the area of applied research. New Zealand doesn't have the resources to comprehensively fund core research but we can continue to make gains by adapting the findings of fundamental research from the EU and USA to New Zealand systems.
- > Current market signals are not strong enough for industry to show a major lead in the area of environmental sustainability. Efforts to date (e.g. Clean Streams Accord) have been driven by risk management rather than achieving premiums. This means that leadership will be financially costly in the short term for the industry.

- > The industry doesn't have a legal responsibility to care for the environment except through the consent process and therefore there will always be a conflict between regional councils and industry.
- > An observation is that Fonterra does take leadership but needs more resources on the ground and in the area of information transfer, advice, and research.
- > In some sensitive regions all the currently available mitigation options won't be enough to manage nitrate leaching from pastoral farming systems to achieve environmental targets.

4.5.6 *Role of regional councils*

- > Regional council's role is to set targets not provide a toolbox of technologies to achieve the targets.
- > Regional councils face difficulties in providing both targets and tools especially in regions with multiple land uses.

4.5.7 *General*

- > The relevant questions for nitrate management are:
 - What are the outcomes we are looking for?
 - Should regional councils or industry be responsible for providing solutions to the nitrate issue?
 - Is the New Zealand pastoral system fundamentally flawed if we want annual productivity gains of 4% *and* desired environmental outcomes?
 - > Nitrogen will be the next global environmental issue after water.

Open forum following small group presentations

4.5.8 *Effects-based mitigation strategies*

- > We need to be wary of single mitigating options and using inputs rather than effects-based systems. A good example of the flaws of capping inputs is the Netherlands where a stocking rate limit was applied (two cows/ha) which led to large increases in feed consumed and milk production per cow and no reduction in nitrate losses. A 100% tax on nitrogen fertiliser also had little effect in Sweden.
- > Using an effects-based system avoids these problems. Our approach is focus on the effects various land uses and practices have on the local water body.
- > Effects-based systems also maintain incentives to innovate. Cap-and-trade systems need low transaction costs and solid science to work.
- > Regional councils need to be wary of using input-based policies (such as stocking rates). That is an administrative convenience but it may lock farmers into existing systems that are inefficient. It also limits flexibility and the ability to adapt and innovate while still meeting the effects-based targets. Appropriate policies should allow farmers the freedom to choose the systems that meet effects-based targets. Monitoring is critical in this regard.
- > The EW team posed the question that if we are heading towards consents for farming in sensitive catchments; how do we implement the process? How do we monitor it?

4.5.9 *Impediments to achieving compliance*

- > In catchments like Lake Rotorua and Lake Taupo there are a range of options to achieve a 5-15% reduction in nitrate leaching (and entering the lake) with little cost. However anything over 15% needs major changes in farming systems and at significant cost.
- > It is best to monitor water quality at the bottom of the catchment as a target. However time lags in nitrogen reaching a water body may mean that detection is too late to achieve water quality goals.

4.5.10 *Costs of compliance – who should pay?*

- > Under the RMA, society should choose what the environmental bottom line is, mindful of the social and economic implications of this choice.
- > Horizons-MW believes that the allocation of cost and benefits made under the One Plan is equitable and fair.
- > EW believes that its cap-and-trade system in the Taupo catchment allocates the costs and benefits fairly.
- > Regional councils should be responsible for setting targets and the onus should be on industry (not regional councils) to meet the targets.

4.5.11 *Different policy approaches to managing nitrate leaching*

- > In regard to policies that deal with nitrate leaching, policies should contain three dimensions:
 1. Caps or quantifiable measures;
 2. Allocation among land-users; and
 3. Transition time and costs.
- > However when we look at New Zealand's history of allocating quota and the fishing industry, management of these resources has not achieved the desired environmental outcomes.
- > Sustainable land management and water quality policies are changing in the EU. The international nitrate-N standard of 11 mg per litre is now being questioned. Some are questioning the need to enforce this standard in non-sensitive zones. Governments in Europe are now moving to catchment level management similar to the approach traditionally adopted in New Zealand.
- > EW has set prescriptive permitted activities in sensitive regions (i.e. Lake Taupo catchment) where most farming activities need consents. The policy option taken by EW is a mix of permitted and controlled activities. For example in the Taupo Lake catchment permitted activities are allowed for properties with relatively low outputs e.g. with low stocking rates.
- > At Horizons Manawatu the approach proposed is to set limits within a catchment based on natural capital (using land use capability). The approach taken by EW in the Lake Taupo catchment is based on historical nitrate leaching (2001-2005) for each farm i.e. "grand-parenting". Both approaches have potential equity issues.
- > Environment Canterbury has three trigger levels for nitrate concentration in groundwater in their proposed policy. Each requires a different level of action.

4.5.12 Link between water quality and climate change

- > The group agreed that there is a definite synergy between water quality and climate change objectives however climate change has no regional boundaries.

4.6. GROUP DISCUSSION ON SETTING NITROGEN LIMITS

Set question to address:

- What targets should be set for different landscapes and soil types?

4.6.1 Responses

- > At Horizons Manawatu the approach proposed is to set limits within a catchment based on natural capital (using land use capability). The approach taken by EW in the Lake Taupo catchment is based on historical nitrate leaching (2001-2005) for each farm i.e. “grand-parenting”. Both approaches have potential equity issues.
- > It is possible and more simple to manage inputs (e.g. stocking rates) but this may lock farmers into existing systems. It also limits flexibility and the ability to adapt and innovate while still meeting the effects-based targets. The best approaches retain flexibility.
- > It is best to monitor water quality at the bottom of the catchment as a target. However lags in nitrogen reaching a water body mean that this may be too late to identify changes and to achieve water quality goals.
- > The policy option taken by EW is a mix of permitted and controlled activities. For example in the Taupo Lake catchment permitted activities are allowed for properties with relatively low outputs e.g. with low stocking rates.
- > Environment Canterbury has three trigger levels for nitrate concentration in groundwater in their proposed policy which require different levels of action.

4.7. GROUP DISCUSSION ON COMMUNICATING WITH FARMERS

Question to address:

- What works, what doesn't work?

Responses

4.7.1 *Issues for regional councils*

- > The theoretical best practice for communicating science and achieving behaviour change was discussed and the practicality of achieving this was questioned given regional council resources.
- > Communication approaches are changing in an effort to keep pace with the changes in farming generations.
- > The BtG research finding that the one-on-one approach is most successful in achieving adoption was challenged by Horizons-MW. The one-on-one advisory approach to managing soil erosion in the Manawatu-Wanganui region has been very popular with farmers but the council doesn't believe it has achieved sustainable land management objectives or land use change.
- > It is important not to patronise landowners.
- > Farmers need to understand the principles behind council requirements and mitigation measures.

4.7.2 *Issues for agribusiness professionals*

- > Agribusiness professionals are not trained in environmental technical transfer. Very few consultants are lining up to learn and up-skill on sustainable land management because there is no incentive to provide environmental advice to clients and no confidence to do so.
- > Consultants don't know how to charge for advice on environmental issues because they are not increasing farm productivity (at least in the short-term).
- > Dexcel discussion groups have become too large for farmers to get value from attendance and DairyNZ has a limited capability to bring sustainable land management into discussion group content.

4.7.3 *Motivators to change practices – importance of economics*

- > In the dairy industry current market drivers for premiums (for products that have environmental integrity) are not likely to reach the farm gate. The Clean Streams Accord is driven by risk management (the risk of losing market share) and capturing premiums.
- > Nitrate management is primarily seen by the industry as a public good issue whereas erosion and possum control have private benefits and the issues are visible and clear.
- > Farmers intuitively undertake cost benefit analysis on the adoption of sustainable land management practices. When there is an uncertainty around the expected benefits, farmers are expected to manage this risk. A lack of information on the science makes this difficult. The costs incurred in this process include time, money, lifestyle and penalties. If farmers see an

economic benefit their need for definitive information is less – they are prepared to take more risk.

- > There is a need for penalties that create the incentive to change or that create a market risk such as the measures Fonterra have recently announced (reduced payout or refuse to pick up milk of non-compliers).
- > Need to make economic advantages of nitrate management measures explicit – savings in nitrogen fertilisers, savings in animal health bills.
- > If farmers see an economic benefit their need for definitive information is less – they are prepared to take more risk

4.7.4 Importance of accommodating differences – farmers not homogeneous group

- > In regard to developing communication approaches, farmers shouldn't be treated as homogenous group – there is no “one approach fits all”. Each has different drivers and “best practice” in technology transfer needs to be able to adapt to take account of these differences. Different approaches and methods are needed for different types of farm management structures including
 - corporates and owner-operators
 - those who live on their property and absentee land-owners
 - individual farmers.
- > It's important to have strategies for different management structures – shareholders and employees may not have same motivation to learn and comply as farm owners.

4.8. WHERE TO FROM HERE? WHAT IS REQUIRED TO DO BETTER?

Responses:

4.8.1 Specific actions required

- > The Sustainable Water Programme of Action programme needs to get some traction.
- > Industry (Fonterra, Dairy NZ) should be more involved in the promotion and monitoring of Best Management Practices.

4.8.2 Consistent approach that accommodates differences

- > There is a need for a consistent, workable approach across NZ to deal with nitrate leaching. *“We are all watching the progress of Horizon's One Plan with great interest. Results need to be monitored and reported to all councils.”*
- > This was challenged on the basis that regional variation in environment and farming systems and difference in community expectations mean that national consistency may be more damaging than helpful. *“What is really required is for us to learn from each others experiences and use that learning to find regionally appropriate solutions.”*

4.8.3 Regular Forum for Regional Council staff

- > There was broad support for the establishment of a regular forum for regional council staff to facilitate the sharing of information on nitrate management. It was suggested that this forum could meet 3-4 times a year, that the group

should be outcomes-focused and should include policy and extension staff as well as representatives from MAF and MfE. Specific comments included:

“We need more of a special interest group approach to this subject. Perhaps separating the participants on a technical vs policy basis, e.g. a SIG on N leaching mitigation technology and efficacy, producing directive advice about where research should be focused on filling the science knowledge gaps. Maybe another on the planning and policy side. In this workshop we had these different specialities altogether in the same room – leading to some frustration.”

“An ongoing forum should be setup particularly amongst councils who are progressing with the farm leaching and runoff issues. Ministry for Environment should be included, I see many benefits in doing this.”

4.9. GENERAL COMMENTS ON THE WORKSHOP

The comments below were submitted by participants of the Nitrogen workshop. These comments will help to provide guidance if recommendation 6 is adopted.

- > *My general feeling coming away from this was that we did not really capture the actual views and comments from various regional councils and individuals very well – given the time frame allocated, the complex and high number of challenging aspects of the nitrogen issue, and the various levels of understanding present, and the mixed drivers, there was no way that we could do justice to the nitrogen (or phosphorous) issue. I agree that this was potentially a good forum for councils to cross fertilise and is to be encouraged. But the process needs more time and rigour to be of good value.*

- > *Judging from some of the comments – it was clear to me some participants were not technically aware of the known nutrient loss pathways whereby nitrate escapes the farming system and how this pathway is often distinctly different from the P-loss route. During the course of the day these people may have become more aware that this issue is something they need to up-skill on – so I guess that is a very good outcome in itself.*

5. Discussions with key stakeholder organisations

Discussions were conducted with the key stakeholders identified through the institutional analysis process. These included Meat and Wool New Zealand, Ministry for Environment, Fonterra, Dairy New Zealand, Department of Conservation together with the Animal Health Board, NZ Landcare Trust together with Landcare Research and Massey University. This section documents the outcomes of these discussions.

5.1. PRESENTATION TO MEAT AND WOOL NEW ZEALAND

This presentation was undertaken on 28 June 2008. Six representatives from Meat and Wool New Zealand (MWNZ) and Deer Industry New Zealand (DINZ) attended the presentation and discussion which ran for two hours. Participants included:

- General Manager Operations, Meat and Wool New Zealand
- Consortium Manager, Pastoral Greenhouse Gas Research Ltd
- Manager International Technical Policy, meat and Wool NZ
- Senior Economist, Meat and Wool New Zealand
- Science Manager, Deer Industry New Zealand
- Project Manager, Meat and Wool New Zealand

The key findings from the *Bridging the Gap*'s research were presented to the group. Given that the group's primary interest is in the sheep and beef industries, the case study discussion focused mainly on soil erosion and pest management. Relevant conclusions from the nitrate leaching case studies were also presented and discussed.

The group actively engaged in a discussion on the findings both during and after the presentation. The topics of particular interest were the project's conclusions on the need to improve industry leadership, the need for national water quality standards and the conclusion that, while effective tools and information transfer will go a long way to achieving more environmentally sustainable land management practices, rules and regulations were still required.

The main points from the presentation are summarised below:

5.1.1 *Farmer awareness of environmental issues*

The group was surprised at the low level of awareness on nitrate leaching in the dairy case studies. There was a feeling that environmental awareness among farmers has increased significantly since the case studies were undertaken (2006/07), due to advocacy efforts from the industry and also due to the high-profile of environmental issues in the media over the past two years. However, participants felt that the concept of environmental sustainability hasn't been sufficiently defined for farmers to use as a goal.

5.1.2 *Need for scientific evidence to support performance targets and cost allocation*

The nitrogen issue has relevance for all farmers because of the implications that nitrogen fertiliser use has for New Zealand's climate change policies, but it has particular relevance for sheep and beef industries in sensitive regions such as Lake Taupo. The group felt that rules and regulations that limit inputs rather than outputs (i.e. nitrogen losses) reduce farmers' ability and flexibility to farm innovatively to meet targets.

It was agreed that a lack of scientific evidence upon which to establish clear targets, and the limited tools to achieve those targets was a barrier to improving nitrogen management.

The lack of scientific evidence upon which to effectively allocate the costs of improving water quality was also a problem, given that there are public and private sector benefits from such investment. No agreement could be reached on how the costs of improving water quality should be allocated. This was acknowledged as a particularly difficult issue to solve.

5.1.3 *Current efforts to achieve environmental sustainability*

The group contended that sheep and beef farmers *are* farming in an environmentally sustainable way and that there *weren't* major environmental sustainability issues to deal with in the sector. The idea that government subsidies had encouraged the development of marginal land and acted as a major driver of soil erosion was also discussed. This discussion led to the notion that given the government's role in encouraging development of steep hill country, it should have a major role (i.e. financial support) in solving the issue. The East Coast Forestry Project was viewed only as an isolated example of this.

5.1.4 *Incentives*

The group believed that despite market signals that encourage environmental sustainability, market drivers do not provide sufficient financial incentive for farmers to do more than current efforts.

A hypothetical question was raised about whether farmers would respond to a doubling in lamb prices by developing and grazing marginal farm land that has been retired in recent years due to poor returns and erosion problems. The group's view was that the institutional memory of farmers would include the problems and costs (environmental and financial) associated with the development of marginal hill country. They believed that while small areas may be brought back into production, significantly improved returns wouldn't result in a major shift to farming marginal hill country.

5.1.5 *The role of agribusiness professionals*

The poor linkage between environmental sustainability and financial sustainability has meant that environmental sustainability is not an important part of the advice provided to farmers by agribusiness professionals. The participants couldn't see the situation changing rapidly.

5.1.6 *Industry leadership*

The group disagreed that there was a lack of industry leadership on environmental issues and that market drivers for more sustainable farming practices were weak. They believed that in all pastoral agriculture industries – dairy, sheep and beef, processing companies and industry-good organisations have shown able leadership in encouraging the uptake of sustainable land management practices.

The group also believed that New Zealand's markets for sheep meat and beef demanded that products have environmental integrity and that this has resulted in the development of industry supply programmes to achieve this. Meat & Wool NZ's involvement in environmental sustainability programmes is summarised in the box below.

MWZN's involvement on environmental sustainability

MWZN annually invest around \$13 million in research and development to improve industry returns and competitiveness. Much of this research is conducted on-farm and includes projects with a focus on environmental sustainability. A number of on-farm research trials incorporate environmental sustainability and five of the 58 active research projects are dedicated to environmental sustainability. This includes guidelines for organic conversion, irrigating processing-plant wastewater and sustainable land management.

Pastoral Greenhouse Gas Research Consortium (PGGRC)- Meat & Wool NZ is one of eight partners in the Pastoral Greenhouse Gas Research Consortium. The PGGRC is an investment vehicle that aims to understand and provide mitigation solutions for greenhouse gases produced by grazing animals. The PGGRC has been successful in securing a further five years of FRST funding (up to 2012). Projected investment in greenhouse gas mitigating research is \$25 million over five years.

Pastoral 21- This is an association of MWZN and industry partners Fonterra and Dairy NZ, working with central government to invest in pastoral sector research. An extra \$7 million each year for four years has been secured from the government for pastoral research. Pastoral 21's work is based on the premise that on-farm efficiency is essential for international competitiveness of the sector. Pastoral 21 sees the need to increase on-farm productivity to secure and enhance the sector's competitiveness. It is also driven by a recognition that New Zealand's pastoral farmers need to be able to promote their reputation as good stewards of the land, if they are to retain freedom to operate at home, and access to markets overseas.

5.1.7 Application of Bridging the Gap findings

Findings from the *Bridging the Gap* research which participants thought were particularly relevant to the future work of Meat & Wool and Dairy NZ included:

- Research Priorities
 - the economic benefits of environmental sustainability, such as reduced erosion on hill country;
 - improved scientific data on the environmental impacts of farming and the costs and benefits of changing environmental outcomes to assist in setting achievable targets.
- Nitrate leaching, due to the time lag effect, will be a long-term problem and should be an industry priority.
- There is a view that environmental advocacy groups have a poor understanding of the challenges and practicalities of farming and the industry is unfairly blamed for poor environmental outcomes. This needs to be addressed through better information transfer from the industry to the wider community.
- More inclusive and collaborative approaches are needed to fairly allocate the costs and benefits between industry and the public of investing in environmental enhancement.

5.2. PRESENTATION TO MINISTRY FOR ENVIRONMENT

This presentation was given on 19 June 2008. About 25 Ministry staff attended the presentation which ran for one and a half hours. Areas of responsibility represented among those attending were:

- Local Government (including the Sustainable Water Programme of Action)
- Sustainable Business

- Reporting and Review
- Climate Change
- Sustainable Outcomes.

In addition to the standard slide show presentation (with a focus on nitrate leaching), additional slides were included on the outcomes of the regional council workshop.

Participants were very interested in the research and actively engaged in a discussion of the findings both during and after the presentation. Topics of particular interest were standards of water quality, the relationship between the Clean Streams Accord and management of nitrate leaching, and the need for a regular regional council forum to facilitate discussions on responses to nitrate leaching and who should be responsible for taking the lead on that.

Main points to emerge from the discussion included the need for water quality standards, the importance of leadership, the importance of recognising good practice and the need for a regular forum for regional councils dealing with nitrate issues:

5.2.1 Water quality standards

Bridging the Gap found that the lack of national standards or guidelines on nitrate contamination was proving an impediment to regional councils developing policies and rules appropriate for the particular soils and climatic conditions in their regions. The variations in water quality standards between regions were generally viewed by farmers as being inconsistent without reason. Several councils had taken action to implement water quality standards based on “acceptable” levels of nutrient losses; however this is proving difficult and complex. The research concluded that until water quality standards are supported by a robust science, regular monitoring regimes and effective extension services, indirect measures such as those promoted under the Clean Streams Accord will continue to be used and real progress on reducing the impact of farming on water quality will be slow and patchy.

The staff working in the Sustainable Water Programme of Action confirmed that the National Policy Statement for Fresh Water Management should be available for consultation within the next month (by the end of July 2008). The Statement is likely to have a requirement for regional councils to draw up regional standards based on catchments and the aspirations of the local community concerned.

A stock-take is being taken of the Clean Streams Accord. The Ministry is aware that the measures set out in the Accord have been seen as the total solution to water quality. The review will be aiming to make it clear where the Accord fits into the solution and what else is required.

5.2.2 Leadership

Bridging the Gap found leadership from policy makers, industry and the farming community, to be an important factor in the adoption of new technologies and the maintenance of environmentally sustainable practices. The research also found that in general, industry leadership was not strong. Environmental standards were not being enforced and agri-business professionals tended to focus on increased production rather than sustainability

The participants considered that the situation had improved significantly since the field work was completed. Participants were certain there has been an improvement in

leadership and in farmer awareness and attitudes towards environmental issues. This was not to deny that there was still room for improvement. Participants acknowledged the importance of leadership – including from Fonterra and the primary sector representatives.

5.2.3 Awarding good farming practices

There was some discussion about the Green Ribbon Awards and the Ballance Farm Awards and the extent to which these give recognition to environmentally sustainable farming practices. Participants felt that the Green Ribbon Awards have rewarded sustainable farming practices in the past but a subsequent review of the Green Ribbon Award winners since 2001 shows that very few if any farming operations have received this award.

The Ballance Farm Awards celebrate people who are farming in a manner that is economically, environmentally and socially sustainable. Staff from the Sustainable Business unit expressed the view that increased production does not necessarily result in increased environmental damage. There is a need to look for new technologies that will allow for growth (including increased stocking numbers) without causing environmental damage.

5.2.4 Regular Forum for regional council staff dealing with nitrate leaching

Initially there was considerable resistance to the suggestion that MfE could take responsibility for organising a regular forum for regional council staff to share their approaches to managing nitrate leaching and learn from each other. Initially it was felt that regional councils should organise this themselves and invite MfE and MAF representatives to attend. In the end it was agreed this suggestion should be put before the (Regional Council) Chief Executive's Environment Forum and Local Government New Zealand (LGNZ) to assess the level of support for such a special interest group. It was seen as important to get buy-in to a regular forum from the CEOs of regional councils so that the staff who would wish to attend would have the necessary support to engage in the process. It was agreed that if the CEOs and LGNZ supported the need for a special interest group on this issue, then MFE would be prepared to take responsibility for organising, hosting and supporting the forum.

5.3. DISCUSSION WITH FONTERRA

John Hutchings Sustainable Production Manager at Fonterra had read both the Phase One and Two reports and the slide show used for the stakeholder presentations. In addition, one of his staff had attended and reported on the regional council workshop. After several attempts to arrange a face-to-face meeting with John and his staff it was agreed that, given John's familiarity with the research findings and the multiple demands on his time, an on-line interview based on a set of questions would be adequate to for obtaining a response from Fonterra to the research findings.

5.3.1 Extension

John advised that over the past few months Fonterra has put a number of programmes in place to incrementally assist suppliers to adopt Best Practice Nutrient Management Plans. The *Bridging the Gaps* reports have assisted Fonterra to understand how best to get supplier support for these programmes.

The claim that Fonterra did not have enough skilled people available to work with regional councils on improving environmental sustainability, (a claim made at the regional council workshop) was discussed. John's response was that Fonterra works with DairyNZ and consultants to achieve sustainable dairying objectives. There is a shortage nation wide of persons with overseer skills. Fonterra has an arrangement to work with the fertilizer industry to roll out whole farm Nutrient Management Plans in selected areas. He considered that regional councils are also short of the necessary resources and in his view they have not committed sufficient priority to providing advice on sustainable dairying

With regard to farm discussion groups and the *Bridging the Gap* finding that the Dexcel Farm Discussion Groups were losing farmer support John confirmed that DairyNZ was changing the Dexcel approach and will be providing more one-on-one advice. DairyNZ has also prepared a Farm Enviro-Walk programme to ensure that sustainable dairying remains a component of Farm Discussion Groups.

5.3.2 Performance Monitoring

In response to questions about the extent to which Fonterra takes responsibility for checking the application of nutrient budgets, John advised that Fonterra carries out an annual assessment to determine if suppliers have a nutrient budget. Fonterra does not check to see if that budget is actively applied – but the company will work toward this end in selected catchments.

5.3.3 Enforcement

To assist Fonterra's ability to enforce good environmental practices among its suppliers, an effluent indicator system has been developed in conjunction with local councils. Farmers who have significant and persistent breaches in their effluent management practices will now be picked up by this system and the company will respond by deducting their milk payout or stopping their milk pickups.

5.3.4 Increased production and environmental sustainability

John did not think that Fonterra's objectives of increasing production and reducing environmental impact were incompatible. He was clear that in his view sustainable dairying implies a careful balancing of social, environmental and economic aspects of production. He said there were four drivers behind Fonterra's initiatives to reduce the environmental impact of dairy farming. These were consumer/customer preference; domestic licence to operate; resource use efficiency; and supplier stewardship commitment

5.3.5 Clean Streams Accord

When asked about the relationship between the Clean Streams Accord and the management of nitrate leachate John did not think there was confusion between the two and that both have a role to play in the protection of freshwater resources.

5.3.6 Gap between rural and urban communities

Bridging the Gap found there were concerns in the rural community about the level of understanding in urban areas about the demands and difficulties the farming community faces. Some of the other stakeholders interviewed in Stage Three also expressed this concern. John advised that to address this and to let people know what Fonterra was doing to address the environmental sustainability of the industry, Fonterra has a strong

communication team and several initiatives underway and in addition Fonterra staff, and John in particular, attend and contribute to many meetings.

5.4. PRESENTATION TO DAIRY NEW ZEALAND

This presentation was given on July 11 2008. Two DairyNZ personnel representing the sustainability strategic platform met to receive and discuss the findings from the case studies. The presentation and discussion ran for approximately two hours. The participants were:

- Dr Rick Pridmore, Strategy and Investment Leader-Sustainability
- Dr Mike Scarsbrook, Development Team Leader-Sustainability

The key findings from the *Bridging the Gap*'s research project case studies were presented and discussed. While there were relevant conclusions from the erosion and possum control case studies, the presentation and discussion focused on the findings and conclusions of the nitrogen case studies.

Of particular interest to DairyNZ were the findings of the CINTA dairy farmer survey, the level of awareness and understanding of nitrate leaching by farmers and regional councils, the need for improved social and economic research to allocate the costs of sustainable land management and the need for improved industry leadership.

The main points from the presentation are summarised below:

5.4.1 Problems with Nutrient Budgets

The results of the CINTA survey were found to be interesting although with the implementation of the Clean Streams Accord (CSA) it was felt that the percentage of farmers who had taken action to manage run-off would be higher now than in 2006. While nutrient budgets are being developed as a requirement of the CSA the nutrient budgets being produced by advisers were of variable quality. It was believed that a lack of training and technical knowledge within the main agencies responsible for advising farmers on nutrient budgets (i.e. regional councils and fertiliser sales staff) cause this problem. With an estimated 25% annual turnover of fertiliser company sales staff, a lack of training and experience is a difficult issue for the fertiliser industry to address. To address this quality issue, Ravensdown, Ballance and Summit Quinphos have now implemented an audit process on nutrient budgets developed by their staff.

DairyNZ is now promoting Nutrient and Waste Management Plans (NWMP), which utilise nutrient budget information, along with effluent and land management information to provide a clear process whereby farmers can identify the pathway to environmental best practice. This document links on-farm environmental best practice into farm systems, with prioritisation of actions based on farm financial constraints. The NWMP will link appropriate actions to agreed goals and targets over a three year period and include an audit process for quality.

5.4.2 Awareness and understanding of nitrate leaching

It was agreed that there is a wide range of awareness and understanding of nitrate leaching among farmers and regional councils. A lack of qualified regional council staff was seen as a threat to the adoption of practical and technically sound sustainable land management practices. The ideal of having certified industry advisers that advise farmers on sustainable land management practices and who could also sign off on the NWMP was

discussed and is part of DairyNZ's future plans. It was noted that poor advice on sustainable land management is a main cause of poor adoption by farmers.

Best management practices need to be defined by region and this requires advisers with local knowledge but also with an understanding of the national context and objectives.

The finding on the relationship between stocking rates and nitrate leaching was discussed. The DairyNZ representatives considered that while farmers understand the effect that high stocking rates have on soil quality (e.g. the cause of pugging), they do not necessarily make the link with nitrate leaching. It was noted that in some research trials, stocking rate was not a major determinant of nitrate leaching.

5.4.3 The need for improved scientific and economic understanding of sustainability

The DairyNZ representatives felt that the lack of scientific and economic data on the nitrate issue created problems in effectively allocating the costs of improving water quality, given that there are public and private sector benefits from such investment. It was also felt that farmers' efforts to manage their properties in a sustainable way, using knowledge built up over a number of generations, was not adequately recognized in the debate on sustainable land management.

5.4.4 Balancing economic and environmental sustainability

The point was made that Fonterra has for many years encouraged increased production. New Zealand is reliant on agriculture for economic well-being but it is difficult for society in general to understand the trade-offs between environmental and economic sustainability. An interesting point was made that because the economics of dairy farming are currently favourable, trade-offs between financial and environmental sustainability favour the environment. The industry needs to be careful not to go past the market on environmental sustainability and end up causing damage to the industry by eroding the industry's competitive advantage.

5.4.5 Factors affecting uptake

The findings on factors affecting uptake were discussed. The need for an economic benefit to encourage sustainable land management was seen as a weak excuse by the DairyNZ representatives. They felt that sustainability requires leadership at the local level (which is congruent with the case study findings) and that peer pressure is the strongest driver for adoption.

5.4.6 Application of Bridging the Gap findings

Findings from the *Bridging the Gap* research which participants thought were particularly relevant to the future work of Dairy NZ included:

- > The public don't understand enough about the trade-off between achieving environmental and economic sustainability. More economic and social research is needed to articulate this trade-off.
- > There is a need for a central institution to educate regional councils. Currently regional councils represent all aspects of sustainability (economic, social and environmental) and priorities given to each of these three aspects change over time.
- > There is a need to improve industry communication to the wider community. Presently, communication of environmental sustainability, new technology and

farmer success stories is directed within the industry. There needs to be an independent third party to deliver important messages to society at large.

- > Environmental sustainability won't be achieved without some economic losses (or constraints to productivity) to the industry.
- > Fines have less impact on farmer behaviour than peer pressure. Many insurance companies include payment of fines under farm policies, so any financial pain from fines is negated. Approaches that can tap into peer pressure and use the social capital that exists in farming communities to encourage behaviour change is all important.

5.5. DISCUSSIONS WITH THE DEPARTMENT OF CONSERVATION AND THE ANIMAL HEALTH BOARD

Although a meeting of the two agencies together could not be organised, individuals within the agencies were spoken to about the Phase 2 findings. Discussions were held with Herb Christopher in DOC Policy and Carol West in DOC Research and with Nick Hancox in the AHB.

For both DOC and the AHB the benefits of possum control are obvious and measurable. The findings of the Phase 2 report were largely accepted. Seeing and being able to measure the benefits of possum control were acknowledged as critical. Discussions focused on the lack of funding to control possums in areas where TB was not currently a problem and biodiversity protection was not a priority for DOC. Paying for possum control in these areas falls on individual landowners usually, but not always, supported by regional councils. DOC also recognised the need to adopt a "whole catchment" approach to sustainable land management and supported practical efforts to achieve this where resources are available.

5.5.1 *Doc and AHB operational alignment*

DOC and the AHB have recently engaged in discussions over the alignment of their respective control efforts. DOC is currently in the process of creating mapped information to identify those forest areas on the Conservation Estate that would benefit most from possum control. These forest areas are to be displayed in relation to TB infected areas. This will enable the agencies to better identify the gaps in control. The AHB pointed out that it controls possums over a larger area of conservation land than DOC does and therefore DOC should be funding the biodiversity benefits of AHB control². This is in line with two findings from the Bridging the Gaps research: the views of industry representatives that the public good benefits of sustainable land management initiatives are not clearly and transparently recognised and funded; and that control agencies need to coordinate their efforts for more effective and sustained possum control (e.g. as in the Pukaha Mt Bruce buffer zone).

5.5.2 *Doc's involvement in possum control beyond the conservation estate*

DOC recognises the benefits of biodiversity protection on private land and supports community initiatives to this end. The department has field centres across New Zealand and is now the only central government agency with a presence in rural communities. Although DOC has a very limited ability to provide financial assistance, the Department's field staff have the experience, skills and expertise to provide advice and operational support. This support was acknowledged by landowners in Taranaki and the Wairarapa.

² The AHB is funded to control the spread of TB in the interests of the agriculture industry, not biodiversity protection.

The Department also engages with regional councils in their production of Pest Management Strategies and assists in the identification of critical indigenous ecosystems and habitats.

5.5.3 *Possum control and whole catchment management*

DOC is aware of the fact that they control the headwaters of most of New Zealand's critical water catchments, and that the health of these catchments is fundamental to sustainable land production systems. Formerly managed by the NZ Forest Service, these catchments were designated *Protection Forests* and possum control was a priority. For DOC their primary responsibility is for biodiversity protection and with limited funding many critical catchments do not qualify for treatment. Whether possums are controlled on private land lower down the catchments depends largely on the availability of funding from regional councils. While the land owners interviewed recognised the benefits of possum control, they were often reluctant to undertake control without financial and technical support. There is also the issue of re- invasion from DOC land where possums are not controlled – an issue for the Canterbury farmers interviewed in Phase 2.

DOC has undertaken some research to establish the significance of the more critical catchments that they manage. Within regions there is a high level of awareness of the relative significance of water catchments. There is however no formal mechanism to recognise and fund the combined benefits of possum control for biodiversity protection, TB control, and soil and water protection, nor is there a mechanism to deliver control in an integrated way. Improved possum control for sustainable land management is therefore constrained by three poorly integrated funding streams.

In discussing these observations with DOC staff it was revealed that a specially funded project in the Coromandel with which DOC is associated has adopted a 'whole catchment' approach. Called the *Peninsula Project* it was funded by central government following an approach by the regional and district councils in 2002 when serious erosion was caused by extreme rainfall conditions³. DOC is responsible for possum control across the whole catchment including both public and private land. Where DOC was previously able to control possums over only 6,000 hectares, the department is now able to control them over 49,000 hectares. Environment Waikato is carrying out flood control works in the lower catchment, including major restoration planting. The responses of landowners have been extremely positive and along the lines of those recorded in Phase 2.

5.6. PRESENTATION TO NEW ZEALAND LANDCARE TRUST AND LANDCARE RESEARCH

This presentation was given on July 11 2008. A total of six representatives from New Zealand Landcare Trust and Landcare Research attended the presentation and discussion which ran for one and a half hours. Participants included:

- CEO, New Zealand Landcare Trust
- Waikato Wetland Coordinator, New Zealand Landcare Trust
- Landcare Research Ecologists and Scientists (4).

The key findings from the *Bridging the Gap* research were presented to the group. The group had a broad interest in the case study findings with the issue of nitrate leaching sparking particular interest and discussion. The topics of particular interest were the

³ Funding for the Peninsula Project is for \$10.2 million over 5 years.

project's conclusions on a need for national water quality standards (and their apparent success in other countries), a lack of coordination between various agencies and the need for a national approach to encouraging sustainable land management and to technology extension practices.

The main points from the presentation are summarised below:

5.6.1 Farmer awareness of nitrate leaching

The group found the CINTA survey findings interesting, particularly the finding that roughly half of the surveyed dairy farmers believed that nitrate leaching from farms into waterways is the sole responsibility of dairy farmers. In general the group felt that the survey findings were becoming out of date (e.g. only 30% had a nutrient budget) and believed that farmers now had a better understanding of the nitrate issue and their ability to mitigate nitrogen losses. There was also a feeling that environmental awareness has increased since the case studies were undertaken in 2006/07.

5.6.2 Need for national water quality standards

Participants agreed with the research finding that national water quality standards (as opposed to the guidelines established in New Zealand) are needed to set standards for regional councils and to provide a basis for regulation. National water quality standards have been used in the US for a number of years and it was suggested that this has been a successful approach to addressing land management practices that affect water quality.

5.6.3 The importance of locally relevant science

There was general agreement on the importance of locally relevant science to achieving adoption of sustainable land management practices. It was felt that more scientific data was needed at a local level to understand how various soil types, climates and land-uses affect the nitrogen cycle and losses to groundwater systems.

5.6.4 Need for institutional learning and leadership from MAF

Some frustration was expressed within the group about the need for long-term consistency in the approach taken to achieve sustainable land management. Current efforts are believed to be ad-hoc and under-funded and consequently many of the findings from *Bridging the Gap* are not new. The group was sceptical as to whether the conclusions and feed back from the research project would gain traction within MAF. It was felt that there is a need for more leadership from MAF in this area.

The group considered there was a need for MAF to take a more proactive role in encouraging sustainable land management. The funding provided through the MAF Sustainable Farming Fund was acknowledged, although a more direct engagement with the sector (e.g. by providing a national interpretation of relevant science) is needed.

5.6.5 Need for industry leadership

The group contended that it was in the best interests of the farming sector to embrace sustainability so as to "future-proof" the brand of New Zealand products. In addition, processing and marketing companies need to demonstrate leadership in this area given that achieving environmental sustainability is likely to result in financial costs for farmers.

5.6.6 Social and economic research

The group felt that a lack of scientific and economic data created problems in effectively allocating the costs of improving water quality, given that there are public and private sector benefits from such investment. It was also felt that farmers' efforts to manage their properties in a sustainable way, using knowledge built up over a number of generations, was not adequately recognized in the debate on sustainable land management. The group agreed that improved approaches are needed to fairly allocate the costs and benefits of investing in environmental enhancement between industry and the public.

5.6.7 Extension

The participants considered there is a need for an institution that provides ongoing consistent support to farmers and regional councils to achieve sustainable land management. The support should include the interpretation of technical information, the provision of financial support and facilitation services to sustainable land-management groups.

The NZ Landcare Trust believes that it has found a successful approach to providing support and facilitation to community groups but that it is severely constrained by a lack of funding.

There was a view that New Zealand lacks a national extension service to encourage adoption of sustainable land management practices that have public sector benefits. Most of the benefits arising from improved outcomes in the three topic areas covered by the research, accrue to society as a whole. A national extension service that covers the commercial and public good aspects of landuse would be beneficial. The US model that uses County Extension Agents funded within the university system, where officers are seen as independent providers of farm technical advice was suggested as a potential model.

5.7. PRESENTATION TO MASSEY UNIVERSITY

This presentation was given on July 14 2008. A total of 12 Massey University staff met to receive and discuss the findings from *Bridging the Gaps*. The presentation and discussion ran for approximately 1 ½ hours. The participants were from the departments of Soil Science, Natural Resources and Farm Management.

Of particular interest to Massey University were the findings on a decline in skills and experience within regional councils and the need for more leadership in the farming sector. The changing nature of farming was discussed as was the concept of applying different values to different catchments and locations around New Zealand.

The main points from the presentation are summarised below:

5.7.1 CINTA research findings

The results of the CINTA survey generated a discussion on whether the 48percent of farmers that agreed that nitrate leaching from farms “was the sole responsibility of dairy farmers” was supported further in the case studies. There was also the general feeling that with the implementation of the Clean Streams Accord (CSA), the percentage of farmers taking action to improve water quality would be higher now than in 2006.

5.7.2 Implications of the changing nature of farmers for succession, knowledge transfer and effectiveness of fines

During the general discussion on findings from the nitrogen and soil erosion case studies, it was noted that the nature of the farming sector is changing with a shift from small family farms to large scale corporate farmers. This shift is having a significant impact on rural communities.

Succession issues facing the industry will have an impact on the social sustainability of rural communities. Succession issues may disrupt historical knowledge of sustainable farming practices on individual properties passed from one generation to the next. This issue was raised in connection with the Starborough-Flaxbourne Soil Conservation Group in Marlborough where knowledge of high country management was important for sustainability.

The shift from small family farmer to corporate farmer also raised the question of whether fines imposed by regional councils provide a sufficient incentive to improve environmental outcomes. Given these changes, stronger leadership is needed and the application of incentives that appeal to this new type of farmer – e.g. processing companies developing premium brands that communicate environmental integrity to consumers through such measures as farm certification.

It was also noted that New Zealand farmers have an international reputation for being willing to voluntarily invest in environmental enhancement projects without government financial support. By comparison, European and North American counterparts receive significant financial support to achieve similar environmental outcomes. Improved recognition and valuation of the public benefits of sustainable land management in New Zealand is an important future step.

5.7.3 Industry leadership has been weak and fragmented

While the Clean Streams Accord was initiated by Fonterra, and is seen as a worthy example of industry leadership, the group felt that on the whole, farming sector leadership has been fragmented. Industry leadership in the sheep and beef industry has been lacking and efforts to improve sustainable land management have relied upon individuals and local community initiatives.

It was considered that to achieve improved industry leadership it was not necessary to establish a new organisation. It was also considered that there was a clear role for an existing organisation (such as MAF) to facilitate and coordinate current initiatives. A holistic view of sustainability (including environmental, financial and social aspects) is needed at a national level and this view needs to be strongly communicated with key industry partners and customers. If this view is not developed by the industry it will be developed outside the industry and this may have a negative impact on the brand value of New Zealand primary products.

5.7.4 A need for improved social and economic research is critical

Improved economic research is needed to test the concept of how to value various catchments. For example, it may be preferable to accept the financial cost of land use change in catchments that have particularly iconic or valuable ecosystems. Further, in some locations society may accept lower environmental standards for improved economic

or social values. Understanding this trade-off requires a better understanding of society's values based on social and economic research.

Social research on bridging the urban-rural divide will be increasingly important as New Zealand society becomes more urban. The danger for the industry is that as this trend continues, understanding of the practical challenges and economic importance of farming will be lost within the wider community.

5.7.5 Factors affecting uptake

It was noted during the discussion that the factors affecting uptake of sustainable land management practices as identified in *Bridging the Gap* were “nothing new”. A view was expressed that MAF should take a more central role in organising a nationally-funded extension service that recognised the public benefits of improving environmental outcomes in agriculture.

It was also felt that despite the important role that regional councils appear to have in encouraging the uptake of sustainable land management practices, these councils could do more to make their information resources available to farmers. Examples included information on soil types and water quality that could help farmers better manage the environmental impacts of their farming practices.

5.7.6 Application of Bridging the Gap findings

Need to address skill shortages

Findings from the *Bridging the Gap* research which participants thought were particularly relevant to Massey University's operations included:

- The shortage of skills and experience in sustainable land management which is currently undermining the effectiveness of regional councils is also an issue affecting other agriculture and natural resource related sectors.
- The industry needs to improve its communication to schools and other organisations that influence the next generation's views on agriculture as a viable career option. The “best and brightest” school leavers are often discouraged from choosing agriculture as a career option because of a low opinion of the industry. Those that do choose the industry are often attracted to the banking industry by high salaries.
- There is a lack of trained graduates with technical and business training in agricultural sustainability.

Need for research on impacts of changing trends in farm ownership

The impact of the shift from small family farms to large scale corporate farmers on local communities and sustainable environmental outcomes needs further analysis through economic and social research. Social research on bridging the urban-rural divide will also be increasingly important as New Zealand society becomes more urban.

6. Conclusions and Recommendations

One of the benefits of exploring three critical issues for sustainability, each with its own history of science and delivery, is that comparisons are possible. Similarly, having the responses to *Bridging the Gap* from a wide range of stakeholders has provided a rich mix of informed comment and ideas. From this it becomes possible to identify approaches that work and to gain considerable agreement on what is needed, even if agreeing to who should accept responsibility remains somewhat fraught.

The regional council workshop and discussions with industry, land-care organisations and research institutes confirmed many of the findings of *Bridging the Gap*, challenged some findings and provided new insights into other areas. These discussions also showed that awareness of the need to improve land management practices to address environmental sustainability is increasing, and that some of the issues noted in the Phase Two report are already showing signs of improvement. In particular, most organisations consulted in this final phase of the research considered that over the past few years farmers have become much more aware of the need to take action on environmental sustainability in general and in the area of nitrogen management in particular.

Many of those consulted also considered that there had been an improvement in the quality of leadership within the farming industry towards sustainable land-management practice, but at the same time, it was considered that this leadership was fragmented.

DairyNZ has been actively developing and gathering support for the company's Best Practice Nutrient and Waste Management Plans. Fonterra confirmed that the means for generating buy-in from farmers are closely linked to the lessons from *Bridging the Gap*. With a lack of support for traditional discussion groups, DairyNZ is taking a different approach to extension with more one-on-one advice. This agency has also prepared a Farm Enviro-Walk programme to ensure that sustainable dairying remains a component of Farm Discussion Groups. These are among a number of measures designed to improve the performance of Fonterra's extension services.

Also, since the Phase Two research was completed, the Ministry for Environment has published the *Primary Sector Water Partnership Plan of Action* which sets out goals and specific targets for the achieving sustainable use of freshwater resources in the primary sector. This document includes specific action points that relate closely to the findings of *Bridging the Gap*. MAF facilitated the establishment and provided input into setting targets for the Primary Sector Water Partnership Group⁴. This is a positive example of the type of MAF leadership called for by stakeholders to progress towards desired environmental outcomes in the primary sector.

MfE is undertaking a review of the Clean Streams Accord which will make it clear how it sees the Accord fitting into water quality management. It will also identify what other measures are required.

⁴ The Primary Sector Water Partnership Group includes Fonterra, DairyNZ, Foundation for Arable Research, HortNZ, Meat & Wool New Zealand, NZ Forest Owners' Association, NZ Farm Forestry Association, Fertiliser Manufacturers Research Association, Irrigation NZ and Federated Farmers NZ.

6.1. SUSTAINABLE LAND MANAGEMENT TECHNOLOGIES AND EXTENSION

Stakeholder discussions tended to support the need for a more holistic view of sustainability (including environmental, financial and social aspects) at the national level to protect the brand value of New Zealand's primary products. This view needs to be strongly communicated to suppliers and consumers. Sustainability needs to be presented as an opportunity to lock in the long-term economic value of the environmental and social integrity of New Zealand's farming systems and an opportunity to gain an edge in world markets, rather than simply a financial cost.

An example of a more genuine effort to achieve sustainability is Ravensdown, Ballance and Summit Quinphos all of whom are now conducting audits of the nutrient budgets developed by their staff. This is being done to improve the standard of nutrient budgets being developed as a requirement for the Clean Streams Accord (CSA). DairyNZ is also promoting Nutrient and Waste Management Plans as an improved and simplified alternative to Nutrient Budgets (see 5.4.1).

Bridging the Gap Phase Two identified concerns about the degree to which nutrient budgets were actually being applied. Fonterra confirmed that it undertakes an annual audit of farms to ensure that suppliers have nutrient budgets in place but it does not currently check that the budget is applied. This is a matter which the company is looking to take up in selected catchments in the near future.

Participants in the workshop for regional councils considered that the effectiveness of a technology depends to a large extent on how well it is understood and managed by individual farmers. Participants thought that farmers needed to be able to select from a range of options, the response which best meets their economic and social constraints as well as environmental requirements.

Also the effectiveness of some technologies (e.g. nitrification inhibitors, drought tolerant pasture species) is affected by local conditions. This makes local trialling and local information about the use of the particular technology very important. There is also concern that the variable range of technical knowledge and expertise within regional councils is causing confusion among farmers seeking a consistent message for nitrate management. Declining primary sector expertise and experience in regional councils was identified in the research as a long-term issue for implementing sustainable land management.

The limited technical support provided to farmers on how to achieve environmentally sustainable land management has been interpreted by the research team and the stakeholders interviewed as a reflection of the fact that agri-business professionals are primarily employed to provide advice on how to increase farm profitability. Historically, agri-business professionals have not been trained in environmental technology and there is little incentive to provide environmental advice to farmers. Consequently there is a shortage of consultants wishing to up-skill on sustainable land management practice.

Discussions on this issue with stakeholders indicated that with the changing nature of farming enterprises (from small family farm to corporate) there is a need for future extension models to plug into a wide range of incentives and communication strategies. These need to cover the range of farm business models (family farmer to corporate).

Recommendations

- i. MAF should be consulted on the conclusions and recommendations of the Clean Streams Accord review currently being undertaken by MfE to ensure that issues closely related to the findings of the *Bridging the Gap* research are addressed in the review.
- ii. Feedback on the topic of advisory services for sustainable land management indicates two things:
 - there is a lot of support for an independent farm advisory service that can provide farmers with a range of farm production and environmental sustainability advice;
 - discussions with stakeholders highlighted the complexity of issues and the current lack of available expertise.

It is recommended that MAF consider a more proactive role in providing a central view on sustainable land management technologies to assist farmers and key organisations (e.g. regional councils) form a more uniform understanding of relevant technologies. MAF needs to consider what type of service would be best to “bridge the gap”, i.e. either a diverse range of expertise or, smart generalists whose job it is to translate and transfer information.

6.2. MONITORING AND BROADER INSTRUMENTS

Monitoring of land-use practices is time-consuming and many regional councils are already struggling to meet their RMA obligations in terms of skills and staff numbers. Rural communities can be effective monitors if they know the standards and practices required. Monitoring is difficult for nitrogen (especially non-point discharges) but it is essential to support enforcement of standards.

Regional councils felt that while effects-based systems maintain incentives to innovate, and are preferred by farmers, they require careful and continuous monitoring which most regional councils do not have the resources to provide. Alternatives such as a nutrient cap-and-trade system need to have low transaction costs to work efficiently. Input-based policies such as limits on stocking rates can lock farmers into systems that are inefficient.

Whatever instrument and monitoring is adopted, it needs to be comprehensible to those to whom it is directed and it needs to be supported by robust science. Ownership of outcomes by farmers and the wider community is also important for voluntary compliance.

6.3. ENFORCEMENT

Rules must be clear and practical and farmers need to be involved in their drafting to ensure this is achieved. An example of extensive farmer consultation to achieve water quality objectives are the processes adopted by Environment Waikato and Environment Bay of Plenty to improve lake water quality at Taupo and Rotorua.

Current market signals for dairy products were seen by regional councils to be insufficient to influence the environmental sustainability of land management practices. Councils felt that there is a need for penalties that provide stronger incentives to reduce the environmental impacts of farming. This finding has clear links with a need for more

proactive industry leadership. At the time of writing, Fonterra was responding to calls for it to take action against suppliers who pollute waterways.

Peer pressure was considered by several of the stakeholder organisations to be a powerful tool to use in gaining compliance.

Recommendation

- iii. MAF is able to take an holistic, national view of sustainability to achieve favourable outcomes for both the farming industry and wider society. MAF is therefore in a good position to work with MfE, MED and industry to develop market mechanisms which could be applied to the farming sector to discourage land management practices which are environmentally unsustainable.

6.4. ALLOCATION OF COSTS

Nitrate management is primarily seen by the industry as a public good issue whereas erosion and possum control have private benefits and the issues are visible and clear.

It is widely accepted that farmers intuitively undertake cost-benefit analysis on the adoption of new practices. Uncertainty around the expected benefits increases risk. If farmers see an economic benefit in undertaking particular practices, their need for definitive information is less and they are prepared to take more risks. Industry stakeholders saw a need to make the economic advantages of nitrate management explicit. Regulation is needed where certain sustainable land management practices are essential to achieve society's desired environmental outcomes but also likely to result in economic losses.

Recommendation

- iv. MAF needs to invest in a number of research areas to support environmentally sustainable land management practices. These include:
 - Research that can recognize in economic terms the wider benefits of the farming sector's investment in environmental enhancement. This may help to allocate the costs (between the private sector and the public) of such investment more equitably. This research will also help to understand in simple terms the trade-offs that may occur for society to achieve its desired economic, social and environmental outcomes.
 - Trade model research that considers the long-term economic benefits of the farming industry's investment in environmental sustainability (i.e. insurance against potential trade shocks).
 - Further research into identifying on-farm economic benefits of improved nitrate management at various sites around the country.

6.5. THE INTEGRATION OF SCIENCE, POLICY AND DELIVERY

What has become clear from responses to the *Bridging the Gap* findings is that roles and responsibilities in delivering science and information to farmers are often confused and conflicting. While there seemed to be broad acceptance of the research findings, there were varying views on what the practical responses might be.

Those from industry stressed the need to acknowledge the fundamental tension between production and environmental outcomes at all levels of the industry; efficient production to generate profit is fundamental to industry viability. If the community wants improved

performance in terms of environmental outcomes then the community may have to accept some of the costs. There was a feeling that a far broader engagement with communities was required in order to confront some of the tensions in land management and create a more in depth understanding of the costs and benefits of land based production.

Sustainable land management is a national issue and it was felt that a national agency should be providing a focus for discussion and debate. Regional council people also wanted a national forum within which to share experiences and be provided with the latest science on nitrate management and water quality. Those involved with possum control are very well served in these regards. There is a national coordinating body for possum control comprising representatives from all of the interest groups, as well as a national centre for technical advice. The tension between funding streams is transparent with DOC being funded for biodiversity protection and the AHB funded to control Tb (AHB funding comes from both central government and Industry). In areas where neither Tb nor threats to indigenous biodiversity are of a sufficient urgency to justify control, regional councils often, but not always, fill the gap.

At a catchment scale the benefits of possum control are acknowledged not just for biodiversity protection but also for soil and water protection. In addition, healthy vegetation along waterways is recognised as assisting in screening nutrients entering waterways. Regional councils recognise the benefits of integrated management to achieve multiple benefits but are not always supported in this objective by national arrangements. Sustainable land management is not a simple objective and supporting land managers to achieve it requires well coordinated and integrated systems of delivery.

Although there is no longer a 'science centre' for erosion control there are sufficient remnants of the old soil and water network to provide reasonable technical support to farmers. Shortfalls in advice were noted in Phase Two of this project but in general information is available and accessible through regional councils however funding sources were limited and inconsistent.

By contrast, the delivery of science and technical advice on nitrate management appears patchy and confused. To some extent this can be explained by the high levels of innovation; there is a genuine commitment to better practice and to finding better ways of managing nutrient run off. There is however no 'centre of responsibility' for monitoring innovation and transferring the findings of the different initiatives beyond immediate communities of interest.

Recommendation

- v. MAF, in consultation with stakeholders, clarifies the existing relationships between science, policy, and delivery for each of possum management, erosion control, and nitrate management. Funding streams, public and private, should also be identified.
- vi. MAF, in consultation with stakeholders, explores the benefits of an integrated delivery of science and information aimed at whole farm planning and sustainable land management at a catchment scale.

6.6. RESOURCING REGIONAL COUNCILS TO SUPPORT THEIR RMA AND EXTENSION FUNCTIONS

Work is needed to promote standards, methods and approaches to sustainable land management. Phase One of *Bridging the Gaps* concluded that, regional councils were best placed to take responsibility for the transfer of sustainable land management knowledge and technologies to farmers given the range of skills and local knowledge. However, the practicality of regional councils taking on the role of transfer agents to support the adoption of practical, technically-sound sustainable land management practices was questioned by regional councils and others.

The limited numbers of staff within most if not all regional councils who have the necessary, skills, knowledge and experience to advise farmers was noted in *Bridging the Gap* Phase Two and echoed by DairyNZ, Fonterra and Massey University. This general skills shortage was exacerbated by high staff turnover in some regional councils.

Some regional councils said they had difficulty providing both targets and technology tools to achieve those targets given the multiplicity of land uses across each region.

Regional council staff dealing with nitrate leaching issues called for the establishment of a special interest group to develop effective policy responses and mitigation technologies on this issue. The group would meet regularly (3-4 times a year) to share information and develop responses. It could also help to identify science knowledge gaps.

Recommendation

- vii There is much confusion about the management of nitrate (and phosphate) issues. To address this problem there is a need for a regular forum for regional council staff dealing with nitrate issues to facilitate the sharing of information about approaches and solutions with the objective of promoting best practice. This forum should be lead by MAF and/or MfE. Such a forum would include regular updates from science and where possible a translation of science findings into practical outreach. Whatever format is used, it is important that policy and extension staff are included and that membership includes senior representation from both MAF and MfE.

6.7. SKILLS SHORTAGE

Massey University staff expressed concern about the shortage of skills and experience in sustainable land management which is affecting regional councils as well as the agriculture sector and other natural resource related sectors. Skills shortages in the primary sector and environmental sciences were noted in *Bridging the Gap* and confirmed by regional councils, Fonterra and DairyNZ. There is a need to raise the status of agriculture and natural resource management as a career option for school leavers so that the best and brightest are attracted to the industry.

Recommendation

- viii In addition to the input that MAF is making through Rural Education Activities Programmes (REAPs) MAF should explore avenues to improve the status of agriculture and natural resource management as viable career options for school leavers.⁵

6.8. FONTERRA'S CAPACITY TO WORK WITH FARMERS AND REGIONAL COUNCILS

Regional councils thought that Fonterra needed to increase its capacity to work alongside farmers and regional councils to address the issue of nitrate leaching. This includes the provision of information and advice to farmers as well as undertaking research. Fonterra considers its field-work capacity is as good as can be expected given the nation-wide shortage of people with extension skills. Collaboration with DairyNZ and the fertiliser industry helps the company to work more directly with farmers. Fonterra confirmed the impression of others consulted, that regional councils themselves were short of the necessary resources to work effectively with farmers.

6.9. LEADERSHIP

Farming sector leadership (particularly for sheep and beef) was seen by some of the stakeholders consulted as being weak and fragmented. As a result, efforts to promote sustainable land management practices have relied on individuals and local community initiatives.

Industry (including Fonterra, DairyNZ, Meat & Wool and Federated Farmers) needs to be more involved in the promotion and monitoring of Best Management Practices.

Some stakeholders expressed the view that MAF should take a more proactive role in encouraging sustainable land management practices and facilitating and coordinating current initiatives.

The need for an institution that provides ongoing consistent support to farmers and regional councils was seen as important. It was thought likely that an existing sustainable land management organisation could fill this role (rather than establishing a new one). Such support would include the interpretation of technical information, the provision of financial support and facilitation services to sustainable land-management groups.

Several of the organisations consulted including DairyNZ and Meat & Wool New Zealand, considered there was a need for a third party to improve communication about farming to the wider community.

Recommendations

- ix. MAF should consider its role in bridging the gap between farmers and the non-farming community, educating the general public on the challenges and practicalities of farming and the public benefits of sustainable land management practices.
- x MAF should consider expanding its current role to include support to farmers, regional councils and sustainable land-management groups as detailed above.
- xi In recognition of the public benefits of improving environmental outcomes in agriculture, MAF should consider ways by which a nationally funded extension service could be provided.

6.10. Research Gaps

The regional council workshop and discussions with industry and research organisations identified a number of areas where further research is required. These included:

- Data on how various soil types, climates and land-uses affect the nitrogen cycle and losses to groundwater systems which can be used at the local level
- Effective methods to monitor non-point discharge of nitrogen
- Economic research to test the concept of catchment valuation taking into account land-use change, landscape and ecosystems
- Scientific evidence, that takes into account public and private benefits, which can be used to allocate the costs of improving water quality
- Improved data on the impacts of farming on the environment and the costs and benefits of changes in environmental outcomes
- Economic and social research on the tradeoffs between environmental and economic sustainability.

Other areas of uncertainty resulting from a lack of awareness of existing research included:

- A lack of awareness of research into the relationship between rates of fertiliser application, productivity and environmental effects taking into account the local environment;
- An erroneous view by some regional councils that Overseer produces only reference points rather than absolute values of N losses;
- Research into mitigation options with co-benefits (e.g. reducing greenhouse gas emissions for climate change benefits)
- The research that is currently funded by MAF on the economic benefits of environmental sustainability such as reduced erosion on hill country
- Recently MAF commissioned social research on bridging the urban-rural divide to help improve understanding of the challenges and economic importance of farming to New Zealand.

The number of priority research areas noted by the stakeholders highlights a need for MAF to improve its communication with industry stakeholders on the Ministry's current and completed research.

Recommendations

- xii. There is a need for MAF to take a stronger lead in research, especially applied research. To a large extent, research on sustainable land management can build on work undertaken in the EU and the USA, adapting the findings to New Zealand systems. MAF's contribution to the Fast Forward industry-government research and innovation initiative is a good example of the type of leadership in research called for.
- xiii MORST and FRST should also be made aware of the research gaps noted above so that they can take these into account when considering applications for funding.

6.11. BRIDGING THE GAP

The responses of stakeholders suggest that there are three scales to be considered in bridging the gap between environmental knowledge and research, and desired

environmental outcomes: national, regional, and local (or catchment). At each scale there is a need for policy formulation, centres of science and information advice, and the integration of all of these in the broader context of sustainable land management. Delivery systems must be designed to ensure that the right mix of information and advice comes together at a catchment level, appropriate to the needs of particular catchment communities and land managers.

Given that possum control, erosion control, and nitrate management are all critical land management issues for carbon sequestration and climate change there would seem to be an urgent need to further explore the unresolved issues our discussions with stakeholders have raised.

7. References

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Appendices

Appendix 1: Most influential factors in achieving sustainable land management as identified in Phases One and Two of *Bridging the Gap*

Appendix 2: Information Sheets on erosion, nitrate leaching and possum control

Appendix 3: Institutional Analysis Table used to identify priority stakeholders

Appendix 4: Letter to PCE and Research Institutes about the *Bridging the Gap* research project and findings

Appendix 5: Presentations from Regional Councils on managing nitrate leaching delivered at the workshop for regional councils on 26 March 2008

Appendix 1: Most influential factors in achieving sustainable land management

The following factors were identified in the stage one report as being highly influential in bridging the gap between environmental knowledge and research, and desired environmental outcomes to achieve sustainable land management. These factors can be motivators, barriers or key to maintaining good practice.

- Economic costs and benefits
- Visibility of the environmental damage
- Being able to see the results of taking action
- Time constraints
- Trust in or scepticism of the new practices/advice being promoted
- On-going support and encouragement
- On-going education and information
- Enforcement of rules and regulations
- Social/peer pressure

Appendix 2: Information sheets for stakeholders:

- summary of findings from Bridging the Gap
- fact sheets and summaries of case study findings for nitrogen, erosion and possum control

Regional councils have a key role in Bridging the Gap

Regional councils were found to fulfil an important role in the transfer of science from scientists to land managers and utilised cost sharing to good effect. However, the size of the environmental concern and regional council resources are seldom aligned.

Rules and regulations are needed where economic incentives are insufficient

Where economic incentives are difficult to identify, rules are needed for the minority to adopt sustainable land management.

Science on Nitrate leaching is still developing and solutions are relatively unproven

This situation causes a degree of uncertainty and scepticism among farmers regarding recommended best practice. It also leads to the main cause of nitrate leaching in dairying (urine patches at high stocking rates) not being addressed directly and current strategies are only dealing with the problem around the edges. Although badly needed, immature science means that establishing measurable goals for reducing nitrate leaching is difficult.

Land managers need locally relevant science and solutions

As well as locally relevant science, the delivery of this science is also critical. Approaches that included a skilled facilitator bringing together farmers, technical advisers and scientists to identify problems and solutions worked well. Local advisers need knowledge of the local region and ensuring credibility amongst land managers.

Visibility of the problem and of environmental improvements is essential for awareness and sustained action. Innovative ways to improve the visibility of environmental outcomes is required.

Conflicting goals are a barrier to sustainable land management

The agriculture industry still talks in terms of trading off economic gains with environmental goals rather than recognising that the long-term future of the New Zealand's farming industry needs the three aspects of sustainability (economic, environmental and social). Strong industry leadership is needed to achieve a paradigm shift in both rural and urban views on sustainable land management.

Agribusiness professionals need to embrace sustainability

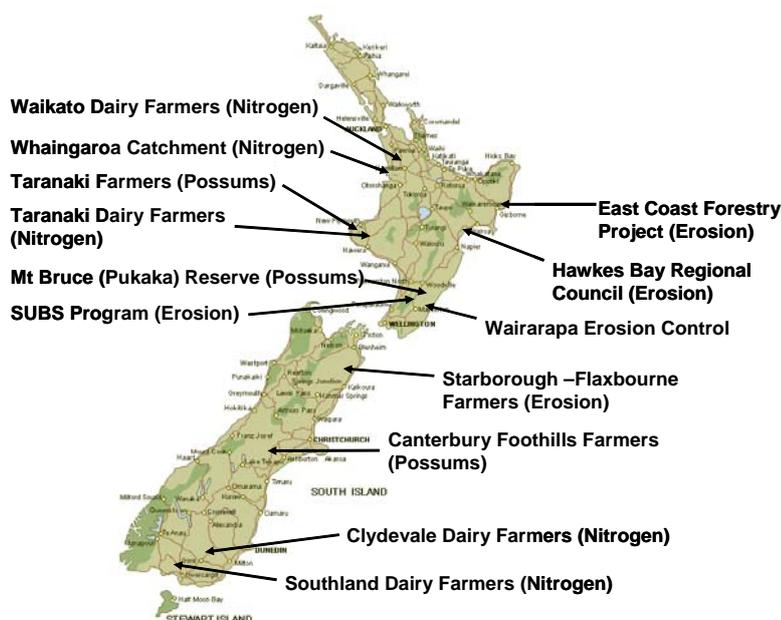
Sustainability is not yet an integral part of the discipline of "farm management" and not an essential part of the service provided to land managers (e.g. environmental enhancement is discretionary).

Economic and social research is critical to advancing sustainability

New areas of research is critical to improving the effectiveness of market driven economic incentives and to help allocate the cost of environmental improvements between landowners and the wider public more equitably.

Recognising good practice is important

This recognition helps reinforce sustainable land management especially where the benefits are not easily visible. The case studies demonstrate that changing land management practices requires an integrated approach.



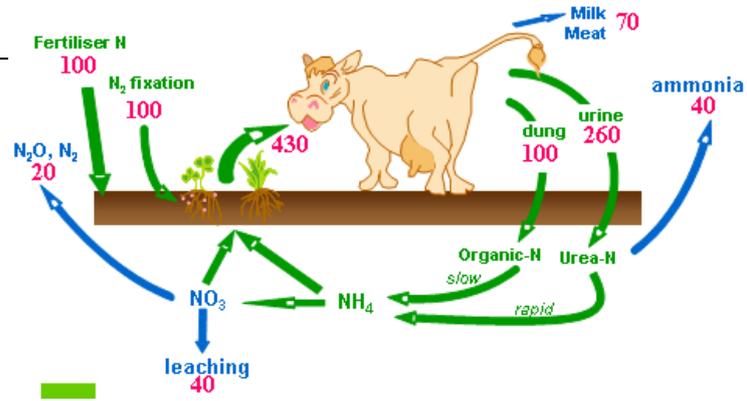
Simplified Nitrogen cycle

Fact Sheet: Nitrogen

What's the problem?

Nitrogen is an important plant nutrient and its loss from farming systems not only affects both plant growth and productivity (e.g. the quality and quantity of feed available for grazing) but can have deleterious effects on the environment. In recent years there has been increased concern about the environmental and human health impacts of nitrogen loss from farming systems. The most pressing concerns are:

- ❖ Increased incidences of nitrate toxicity to humans and livestock through the contamination of aquifers
- ❖ eutrophication of waterways from excessive algae growth
- ❖ increased greenhouse gas emissions mainly nitrous oxide (Singh and Bolan 2005).



N losses occur when N inputs are greater than the absorption capacity of pasture or crops. Losses occur through ammonia volatilisation, biological denitrification and nitrate leaching. The diagram on the left depicts the flow of N in a pastoral dairy system (Ledgard, 2006).

Nitrate (NO₃) lost by leaching through soils into groundwater systems is referred to as non-point source water pollution. Non-point sources (as opposed to point-source such as a dairy shed effluent pipe) are difficult to manage. The level of nitrate leaching varies considerably and depends on the farm system.

Variations in nitrate leaching

| Land use type | N leaching loss (kg N ha ⁻¹ yr ⁻¹) | |
|----------------------------------|---|-----------------|
| | Range | Mean |
| Market gardening | 80 – 292 | 177 |
| Dairy pasture | 15 – 115 | 65 |
| Mixed cropping or arable farming | 35 – 110 | 61 |
| Orcharding | 50 ^a | 50 ^a |
| Sheep | 6 – 66 | 21 |
| Forestry | 3 – 28 | 3 ^b |

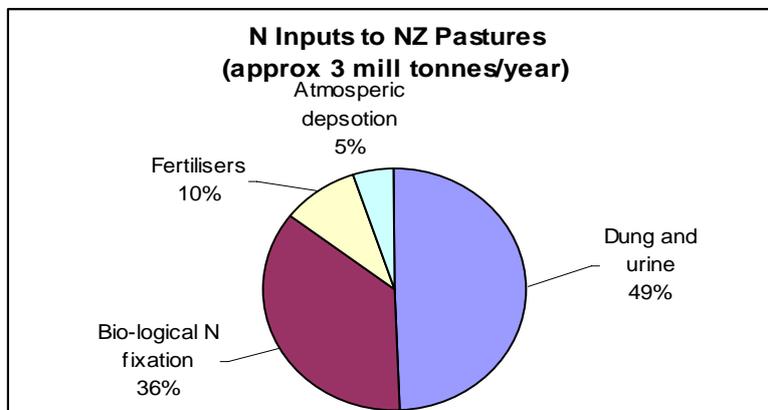
^a Single study with Kiwifruit

^b Best estimate for undisturbed exotic forestry

Source: Menneer *et al.* (2004)

What can we do about it?

The main cause of nitrate leaching from pasture systems is the leaching of nitrate from dung and urine patches. The soil’s ability to assimilate N decreases as N loading increases. Nitrate leaching increases as the soil’s ability to fix excess nitrogen within soil organic matter decreases (PCE, 2004).



The link between increased nitrogen fertiliser usage and nitrate leaching is primarily the significant increase in stocking rates that nitrogen-boosted pasture enables (Menneer *et al.* (op cit)). The measures set out in the Clean Streams Accord primarily aim to control eutrophication of waterways on farms. These measures only deal with part of the problem.

Management options to reduce nitrate leaching

Current management practices to reduce nitrate leaching focus on manipulating three main areas of the farm system; animal (grazing management, low-N feed types or reduced stocking rates); plant (improved pasture species); and soil (nitrification and urease inhibitors). The table below shows various strategic management options for reducing nitrate leaching losses from grazing systems.

| Management Option | Potential reduction in N leaching | Estimate of Cost |
|--|-----------------------------------|----------------------|
| Strategic use of N fertiliser | low | small-nil |
| Supplementary feed type | low-medium | small-nil |
| Land application of dairy effluent | low-medium | small-moderate |
| Plant type | low-medium? | unknown |
| Nitrification inhibitors | medium-large | moderate |
| Winter management (feed-pads, grazing off) | large | high (capital costs) |

Source: Stewart Ledgard, Dairy3 Proceedings 2006

Reducing nitrate leaching from pasture requires a whole farm system approach. There is a common perception that reducing the stocking rate will decrease nitrate leaching, however, other factors come into play such as increased animal feed N intake. Reducing stocking rates is only one measure of a suite of options that may need to be taken to ensure future pastoral systems are economically, environmentally and socially sustainable. Strong industry leadership will be needed to drive the required changes.

Nitrogen case study findings

Five case studies were conducted analysing various approaches to reducing the impact of nitrogen.

Prior to the field work CINTA Research surveyed 1,000 dairy farmers (nationwide) on their attitudes to nitrate leaching, survey highlights are listed below:

- 52% disagreed that nitrate leaching from farms into waterways is the sole responsibility of dairy farmers.
- 77% believed the problem is the responsibility of the entire farming industry.
- 56% believe they are being unfairly blamed for nitrate pollution of waterways (80% in Cauty, 48% Taranaki).
- Farmer actions taken

| | | |
|--------------------------------|-----|-----|
| - fenced off waterways | 42% | |
| - reduced N fertiliser | 32% | 32% |
| - developed a nutrient budget | 30% | |
| - improved effluent irrigation | 30% | |
| - strategic fertiliser | 18% | |



A wide range of awareness and understanding leading to scepticism of new technology- There is a general lack of awareness on the direct environmental impact from excessive nitrogen in pastoral farming. Consistent and credible reasoning as to the basis of the policies and standards set by regional councils is absent or not conveyed to farmers. *“At present there is a lot of conflicting evidence... we need proof that cows are the source of the problem”.*

Riparian planting, fertiliser application and effluent management seen as the key to tackling the problem of nitrate leaching- The means of achieving the five targets of the Clean Streams Accord largely fail to address the major cause of nitrate leaching— urine patches. Increased excretion of urine, such as via increased stocking rate, is receiving limited attention. Nitrogen issues are complex and require “new” science to develop a wider range of practical solutions

Visibility stimulates action- The ability to see and measure results was important. Nitrate leaching is largely an invisible problem and raising awareness and adoption of best practice requires regular testing of stream water quality over time and communication of the results.

Economic incentives are important- Economic benefit was the primary motivator for farmers adopting best practice (e.g. effluent irrigation, riparian management). Dairy industry economic and environmental sustainability goals are not directly apparent or linked for farmers.

Balancing enforcement with more effective information transfer- The majority of dairy farmers believe in the necessity to uphold a good environmental image for the industry and agreed that enforcement is necessary for those farmers who do not respond to encouragement and assistance.

More science is needed to establish water quality standards, the ability to measure progress and practical tools to achieve them- Practical tools to reduce the impact of nitrogen need to be demonstrated at a local level, the most successful tools are also linked to economic sustainability.

Water quality standards supported by robust science are needed to support enforcement- There are no national standards or guidelines on nitrate contamination to assist regional councils to develop policies and rules appropriate for the particular soils and climatic conditions in their regions. Several councils have taken action to implement standards based on “acceptable” levels of nutrient losses; however this is proving difficult and complex.

Soil Erosion Awareness Sheet

What's the problem?

Soil degradation takes many forms. Erosion, or the physical removal of soil, is a serious environmental issue in farming regions throughout New Zealand. While soil erosion is a naturally occurring process without which New Zealand would not have the alluvial flats, clearance of woody vegetation and grazing accelerate this process in sensitive areas. The main types of erosion affecting New Zealand soils are:

- Surface erosion (e.g. gully erosion)
- Mass movement erosion (deep seated and shallow)
- Fluvial erosion
- Stream bank erosion.

New Zealand's soils are particularly vulnerable to erosion given their skeletal nature (they evolved under forests and are geographically unstable) and the pressures placed upon them. Slope angle, rainfall, soil strength, and vegetation cover are all important factors in determining the risk of hillside erosion (Dymond *et al.*, 2005).



Gully erosion, East Coast
(Source: MAF, June 2005)

approximately \$127 million (1998 dollars). The type of erosion, topography, severity of climatic events and proximity to towns, cities and infrastructure, influence the extent of the off-farm costs. The economic costs of Cyclone Bola in 1988 were estimated at approximately \$105 million. The cumulative effects of erosion in Taranaki were estimated to be a 20-30 percent reduction in long-term productivity on moderate slopes (30 degrees or less) and a 60 percent reduction on steeper slopes (Gane *et al.*, 1991 in Taylor and Smith, 1997).

Current treatment options and scientific knowledge

Gully erosion is recognised as the most severe type of erosion and requires early intervention to prevent increases in scale and severity (Marden, 2005). Gully erosion is the removal of soil and/or rock by running water. Where surface wash becomes a concentrated flow it erodes small channels (rills) that, with time, grow in size to create a gully, ravine or channel. Vegetative cover reduces this effect.

Current knowledge on soil erosion includes:

- removal of woody vegetation on steep hill country greatly increases erosion damage caused by climatic events
- gully-derived sediment is the predominant source of sediment associated with riverbed aggradations, damage to infrastructure, lateral erosion of river banks, increased flooding and loss of low lying productive land



Surface erosion can occur on steep hillsides in Central Hawkes Bay from summer-dry winter-wet cycles

Gullies and slips occur in large areas of Gisborne, Hawke's Bay, Eastern Wairarapa, the Volcanic Plateau and inland Taranaki. Regionally, the proportion of farmland prone to erosion ranges from 10 to 90 percent. Research indicates that gullies produce more than 50 percent of the total sediment yield of the East Coast Region's major river systems (Marden, 2005). Wind blows can remove 20-125 tonnes per hectare of top soil (Basher and Painter 1997).

Economic and environmental impacts of erosion

The impact of accelerated soil erosion occurs both on-farm (crop and pasture damage) and off-site (flooding and damage to infrastructure). Research indicates that the total annual economic cost of soil erosion is

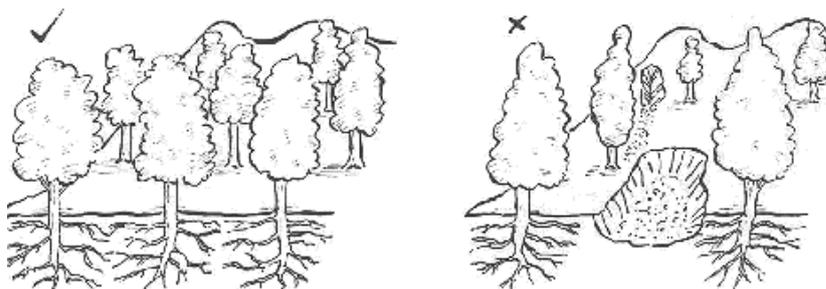
- in contrast, earth flows and slumps, though widespread on Class 7 land can be active for short periods (days to months) and inactive for long periods (decades), and are believed to contribute significantly less sediment to water courses than gullies.
- treatment options are available to address the problems of hill country soil erosion and need to be implemented, otherwise untreated gullies will continue to expand.

Research in both agriculture and forestry has provided techniques to control soil erosion:

- the maintenance of adequate vegetative cover (e.g. tussocks on dry high country slopes)
- spaced or close tree planting (e.g. poplar pole planting)
- indigenous and accelerated reversion retiring land completely from pasture and grazing
- fencing off erosion-prone areas and planting stream banks
- building debris dams and water tabling to reduce the rate of water build-up and flow.

Spaced tree planting – close enough for roots to interlock across a slope

Stabilisation of active gullies can be achieved by re-establishing a closed canopy forest within the watershed surrounding the gully. Research indicates that the best treatment options are either plantation forestry, supplementary planting into scrub, or reversion into indigenous forest. Other than mature reversion, plantation forest is the most effective way to control erosion in the shortest time. For gullies of less than 2 hectares, pole planting along banks is usually the most preferred means of on-farm erosion control. Without treatment, these gullies can increase in size at a rate of 2-4 percent per year.



Close canopy planting creates a continuous root mass on very unstable slopes



Research indicates that a reforestation programme targeted at gullies can reduce sediment yield by two thirds over one forest rotation (approximately 25 years).

The focus of soil science in New Zealand is now on developing options for land managers to adopt erosion-control practises on the most sensitive areas of their properties. Success has been recorded in some regions where retiring steep hill country has resulted in improved farm returns through a reduction in costs and improvement in productivity on the remaining better quality land.

Erosion Case study findings

Economic and environmental concerns were major motivators-

The perceived economic benefit of erosion control was a major motivating factor although farmer-understanding of the costs and benefits varied. Where soil loss resulted in pasture loss and hillside scarring, the economic impacts were more apparent to farmers and the links between soil conservation, economic and environmental sustainability were more clearly understood. Maintaining the well-being of local rural communities affected by erosion (and drought) through sustainable farming was also important.

Erosion was accepted as a natural feature of the landscape in most case studies. Farmers in all case studies also expressed a genuine desire to conserve those parts of their farms with significant natural values. Seeing the results of previous plantings also provided motivation to continue.

Financial and institutional support- Regional Councils played a major role in bridging the gap by providing financial and technical support through regional council farm plans. Cost-sharing was important for an initial uptake and awareness-raising, maintaining action and for reducing the time taken to reach erosion control objectives. Farm plans were valued for the way they facilitate a shared understanding and provided a visual representation of land and resources, and also for the operational direction they provide. One-on-one advice from experienced land managers was an essential component of the support provided by regional councils.

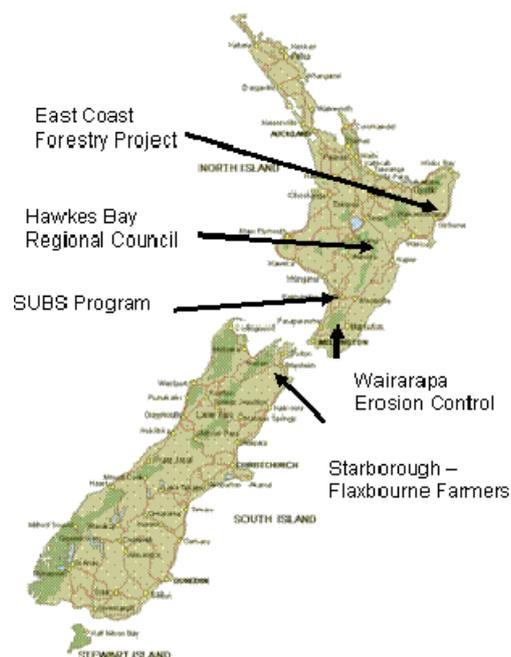
Clear goals and targets worked well- Farmers benefited from having well articulated goals and targets that were seen to be achievable within their farm business. Farm plans developed with regional also set clear goals and targets.

Local leadership was important- The benefit of having strong local leadership was important for raising awareness and creating buy-in of the overall concept of sustainable farming. The success of the Starborough SCG was largely attributable to expert external facilitation, strong local leadership and a shared affinity for the district.

Support from agribusiness professionals- Linking economic and environmental sustainability was important for uptake of SLM. The links between environmental and economic sustainability have not been made by agribusiness professionals and more leadership is needed in this area.

A range of options is needed supported by credible locally relevant science- Farmers were unwilling to adopt erosion control practices where the science hadn't been tested in local conditions. Utilising local knowledge was essential for developing a range of options for farmers. Recognising the farmers' tacit knowledge was essential for developing workable erosion control and drought management options.

Farmers' contributions to land-care need more recognition- Some farmers felt that the benefit of their investment in land-care and the ecosystem services provided to the wider community by farmers are not adequately recognised. This investment includes weed and pest control, erosion control and efforts at conserving biodiversity.



Possum Control: Fact Sheet

The threat of bovine TB has been the long standing imperative for possum control in New Zealand. In the early 1970's it was discovered that possums had contracted TB and become vectors on the West Coast of the South Island. During the 1960s and 1970s a land development push saw the mob stocking of cattle (many becoming TB infected) on marginal scrub-covered hill country. Deer also became carriers of TB.

The Department of Conservation (DOC) manages about 30 percent of New Zealand's land area with a focus on the protection of indigenous biodiversity. The aerial application of 1080 is a critical tool in remote and inaccessible areas. Ground control including the use of traps is increasing and occurs over more than half of possum control areas.

Since the 1960s there has been an awakening to the potentially adverse effects of chemicals on the environment. The health of ecological systems and indigenous biodiversity has become a major concern. In response to this, coupled with a need to be more efficient and effective in achieving as much as possible with the resources available, there has been significant operational and technical innovation. The application rates of 1080 have been reduced from 20-30 kg to 2-3 kg per hectare, which means that application of the active toxic ingredient is down to a few grams per hectare. It is now common for aerial operations to be based on a 2kg/ha pre-feed followed by a 2kg/ha (or less) 1080 cereal bait application. GPS systems enable a very accurate tracking of application so that an even bait coverage is possible.

Ground control has focused on the use of trapping, hand laid 1080 carrot and cereal baits, cyanide (Feratox pellets), brodifacoum (Talon or Pestoff), and cholecalciferol (Feraacol as a paste, Campaign as a cereal bait). DOC uses brodifacoum on offshore islands but not on the mainland due to the persistence/cumulative effects in animals such as pigs which scavenge possum carcasses. The Environmental Risk Management Authority now insists that users of 1080, cyanide, and phosphorous hold controlled substance licences, renewable five yearly.

Prioritising possum control on conservation lands has required a vastly improved understanding of biodiversity values and threats, and integrated pest management is now recognised as critical to achieve worthwhile and sustainable outcomes. Monitoring key species during poisoning operations, native birds in particular, provides hard data on by-kill risks.

The National Possum Control Agency (NPCA) has a range of national protocols that set standards and provide guidelines for operational work. The Agency represents DOC, Local Government NZ, regional councils, unitary authorities, MAF, contractors, manufacturers and the Animal Health Board (AHB). Regional Pest Management Strategies are developed by regional councils/unitary authorities and DOC has clear protocols for consultation and operational monitoring within its Quality Conservation Management System. The AHB's policies and protocols are driven by a National Pest Management Strategy.

Regional councils are generally responsible for delivering and monitoring possum control on behalf of the AHB and may contribute additional resources to satisfy regional needs additional to those of central government. At present councils, DOC, and the AHB endeavour to integrate their operations within the constraints of each needing to satisfy their own strategic objectives. This scenario will soon change; the AHB have signalled their intention to bring bovine vector management in-house nationally, commencing July 2008.

About 38 percent (or 10 million hectares) of New Zealand's land area is suspected of carrying TB-infected possums. The critical role of the AHB is to ensure the containment of these possums to prevent their movement into new areas. To this end the AHB funded the treatment of some 58,000 hectares in Te Urewera National Park in 2006 to keep TB-infected possums out of the East Coast districts of the North Island. The AHB funding of control on conservation land is not unusual where this contains bovine TB.

Funding

In recent years AHB funding has averaged about \$80 million per annum, with about \$55 million being spent on vector control operations. Half of the vector control funding comes from the Crown, 40% from industry, and 10% from regions (usually through regional councils). The AHB has about eight million hectares under sustained vector control.

In 2006 DOC's budget for possum control was some \$15 million and 301,000 hectares were treated. DOC sustains effective control over about 1 million hectares.

The AHB spends some \$2 million per annum on contracted research with a focus on operational effectiveness. DOC research tends to focus on possum physiology and the impacts of possums (and chemicals) on indigenous biodiversity. In the 2006-2007 year DOC contracted some \$800,000 worth of possum research and spent some \$193,000 internally. There is additional internal expenditure on operational monitoring.

Operational costs

Costs vary with accessibility and the frequency of treatment. DOC treats Egmont National Park with an aerial application of 1080 every 5-7 year. The AHB spends up to \$25 per ha on its aerial applications. Ground treatment can cost \$10- \$15 per hectare. The costs of ground treatment are however highly variable. Some council's have contractors undertake operational work while others provide bait to landowners who carry out the work (some landowners employ contractors) and the results are monitored by councils. Costs reduce with declining possum numbers so that maintenance control costs can be as low as \$2 to \$3 per hectare per treatment in improved farming areas.

Peer reviewed by: Ray Clarey, Greater Wellington Regional Council; **Nick Hancox**, AHB; **Herb Christophers**, DOC.

Possum Control Case study findings

Environmental and economic benefits equally important- The majority of farmers recognised the environmental benefits of pest control (it was contributing to stock shelter, stock feed, erosion control, water quality, and amenity values). For all farmers, TB remains a constant threat and most are aware of the benefits of ‘clean green’ products. Only two farmers expressed concerns about the use of 1080 although there were more serious reservations about the use of poison baits, cyanide in particular.

Support- technical and financial- Most landowners talked about the community benefits arising from possum control on their properties and felt that costs should be shared with the wider community. Cost sharing was essential for sustaining and institutionalising control efforts.

Integration between agencies- Integrated operations across all land – public and private was essential for effective sustainable possum control. The most fully integrated control and monitoring occurs at Mt Bruce. Landowners in this area were generally well aware of pest levels across farm properties as well as within the Mt Bruce Reserve. A lack of integration was identified where DOC had failed to match the regional council control efforts. This was especially a problem where public land acted as a reservoir for possum re-infestation on private land (Canterbury Foothills).

Continuity of advice and support- Longstanding relationships between land managers and regional council officers was important for building trust and providing ongoing advice. This continuity in relationships and support, (both technical and financial) existed against the background of an evolved policy position developed jointly between land managers and regional council.

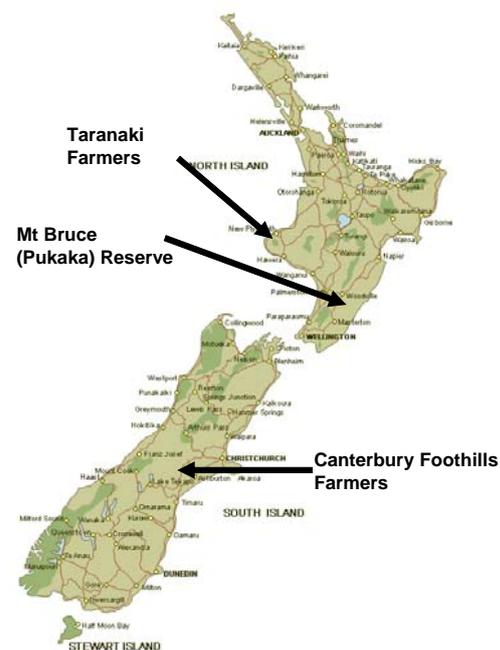
Integrated land management- There was a very clear integration of possum control with other sustainable land use initiatives in Taranaki raising awareness of the wider benefits of possum control. Talking about possum control in the context of sustainable land management immediately prompted landowners to raise related issues, including fertilizer use.

Utilising local knowledge and understanding communities- Developing strategies and operational systems as joint ventures between land managers and agencies that utilised landowner-knowledge of their properties, with clear feedback provisions, was essential to sustaining interest and commitment.

Creating links between sustainability and farm business success- Enthusiasm and commitment, though difficult to measure, were clearly greatest when landowners are able to relate possum control benefits to farm productivity, sustainability, and enhanced property value.

The monitoring and measurement of outcomes- For the benefits of possum control to be recognised within the broader context of sustainable land management, there is a need for more comprehensive monitoring. If vegetation health is improved with pest control, and bird life is enhanced, there needs to be some objective measurement of this.

Local leadership is critical to ensuring farmers’ buy-in at a community level- Successful pest control requires a collective commitment across properties. Leadership is essential to ensure coordinated operations and sustained effort. This needs to come from within the community, or from individuals who have a regular presence within it.



Appendix 3: Institutional Analysis Table

Organisations to consider for inclusion in priority stakeholders

| Organisation | | Function | | | | | | | | N | R | L |
|--|--------|---------------------------------|-----------------------------|----------------|------------------|-------------------|------------|----------------|------------------------|---|---|---|
| | | Governance (regs and standards) | Apply incentives/ penalties | Devp info/tech | Convey Info/tech | Provide resources | Apply info | Monitor change | Press 4 change (lobby) | | | |
| AgResearch | A | | | √ | √ | √ | √ | √ | | √ | √ | √ |
| Landcare Research | A | | | √ | √ | √ | √ | √ | | √ | √ | √ |
| Fonterra | N | √ | √ awards | √ | √ | √ | | | √ | √ | | |
| Tatua Co-op Dairy Co | N | | | | √ | √ | | √ | | | | √ |
| Westland Co-op Dairy Co | N | | | | √ | √ | | √ | | | √ | √ |
| Dairy NZ (Dairy InSight/Dexcel) | N | | | √ | √ | √ | √ | √ | | √ | √ | √ |
| PPCS, AFFCO & Alliance | A | | | | √ | √ | | | √ | | √ | √ |
| Fed. Farmers and Dairy Farmers of NZ Council | A | | | | √ | √ | | | | √ | √ | √ |
| NZ Grasslands Assn | E P | | | | √ | | | | | | √ | √ |
| Meat and Wool NZ | A | | | √ | √ | √ | | √ | √ | √ | √ | √ |
| LGNZ * | A | | | | √ | | | | | | √ | √ |
| MAF Policy/SFF | A | √ | √ | √ | √ | √ | | | | √ | √ | |
| Water Program. of Action | | √ | | | | | | | | | √ | |
| MFE | A | √ | √ awards | √ | √ enviro link | √ SMF | | | | √ | √ | |
| DOC | P E | √ | √ | √ | √ | √ | √ | √ | | √ | √ | √ |
| TPK/Maori Trust | A | | | | √ | | √ | | | | | √ |

| Organisation | | Function | | | | | | | | N | R | L |
|-------------------------------|---|---------------------------------|-----------------------------|----------------|------------------|-------------------|------------|----------------|------------------------|---|---|---|
| | | Governance (regs and standards) | Apply incentives/ penalties | Devp info/tech | Convey Info/tech | Provide resources | Apply info | Monitor change | Press 4 change (lobby) | | | |
| Office | | | | | | | | | | | | |
| PCE | A | | | | | | | √ | √ | √ | √ | |
| NZ Landcare Trust | A | | | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Ballance | N | | √ (awards) | | √ | √ | √ | | | √ | √ | √ |
| Ravensdown | N | | √ (awards) | | √ | √ | | | | √ | √ | √ |
| NZARES | N | | | √ | √ | √ (scholarships) | | | | √ | | |
| Fish & Game | N | | | | √ | | | √ | √ | √ | √ | √ |
| ECO | A | | | | | | | | √ | √ | √ | |
| Sustainability Council | A | | | | √ | | | | √ | √ | | |
| AHB | P | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ | √ |
| Nat. Possum Control Coord Grp | P | | | | √ | | √ | √ | √ | √ | √ | |
| Reg. Councils | A | √ | √ | √ | √ | √ | √ | √ | √ | | √ | √ |
| AGMARDT | A | | | | | √ | | | √ | √ | | |

| Organisation | | Function | | | | | | | | N | R | L |
|---------------------------------|--------|---------------------------------|----------------------------|----------------|------------------|-----------------------|------------|----------------|------------------------|---|---|---|
| | | Governance (regs and standards) | Apply incentives/penalties | Devp info/tech | Convey Info/tech | Provide resources | Apply info | Monitor change | Press 4 change (lobby) | | | |
| Crop and Food Research Ltd | N | | | √ | √ | | √ | √ | | √ | √ | √ |
| HortResearch | N E | | | √ | √ | | √ | | | √ | √ | √ |
| NIWA | N | | | √ | √ | | √ | √ | | √ | √ | √ |
| Possum New Zealand Inc. | P | | | | | | | | √ | √ | | |
| Inst. of Primary Industry Mgmt | A | | | | √ | | | | | √ | √ | |
| NZ Farm Foresters Assoc | E P | | | | √ | | √ | | √ | √ | √ | √ |
| NZ Forest Owners Assoc | E P | | | | √ | | | | √ | √ | √ | |
| NZ Institute of Forestry | E P | | | | √ | | | potential | √ | √ | | |
| Landcorp Farming Ltd | A | | | √ | √ | | √ | | | √ | | √ |
| Agriculture ITO | N P | | | | √ | | | | | | √ | √ |
| Lincoln and Massey Universities | N E | | | √ | √ | √ | √ | √ | | √ | √ | √ |
| PGG Wrightson | A | | | √ | √ | √ (sponsor awards) | | | | √ | √ | √ |

| | | | | | | | | | | | | |
|------------------------------------|--------|--|--|--|-----------|-----------|--|--|---|---|--|--|
| NZ Instit. of Agricultural Science | E N | | | √ Awards 4 research & tech transfer | √ | √ | | | | √ | | |
| Primary Sector Partnership Group | A | | | √ | potential | | | | | √ | | |
| Organics Aotearoa NZ | A | | | | √ | potential | | | √ | √ | | |

* LGNZ promotes good practice in regulation drafting and incentives at CI level

Key:

The letters in the second column demote the focus of the organisations in relation to the three topic areas of this research project

A = all i.e. nitrogen, erosion and possums

N = nitrate leaching

E = erosion

P = possums

The last three columns note the level at which the organisation operations – N = national, R = regional and L = local

Appendix 4: Letter to stakeholders

Dear [NAME]

**“Bridging the gap between environmental knowledge and research,
and desired outcomes”**

We are pleased to share the findings of a recent research project that may interest your organisation. The attached papers summarise the findings of a three year research project funded primarily by the Ministry of Agriculture and Forestry (MAF). The aim of the project was to identify ways to bridge the gap between environmental knowledge and research and desired environmental outcomes, to achieve sustainable land management. The objectives of the project were to:

- identify successful and sustainable approaches for bridging the gap;
- analyse why these approaches work;
- identify key characteristics of successful models; and
- present the findings to those agencies and organisations most able to influence land management practices and to help them identify ways to increase their contributions to bridging the gap between knowledge and outcomes.

Some background to the research:

The research was undertaken by Nimmo-Bell and Corydon Consultants with input from AgResearch and Massey University. The research focused on three environmental issues – nitrate leaching, erosion and possum control. The first year of research entailed a review of the theories and education models of behaviour change, and policies and programmes adopted in a range of countries to achieve sustainable land management. We also analysed the historical drivers for current land management practices in New Zealand. From this work the factors influencing the uptake of environmental science by farmers were identified.

The following year (2006/7) the team undertook fieldwork with 13 groups of farmers around New Zealand each of which was dealing with one or more of the three focus issues. The purpose of the case study research was to test the extent to which the influential factors identified in the theory and through the experiences in other countries applied to New Zealand farmers. This research was supplemented with a nationwide telephone survey of 1,000 dairy farmers to gain an over-view of farmer attitudes to nitrate leaching and nutrient management. From this research the factors influencing the uptake of sustainable land management practices were refined to fit the New Zealand context.

From the research, a wide range of recommendations have been made on how New Zealand can reduce the gap between awareness of environmental degradation and implementation of more sustainable practices on the land. Some of these recommendations are likely to relate directly or indirectly to the work and responsibilities of [ORGANISATION].

MAF has provided a 3rd year of funding so that the team can take the findings out to some of the key stakeholders such as [ORGANISATION] with the aim of encouraging greater awareness and implementation of the research findings.

The publications resulting from the research to date are posted on the MAF website. They are: *Bridging the Gap Phase One* and *Bridging the Gap Phase Two* (the latter is in 2

volumes, one being the case-studies with farmers). The purpose of the reports is to provide direction to policy needs in relevant areas of sustainable land management.

If you have any questions on the project feel free to contact me, as I am happy to discuss the research findings or respond to any queries you have. Alternatively call Dianne Buchan of Corydon Consultants (04) 384 0116.

Regards



Nick Giera
Agribusiness Consultant
Nimmo-Bell & Company

Nimmo-Bell
& COMPANY LTD

CORYDON
CONSULTANTS LTD

 **Massey University**


agresearch

Appendix 5:

WORKSHOP FOR REGIONAL COUNCIL STAFF INVOLVED IN MANAGING NITRATE LEACHING

Presentations from Regional Councils

Each council then gave a brief presentation on their particular strategies for managing nitrate leaching. Format for the presentations covered the following points

- Existing policies and rules
- Methods of communicating with farmers
- Technologies being used and trialled
- Who is involved in the trials and how are results communicated
- Level of compliance and methods of enforcement
- Lessons learned to date.

Environment Southland

Policies and Rules

- ES's regulatory focus in terms of N leaching has previously focused on discharges of farm dairy effluent.
- This is a consented activity and every current consent specifies a max N limit of 150 kg/N/ha/yr.
- Guidelines released last year promote deferred irrigation and low application rate systems. These have become "defacto" policy.
- ES set a goal in 2005 to have "beaten non-point source pollution by 2015".
- This is further defined in the ES Water Plan as achieving a 10% improvement in levels of N, P, sediment and microbes in degraded waterways.
- A new project called the Discharge Plan is viewed as a key means of achieving this goal.
- Phase 1 of the project focusing on agricultural effluents/sludges and the cumulative effects of intensive land use – likely to utilise risk assessment work completed last year.

Communication Methods

- Field days and seminars
- Land Sustainability officers provide one on one advice.
- Dairy Liaison officer first point of call for new conversions and advice on effluent mgmt.
- Promotion of industry BMP's such as herd homes, nutrient budgeting etc.
- Quarterly dairy news letter.
- Requirements for 60 to 90 day effluent storage ponds and one-on-one advice is important.

Technologies

- Dairy green project.
- Soil moisture network.
- Risk assessment of nitrate losses to ground & surface waters from FDE disposal.
- Ground Water Risk Map

Compliance

- Levels of compliance 06/07 Dairy effluent discharge:
- Infringement notices 23
- Abatement notices 3

- Prosecutions 5

Methods of enforcement:

- All farm receive on farm inspection annually
- Responding to complaints
- Aerial monitoring
- Started monitoring application rates of FDE

Lessons to date

- The need to keep up with science and apply this info to consent conditions in a way that manages N loss.
- The need for storage as majority still only have 2 days.
- One to one communication important in changing attitudes and conveying science and BMP's.

Environment Waikato [J Hania, J Young & C McLay]

Environment Waikato's (EW) existing policy guidance is general rather than specific although there are some variations that are in specific sensitive catchments e.g. Taupo catchment.

There are no specific nitrogen standards. EW's rules focus on point source rather than non-point source and regionally focused. There are targets for N losses and in the Taupo catchment where farming as a "permitted activity". EW has found 13% of farmers with serious non-compliance.

EW achieves its policies through funding for fencing, education and one-on-one advice.

A recent EW survey showed that only 50% of farmers in the region were aware of the rules; over 50% of all farmers used less than 60 kg of N fertiliser per hectare; and the remaining farmers used over 60 kg of N/ha/year.

EW rules stipulate that when the farmers use over 60 kg of N per hectare they require a nutrient management plan.

The variation in EW's regional plans needs to be quite enabling. EW is now looking at the Taupo lake catchment and investigating the use of time bound, measurement and targets for one catchment. Farming in the Taupo lake catchment is a "controlled activity". EW monitors stocking rates, effluent management and fertiliser use.

Farmers are benchmarked on historic farming practices from 2001 to 2005, to derive a Nitrogen Discharge Allowance (NDA) using Overseer. Farmers then have to supply a nitrogen management plan to show how they will confirm with their NDA as part of their resource consent application. Farmers can also trade NDAs by way of change of consent conditions. In the Taupo lake catchment rules and guidance for farmers is very specific.

The Council spent 35 half day's session working with farmers to develop the variations to the plan. EW is making progress towards water quality targets in some catchments however, in many catchments water quality is declining.

Lessons learned

- Political support has been critical for implementing the plan.

- Relationships between stakeholders are important especially in the case of the Taupo Lake catchment.
- It has been hard to prove the science around nitrogen management policies.
- It's hard to develop the policy.
- It's even harder to implement the policy because industry and livelihoods are at stake, and uncertainties exist.

Environment Canterbury

Context

- Deep unconfined aquifers & confined aquifers, inland rivers & lakes – water quality generally high
- Shallow unconfined aquifers & spring fed streams – water quality affected by human activities
- Largest use – agriculture (84%). est. 350,000 ha is irrigated
- Groundwater principal source of drinking water for communities, dwellings, & businesses (13%)

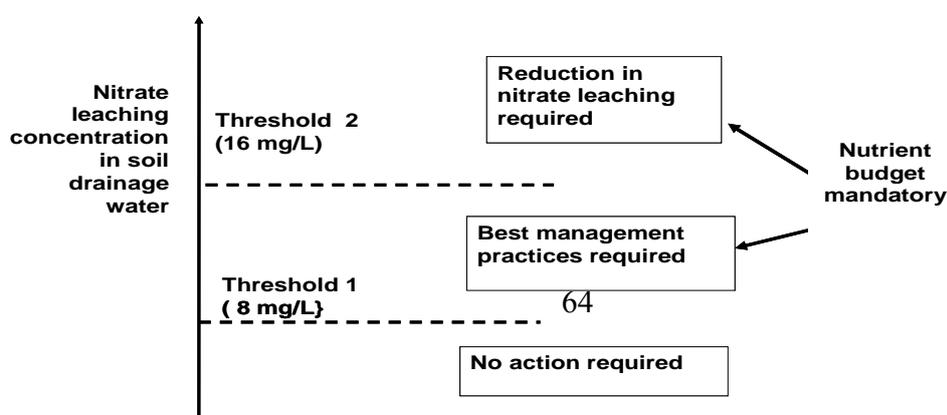
Proposed Natural Resources Regional Plan

- Land & water chapters notified – **July 2004**
- Objectives – numerical water quality outcomes
 - Surface water:
 - Maintain natural state water quality
 - Nutrient indicators – macrophytes, algae biomass
 - Groundwater:
 - Maintain natural state water quality
 - < 2mg/L N above max. conc. measured between 1996 & 2001 & not exceed 11.3 N mg/L
 - Community water sources: < 5.6 N mg/L
- Policies – point source, non-point source discharges & land use activities
- “Tool box” of non-regulatory and regulatory methods

Nutrient management provisions

- Promote best management practices, nutrient budgeting, codes of practice
- Work with landowners to improve water quality
- Regional rules
 - nitrate leaching
 - discharges to land & water
 - certain land uses – e.g. sewerage networks, bore construction
 - Use of irrigation water in inland basins – nutrient losses
- Investigations – e.g. IRAP programme
- Monitoring – groundwater quality, resource consents

PNRRP – Nitrate leaching regional rule (WQL 18)



Implementation

- **Regional rules**
 - more stringent conditions: e.g.
 - discharge animal effluent to land
 - domestic wastewater systems
 - construction of bores
 - more activities covered by rules. e.g.
 - feed pads
 - effluent storage ponds
 - reticulated sewerage networks
- **Compliance monitoring**
 - e.g. discharge dairy effluent – results reported in media
- **Community restoration projects**
 - Pahau catchment – excess irrigation wipe off water
 - “Living streams” – restoration lowland streams
- **Advocacy and Information**
 - Industry best practice guides

Future Directions

- **Hearings on regional plan**
- **Catchment scale assessments:**
 - Upper Waitaki valley, Hakataramea valley
 - Canterbury Strategic Water Study
- **Possible variation on non-point discharge provisions**
 - interim approach assess use of water for irrigation
 - may lead to maximum N limits for catchments

Environment Bay of Plenty

Rotorua Lakes Nutrient Management

Introduction

- A decrease in lake water quality measured by TLI
- 5 out of 12 lakes are below the target TLI and come under Rule 11
- Nutrients come from:
 - landuse
 - sewage
 - natural geothermal sources
 - internal nutrient cycling
 - others
- Rule 11 is only part of the solution

Rule 11

- Became operative in October 2005 to be reviewed 2008
 - Settled by consent order
 - EBOP adopted a Grandparenting approach
 - Caps Nitrogen and Phosphorus discharge from landuse
 - Farming is a permitted activity
 - It allows the offsetting of N and P discharge through mitigation

Implementation Issues

- Benchmarking proving difficult because:
 - Large number of properties
 - Complexity of farming systems
- Implementation of Rule 11 affected by:
 - Software (NPLAS/Overseer)
 - Lake Catchment boundary (surface/ground)
 - Accurate Valuation database from RDC
 - Rural community co-operation
 - Adopted a softly-softly approach

From 2005 to 2008

- Nutrient model – software development and methodology
 - NPLAS
 - NPLAS and Overseer advanced
 - Overseer 2008?
- Development of database, support systems and documentation
- Finalised Rule 11 boundary
- On-going research (BMPs, mitigation etc)

Summary of Lessons learned

- Rules in place before implementation tools available
- Underestimated required resources
- Consequences of Rule 11
 - Future of farming uncertain
 - Land value uncertain, rating issues
 - Inequity of grandparenting
- Benefits of Rule 11
 - Prevented widespread land use conversion
 - Change of attitude throughout the community
 - Able to be modified/superseded by catchment specific rules

Hawke's Bay Regional Council

N Leaching and Land Use: HBRC Policies & Implementation

Policy background & Rules framework

- Regional Resource Management Plan: operative by 2006
- Proposed in 1999: Regulation v. Voluntary
 - > voluntary, mostly due to insufficient conclusive evidence
- Regulatory focus restricted to effluent disposal (mainly dairymshed effluent, also on-site septic systems)

- Rule 14: Controlled Activity: max 150kg N / ha / yr
- Rule 15: Discretionary Activity in sensitive catchments (listed)
- Rule 50/51: Disturbance of river/lake bed by livestock
- **Non-regulatory provisions:**
 - e.g. fertiliser application: Permitted Activity status if compliant with Fert Code of Practice
 - Policy 15: Non-regulatory advocacy
 - Provide education & information
 - Promote/support self-regulation by resource users (mainly through guidelines & codes of practice)
 - Objective 21: No groundwater degradation in Heretaunga & Ruataniwha Plains aquifers
 - Objective 22: Maintain or enhance groundwater quality

Non-regulatory Implementation: Land Management section of HBRC

Methods of communicating with farmers

- One-on-one (incl. farm plans)
- Tap into resource user groups
 - *Grower groups*
 - *Monitor farms*
 - *Industry Associations*
 - *Dairy discussion groups*
- HBRC-sponsored groups/events very limited
- Also HBRC written material limited at this stage (again, tend to support industry literature).

Technologies being used & trialed

- Large focus on cropping
 - crop calculators
 - irrigation practice
 - controlled trafficking or “tramlining” (cultivation along same rows each year by GPS-controlled tractors)
 - LMI Index

Dairy industry increasing

- Herd Homes
- 60% of dairy farmers on Ruataniwha Plains have adopted biological farming

Who is involved in the trials? How are results communicated?

- Applied research / partnerships between HBRC-Industry-CRI's
 - SFF
 - Landwise
 - Sustainable Winegrowers
 - not so much with fert industry in HB
- Again – communicated through industry-based groups/meetings

Level of compliance & methods of enforcement

- Compliance generally good (~80 dairy farms in HB)
- 3-step enforcement action:
 - Abatement Notice

- Instant fine \$1,000
- Evidence gathered for prosecution
- Effluent sampling requirements now monthly, since HB Dairies case in Environment Court

Otago Regional Council

- The consultation stage for our first generation, Regional Plan: Water began in 1996 and was adopted in 2004. It is 12 years old. Community expectations, our understanding of Otago's waterways and landuse impacts are just two of the many things that have changed in that time.
- ORC has no general policies to manage non point source nitrate leaching. There are dairy effluent management rules in the plan. Otago is trialling a new consent condition on an irrigation on company take requiring every irrigator to have an environmental farm plan. These plans are audited annually.
- The ORC does not play a leading role in researching nitrate leaching although, we have a close working relationship with AgResearch scientists, we partner with farmers and others in SFF projects and work with farmers to do on farm investigations.
- ORC Compliance staff inspect every farm's effluent systems annually. This year a tougher stance on farmers with non-compliant effluent systems was taken. As there are not any rules relating to non point source nitrate leaching, there can not be an assessment of compliance with those rules.

Taranaki

For the Taranaki Regional Council the RMA and LTCCP set the strategic framework for its regulatory and non-regulatory programmes. Farm dairy discharge monitoring and riparian management programmes presented as examples. Non-regulatory riparian programme mitigates the effects of intensive dairy farming.

The TRC takes a strong regulatory approach checking every farm for compliance with regional planning rules on effluent management.

The TRC believes that appropriate enforcement using all the tools under the RMA is needed for the Regional Council to gain respect from farmers and ensure that the policy has integrity.

62%+(?) of farmers had nutrient management plans in the Taranaki region under the Accord as managed by Fonterra.

The TRC put research money into the Whareroa Trial Farm so that the science needed to support their policies as locally relevant.

Lessons learned:

- Managing relationships between farmers and the regional council is important- face-to-face contact is vital in this regard;
- The TRC policy must be supported by monitoring and enforcement;
- Applied research is important to support policy;
- It's important to have good communicators working with farmers;
- The TRC uses a very strategic approach placing equal importance on: policy development; compliance and SEM monitoring; enforcement; policy effectiveness review to maintain and enhance Taranaki's water quality.

Horizons Manawatu – Wanganui

What sort of response should we have?

- Halt the decline in water quality, aim for future improvement
- Recognise the importance of farming in the economy
- Outcome focused – not regulating inputs
- Be targeted
- Promotes current best practice
- Gives as much future certainty as possible

Proposed One Plan response

- New Rule
- Require intensive farms to prepare a nutrient management plan to reduce nutrient loss
- Wider than N – includes P, sediment and faecal contamination
- Target catchments
- Set timeframe targets
- Set reduction targets

FARM Strategy

- Farmer Applied Resource Management Strategy – farmers making the decisions and adjusting their practices
- Tool box of options to manage N loss
 - Effluent block management
 - Winter grazing options (off farm, feedpads etc)
 - Fertiliser policy
 - Riparian management
 - N inhibitors

Communicating with farmers

- Anytime, anywhere, anyone
- Tour of town halls
- Media, advertising
- Submission process
- Test FARMS – potential for field days
- Meeting everyone?
- Local research? Testing the approach

Testing the approach

- Test FARMS
- Chose willing farmers, ‘farming leaders’, range of locations
- A range of challenges and farm types
- Test concept
- Identify costs
- Get information to ‘iron out the creases

Barrow FARM Strategy

(TABLE HERE)

Compliance and enforcement

- A few years out from this
- Planning to do audit of FARMS to check actual with reported
- SOE monitoring will pick up areas to focus on

Lessons learnt

- How do we deal with changes?
 - Farm management
 - Extreme events
- Getting consistent information
- LUC – overcoming limitations
- Need to set a P target?
- Costs