

ISSN 1172-9139

# **BROADSHEET**



**NEW ZEALAND  
ASSOCIATION OF  
RESOURCE  
MANAGEMENT**

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**November 2004**

**NEW ZEALAND ASSOCIATION OF RESOURCE MANAGEMENT**  
**Executive 2003-2004**

- President: Chris Phillips, Landcare Research, PO Box 69, LINCOLN.  
Ph. (03) 325 6700 Fax. (03) 325 2418  
*PhillipsC@landcareresearch.co.nz*
- Immediate past President: Alan Campbell, Environment Waikato, Box 4010, Hamilton East, HAMILTON. Ph. (07) 856 7184 Fax. (07) 856 0551  
[Alan.Campbell@ew.govt.nz](mailto:Alan.Campbell@ew.govt.nz)
- Treasurer: Simon Stokes, Hawkes Bay Regional Council, Private Bag 6006, NAPIER. Ph (06) 835 9209, Fax (06) 835 3601  
*simon-stokes@hbrc.govt.nz*
- Secretary: Tabitha Anthony, Horizons.MW, PO Box 10362, PALMERSTON NORTH. Ph. (04) 917 7454 Fax (04) 917 7523  
*tabitha.anthony@horizons.govt.nz*
- Committee: Glen Sutton, 82 Hallet Road, RD 2, WHAKATANE. Ph (07) 304 8457  
*glenn.sutton@clear.net.nz*
- Co-opted: Murray Harris, Land & Forest, 7 Harden St Glenleith, DUNEDIN. Ph. (03) 467 9257  
*landfors@es.co.nz*
- Broadsheet Editor: Chris Phillips, Landcare Research, PO Box 69, LINCOLN.  
Ph. (03) 325 6700 Fax. (03) 325 2418  
*PhillipsC@landcareresearch.co.nz*
- Regional Coordinator: Glenn Sutton  
[glenn.sutton@clear.net.nz](mailto:glenn.sutton@clear.net.nz)
- CPRM Coordinator: Alan Campbell  
[Alan.Campbell@ew.govt.nz](mailto:Alan.Campbell@ew.govt.nz)

Broadsheet is a newsletter of the New Zealand Association of Resource Management. Authors must be consulted before their articles are cited in publications.

The Editor welcomes correspondence, reviews of recent publications, interim reports of current research or resource management issues, news items, other articles, and lighter items about members activities and career movements. Unless specifically indicated otherwise, opinions expressed in the Broadsheet are not to be regarded as the official view of the Association. Copy sent by E-mail is preferred, although typed copy is also acceptable. Items can be sent to:

P.O. Box 69	Phone (03) 325 6701 Xtn 2232
Lincoln	Fax (03) 325 2418
E-Mail	<a href="mailto:phillipsc@landcareresearch.co.nz">phillipsc@landcareresearch.co.nz</a>

The Association's financial year begins on January 1st.

NZARM address: Private Bag 5280, Palmerston North.

Web site [www.nzarm.org.nz](http://www.nzarm.org.nz)

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## Editorial

Dear All,

This may be the first, and perhaps last, editorial I will make as the in-coming President. I am now on a quest to find someone to take over the role of Broadsheet editor (well not really an editor, as I tend to accept and publish just about anything that comes my way). If anyone is interested in serving the Association by taking on this role please get in touch with me (trust me it's not too onerous and it is one way of finding out what people are up to).

We recently convened our first Exec. meeting since the annual conference in Gore and apart from the normal routine matters that we deal with, we set aside some time to think about our strategic directions as an association. We want to be sure that we continue to deliver the benefits that members want as well as sustain a vibrant and viable organisation. Of the things we brainstormed, "promotion" seemed to be the one area that we all felt we should be doing something more about. While we have not yet developed any formal plan we are keen to get some feedback on this topic from the membership as an area that we might focus on for the next 2 years – so if you have something you want to say about this or any real good ideas get in touch with one of the Executive.

One of the things we would also like to see, is our cash reserves being used in effective ways to benefit you, our members. The executive would like to see more applications for the McCaskill award and for funding of regional workshops or events – the latter being an effective way to promote the association and provide knowledge-sharing and networking opportunities. We therefore urge you to consider the Association as a co-funder of any event that you might consider holding in your region in the coming year and to get in touch with Glen Sutton who takes over from Simon Stokes as the Regional Coordinator.

Another area of discussion centred on the recent release of the Parliamentary Commissioner's Report on sustainable agriculture: "Growing for good: Intensive farming, sustainability and New Zealand's environment". We briefly considered how the association and its membership might contribute to either the re-design of NZ's agriculture or in the implementation phase of any re-design. While we did not resolve if, or how, we might do this, we were clear that our members should take the opportunity to be familiar with what is in the report. We recommend that if you have the opportunity to attend one of the PCE's presentations then try and make the effort to do so (also see a brief article by Alan Campbell later in this issue).

Cheers

**Chris Phillips**

*PS. If anyone wishes to jump on a soap box and have a rave, feel free to send a letter in to the Editor or if something is really getting to you how about a Guest Editorial?*

# Regional Roundup

## Bay of Plenty

Greetings from the Bay of Plenty.

**Andy Woolhouse** and **Glenn Sutton** have just completed a series of Unit Standard Training Courses (and Assessment) for Norske-Skog covering the environmental aspects and issues relating to Pulp and Paper Manufacture. This has been interesting and also included an environmental audit of the site. Hopefully there will be more next year.

Andy is also filling in at CHH in Tokoroa for Sally Strang who will soon be going on maternity leave. There are lots of interesting issues in the pipeline. Also in Tokoroa, he is preparing a Resource Consent for Forestry conversion to Dairy....and ....yes he does feel like a traitor to the industry!

Andy joined **Bridget Robson**, **Colin Maunder** and **Kit Richards** as the Forestry Contingent in a recent meeting at Environment Bay of Plenty on their Forestry Accredited Operator Scheme (part of the Regional Water and Land Plan), under the stewardship of Ms Feist and Mr Whale. There was an open exchange of views with DOC and Forest and Bird.

**Colin Maunder** is busy trying to keep Forest Stewardship Certification (FSC) at a reasonable level of compliance under the current forestry economic climate, including dealing with complaints from stakeholders on the fallout of the recent Kaingaroa Timberlands harvesting tenders. He has also been dealing with a plethora of planning issues such as EW's Lake Taupo variation, Environment Bay of Plenty's Accredited Operator and other Water and Land Plan issues plus the usual RDC, TDC and WDC issues.

Highlight of the year (to date) has been a sojourn to Bonn in Germany to attend and present at the FSC Plantations Review and 10<sup>th</sup> Anniversary Conference. The highlight of course being the fine German beer.

Having just purchased a new boat Colin is hoping the fish will be where he is, but that may be somewhat hampered by the imminent arrival of child #1 in December.

**Glenn Sutton**, as well as running environmental training courses with his old colleague Andy W, has also been preparing resource consents for various clients. The applications include log processing/storage yards, quarries and recently, lake water quality remediation trails for John McIntosh of Environment Bay of Plenty.

Glenn has also been helping friends clean-up their farm after the July floods; raising a few calves; winter pruning and planting; applying organic fertiliser and fencing a large paddock for Janice's horses. He hopes to be able to secretly graze his Dexters in that paddock when Janice is away!

Following an enjoyable NZARM Conference, **Norm Ngapo** has managed to get over the jet lag after flying home from the deep south, and has been kept busy on land use consent work for Environment Bay of Plenty as well as a flurry of LRI reports for subdivision on the Rangitaiki Plans. Norm has also started on a small project looking at the Water and Land Plan rules for earthworks, forestry, cultivation and grazing. Following the severe eastern Bay of Plenty storms in July, the project brief for catchment survey of the Nukuhou River Catchment (flowing into Ohiwa Harbour) has been amended to include a range of issues, and the field work should be ready to start just as the summer weather starts to improve. Also, more work on identifying contaminated sites (for presence of wood waste from the Whakatane Board Mills), and the Annual Review of the Rivers and Drainage Code of Practice for their operations.

On the home front, Norm has managed to complete most of the house alterations - new front and rear decks (complete with bar outside the kitchen window) just in time for the summer fishing and diving program.

**Willie Shaw** has been involved in providing advice on ecological restoration and survey and monitoring projects, including presentations as far a field as Tasman District. He has also been involved in a busy round of AEE's and Environment Court hearings on various matters. Willie also managed to get away for a couple of weeks off in Hawaii – Sarah raced in the Xterra multisport world champs on Maui (4<sup>th</sup> in her class) and he tagged along as support crew and checked out the tremendous beaches and snorkeling.

**Clive Tozer** and his team at Environment Bay of Plenty have been up to their armpits since the devastating Eastern Bay of Plenty storm, flood and earthquake event of 17 and 18 July. Damage to the Whakatane-Waimana and more particularly the Rangitaiki-Tarawera River Schemes has been substantial. Total cost of response and asset recovery is costed at \$10.5 million for the River Schemes alone. Application for post disaster financial assistance has been made to Government (CDEM). The Schemes will be in a serious predicament without this financial assistance.

Clive and Wendy did manage to get away for a much needed break in South America over the past few weeks and with their daughter who has been studying, working and travelling in the sub continent, had a real adventure off the main tourist route. He was blown away by the fact that the subsistence farmers in the valleys of the Andes (Peru) were harvesting corn, spuds and barley at 3600m above sea level in mid to late October! And yes the erosion is quite disconcerting in places.

**Ruth Feist** and **John Whale** are working with appellants on the Regional Water and Land Plan, looking to resolve last issues. We can confirm a constructive negotiation with Andy Woolhouse, Bridget Robson, Colin Maunder, Kit Richards, DoC and twig n tweet on the Forestry Operators Accreditation System. Looks promising X'd fingers!!!

We are also awaiting submissions on Environment Bay of Plenty's On-Site effluent Treatment Regional Plan (closes 3 Dec) and we are into the review of the Rotorua Geothermal Regional Plan. With the new National Standards for Air Quality and HSNO updates we will also be into changes to the Regional Air Plan soon. Never a dull moment and the boat is ready to go in the water!!!

We'd like also to thank Murray, Bala, Nicola and their team for the excellent NZARM 2004 conference in Gore. Well done Southerners !

## **GS, Killer Whale and the BOP team**

### **Glenn Sutton and John Whale**

#### **Taranaki**

The riparian team presently consists of 4 with a new officer soon to be appointed on a 12 month contract to prepare plans. The team expects to prepare another 300 plans this year and is well on target to achieve this. Demand for native plants from our plant scheme this year was not as strong as expected, mainly due to the low payout predictions at the beginning of the season. However, overall, over 130000 plants went to plan holders in Taranaki. This season also marked the half millionth plant to be sold through our plant scheme which was celebrated for us by our Chairman David Walter who planted it.

With the departure of **Emma Doherty** on her O.E, **Kevin Cash** has been appointed to a permanent position. Kevin is presently flat out producing riparian plans but will also do some work in the hill country later on. Kevin has a background in farming systems and soils from his previous years as a fertiliser rep and is already revisiting some of his old clients but in a different role.

**Don Shearman** and **Miranda Littlewood** recently attended the NZARM conference in Gore and had a thoroughly enjoyable time. The conference was well organised with excellent papers presented - followed by very interesting field trips. Miranda is currently flat out doing up a house.

The hill country programme is currently targeting the Waitotara/Waverly area of which got smashed in the February storms that hit the lower North Island. To date about 80% of the properties have had comprehensive farm plans prepared. During the winter we had Task Force Green planting poplar poles on targeted class VI land. Next week we move into stage two of the catchment plan in running field days/discussion groups aimed at increasing production on the better classes of land so as farmers can take out the poorer class VII units out of the farming system.

Continuous storm events throughout the year have kept **Dex Knowles** busy with river engineering issues. **Sarah Dudin** (nee Fullerton-Smith) has recently returned from a couple of years of O.E and adds a wealth of experience to the hill country land management team. **Jason**

**Loveridge** spent the whole of September in Switzerland to avoid part of the annual wet season here in Taranaki. **Lynne Hall**, apart from doing riparian plans, has been busy re-measuring forestry PSP plots in Taranaki.

## **Lachie Grant**

### **Waikato**

As most of you will be aware **Alan Campbell** retired as President of NZARM at the National Conference in Gore. Since then he has been involved in implementation of the Cleans Streams project and further promoting the integration of Environmental Education within EW.

For **Michelle Gibbs** it is business as usual after returning from an extended trip to Stewart Island and the South Island after the Gore Conference. Michelle has been kept pretty busy assessing Clean Streams applications and organising a work program for willow removal in the Waitetuna Stream (near Raglan) in conjunction with a fencing and native replanting program.

**Sue McConnochie** (who also visited Stewart Island after the annual conference), **Tane Desmond** and **Karyn Hopkins** have all been kept busy by the flow of clean stream applications after calving.

**Grant Blackie** is currently buried in the Whangapoua Forest (Coromandel) harvesting consent project. He does not anticipate surfacing until around end of February 2005.

After a damp October in the Upper Waikato and Taupo catchments **Jon Palmer** is heading into the busy season of works to soil conservation areas. Jon is also getting stuck into promoting the clean streams project in the Upper Waikato catchment areas.

**Julie Beaufill, Emily O'Donnell** and **Rein van de Weteringh** are focused on the Coromandel 'Peninsula Project'. After receiving Central Government funding for catchment management and flood protection works, community consultation and final design is in full swing with work beginning on the ground. Watch this space.

**Ross Abercrombie** has been continuing work on EW's sustainable agriculture project and the Franklin sustainability Project (see following articles).

**Bruce Peploe** has been involved in trying to resolve the Tongariro River Scheme consents and appeals as well as taking on a management role in the Upper Waipa catchment. Bruce has also attended the recent Regional Land Managers meeting in Taupo.

Although **Judy van Rossem** is no longer a member of NZARM she did email to say that she is back from parental leave and has taken on a special projects role part time at EW currently managing the Biodiversity programme.

As for myself I am continuing involvement with the construction of the Tauranga Taupo and Tongariro River schemes. The final components of the Tauranga Taupo are due to be completed this summer. Consents for the Tongariro River stop banking through the Turangi Township and gravel extraction have been appealed throwing this summers capital works programme into jeopardy.

## **Environmental Education Updates – Ross Abercrombie**

### *Franklin Sustainability Project*

After 6 years of information gathering, research and development of best practice manuals and extension the Franklin Sustainability Project in June the project is now completed. From now on Regional Councils involved (ARC and EW) are moving into a more regulatory stance regarding issues of soil erosion from cropping land. This will address high risk sites that have never implemented erosion control measures where discharges of sediment occur. Many growers have undertaken to implement measures some growers still struggle with the soil sustainability messages of the project.

The regulatory stance will be taken following grower concerns about consistency between those that have and those that haven't spent the money to undertake works. Cross industry issues of fairness also come into play with other industry facing costs of compliance for discharges to land and water. The project has achieved a lot and the Councils involved remain focussed on the issues within the Franklin area.

## **Waikato River Trail – Sue McConnochie**

Now for something a little different. Sue McConnochie of EW has been involved in the establishment of the Waikato River trail. This project aims to create a walkway from Piarere (on Lake Karapiro) to Atiamuri.

A project management team has been established comprising representatives from the South Waikato District Council (SWDC), Raukawa Trust Board, Landowners, Carter Holt Harvey, Mighty River Power, Forest & Bird, Environment Waikato and the South Waikato Economic Development Trust.

The Waikato River Trail has received support from Scottwood Trust, Work and Income NZ, SWDC, Mighty River Power and Trust Waikato. The construction of the Trail has been undertaken by the 'Mighty River Trackers' team with support from the Ministry of Social Development.

The project began with the formation of a steering committee and a project scoping report prepared by SWDC. Once a possible route had been identified the steering group began consultation with major stakeholder organisations and groups and most importantly landowners. With the recent high profile of public access in rural areas in the media this is a crucial component of the project. The steering committee has undertaken not to proceed with any works without the sign off of all the key stakeholders and landowners.

Much of the lakeshore has already been retired from livestock grazing under farm plans implemented by the former Waikato Valley Authority and recently incorporated into the Karapiro Arapuni Catchment Control Scheme. Many of these areas are protected by Land Improvement Agreements.

Work on the Trail started in March 2004 and as of September over 430 hours of volunteer time has been invested in this project. The construction will be broken into stages and the first stage from Arapuni Dam to Jones Landing is due to be officially opened on 5 December.

One key appointment for the early stages of the Trail was the engagement of Gordon Leckey the Project Supervisor. Gordon and the 'Mighty River trackers' have done a great job establishing Stage 1 of the Trail from the Arapuni Dam to Jones Landing. Mighty River Power engineers are designing structures to allow the Trail to pass around the bluff and bridge and area of the inlet of Stage 1. A pest eradication programme is being developed with assistance from Brian Middleton of EPRO Ltd.

The next steps for the project are to continue the consultation programme with stakeholders, investigate the most appropriate structure of the long term management of the Trail, confirmation of Stage 2 & 3 design and planning, and development of an Environmental impact and Restoration Plan. Applications have also been made to the Ministry of Tourism Facilities Development Grants.

## David Perry

### Nelson - Tasman

**Colin Michie** has been dealing with the aftermath of big weather. On October 14th the Tasman area experienced a windstorm which resulted in some 2000 hectares of mature Pine forest being flattened. Because the majority of the windthrow occurred in the Separation Point granites, earthworks associated with harvesting will need resource consent approval. The windthrow (in the Motueka ICM research area) has also attracted the interest of **Les Basher** and **Chris Phillips** of Landcare Research. Hopefully we will be able to get some quantitative data on sediment transportation rates as a result of the trees toppling but also from the subsequent salvage operations. Exciting times - an opportunity for the forest industry and regulatory authority to review techniques (for tree harvest and subsequent ground preparation for replanting) which have developed over time and their suitability when you have extensive wind throw on steep hill slopes. The 2000 hectares (if possible to harvest) would involve over 100 kilometres of new road, approx. the same length of road upgrade and an estimated 200 log processing areas.

The Council has decided to review its rural land management. The high rate of subdivision and other intensive land development is changing the look of Tasman's rural land. The Council has commenced an extensive consultation exercise to see what the local communities want for the

rural land areas and whether the plan provisions are delivering the outcomes that people expected. Steve Markham has taken on the challenge of coordinating this project.

The TDC is to go ahead with the Wai-iti Water Augmentation Scheme in spite of a significant estimated cost increase for the construction. Consents were granted recently.

**Andrew Fenemor** has just breathed a sigh of relief after the successful completion of this year's 3-day annual meeting of the Motueka Integrated Catchment Management (ICM) research programme. The annual meeting included presentations of research results, a workshop on a knowledge delivery Tollbook being developed for the Motueka catchment, a field day around the lower Motueka valley for researchers and the public, and a planning day for future research. This year's public day focussed on iwi environmental issues, effects of the catchment discharge in Tasman Bay, river gravel extraction and riparian restoration with a local school. Details on the ICM website at <http://icm.landcareresearch.co.nz/>. Note also that Les Basher has transferred to the Nelson office of Landcare Research from Lincoln, which allows him easier access to his Motueka field scene where he's researching river gravel dynamics and sediment transfers within the Motueka river system.

**Andrew, Chris Phillips** and others from Landcare Research have also just finished a collaborative project called Travelling River with 2 Nelson artists. This arts and science collaboration produced an exhibition of interwoven community and science images, which was installed at the Suter Gallery in Nelson for a month in August and is now at the Motueka Museum until 10 December. One aim was to introduce catchment research to a wider audience. Travelling River is described elsewhere in Broadsheet - further details and photos can be found at the ICM website

[http://icm.landcareresearch.co.nz/science\\_themes/humandimensions/arts\\_and\\_science\\_collaboration.htm](http://icm.landcareresearch.co.nz/science_themes/humandimensions/arts_and_science_collaboration.htm)

With Travelling River having been so well received, Andrew is keen to find other galleries or venues around NZ who might like to host the exhibition. (see later in this issue)

**Andrew** is a member of the Natural Resources Engineering Advisory Board. The BE(Nat Res) is now taught within the University of Canterbury Civil Engineering Department under **Dave Painter's** leadership. Dave, Andrew and other board members welcome any suggestions for making the BE(Nat Res) curriculum more responsive to the needs of regional councils and consultancies involved in land and water management.

**Mary-Anne Baker**

## Canterbury

It's nearly Christmas already and it seems that the year, which started out being very busy and interesting, is shaping up to end the same way!!

Environment Canterbury has recently commenced a process on the Waitaki River, which seeks to facilitate the development of a community based non-statutory management plan for the lower Waitaki River. This work involves building on the interest and information that was created by the now defunct Project Aqua proposal. ECan is using a web based information management tool called Openstrategy to assist in the development of the plan. This is a first for the Canterbury region and the process that is being used in the Waitaki River is proposed to be moulded to fit a number of other rivers including the Orari River in South Canterbury.

The Environment Enhancement Fund has also recently been worked on by staff at Environment Canterbury including **Dave Maslen** and **David Hewson**. This is the 4th year of the fund and the calibre of the projects keeps improving. It is a very satisfying job for me to visit so many individual landowners that are passionate about ensuring that their farming activities have as minimal impact on the environment as possible.

I was lucky enough to attend yet another very successful and informative NZARM conference this year. Congratulations and thanks to the organising team. I was particularly impressed with the trial work going on with the K-Line irrigation of dairy effluent. It would seem that I may need to update our very recently published “Guidelines for Managing Farm Dairy Effluent” booklet.

Well that’s about all from Canterbury for now, I promise that there will be more next time.

**Chris Phillips** has been doing a bit of globe-trotting since the last issue. In June he headed off to work with Hans Schreier at the Institute of Natural Resources and Environment at the University of British Columbia in Vancouver, Canada. While there he created a multimedia CD-Rom relating to the ICM Motueka Catchment project, attended an International Conference for Sediment and Geochemical Budgets in Geomorphology to honour the retirement of Professor Olav Slaymaker (one of the geomorphology gurus), and looked at low impact urban design and development for housing subdivisions and stormwater runoff course control in the City of Chilliwack. He then spent 3 weeks at Macaulay Institute in Aberdeen in Scotland working with Simon Langan comparing and contrasting ICM approaches in Scotland to New Zealand. A few weeks back in New Zealand, just to remind him that he couldn’t escape the winter entirely, and he was off again to Thessaloniki in Greece. Along with Mike Marden they presented two papers on the stabilising characteristics of our native riparian colonisers at an international conference on “Eco-engineering: the use of vegetation to improve slope stability”. And to cap such a tough couple of months, was joined by wife Adrienne for 3 weeks R&R in Italy.

**Dave Maslen & John Glennie**

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**Otago**

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**NZARM CONFERENCE REPORT  
HELD AT CROYDON HOTEL GORE 11-13<sup>th</sup> OCTOBER 2004**

It has taken the committee some time to get back into normal life after what I can only say was a fantastic event. Although I am biased I can say it honestly as we have had so many favourable reports back. Our intention at the outset was to have a power packed conference full of good speakers with lots of technical information and two field trips each with their own distinctive theme and topics.

We were also very honoured to have **Dr Morgan Williams** and **Phillippa Richardson** (representing Parliamentary Commission for The Environment) attend the whole conference and we certainly did appreciate their comments and lead paper which set the scene on the first day.

Overall we had 104 delegates attend but not all for the three days. The worst logistics were organising transport especially from the airport on the first day and those who had to fly out early but with a great committee it seemed to work out okay.

Furthermore, there was a wealth of technical information and transfer of knowledge over the three days and it will be interesting to see what uptake of this information takes place around NZ over the next decade or so.

We are deeply indebted to the sponsors namely Environment Southland, Ravensdown Fertiliser Cooperative, NZ Landcare Research Ltd, Ministry For the Environment and Telford Rural Polytechnic as their funds enabled the conference to be run at a cost competitive price. This in turn possibly meant that more delegates were able to travel from the far north.

Every Council was represented other than two and the planning committee was very pleased with this result.

Environmental management issues differ around the country but what the committee hopefully demonstrated was that in the south we have a slightly different approach in best management practices often with very desirable results.

We had hoped to get a large number of the local consultants and planners along but were unable to and in hindsight should have had a better balanced programme where day registrations would have suited these vocations.

The social events were great and were interesting as the conference followed two days after the local body elections. The committee were pleased to have many Councillors along for all the events and from the Otago Regional Council we had three Councillors attend the whole time (inc one new Councillor) while another new representative came for a morning session. From Environment Southland we had Chairman **Ted Loose** for the whole time and three others in attendance for most of the programme.

This in itself was an important milestone in our opinion as we need to have Councillors (and Councils both District and Regional) understand the role and importance of a professional body like NZARM and that we need to work closer together in the future to achieve sustainable management.

We are indebted to the management and staff of the Croydon Hotel who made the conference enjoyable not only by the atmosphere they created but the hospitality and great southern food.

On another note we were really pleased to see two of our notable honorary members attend namely **Tony Warrington** from Wellington and **Graeme Anderson** from Alexandra. They were put on the spot at our conference dinner but both responded with great dignity and humour leading to a great night by all (If I remember correctly Graeme was one of the last to bed that evening and he can still sing a great song or three).

For those of you who did not attend you missed out in a special occasion but maybe you should look forward to the next one in the south which could be in ten years time.

Note that there will not be a proceedings as such, but all the papers that are forwarded to us will be published in the forthcoming Broadsheet issues.

As convenor my job was made easier by the great team around me. We started organising the conference about May (which is far too late-not recommended to any in the future) but managed to get it all together on the day.

*So I would like to make a special thanks to my team.....*

Firstly, to **Bala TikkiSETTY** for his tireless work pulling all the abstracts together, chasing up the speakers and coordinating the data show projectors and each speakers power point talks plus all the backroom work he did.

To **Jim Risk** the new member on the block for all his work in coordinating and organising the transport and securing those great conference back pacs.

To **Gary Morgan** for his wealth of experience and coordinating the Southland section of the field trip on the Tuesday which travelled to near the headwaters of the large Mataura river catchment.

To **Nicola McGrouther** from ORC, Dunedin for all her work in organising the social/ catering and local information brochures plus a large number of other tasks she took on.

Lastly, to **Bruce Monaghan** from ORC, Alexandra who coordinated and organised the extensive field day into West Otago and the Taieri Plains on the final day.

A sincere thanks also to both Otago Regional Council and Environment Southland for providing facilities and staff time to prepare notes particularly the abstracts, field trip maps and notes and the vehicles and computer facilities.

Thankyou also to any other names I may have omitted who helped make this conference a great knowledgeable affair.

I would also like to thank **John Whale** and his team for the great help he gave us through the year and the impressive CD Rom that he provided our planning committee based on the knowledge from the great 2003yr 50<sup>th</sup> Anniversary event in Rotorua.

Finally, to my administration team of **Russell** and **Susan Edwards** who handled all the registrations and fees, formatted the programme into pdf file format and a host of other services in Dunedin. We would not have been able to run such a conference in another town as Gore unless we had the use of e mail and the internet.... it enabled it to all happen.

It has been a pleasure convening such a show and we wish next years team all the best.

**Yours from the south**  
**Murray Harris, Convenor**

## **Otago Region Update**

We have all been busy planning and organising the conference so not much else to report in this issue other than an up date on the following new project:

### **Sustainable Farming Fund Dairy Project Clydevale Otago**

This project is part of the larger National Poplar and Willow Users group project and is situated inland from Balclutha near Clydevale. The sharemilkers are the Sharpin Bros who are presently milking 1400 cows on a 500ha property.

The major issue with dairy farms on the heavier clay soils in Southland and Otago occurs when the effluent is irrigated onto the paddocks especially from calving to say November (or can be anytime after a prolonged period of rain if the soils are saturated). The effluent finds its way directly into tile and Novaflo drains and then flows into important waterways.

The objective of this trial was to plant Japanese shrub willows (*Salix Kinuyanagi*) and then irrigate the dairy effluent onto the trees over a set period.. The trial block is close to the dairy shed and effluent pond and is about 0.5ha in total. Over this time the frequency and method of application will be studied.

An assessment of total biomass will be undertaken from the block and at a suitable time (maybe in 2 yrs) the block may be grazed by the cows in mid-late summer. Another option that maybe looked at is the possibility of making silage using a forage harvester from the young leaf and stem growth but care will be required so not to damage the lower vegetative stool.

The initial concern with the project to date was the late approval and thus difficulty sourcing suitable material that could be planted on time. Nevertheless, we managed to plant about 3900

cuttings and 600 rooted trees on 28-29<sup>th</sup> September with a follow up spray in October for grass control. Growth rates to date have been slow but with recent rain we may see some fast growth.

Another new aspect to this project will be the use of the “K line irrigator” to spray the effluent through. This adapted irrigator head and system has been showing great results so far in the south whereby 4-5 mm is irrigated per hour (impressive as this system minimises the potential surface runoff and through flow to tile drains at so low application rates).

**Murray Harris**

## **Southland**

Nothing to report from the south this issue as the team is recovering from the conference!

**Bala TikkiSETTY**

## **Manawatu - Wanganui**

It's a busy time at Horizons (people must be busy, haven't had time to write anything for Broadsheet), flood recovery work continues as does planning for longer term strategies for land management. The Engineers were particularly pleased the government approved the flood recovery package that will help with repairs and improvements to various river and drainage schemes.

The Council recently started consultation on it's One Plan, the policy team are looking to merge the seven existing Regional Plans. One iwi group has told the co-ordinator of the project that they will hold her to keeping the size of the document to a small A4 ringbinder!

**Tabitha Anthony**

## **Gisborne**

I'm not sure if it's been one day short of a week or what, but .....

Suddenly Gissie is flavour of the month in the building stakes (and now every Bush-hating Californian wants to emigrate here too) - which means a ton of geotech. stuff to be given critical evaluation.

Peter Fantham was going to give a run-down of the new ortho photo coverage of the area for the GIS but that hasn't happened. Terry Crippen is here ground truthing it – and finding that LINZ's database is less accurate than the orthophotos ..... are they the B&W stads that took all of our historical aerial photos from the Gissie LINZ office for storage in Wellington?

Thankfully its almost beer o'clock.

**Don Miller**

## **Wellington - Wairarapa**

Nothing to report from this region.

**Dave Cameron**

## **Hawkes Bay**

**Neil Grant** has been judging at the HB Science and Technology Fair, taking enthusiastic school groups around White Pine Bush Scenic Reserve and Lake Tutira during Conservation Week, supervising volunteer planting adjacent to Ahuriri Estuary and Te Angiangi Marine Reserve and securing funding for the addition of a significant area of private indigenous vegetation to Boundary Stream.

At Dexcel, **Anna Lambourne** says that very little work has been done from her desk while she has been on leave for 2 months after getting married and travelling through Nepal. Great fun – of course.

**Garth Eyles** notes the tantalizing reminders of what weather can bring - 170mm in 3 hrs over Napier, causing major flooding and 230mm in the same time at the head of the Huatokitoki Catchment, in from Porangahau which removed a considerable length of riparian protection fencing.

It was very satisfying to attend the HB Farm Forester of the Year field day held on the property of James Hunter, near Porangahau together with 170 people. James also gave a personal award to **Neil Faulknor** with the comment "without the quiet encouragement of Neil, who worked with both my father and me, none of this work would have happened". It was great to see the owner publicly recognising the significant role Land Management officers play in making hill country farms sustainable.

The sale of 140ha of standing timber at the Tangoio Soil Conservation Reserve continues to keep **Joe Devonport** generously occupied. Twelve sets of documents were sent out on CD and to date seven inspections by interested parties have taken place. One of them has done a major plotting exercise with three people involved for some ten days. Meanwhile, contractors have been busy removing all of the internal fences. (Left over from when the Reserve was farmed as probably the earliest soil conservation demonstration farm in New Zealand).

The undoubted highlight of recent months for **Jude Addenbrooke, Simon Stokes** and **Peter Manson** was the NZARM conference. As commented by **Jude**, it was excellent, with good speakers, well-run and interesting field trips. Also, the opportunity it provided to take a few days leave in the hospitable south, doing the Hump Ridge Track.

**Simon** has begun his involvement with the Hawke's Bay High Performance Farming System (HPFS) programme funded by Meat and Wool New Zealand and other sponsors. This will focus on soil health, water quality, and water use efficiency, plus overall farm planning approaches to manage biodiversity, erosion etc. He has also been organising a “*planting and management of indigenous forest species*” workshop at which Local NZARM members are most welcome.

‘Up to his ears in waterways projects with schools’, is how **Ian Cairns** describes his current work. He is also involved in the management of willow clearing and riparian native tree planting in the Maraetotara stream. I also heard that he has been getting excellent prices for his lambs.....

One of our members, **Ewan MacGregor**, is back into governance as a regional councillor, a job which he has had experience at before and certainly promotes good land use practise at all levels. Congratulations Ewan.

## **Peter Manson**

### **Auckland**

#### **Revamped Rural Team**

**Tony Thompson** has departed the ARC after fourteen years and numerous dribbling incidents on the bus. He has seen the way and opted for a job with less travel and is now working for Grow and Spray Ways based in Drury as the General Manager. He also opted out of regional coordinator so now you are stuck with me.

**Glenys Kroon** is the new team leader, taking over the team management duties and continuing on with rural policy, planning and overseeing wastes from production land activities. **Georgina Cranswick** is focusing on rural discharges - consents and compliance, farm planning. **Gwyn Morgan** is dealing with rural discharges - consents and compliance, Clean Streams Accord. Hope to appoint a new Rural Resources Officer in the next few weeks.

Glenys and Amy attended the NZARM Conference in Gore during October and had a thoroughly good time, experienced the best of Southern hospitality and learnt plenty.

### **Status of Air, Land and Water Plan (ALW)**

Decisions were released on 15 Oct 2004. The Plan is subject to appeals and is not operative at this stage and the appeal period is 30 working days. Most resource use issues relating to the rural sectors are not mentioned in the transitional Regional Plan – therefore are innominate, consequently both the underlying provisions of the RMA and Proposed Plan apply. The ALW Plan makes many common activities, Permitted Activities therefore no Resource Consent is required. Prior to the plan even small discharges required Resource Consents. Controlled Activities require a Resource Consent, but the ARC must issue the consent if conditions specified in the Plan are met.

### **The Mahurangi Action Plan**

In September 2004, the ARC appointed Mr Stefan Seitzer as Project Leader for the Mahurangi Action Plan. Mr Seitzer has a Master of Environmental Science Degree and has a background in ecology and freshwater monitoring. He is the founder of ‘The Whitebait Connection’, a multi – regional, non – profit, environmental education and action programme, concerned with the ecological health of rivers and streams in New Zealand. Mr Seitzer’s role is to lead and co-ordinate a diverse project team, to deliver an effective strategic response to the sedimentation problem occurring within the Mahurangi estuary and harbour. The clients include the various landowners and stakeholders within the catchment, e.g. local territorial authority, general public, environmental interests groups, marine farmers, forestry industry, quarry operators, and specifically rural landowners. Community engagement is envisaged to occur largely via a process of engagement events aligned with the principles of integrated catchment management.

### **Clean Streams Accord**

Two new publications have been produced, Dairying and Clean Stream Accord pamphlet and the Clean Streams book (Dairy Insight funded) these along with many other ARC publications will be sent out to dairy farmers and sharemilkers over the next month. **Gwyn Morgan** will be putting together a work plan for the next 12 months, which will include four targeted riparian zone management workshops for dairy farmers in Auckland region. Establishment of two riparian fencing and planting demonstration sites on dairy farms. Facilitate the development and implementation of two nutrient management workshops in collaboration with Dexcel & Fertiliser Companies.

Currently working on quantifying and spatially representing the length of streams associated with dairy farms in the region. Significant wetlands still require defining in some areas, once established spatial locations of dairy farms will be overlaid. Funding sources for farmers to implement fencing and planting will be a key consideration over the next year. Currently framers can apply for “Environmental Initiatives Fund” (EIF), Trees for Survival and have support from Land care groups.

## **Franklin Sustainability Project (FSP) update**

Environment Waikato, Franklin District Council and ARC meet to discuss the end of the Franklin Sustainability Project (FSP) and “where to from here”. Sustainable Farming Fund no longer funds the FSP project. All parties agreed that the education and advocacy programme (FSP) has not been as successful as hoped and that the time for change has come. There are huge costs to the community and environment, sedimentation of infrastructure, removal of sediment from roads, long-term soil quality impacts, all issues that cost the ratepayer and grower. A report was taken to the Inter-Regional Committee meeting in August emphasising the need to change to an enforcement, with cost recovery based approach.

Education and advocacy will still be used to promote adoption of best practice methods, however both Environment Waikato and ARC have budgeted money towards compliance.

## **Stormwater Action Plan**

The Stormwater Action Plan sets out a framework for an integrated work programme involving the Auckland Regional Council, territorial authorities and Water Care to manage the effects of stormwater discharges on water quality. The ARC has established a new team — the Stormwater Action Team - with responsibility for implementing this action plan. Positions are currently being advertised.

## **Sediment Management Project Leader - Transit**

Transit NZ have all the necessary planning approvals, consents from the ARC and obtained funding for eight large roading projects in the Auckland Region. Work will begin over the next 6 months and could continue for up to 6 years. Due to the increased workload relating to the projects, the fact that responsibilities for Transit consents lie across several areas of the Environmental Management teams and the importance placed on compliance monitoring a new position has been created to handle all dealings with Transit NZ, **Mike Dunphy** will begin this role in late November.

From all the members in Auckland we wish you all a merry merry Christmas and a safe and happy holiday. See you next year - Amy

**Amy Taylor**

**Northland**

Nothing from the far North.

## New Members

The Executive extends a hearty welcome to the following new members to NZARM.

**Approved at the Exective meeting on October 12 and November 18, 2004.**

**David Perry** has a M.Soc.Sc (Hons) majoring in Geography and Sustainable Land Management. Worked as a Land Management Officer for Environment Waikato from 98-2000 and was NZARM Regional Co-ordinator for 2 years. Has been involved in Soil Conservation, Nutrient Management, Farm Management, Farm Environment Award, Landcare, Forestry and Environmental Education projects. Current position in Taupo is fosed on River Management, flood protection and Water Quality Issues in the Lake Taupo and upper Waikato projects.

**Ross Monaghan** a scientist working with Agresearch's Land and Environmental Management Group, based at Invermay. Much of his research seeks to identify how farming systems can maintain or improve business profitability whilst delivering improved environmental performance. Research has a balanced component of plot, paddock, farm and catchment scale analysis to maximise relevance. Has B Agr Sc (Hons 1), PhD Soil Science.

**Justine Hughes**, Bachelor of Resource Studies from Lincoln Universtiy, an Environmental Management Officer for Marlborough District Council.

**Debbie Care**, previous work has included research on plants as environmental tools for removing nitrate from the root zone, and root structure and physiology associated with nutrient uptake and root extensiveness. Now a Business Developer (Environment and Animal Welfare) with Dexcel.

**Zane Moss**, as an employee of Fish and Game is involved in analysis of resource consent applications that may impact on the habitat of trout and salmon, and involved in Fish and Games submissions to statutory planning. Also occasionally involved in related fields, such as talking to Landcare groups, or other field-trips with groups interested in land management issues. Masters degree with first class honours in Wildlife Management.

**John Purey-Cust**, a professional forester in NZ forest service 1962-1982. 1983-1992 o/s forestry consulting, landuse planning, resource studies. From 1994 retired, occupied planting trees, NZ Farm Forestry Association, various forestry matters, Councillor Southland Fish and Game, giving priority to proper use of water resources.

**Dr Cecile de Klein**, Senior scientist with Land and Environmental Management group of AgResearch. Main areas of work: impact of land use on environment, in particular nitrous oxide emissions from soil; effects of dairy and deer farming on water quality; nutrient budgeting.

**Gwyn Morgan**, Bachelor of Social Science from Waikato University, double major in Geography and Earth Science. Postgraduate Diploma in Environmental Science from Waikato University. Worked 4 years for Lincoln ventures as a research technician, five years for Fonterra (and legacy NZDG). During this time had three roles, Field Rep, Internet Solutions Manager, and Environment Programmes Manager. During the last twelve months was heavily involved in the Fonterra Clean Streams Accord and various Regional Councils action plans around the accord. Currently Rural Resource Quality Officer with Auckland Regional Council

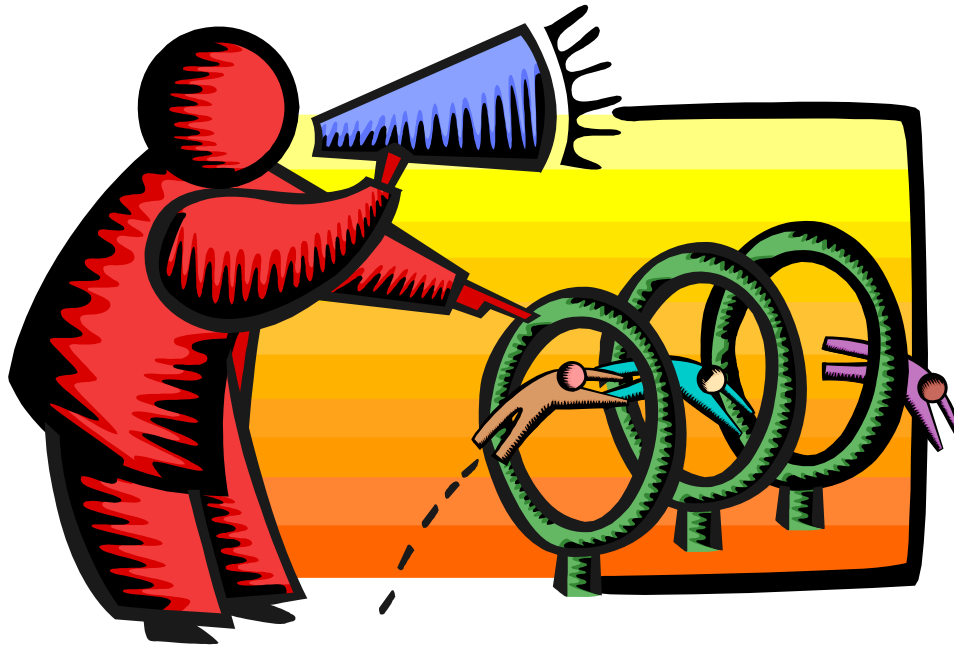
**Shelley Washington**, Masters in Resource Studies from Lincoln University. Worked for three and a half years at NZ Landcare Trust. Work covers the whole of Canterbury and the West Coast where support, encourage and facilitate Landcare Groups and community projects. Also the project manager for two sustainable farming projects (ragwort control and nutrient runoff) on the West Coast as well as being on the Management Group for the Sustainable Dairy Farming in Lake Brunner Catchment project, which is funded by Sustainable Management Fund. All of the groups and projects involve with are about sustainable land management through community involvement.

**Maurice Rodway**, MSc (Hons) in Zoology from Massey. Manager of Fish and Game in Southland for 20 years. Has been an advocate for the sustainable use of land and water resources during this time. A keen trout angler and has been since early trips to the Wairau River in Marlborough in the 1950's. Particularly interested in land uses that affect water quality and quantity, and in river management practices. Keen to see at least partial restoration (within the existing landscape) of the natural character of rivers and streams.

Amy Taylor	These members did not wish to have biographical details published.
Kate Banbury	
Suzy Kirk O'Neil	
Katie Nimmo	
Nick Round-Turner	
Darryl Sycomore	
Donald Harley	
Bill Jarvie	
Brian Preston	
Edward Loose	

# Wanted

## Editor for Broadsheet



No - you don't need to be a circus trainer or learn to jump through hoops.

No – you don't need any special skills (other than perserverance, persistence, and a bit of word-processing)

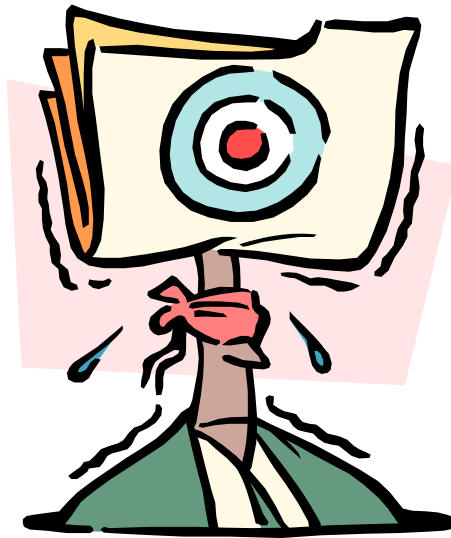
No – it doesn't take a lot of time or effort

Yes – it is rewarding

Yes – it has a huge salary and numerous fringe benefits (nah, just kidding)

**If you think you would like to have a go at keeping NZARM members connected via this important and satisfying task then please get in touch with Chris Phillips or your regional coordinator (details inside cover of this newsletter).**

..... from the Secretary



**Before you know it, it will be the New Year and that means invoice time again!**



**The Executive Committee would like people to note that if you wish to resign and not be charged for the 2005 year, you will need to resign (in writing) before 31 March 2005.**

**Section 11.1 of the Constitution states – “A member may resign from the Association by giving at least one month's notice to the Secretary. Any money payable to the Association at the time of resignation shall remain a debt due and owing to the Association.”**

# **Papers from the 51<sup>st</sup> NZARM Conference in Gore**

## **Key Note Address**

### **Growing for Good: Intensive farming, sustainability and New Zealand's environment**

**Dr Morgan Williams**

**Parliamentary Commissioner for the Environment**













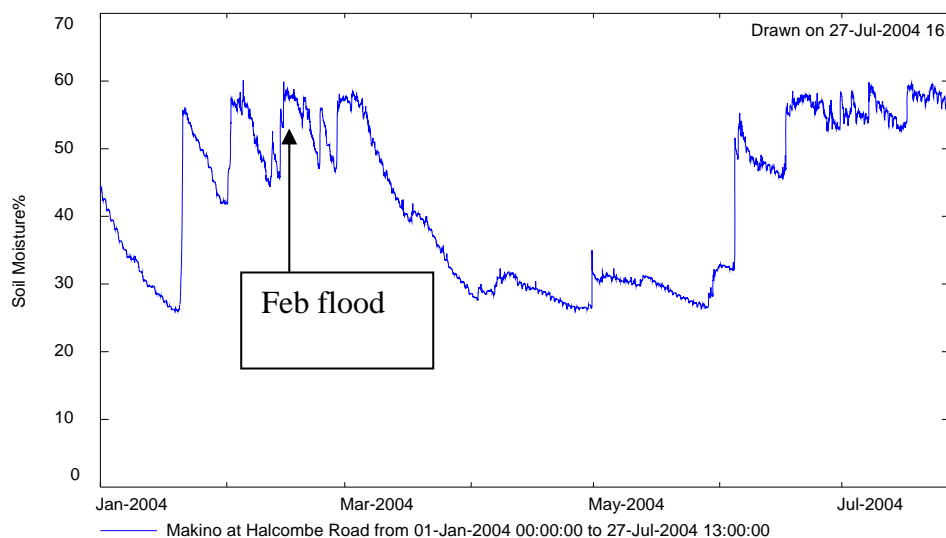






**Manawatu storms Feb 2004: Did erosion control work?**  
**Malcolm Todd**  
**Horizons Regional Council**

On the 13<sup>th</sup> to 15<sup>th</sup> February 2004, all the major rivers in the Manawatu-Wanganui region had record or near record floods. Between 70 and 300mm of rain fell in three days over an area of 300,000 hectares (see Figure 2). This amounted to a 150-year return period rain event for that area. The floods in the Kiwitea stream (above Fielding), the Pohangina and the Whangaehu river were the highest ever measured, while the floods in the Rangitikei and Manawatu rivers were the highest for 75 and 100 years, respectively. Hundreds of houses and hundreds of farms were flooded, condemned or closed for business. A total of 2.5 million tonnes of suspended sediment flowed out the Manawatu River in three days, equal to the annual discharge.



**Figure 1: Soil moisture near Feilding**

In the early days after the event, looking at the total rainfall and the total suspended sediment discharge, it appeared that erosion would not be as bad as in Cyclone Bola, which hit the Gisborne and Hawke's Bay Regions 17 years before. That turned out to be wrong.

The reason why the February storms had just as much erosion as Cyclone Bola while having a third of the 3-day rainfall was likely to have been the high soil moisture levels prior to the storm. February 2004 was exceptionally wet from the outset with a number of high rainfall events, and soil moisture across the region rising to typical winter levels by the middle of the month (Figure 1). In the central Manawatu soil moisture reached peak winter levels early on in the 15<sup>th</sup> of February event and surpluses developed during the event.

After the storm SPOT5 satellite imagery was obtained over an area of 1.5million hectares. Landcare Research pan-sharpened the imagery, processed it to a standardised reflectance, applied an automatic classification to detect the bare ground and quality checked the resulting landslide map.

Over 62,000 individual landslides were identified, with a total scar area of 19,000 ha. The erosion corresponded very closely to the 100-year 72-hour rainfall return period (Figure 2). Within that zone, the only gaps in the erosion were due to forest cover or flat land.

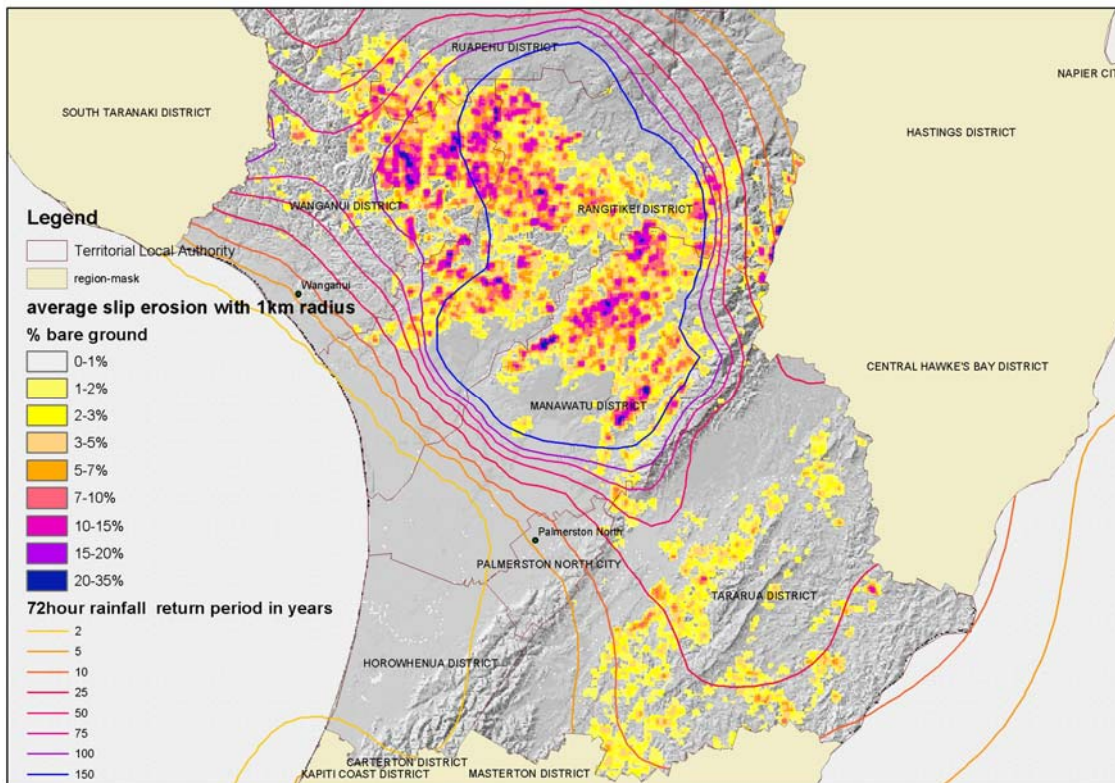


Figure 2: Rainfall return period isohyets (from NIWA) and severity of erosion (from Landcare Research) for the February storm

Figure 2 shows areas of severe erosion (purple) in the Pohangina valley, Kiwitea, Rangitikei, Turakina, Whangaehu and the Whanganui. At the paddock scale these severely eroded hillsides had over 15% bare ground including slip tails and amounted to over 27,000 ha.

Unusually, although this storm came from the southeast, the rainfall was higher on the lee side of the Ruahine range resulting in a 150+ return period event in the Turakina/ Whangaehu area.

Rock type had a large effect on the probability of erosion occurring. Unconsolidated sandstone (light yellow) had more erosion than other rock types at low to steep slope angles, while mudstone (brown) had more erosion than consolidated sandstone (yellow) at steep slopes angles (Figure 3). Greywacke is stable and had very little erosion.

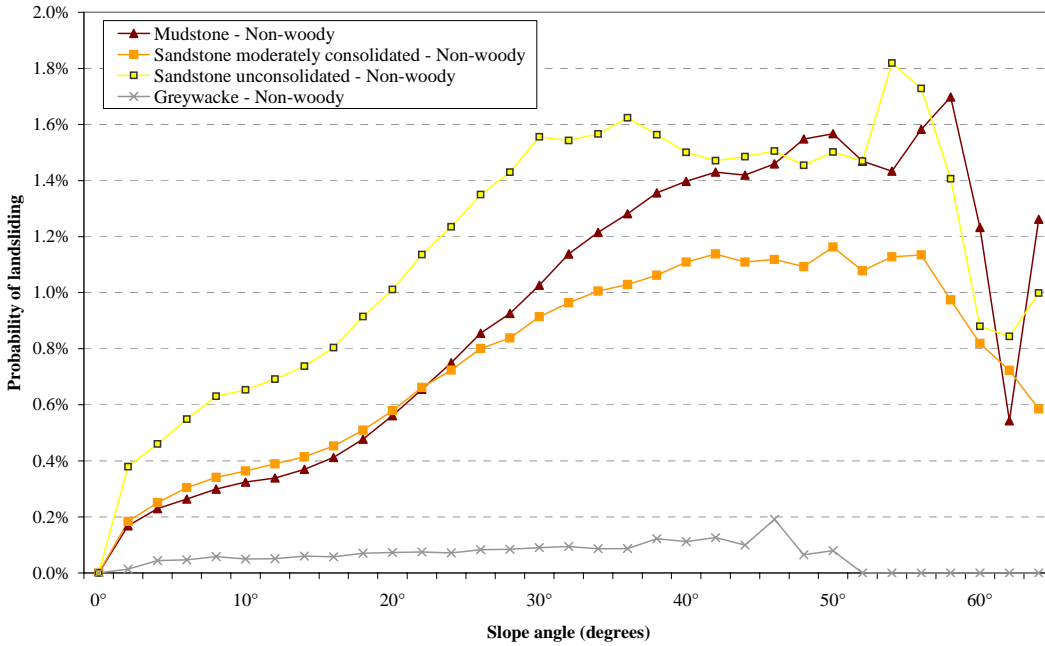


Figure 3: Effect of rock type on erosion under pasture (from Landcare Research)

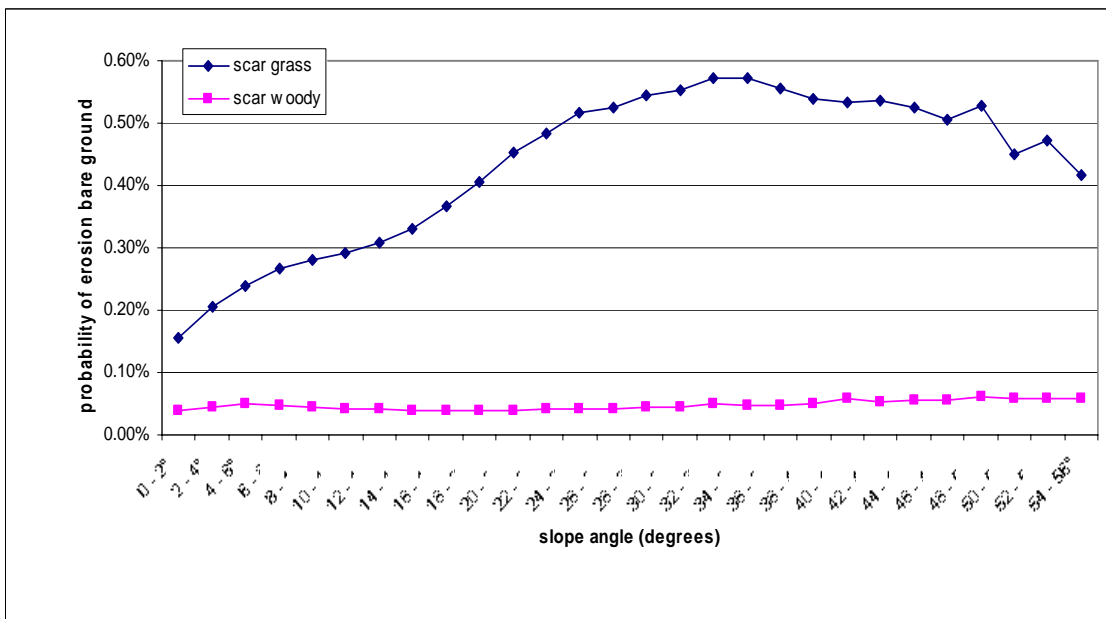


Figure 4: The effect of trees on landslide erosion (from Landcare Research)

Vegetation cover had a profound effect on erosion. Figure 4 indicates that at low slope angles forest reduced erosion by about 75%, while, on the steep landforms more traditionally associated with slips, forest reduced erosion by around 90%.

Of interest is the amount of erosion at low slope angles. This perhaps shows that if you get enough rain you can have landslides on any slope angle. Normally we would expect most slips to be on slopes over 25 degrees, but in this storm half the slip map erosion scars were on slopes not

normally associated with landslides; Land Resource Inventory C and D slopes. These slopes are less than 20 degrees and can be ploughed.

In order to enable quality checking of the satellite imagery, 448 1:15,000 colour aerial photos were flown, post-storm, over 200,000 ha of the worst erosion, from Jerusalem (up the Whanganui river) to the Manawatu Gorge. Doug Hicks of Ecological Research Associates analysed them. A random sample of 400 one-hectare sites were located within 20 randomly selected aerial photographs and analysed for vegetation cover, erosion type and differences with the Landcare Research slip map. Results are shown in Figure 5.

The samples were not stratified for erodibility in the analysis, the results therefore underestimate the effectiveness of trees in preventing erosion. This is partly because tree planting has been targeted towards the more severely eroding landforms particularly on NZLRI Class 8. Most Class 8 unconsolidated sandstone gullies have been afforested, but still have substantial pre-existing gully erosion.

	Aerial photos				satellite	Correction factor
	All bare ground	Mass movement	Gully & streambank	Debris & silt	Slipmap landslides	
Pasture & crop	6.4%	4.5%	1.0%	0.9%	4.1%	1.10
Pasture & scattered trees	6.6%	4.0%	0.8%	1.7%	3.2%	1.25
Pasture & extensive trees	6.4%	3.4%	1.1%	1.8%	2.4%	1.42
Forest	4.8%	1.6%	1.4%	1.8%	0.6%	2.67

Figure 5: Results of aerial photography analysis

The results show that:

- Afforestation reduces mass-movement erosion to at least a third of what it would have been, probably more like a quarter.
- Scattered trees don't make much difference to erosion.
- The satellite derived slip map underestimated the amount of erosion present, particularly in forest.

Further analysis is being done on this, but I suspect that the reason is that very small slips and gullies were not detected by the slip map and because large slips in forest were classed as herbaceous vegetation by Ecosat.

Previous work is probably more reliable for judging the effectiveness of spaced plantings (Hicks et al 1993); spaced plantings reduce erosion to about half what would have occurred under pasture if they are densely planted and mature.

Recommendations for analysis of future storms:

- Contingency funds must be available for imagery acquisition and analysis or else it may not be done on time. If there is to be any hope of capturing the extent of floodwaters on the satellite imagery, it must be acquired on the first fine day following the storm. Oblique aerial photography is essential immediately after the storm to capture flood extent. Photos

should be GPSed. Of slightly lower urgency is oblique photography in hill country to capture the extent and nature of erosion.

- Satellite imagery analysis needs to be backed up by aerial photo analysis for quality control. Analysis of the SPOT imagery provided a very valuable dataset that can now be used for risk mapping of erosion hazards and sediment budgeting to target forestry to the most important areas to prevent floodway aggradation. Analysis of photographic imagery at the same scale would not have been possible within budget and time constraints.

Acknowledgements to Doug Hicks, John Dymond, Craig Thompson, Anne-Gael Ausseil, Marianne Watson, Jon Roygard and Lindsay Fung.

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## Data for mapping risks to soil and water quality

Allan Hewitt<sup>1</sup> and Robert Gibb<sup>2</sup>

Landcare Research, <sup>1</sup>PO Box 69, Lincoln; and <sup>2</sup>Private Bag 11052, Palmerston North.

Raw data held in databases have enduring value in underpinning present and future resource management. However, raw data by itself is of limited value unless it is transformed into useful information using models. In this paper we survey the adequacy of NZ soil and land data from the point of view of its application in mapping environmental risks to soil and water quality.

Information on risks to soil and water quality may be based on mechanistic models, empirical statistical models, or logical models. Each requires good point datasets for model development and spatial data to map the results. We describe an application of EnSus as an example of a logical model that has been applied in mapping environmental risks to soil and water quality, and we evaluate the adequacy of underpinning data.

EnSus is used to analyze and map the relative risks different land uses pose to soil quality and water quality. EnSus maps the risk of a specified hazard by combining maps of land management pressures with maps of the vulnerability of the land to those pressures. We recently used it<sup>1</sup> to produce a national map of relative risk classes of nitrate leakage from soils to surface and ground waters. The input pressure and vulnerability maps are based on the best available data, and knowledge is expressed as sets of logical rules.

Land use pressure data for the national nitrate risk map was derived from Agribase, and the Land Cover Database (LCDB1). Resolution was sufficient for national and regional mapping. The value of higher resolution paddock scale monitoring by remote sensing has been demonstrated in Canterbury cropland where winter fallow, a source of nitrate leaching, has been mapped. Artificial drains are an important factor in nitrate leakage from land to water, but there is no data on subsoil drainage.

Vulnerability for the national nitrate risk map was based on soil available water capacity, rainfall, natural soil drainage, and permeability data. This soil data was drawn from the fundamental data layers of the NZLRI, and was suitable for national resolution. The better resolution soil data in Southland, Otago and Canterbury is not yet part of the national soil layers and could not be efficiently incorporated into the national analysis. This will be addressed in the new soil database S-map that will provide consistent resolution of soil data of NZ by incorporating new digital data and filling gaps with new data. It is part of a new investment in nationally significant databases that will deliver better access to land and soil data and information.

We conclude that good data is available for generalized risk mapping but its spatial distribution is patchy. Data on type and location of drains is needed to effectively model water quality risks.

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<sup>1</sup> Predicting the effects of land use on water quality, funded by Min. of Agriculture and Forestry, a cooperative of NIWA, Landcare Research, HortResearch, Lincoln Ventures, Aqualink, and Harris Consulting

## The science behind the use of '*eco-n*' nitrification inhibitor

**Keith Cameron and Hong J Di**  
**Centre for Soil and Environmental Quality**  
**Lincoln University**

### Introduction

Lincoln University and Ravensdown Fertiliser Co-operative have developed a new soil treatment method, called '*eco-n*' technology, which can be used to reduce the environmental impacts of dairy farming.

Our research results show that *eco-n* can:

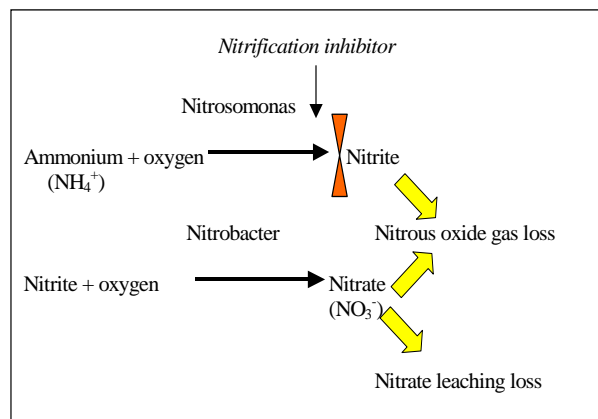
- reduce nitrate leaching by 60 per cent
- reduce cation leaching by 50 per cent
- reduce nitrous oxide emissions (a potent greenhouse gas) by 75 per cent, and
- increase pasture production by 15 per cent per year.

This paper will cover the science behind the development of *eco-n* technology and the practical application of using *eco-n* technology.

### Science behind *eco-n* technology

Nitrate leaching from dairy farming is a major environmental concern because a high nitrate concentration in drinking water is potentially harmful to humans and livestock, and elevated nitrate concentrations in surface waters may cause pollution which in turn affects fishing etc. (Cameron et al. 2002; Di & Cameron 2002a). It is now proven that in a grazed pasture system direct leaching losses of nitrate from applied fertiliser nitrogen (N), or farm dairy effluent (FDE), are relatively small compared to the large leaching losses that occur from animal urine patches (Scholefield et al. 1993; Di et al. 1998, 2002a; Silva et al. 1999; Ledgard et al. 1999; Di & Cameron 2002b; Monaghan et al. 2002). Because of the random distribution and irregular timing of cow urine returns it is very difficult to reduce nitrate leaching from animal urine patch areas compared with that from the fertiliser per se.

However, Di and Cameron (2002c, 2003, 2004a,b) recently reported a series of trials showing the effectiveness of treating grazed pasture soils, including animal urine patches, with a nitrification inhibitor (*eco-n*) to reduce nitrate leaching from a free-draining shallow stony Lismore soil and a deep sandy Templeton soil. This work involved making direct measurements of nitrate leaching from large soil lysimeters. The nitrification inhibitor slows the first stage of nitrification and reduces the rate that ammonium is converted into nitrate in the soil (Figure 1). Ammonium ( $\text{NH}_4^+$ ) is adsorbed onto the negatively charged cation exchange sites on soil clays and organic matter, thus protecting it from leaching and allowing it to be taken up by plants or be immobilised into soil organic matter. However, nitrate ( $\text{NO}_3^-$ ) is easily leached from the soil because it has a negative charge and is not held by the negative charged sites on the clay and organic matter. Therefore reducing the rate of conversion from ammonium to nitrate can help to retain more nitrogen in the soil for plant use.

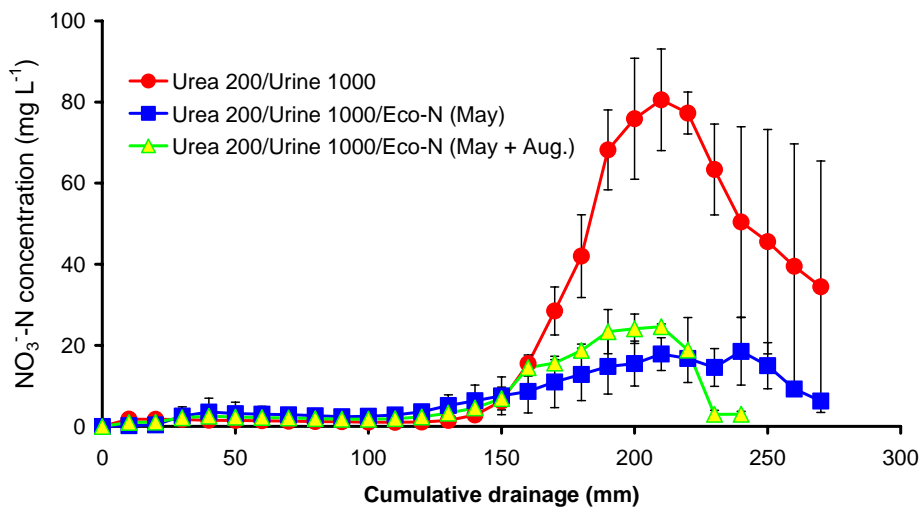


**Figure 1.** The nitrification inhibitor slows the rate of conversion of ammonium into nitrate in the soil and thus reduces the loss of nitrogen.

Nitrification inhibitors have been used in the past to increase the efficiency of N in fertilisers but until recently their potential to reduce nitrate leaching losses from grazed pasture systems had not been rigorously tested through direct measurements of leaching losses from lysimeters.

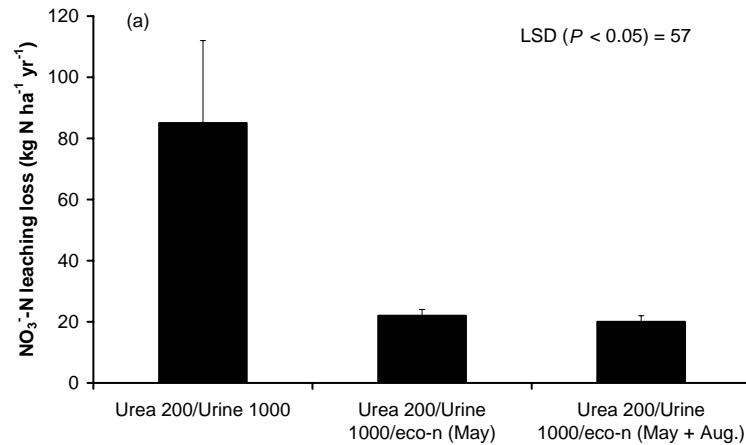
### How many applications of *eco-n* are required?

Our initial research results showed that multiple applications of *eco-n* could reduce nitrate leaching by 60% (Di and Cameron, 2002c). Our more recent results show that reductions in nitrate leaching of 60% can be achieved with a single application of *eco-n* in the autumn (May) or two applications in the autumn plus spring (May plus August) (Figure 2).



**Figure 2.** The effect of *eco-n* applied in May and May plus August on the nitrate concentration in drainage water from below cow urine patches applied in May (Templeton soil) (Di and Cameron, 2004b).

However under normal farming conditions we recommend two applications of *eco-n* to reduce nitrate leaching from both the winter and spring urine depositions. The effect of two applications of *eco-n*, one in May followed by one in August, on the amount of nitrate leached from a Templeton soil are shown in Figure 3. Both have significantly reduced the amount of nitrate leaching by over 60%.



**Figure 3.** Total amount of nitrate leaching losses from large Templeton soil lysimeters following one application (May) and two applications (May and August) of *eco-n* (Di and Cameron, 2004b).

### How long does *eco-n* last in the soil?

We have recently completed a detailed incubation experiment conducted under controlled temperature conditions to make direct measurements of how long *eco-n* will last in the soil (Di and Cameron, 2004c; Table 1).

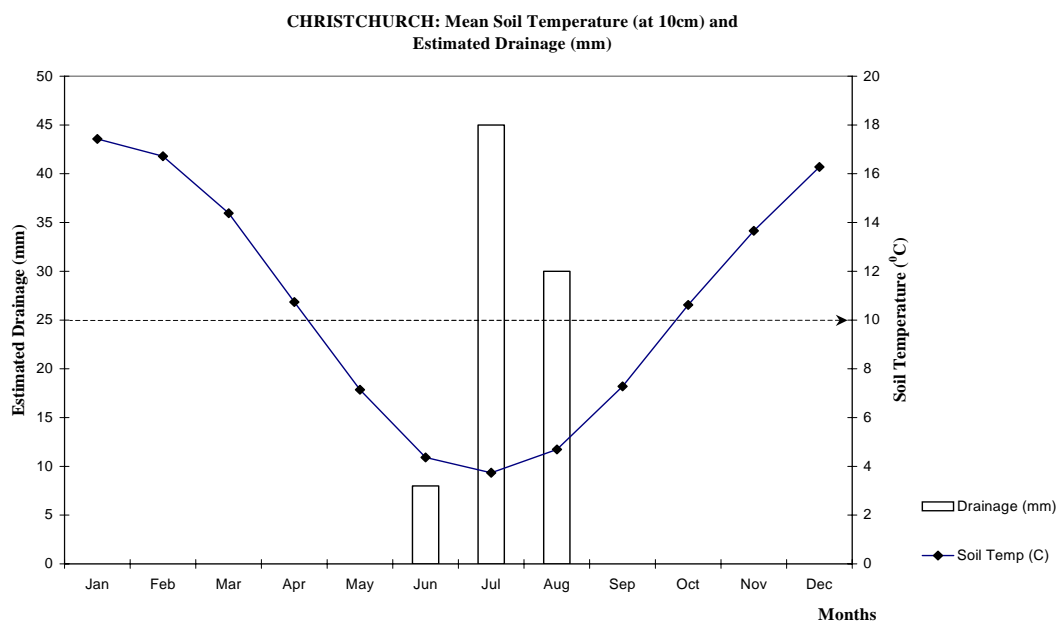
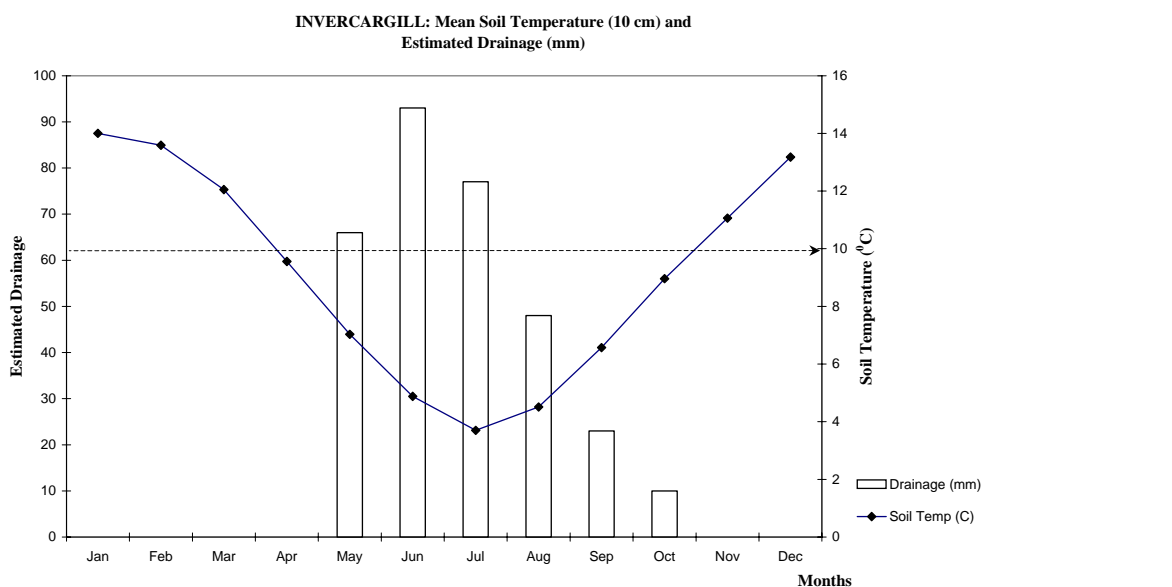
**Table 1. Half-life of *eco-n* in the soil at two soil temperatures**

Treatments	Half-life (days)	% remaining after 25 days
Temperature of 8 °C	111	84 %
Temperature of 20 °C	25	50 %

The results in Table 1 show that at a soil temperature of 8°C the ‘half-life’ of *eco-n* was 111 days. (The ‘half-life’ of a substance is the time taken for the concentration of that substance to be reduced by half.) Thus a half-life of 111 days means that there will still be half the original concentration of *eco-n* remaining in the soil after this 3.5-month period. The rate that *eco-n* is decomposed in the soil is influenced by soil temperature and at a soil temperature of 20°C the half-life of *eco-n* was found to be 25 days. At 8°C the percentage of the applied *eco-n* remaining in the soil after 25days is 84% and at 20°C the percentage remaining is 50%.

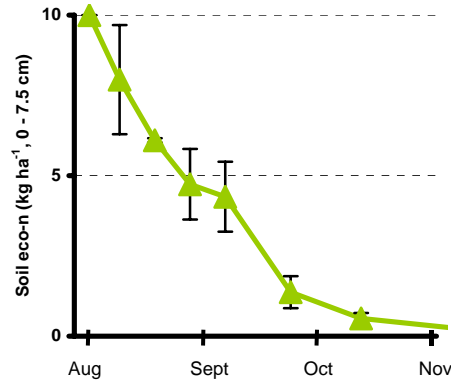
In Southland, coastal Otago and Canterbury, nitrate leaching mostly occurs during the main drainage period of the year (approximately June to September) when the soil temperatures are generally below 10°C ( see Figure 4 ). During these winter months the *eco-n* is therefore likely to remain effective during this critical time of the year. The effectiveness of *eco-n* following a May application will be approximately 3 to 4 months (i.e. covering the critical drainage period from

May to August). A subsequent application of *eco-n* in August will normally be effective for about another 2 months and will reduce leaching losses during the spring.



**Figure 4.** Long-term average mean monthly soil temperatures and estimated drainage in Southland and Canterbury (NB. actual drainage amounts will vary depending on soil type).

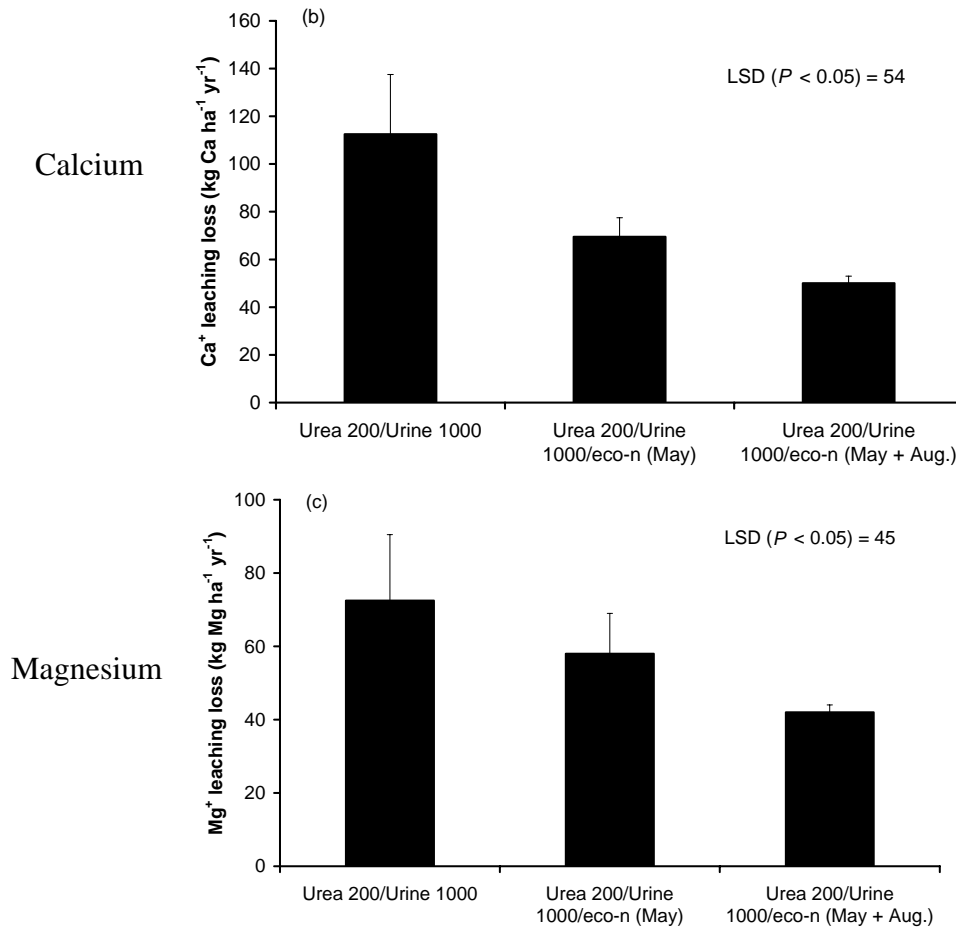
Measurements of the concentration of *eco-n* in field trial plots on the Lincoln University Dairy Farm have confirmed that 2 months after application in August the *eco-n* was still present at significant concentrations in the top 7.5 cm soil (Figure 5).



**Figure 5.** Soil *eco-n* concentrations following *eco-n* application in August.

### Eco-n reduces leaching losses of potassium, calcium and magnesium

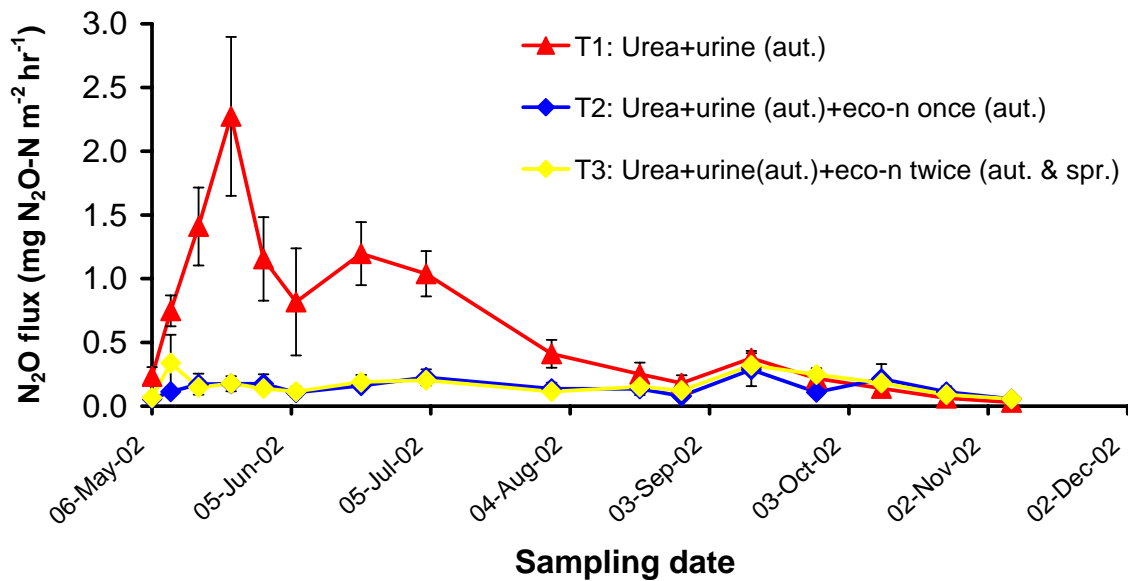
Because nitrate leaching is usually accompanied by calcium, potassium and magnesium ions (i.e. ions with an opposite electrical charge), the leaching of these nutrients has also been found to be reduced by applying *eco-n* (Di & Cameron 2004b: Figure 6)



**Figure 6.** Effectiveness of *eco-n* application in reducing the leaching loss of calcium and magnesium from Templeton soil lysimeters (Di and Cameron, 2004b).

## Eco-n also reduces greenhouse gas emissions

The use of *eco-n* has also been shown to reduce nitrous oxide (N<sub>2</sub>O) emissions by 75% (Figure 7). This is important because nitrous oxide is a powerful greenhouse gas and its emission from grazed pasture soil represents about 33% of all greenhouse gases emitted from NZ agriculture. The availability of *eco-n* technology to reduce this greenhouse gas emission provides NZ farmers with a new tool to reduce NZ greenhouse gas emissions, as required by the Kyoto protocol. This farmer-funded research breakthrough was of considerable significance during the recent debate about the scrapping of the so-called ‘flatulence tax’ and will continue to be of increasing importance in future years.

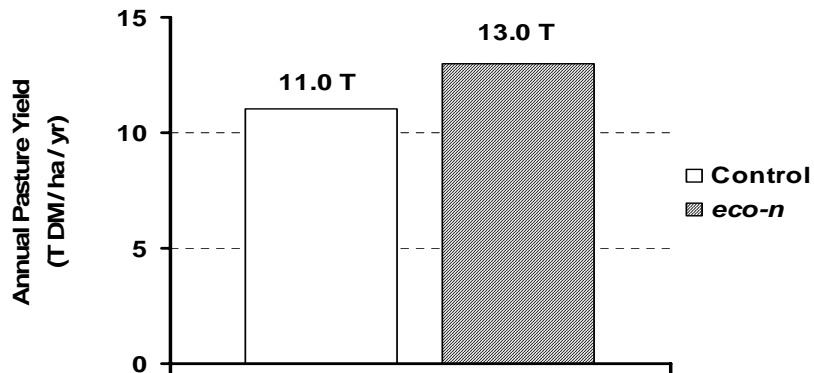


**Figure 7.** The effect of *eco-n* on nitrous oxide emissions from urine patches (Di and Cameron 2003).

## How many applications are needed to get a significant pasture response?

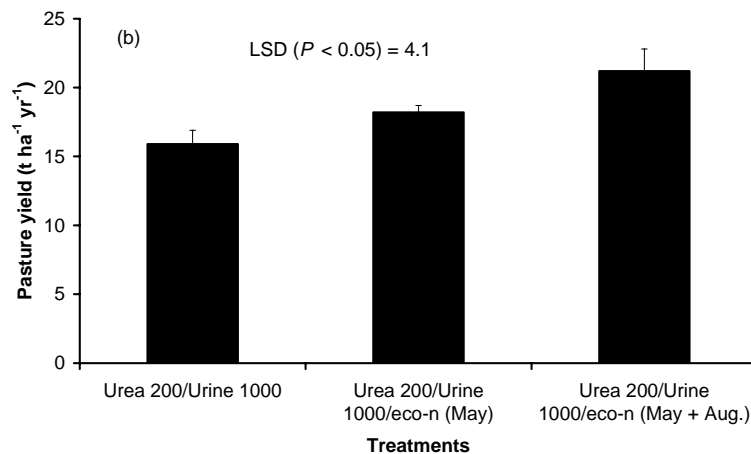
Pasture yield increases occur because of the reduction in N losses meaning that more nitrogen remains in the soil for the plant to use. There is some variability in the pasture yield data, in a similar way to the variable responses to nitrogen fertilisers, but whole paddock measurements under dairy grazing e.g., on a poorly drained Temuka soil (Figure 8) suggest annual production lifts of 10% to 15% are likely to occur. Increased pasture production is being achieved between urine patches as well as from within the urine patches.

**Pasture Yield: Lincoln University Dairy Farm  
May 2002 - May 2003**



**Figure 8.** Increase in pasture production due to *eco-n* application under dairy grazing on a Temuka soil.

Our lysimeter research results have also shown that significant pasture yield increases can be achieved by two applications of *eco-n*, one in May followed by a second application in August (Di and Cameron 2004b; Figure 9). Figure 9 shows that the total annual pasture yield with *eco-n* applied in May and again in August resulted in 21.1 t/ha/y compared with the yield on the control lysimeters of 15.9 t/ha/y. This represents a yield increase of over 30% under the carefully managed lysimeter conditions.



**Figure 9.** Total annual pasture yield on large Templeton lysimeters (Di and Cameron, 2004b).

### Cost effectiveness of *eco-n*

The applied cost of *eco-n* in 2004 is \$63.00 per hectare. This is required twice a year as discussed, so the annual applied cost is \$126.00/ha/year (GST exclusive). Valuing environmental gains is difficult but dairy farmers can more easily relate to the value of feed grown, as discussed by Christie (2004) and Christie and Roberts (2004).

The research work indicates increases in annual paddock pasture production from the use of *eco-n* of around 15%. Because of some inherent variability in measuring pasture production, a conservative figure of 10% may be safer to use. If we assume a base annual pasture production of 13,000 kg DM, 10% provides an additional 1,300 kg DM and 15% is 1,950 kg DM.

Extra feed grown in the paddock is the most economic to harvest and convert to milk. Alternatives to obtaining this extra feed include applying nitrogen fertilisers or purchasing feed. At normal N responses, urea costs are similar to purchasing feed at around 10 cents/kg DM. This provides us with one basis of comparison.

Another basis of comparison is the value of extra feed when converted to milksolids. This will vary between farms depending on what factors are limiting per cow production and the profile of variable costs. However, at 80% pasture utilisation and a conversion ratio of 15 kg DM to 1 kg MS, this equates to around 19 cents of additional value per kg DM.

Table 2 summarises the additional returns per hectare and the return on the *eco-n* investment based on 10% and 15% extra pasture growth scenarios.

**Table 2.** Net benefits and returns for using *eco-n* on dairy farms.

<b>Return on <i>eco-n</i> expenditure</b>				
<b>No Cation Credit</b>				
Assumes 13,000 kg DM/ha/yr before <i>eco-n</i>				
	<b>Feed Value</b>		<b>Milk Value</b>	
	\$0.10	/kg DM	\$3.50	/kg MS
<b>Net benefit per hectare +15% grass</b>	<b>\$69.00</b>		<b>\$238.00</b>	
<b>Net benefit per hectare +10% grass</b>	<b>\$4.00</b>		<b>\$116.67</b>	
<b>Return on <i>eco-n</i> expenditure +15% grass</b>	<b>54.8%</b>		<b>188.9%</b>	
<b>Return on <i>eco-n</i> expenditure +10% grass</b>	<b>3.2%</b>		<b>92.6%</b>	

The sensitivity to increased grass production achieved by *eco-n* (due to the better retention of nitrate-N) can be seen in the different financial outcome for 10% and 15% pasture production increases. At 13,000 kg DM base production, achieving a 10% lift is comparable with using N fertiliser or purchasing feed at 10 cents per kg DM. If either the pre-treatment production is higher than 13,000 kg DM, or the extra yield is above 10%, then *eco-n* has significant advantages over purchasing extra feed. When the farm maximises the conversion of additional feed to milksolids, both the return per hectare and on the application investment are excellent, even with 10% extra grass growth.

In addition to the less financially quantifiable environmental benefits achieved when using *eco-n*, farmers should also consider the saving that will occur due to the reduced loss of cations. Potassium, calcium and magnesium losses will vary due to soil type, but on the lighter soils

where potassium losses are high, additional gains of \$20/ha/yr or more can be expected over time from the reduced demand for the replacement of leached potassium, magnesium and calcium.

Dairy farmers who produce around 13,000–15,000 kg DM hectare a year and apply *eco-n* can expect increased pasture production. Higher N users (at around 200 kg/ha) and who produce very high pasture yields such as 18,000 kg DM hectare a year should be able to apply *eco-n*, reduce their N inputs, and still have similar levels of pasture production.

### **When should *eco-n* be applied?**

*Eco-n* should be applied to recently grazed (short) pasture where it can more quickly get into the soil, and receive 10 mm of rainfall or irrigation soon after application to wash it into the soil. Treat in a similar manner to fertiliser by not applying while stock is in the paddock and allowing it to be washed in before regrazing. It is unlikely to have any effect on animals if grazed after application, but its effectiveness will be reduced if it does not reach the soil.

Application in spray form is necessary because it is vital to ensure even coverage of the whole grazed pasture soil area. A suspension is used as the most practical way to apply *eco-n*. Timing is very important. The April/May application covers the high-risk leaching period over winter, while the August/September dressing ensures coverage through spring. The product is not persistent over long periods and three to four months of protection per application is achieved.

Ravensdown will closely manage the application of *eco-n* through the use of approved spray applicators that can provide proof of placement. This will mean that the product is sold on a per hectare applied cost basis. Taking this approach allows Ravensdown to ensure that the new product is applied appropriately (at the right rate and time) and on farm types where it will be economically effective. The accurate recording of where all product is applied also allows further studies on a regional and national basis in relation to the environmental benefits, particularly for greenhouse gas inventories.

### **Acknowledgements**

We would like to thank Ravensdown Fertiliser Co-operative and Lincoln University for funding this research project. We would also like to thank Richard Christie and Ron Pellow of Ravensdown for their valuable contributions to the research project and Jim Moir, Trevor Hendry, Steve Moore and Nigel Beale of Lincoln University for all their hard work.

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## **Did Soil Conservation Practices Work In The Manawatu 2004 Storm Event**

**Kevin Rooke**

The success or not of soil conservation works in the Manawatu Catchment on land stability as a result of the February 04 storm event.

I wish to comment specifically on the Oroua River and Pohangina River catchments both are larger sub- catchments of the Manawatu River. [ 856 sq km ].

Both of these catchments are within my work area, and I live in the Pohangina catchment.

Both these rivers rise out of the Ruahine Ranges and side-by-side their catchments flank the western side of the ranges traveling south, the Pohangina Rivers confluence with the Manawatu River is at the western end of the Manawatu Gorge while the Oroua joins the Manawatu River at Opiki.

Major sub-catchments of the Oroua River are the Kiwitea and Makino streams. These two streams caused major flooding and damage in Fielding.

The upper catchments of the Oroua and Pohangina rivers in the Ruahine Ranges received up to 260mm of rain for the 24 hrs 15/16 Febuary, and the hill country of both catchments had up to 150mm of rain.

By 1906 a considerable portion of both of these catchments had been cleared of their indigenous forest cover in preparation for farming.

Herein commences the present day problems.

Before we can evaluate the effect of the storm on the hill country soil conservation works in these two catchments, we first need to go back a few years to gain an appreciation of the erosion problems and the measures applied to fix them, by the then soil and water authority responsible the Manawatu Catchment Board.

The Manawatu Catchment Board was the first Catchment Board in NZ, constituted in 1943 and remained so until the local body reorganization in 1989.

They appreciated that the majority of the Manawatu hill country required soil conservation plantings, but the two major problems where -----

1. 13,000 Ha of unconsolidated sands in the Oroua / Pohangina catchments.  
[ Pohangina Unconsolidated Sandstone ] located on very steep hill country.  
This results in extensive slip and gully erosion and canyon gullying during major storm events.
2. Ruahine Ranges, shingle loading contributing to bed aggregation of the Pohangina and Oroua rivers. This reduces channel capacity and increases lateral erosion. This may have aggravated circumstances resulting in the loss or damage to many bridges across these two rivers.

Both of these problems are natural processes aggravated by the modification of the natural vegetative cover.

Clearance of indigenous forest off the hill country in preparation for farming and the introduction of noxious animals to the bush covered ranges, deer and possums.

The Manawatu Catchment Board embarked on soil conservation programmes to deal with these problems, and this is continued by the Horizons Regional Council.

To control the hill country erosion in the Oroua / Pohangina catchments the following works were commenced ---

- Open planting with poplars
- Gully planting with willows
- Fencing of canyon gullying & erosion control.
  - Eg Goulters Gully
- Land retirement.

That is a brief history of soil conservation in the Oroua / Pohangina catchments, now to discuss what effect did the February 04 storm event have on these works.

On the weekend of the 14/15 February we had the extreme rain event and soil conservation plantings proved they needed to be older than say 6 years to really contribute to slope and gully stability.

And as the tree density increased so the erosion decreased, open planted poplars as compared with complete afforestation.

Flooding also resulted in silt deposition in the gully floors and on the river flats, and damage to farm buildings and fences.

The following weekend 21/22 February came the gale force winds that did their best on trees standing in a sodden landscape.

This resulted in older trees with a significant 'sail' area and in full leaf on exposed sites suffered extensive damage and woodlots were opened up and open planted trees were uprooted or damaged. This has often meant that early milling of the remainder of the block has to be carried out.

On August 17 the Pohangina / Oroua Catchments again suffered from heavy rain, this time it was not wind that compounded the damage but a very heavy snowfall. This resulted in a further 3 bridges being put out service by flood damage, further road closures by slipping, and on farmland more erosion and silt deposition. As a result of the heavy snowfall widespread damage occurred in bush blocks and conservation plantings.

It is impossible to go through a storm event such as this without incurring severe damage to established conservation plantings. However it is apparent that ongoing maintenance during the life of the tree will produce plantings better able to withstand the ravages of nature. This includes form pruning, silviculture, pollarding and even revisiting historic plantings to see if it is still the appropriate tree species to have on the site.

eg pines in sandgullys. And what do we do with our old man poplars and willows that are long past their use by date??

We must be careful when assessing success or failure in an extreme event as we had. I do not believe that you can protect yourself 100% for events such as we had. But I think land use needs to be looked at again as it always seems to be after a major storm.

Unfortunately it often means nothing happens, on the large tract of unconsolidated sandstone in the Oroua / Pohangina catchments, it is obvious that forestry is the appropriate land use and this is clearly demonstrated by the forestry already established.

There is of course the option of allowing this land to revert to its natural cover. Given half a chance nature is a great healer which is just as well considering some of the historic land use choices made. Excluding grazing stock from these areas and putting in place a robust animal pest control programme, reversion will take place very rapidly.

What historical has happened on this class of land after severe storms, slips are over sown, fences put up and tracks cleared and then it is business as usual until the next big storm.

Often as the case this year these recovery works are done with the aid of Government monetary assistance. When really assistance money from central government should be directed at assisting affected farmers on to land that can be sustainable farmed.

This has to be a central government initiative because of the cost and the fact that historic land development subsidies offered by past governments compounded the present situation.

We know what the problem is and most thinking landholders know what the problem is. Every major storm that comes along reminds us that we still farm unstable, unsustainable hill country and what is needed is clear policy direction from central government and a financial lead to carry out that policy.

## Landuse impacts on water quality within four intensively farmed catchments

Ross Monaghan<sup>1</sup> & Bob Wilcock<sup>2</sup>

<sup>1</sup>AgResearch, Invermay, Private Bag 50034, Mosgiel

<sup>2</sup>NIWA, PO Box 11-115, Hamilton

### Introduction

Commenced in 2001, the Best Practice Dairying Catchments for Sustainable Growth Project has the aim of integrating environmentally sustainable practices into dairy farming, against the background of the industry's policy of increasing farm business productivity. Coupled with this expansion and intensification has been a growing concern about the impacts of intensive land use on soil and water quality. This concern has been most apparent in many South Island regions that have seen a rapid shift from relatively low intensity dry-stock farming to higher intensity dairying. The initial phases of the project have focused on characterizing the physical resources and farming systems within each of the four catchments. The catchments are Toenepe Stream (Waikato), Waiokura Stream (Taranaki), Waikakahi Stream (Canterbury) and Bog Burn (Southland) (Figure 1). The broader goals of this project are (i) to identify key local environmental and productivity issues surrounding landuse within the catchments, (ii) where necessary, identify and develop improved practice to address these key issues, and (iii) encourage the adoption of these practices. This paper documents progress on the first two of these objectives.

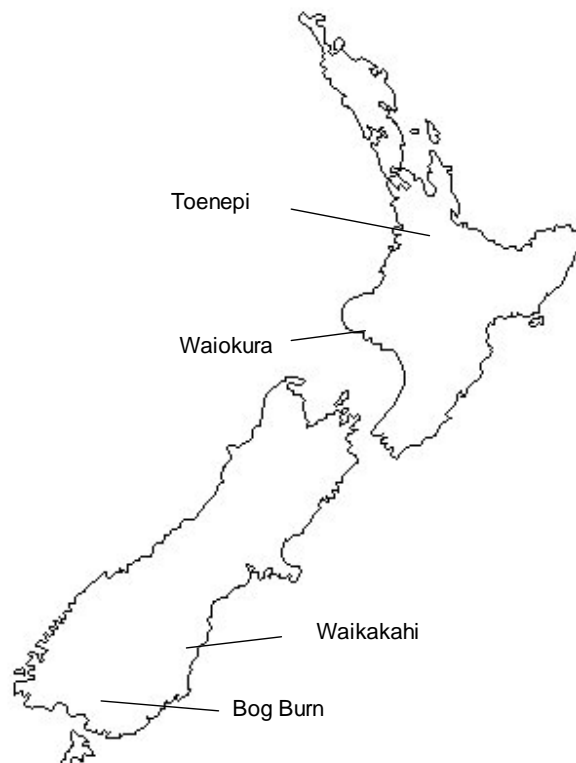


Figure 1. Catchment locations

### Water quality of streams

Monthly stream monitoring over the past 3 years shows that water quality in all of these intensively farmed catchments can be generally described as poor, with concentrations of nutrients (N and P; Figure 2), sediment and faecal bacteria regularly exceeding recommended guidelines for surface waters.

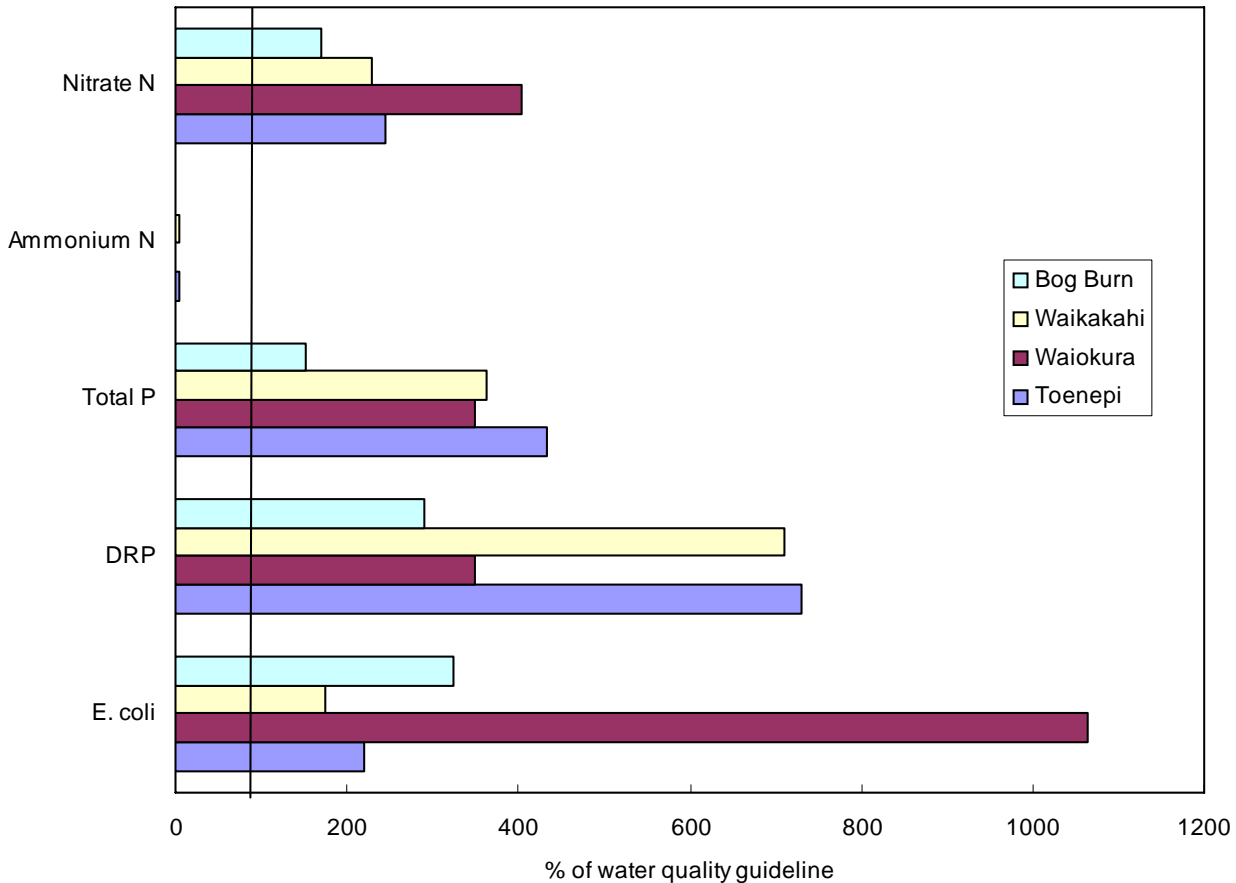


Figure 2. Median values for stream water quality, expressed as a proportion of ANZECC and MfE guidelines

Particularly high levels of *Escherichia coli* (*E.coli*) are observed in the Waiokura catchment, for reasons that are not yet fully clear. Notably high levels of dissolved P (DRP) are also observed in the Toenepi and Waikakahi catchments, the latter a catchment where considerable amounts of border dyke irrigation wash has been observed to contribute significant amounts of water, nutrients and faecal bacteria to summer stream flows (Carey et al. 2004). Whilst it is probably unrealistic to expect “infertile waters” to flow from fertile and highly productive land – and it is important to note that the recommended guideline values used in Figure 2 represent conditions that might “trigger” an adverse response in New Zealand lowland streams - there is clearly a need and desire to ensure that farm leakages of the above stream contaminants are kept to a minimum.

### **Key sources of contaminants**

Field measurements, farm management surveys and farm systems modeling have identified some land management practices that appear to be key sources of many of these pollutants. These sources include subsurface drainage systems, including the preferential flow of irrigated effluent through these soils, border dyke wash, effluent ponds and the practice of intensively wintering cows on forage crops.

The latter practice is one of relevance to the two South Island catchments where cows are sent off the milking platform for 9 – 10 weeks during winter to allow pasture covers to increase, thus also avoiding soil and pasture treading damage during this wetter time of the year. Unfortunately, on the grazed forage crop where the cows are wintered, this practice has the inevitable consequence of making large amounts of mineral N available for leaching due to

- (i) the accumulation of relatively large amounts of soil mineral N following cultivation of the pasture and forage crop establishment, and
- (ii) the deposition of large quantities of N in animal urine onto bare soil.

An alternative to this wintering system that is receiving increasingly close attention by farmers in the south is to consider wintering the dairy herd on a covered feedpad. If correctly designed, these systems appear to be a cost-effective alternative whereby excretal-N can be retained within the dairy farm system during wet winter and spring months and then returned to soil/pasture when conditions are more favourable.

An additional BMP that has been recently developed to minimize N leaching losses from dairy farms is the use of a nitrification inhibitor (see Cameron & Di, these proceedings). Projected N leaching losses from dairy farm systems within the Bog Burn catchment are shown in Figure 3, and include the projected losses assuming the “Average” model dairy farm adopts the use of these 2 BMPs.

It is evident that these BMPs both

- (i) significantly reduce N leaching losses, and
- (ii) are reasonably cost effective, as defined by Earnings Before Interest & Tax (EBIT) values.

Depending on whether these BMPs were applied individually or in tandem to all dairy farms within the Bog Burn catchment, at a catchment scale these BMPs are projected to reduce N leaching losses from farmland by between 15 – 65%

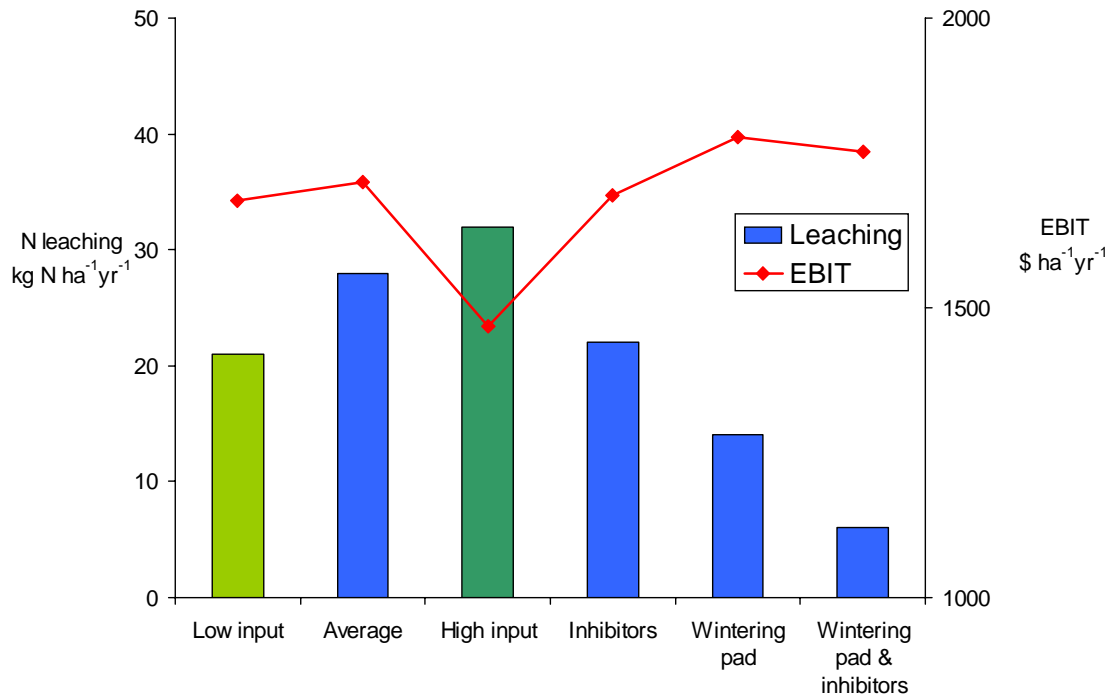


Figure 3. Projected nitrogen leaching losses from model dairy farm systems within the Bog Burn catchment. Loss estimates for improved Inhibitor and Wintering Pad BMPs based upon “Average” farm system. Right-hand y axis shows Earnings Before Interest & Tax (EBIT) values.

Developing cost-effective BMPs for achieving reductions in dairy farm P and faecal bacteria losses remains a considerable challenge, however. For the heavy, mole-tile drained Pukemutu soils within the Bog Burn catchment, overland flow, background (i.e. rain-induced) mole-tile drainage and direct drainage of effluent through the mole-tile network are processes that are estimated to currently contribute approx. 38, 29 and 33% of dairy farm P losses, respectively.

The introduction of improved effluent pond storage and/or treatment facilities, particularly during wet spring periods, is likely to eliminate the latter source of P (and faecal bacteria).

Increasing effluent irrigator groundspeed or the use of low-rate effluent application systems such as K-line is also projected to much reduce losses of effluent P in drainage and overland flow.

However, even with these BMPs in place, P losses from dairy farms on these soils, and from the catchment as a whole, are likely to remain relatively high due to the inputs from overland flow and background mole-tile drainage (Figure 4).

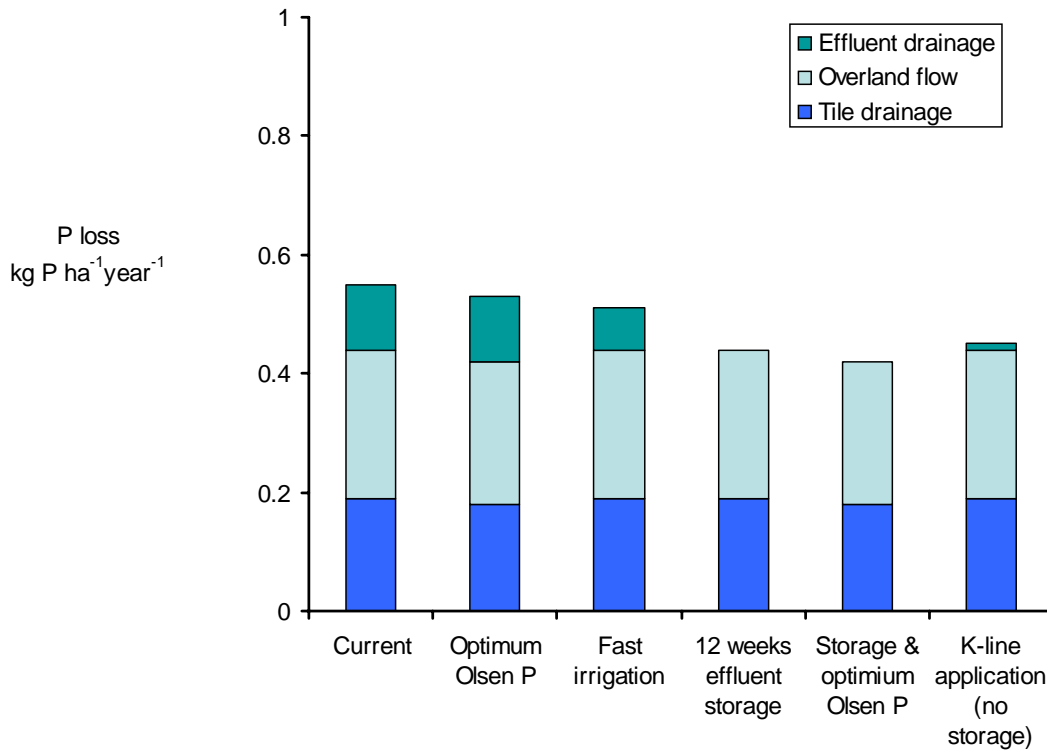


Figure 4. Modelled phosphorus (P) losses from farmland within the Bog Burn catchment under a range of BMP scenarios targeted at dairy farms only.

Monitoring of water, nutrient (P and ammonium-N) and faecal bacteria losses in border dyke wash from the Temuka and Eyre soils within the Waikakahi catchment has identified that this land management practice has the potential to deliver large amounts of these contaminants to stream flow (Carey et al. 2004). Coupled with nutrient modeling analyses, this monitoring has also demonstrated that appropriate BMPs can greatly reduce the transfer of these contaminants.

Some of these BMPs include:

- Bunding of border ends to prevent excessive flow of border dyke wash water, particular for those borders located in near-stream areas.
- Ensuring clock timers are correctly set so as to avoid applying excessive amounts of irrigation water.
- Maintaining irrigation races to ensure system performance is maintained.
- Adherence to Best Practice for the application of maintenance P fertilizer. This includes consideration of the timing (relative to irrigation events) and/or form (dissolved versus less soluble forms of P fertilizer) of P application

An important aspect of the research being carried out within the Best Practice Dairy Catchments project is the recognition that “one size doesn’t necessarily fit all” with respect to the adoption of appropriate BMPs which seek to minimize contaminant losses from soil to water. There are 2 main reasons for this. Firstly, there is a wide range in the physical features that make up a “typical” New Zealand dairy farm. This includes the natural resources of the farm, such as soil-

climate-topography-drainage combinations, and the infrastructure available for the day-to-day management of the dairy system. Secondly, there is growing recognition that water quality targets (and thus required BMPs) may vary from catchment to catchment depending upon the sensitivity of the receiving waters and the expectations of the local community.

### **Summary**

There is increasing concern, expressed both locally and nationally, about the negative effects that intensive farming can have on the environment. Whilst research shows that dairy cows are never the sole contributor to any issue, and there is wide acknowledgement of the key economic and social benefits of the industry, there is also recognition that certain landuse practices on dairy farms can result in degraded water quality.

Research indicates that the adoption of targeted Best Management Practices can deliver significant improvements in the environmental performance of New Zealand's dairy farms, particularly with respect to reducing farm emissions of N. Significant reductions in farm losses of P and faecal bacteria are also achievable through improved management of border dyke irrigation systems within the Waikakahi catchment.

The challenge remains to identify cost-effective land management practices that can reduce P and faecal bacteria losses from farms on heavy soils with artificial drainage systems.

### **Acknowledgements**

Numerous staff from various agencies have contributed to the research being undertaken within this project, including AgResearch, NIWA, Dexcel, Fonterra, Environment Waikato, Taranaki Regional Council, Environment Canterbury and Environment Southland.

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## **Impacts of deer farming on soil and water ~ research directions.**

**Marion Johnson and Richard McDowell  
Deer Systems,  
Invermay Agricultural Research Centre  
PB 50034,  
Mosgiel**

[marion.johnson@agresearch.co.nz](mailto:marion.johnson@agresearch.co.nz)

One of the main environmental issues associated with deer farming is its impact on soil and water quality. This, in reality, is an issue for the agricultural industry as a whole but deer bring their own set of problems, primarily because they are generally farmed to suit a sheep model rather than being managed to compliment the characteristics of a unique animal.

The response of deer held in open, high fenced paddocks to any form of stress, be it nutritional, climatic, reproductive or simply fright, is to pace that enclosing fence line. Continual pacing wears away the pasture and breaks down the soil structure leading to problems of compaction and erosion. Once soils have been compacted their porosity is reduced and thus their ability to soak up water. Nutrients are therefore more likely to be washed off paddocks and into waterways after rainfall events. Compacted soils are also less aerated with an ensuing negative effect on pasture growth. A further consequence of compaction and poor drainage is that poorly drained soils generally emit more nitrous oxide (N<sub>2</sub>O), an important greenhouse gas, than free-draining soil. Therefore fence pacing, in addition to creating problems with erosion, compaction and sediment deposition, may contribute to increased emissions of N<sub>2</sub>O.

Deer can also impact negatively on soil structure through play and camping activities. They like to pick an area of the paddock to rest up in a group, in a large paddock they may split into several mobs. Ideally they will choose a sheltered area with a clear view of the surrounds free from outside disturbances. In small paddocks with no shelter, shade or cover they will be concentrated in one place, often near the gate or they will simply pace. When they are concentrated in one area the soil becomes compacted and large depositions of faeces occur.

Young stock love to play, particularly on bare ground or on areas where it is easy to dig, so damage can occur on slopes or banks, or on paddocks with little grass cover.

Red deer love water; they wallow and play to the detriment of waterways, paddocks or troughs. Wallowing can lead to the disruption of soil structure and it can damage the integrity of stream margins with the subsequent risks of sediment losses and contamination. Deer will wallow in hot or cold weather; if there is no surface water available they will often dig in damp spots and create wallows. If all appealing wallowing sites have been removed they will happily jump in the troughs or dig up damp areas surrounding them. Wallowing is a natural behaviour in deer and may be important for both animal health and social interaction. As such wallowing should be accepted as contributing to the animals' well-being and provision should be made for safe wallowing sites.

The nutrients most likely to affect water quality are phosphorous and nitrogen. Phosphorous is largely transferred through movements of sediment. Nitrate-nitrogen contamination of waterways is most likely to occur through leaching but water quality can also be negatively affected through direct faecal contamination when animals have access to the waterways, or when there is nutrient run off.

Although it is relatively easy to postulate some solutions and to rethink the way deer might be farmed, there is a cost and it is the farmer who has to bear that cost. When contemplating solutions and research directions the expense to the farmer must be borne in mind and, if possible, solutions designed that have multiple benefits and even recoup some costs. Most deer farmers are pro- active and have evolved their own management strategies to try and counter perceived problems. Suggestions to alleviate fence pacing include shifting deer regularly and keeping them well fed, keeping stock densities reasonable, not mixing groups of animals, visual barriers between mobs of animals, altering fence lines, riparian fencing, electric fencing and the provision of shade and shelter. Many farmers contributed their ideas suggestions and solutions to the recently published New Zealand Deer Farmers Landcare manual, the mission statement of which is that it should be

*“A practical landcare guide of best practice for deer farmers to assist in minimising or eliminating any adverse environmental effects of deer farming and to enhance the long term sustainability of the deer farming industry.”*

The manual provides a wealth of sensible suggestions which work in individual situations and may well be applicable to the larger industry. However, there is very little experimental evidence concerning the impacts of the current deer farming model on the environment. without this we cannot truly evaluate the problem nor propose sound industry wide solutions.

Frequently, responses to suggestions of environmental mitigation procedures meet with the response that ‘financially it’s not viable’. But altering management to accommodate cervine behaviour will have many benefits way beyond the environment. Animals that pace are stressed, their production is lower, they are simply walking their weight away. Mobs of hinds that are pacing because they have no cover to calve or have lost their calves through the wire will not be achieving their reproductive potential. Animals that are weaned and wandering will not be growing. Pacing animals are likely to be more vulnerable to parasites and disease. Strategies for managing the quirks imposed on the system by inherent deer behaviour may in actual fact benefit the farm account in many ways. For example, lower health costs, alternative feeds, lower fertiliser bills or income from tree crops planted to create barriers.

The resume of the impacts of deer farming operations on soil and water quality given above immediately suggests several avenues for research. It is essential to find methods of alleviating fence pacing with its destruction of soil structure and consequent effects on water quality. It is also essential to find effective, practical methods of protecting vulnerable waterways.

The deer industry is extremely concerned about sustainability and the impact deer may have on the environment. Deer Industry New Zealand has demonstrated this concern by supporting the Landcare manual and commissioning a report on deer and the environment (de Klein et al 2002).

They have now funded, through DEEResearch Ltd., several projects which begin to address the problems of deer, soil and water and to look at alternative methods of management.

Last year the Sustainable Deer Systems Group at AgResearch Invermay embarked upon a research programme addressing the issue of the impact of deer farming on soil and water quality. In the first experiment soils were sampled from paced and non paced areas in a paddock in which hinds had been grazed at a stocking rate of 25/ha. Soil in paced areas exhibited lowered macroporosity, bulk density and saturated hydraulic conductivity. Under simulated rainfall conditions the flow collected from the paced soils exhibited higher levels of suspended sediments, higher concentrations of total phosphorous ( mainly as particulate phosphorous ), higher levels of nitrate-nitrogen and higher levels of *E. coli* than non paced soils. In the second experiment water samples were taken on a fortnightly basis from 3 catchments on the Invermay Deer farm and two samples were taken from ephemeral waterways after storm events. Although at times levels of nutrients exceeded guidelines in some catchments and in the ephemeral waterways after a storm event, levels were not consistently higher than guidelines and nor did they generally exceed the mean load noted for a range of catchments in pasture in New Zealand. Full details of these experiments are given in McDowell and Paton (2004).

This year a series of projects on wallowing, methods of repairing damaged areas and of creating 'safe' wallows has begun. A study has also begun on shelter and shade systems for deer that will discourage fence pacing, provide visual barriers, improve animal well being and also avoid the soil damage that is sometimes observed when a large number of animals camp in a small amount of shelter.

One solution often postulated when it comes to water quality is too simply fence out every river, creek and ephemeral waterway. On a deer farm with fencing costing around \$12.00 a metre this is just not possible. It is hoped that through detailed catchment studies beginning this year it will be possible to identify critical hot spots on the farm which are likely to contribute the greatest threat to sustainable practices. If these spots can be successfully managed first, then overall environmental quality should improve and mitigation measures such as riparian fencing can proceed more steadily.

If more nutrients are coming onto the land than are being taken off there is a more than a fair chance that the excess are being lost to the environment. AgResearch has developed OVERSEER<sup>®</sup> a software package that calculates nutrient budgets for nitrogen, phosphorus, potassium and sulphur in New Zealand farming systems, so that inputs can be balanced with outputs. The package provides average estimates of the fate of N, P, K and S in kg/ha/yr ignoring year to year variability due to climate and other factors but the model uses equations derived from information pertaining to sheep, beef and dairy farms as there is a dearth of information on nutrient cycling in deer farms. Data from the catchment studies will be used to update OVERSEER<sup>®</sup> so that it can be used effectively on farms running deer.

Although deer farming, as it is currently practised by some farmers, can create environmental problems the industry has the potential to help solve problems experienced by the agriculture as a whole. All stock benefit from shade and shelter, all stock have the potential to pollute waterways, an excess of nutrients leaving the farm is not the preserve of the deer industry alone. In addition

deer have an important role to play in the development of the integrated management systems which will enhance the sustainability of agriculture as a whole.

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The New Zealand Deer Farmers' Landcare manual can be obtained from NZ Deer Farmers Association, P.O.Box 10-702, Wellington.

## **The Dairy Accord – Progress and Ongoing Initiatives**

**Shane Lodge  
Fonterra, Auckland**

The environmental issues facing Fonterra and its suppliers are no different to those facing most other agricultural industries. As one of the more intensive land use the impact of a dairy farm is seen as being greater than that of a similar sized sheep, beef or mixed unit. Negative publicity within New Zealand raises public awareness of the effects of some dairy farms on the environment. Increasingly overseas markets continue to question the effects of our dairying system on the environment.

Internationally there is a growing awareness among food industries, who rely on agricultural materials for this business, that to be successful and continue to be able to perform well they also need to be sustainable. This awareness is driving the development of programmes such as the Sustainable Agriculture Initiative Platform to promote sustainable agriculture.

The effect of dairy farming on water quality (surface and ground water) has received most publicity and research effort. Farm dairy effluent management, nutrient management, stock access to waterways and riparian management have been highlighted. Human waste to pasture, processing waste tile drainage and dairying in sensitive areas are also issues that have been raised. In all these areas its essential that practical solutions are found that work under dairy farming systems.

Fonterra's actions in the on farm environment area are aimed at helping our suppliers reduce their impact on the environment, improve environmental and economic sustainability but also to enable us to highlight the successes.

### **The Dairying and Clean Streams Accord**

The Dairying and Clean Streams Accord was agreed between the Ministry for the Environment, Ministry of Agriculture, Regional Councils and Fonterra in May 2003. The aim is to improve water quality in dairying areas and focuses on 5 priority areas:

- Dairy cattle exclusion from streams, rivers lakes and their banks
- Bridges or culverts on all regular race crossing of watercourses
- Appropriate treatment and discharge of farm dairy effluent
- Effective management of nutrients to minimize losses to ground and surface waters.
- Fencing or existing regionally significant or important wetlands (as defined by regional councils

The Accord also contained targets for each of these areas of interest:

- Dairy cattle excluded from 50% of streams, rivers and lakes by 2007, 90% by 2012
- 50% of regular crossing points have bridges or culverts by 2007, 90% by 2012.
- 100% of farm dairy effluent discharges to comply with resource consents and regional plans immediately.

- 100% of dairy farms to have in place systems to manage nutrient inputs and outputs by 2007.
- 50% of regionally significant wetlands to be fenced by 2005, 90% by 2007.

Throughout the 2003-04 dairying season Fonterra contracted two service providers to carry out, at the time of the annual farm assessment, a assessment against the industry's own Environment and Animal Welfare Policies: which include the Accord target areas. Some of the results are summarised here.

### **Stock Exclusion from Waterways**

On a national basis, the 2007 target has been achieved. Of the Fonterra supplier's farms that have stock access to waterways, 62% have excluded stock from their waterways

71% of Fonterra suppliers have waterways that meet the Accord definition: "Deeper than a red band gumboot and wider (ankle depth) than a stride", and permanently flowing all year round. 78% of farms with waterways estimated their length to be less than 5 km long.

Regionally there are significant differences in the percentage of farmers with 100% stock exclusion. In the lower North Island, 37% of suppliers have total exclusion while in the recently expanded dairying areas of the South Island 75% of all suppliers have total stock exclusion.

Only 11% of farms with streams have 100% access to all waterways on their farms. These require immediate action.

### **Stock Crossings:**

The target has been met nationally. There are 18,805 occurrences of stock races crossing waterways identified. 2087 of these crossings are not bridged or culverted. There are 435 unbridged or culverted crossings on 309 farms that are used more than twice weekly in rotation that require a bridge or culvert to be installed. Many of the 435 require significant expenditure on the crossing.

### **Effluent Disposal**

While the 100% target in this area is not met, 99.6% was reached with follow up with the remaining suppliers being undertaken. 0.4% of Fonterra suppliers did not have a consent when one was required. Fonterra is working with these suppliers so that they complied with council regulations before the start of the season.

Regional variation in the type of effluent system used reflects the local regional councils policies and guidelines. There are a higher proportion of land disposal systems in areas where land disposal is a permitted activity and with recent large conversions.

## Nutrient Management

Nationally, 17.6% of suppliers have a nutrient budget included in their fertiliser programme. This is an increase from a year ago when less than 1% of Fonterra farmers had nutrient budgets. This increase can be largely accredited to two factors: the fertiliser industry offering this service, the raised profile of Environmental Management post the signing of the Clean Streams Accord in May 2003.

The South Island has a higher percentage of farms with nutrient management systems in place. The Overseer nutrient management tool was the most commonly used system.

## Wetlands

In those regions where the Regional Council has identified Regionally Significant Wetlands, council staff confirm that the majority of Regionally Significant Wetlands are not in dairying areas. Where suppliers were able to identify a significant wetland 91% had fenced stock out.

**The Southern Approach:** Southland has 600 dairy farms that are larger than the New Zealand average for size and cow numbers. Even with the challenges of soil type and climate, Southland Dairy Farmers had better results than most other dairying areas for all Accord targets. This reflects the recent growth in dairying, type of dairy farm, and the work done by the dairy farmers and Environment Southland.

## Going forward

Fonterra will continue to work with the Dairy Industry Environment and Animal Welfare Policies.

Raising suppliers awareness and ensuring suppliers have access to the information they need continues to be a key activity. The recently launched EnviroDirect website developed by DEXCEL for farmers and their consultants will be maintained and updated as will the DEC Dairy effluent design and management manuals.

We will continue to promote the Market Focused Environmental Management System for New Zealand Dairy Farmers. This programme picks up the issues raised in the DIEAW policies and includes soil, pesticide and agrichemical management. The programme gets suppliers to identify where they don't meet industry objectives, identify what they can do under their situation to achieve these objectives. The programme has been included in the Best on Farm Practice quality manual for all suppliers. This has seen 12.3% of suppliers voluntarily join the programme last season. This programme is an ideal tool for suppliers to use to manage a range of other environmental issues including the management of tile-drained areas.

Fonterra will continue to work with its suppliers and others at a regional level through the successful Regional Action Teams and the Regional Action Plans. It is essential to reflect regional differences, problems, priorities and solutions. One solution doesn't fit all.

Fonterra is continuing its Environmental Assessment to measure uptake of best practice. The aim in the current year is to have improvement plans in place on supplier's farms to address issues identified at the assessment.

Management of farm dairy effluent (and feed pad effluent) and tile drained areas is a continuing issue and improved and/or innovative ways of managing this problem are being looked at.

Fonterra's suppliers, via Dairy Insight, continues to fund research and ongoing programmes in the on farm environment area with regular review of the outcomes of and the appropriateness of this research. The last such review was in 2003. The monitor catchments which study four catchments in Waikato, Taranaki, Canterbury and Southland are an example of research being carried out to identify regionally specific solutions that can be show cased to the local community. Results from these catchments show that implementing current best practice does have positive environmental benefits.

New suppliers to the cooperative in future years are require to include stock exclusion from waterways, fencing of wetlands and the building of bridges or culverts on all regular race crossings of waterways in their conversion process.

Fonterra has a number of environmental initiatives underway. We need supplier support to make these work. Our suppliers do recognise that there are issues, many have address them already or are working through implementation plans on their properties. We need to be able to meet the growing need for good practical advice.

To meet this need is the challenge to ensure that we have an environmentally and economically sustainable dairy industry.

## **“Growing for good” – comment**

**Alan Campbell**

The PCE’s report into intensive farming, sustainability and New Zealand’s environment has been eagerly anticipated for some long time now, and has finally emerged via a pair of launch events, one of which I was able to attend. My impression at the launch was that the presentation was a lot less hard-hitting than I’d expected, and frankly I was a bit disappointed, having expected a bit of old fashioned fire and brimstone preaching. Of course this would have achieved a major polarisation of officials, politicians and farmers, and not much else. The challenge is to find a way forward, and we have to do that together.

However the report itself is quite clear in its message that intensive farming is on a path that is leading to more and more environmental degradation, and many of the responses to these effects are only treating symptoms. The message is that a ‘fundamental redesign of farming practices and the systems that shape those practices is needed.’

This is a challenge that those of us who work with agriculture need to give very careful attention to. My own history involves nearly thirty years of what the report describes as ‘tinkering’ with treatments to reduce or mitigate the effects of intensive farming systems. And yet our streams are un-swimmable, our groundwater un-drinkable, our soils in a state of decline, and agriculture is dependant on non-renewable resources for its survival.

So what is meant by this fundamental redesign? It clearly goes beyond adjusting a few on-farm practices, and even beyond whole catchment management. It involves reshaping farming to provide a sustainable future in light of the way international markets operate for commodities and consumer products.

An important factor in all of this will be to keep a clear idea of what influence each of us can bring to bear on the discussion. Those of us in bureaucratic or advisory roles can influence farm practices by advice, incentives, or controls, and some can draft the policies that make that possible. But it is the farmers themselves who actually design and control those practices. And we are all constrained by factors such as legislative frameworks and market conditions both here and in overseas markets, and those who are in a position to influence or control those elements of the total farming system must take a lead in redesigning the future of farming.

The question now is whether the leaders of our major industries will continue on the current treadmill of price-taking commodity production that will lead to ever-reducing real returns for farmers, and ever increasing environmental effects as farmers are pushed to produce more and more from the same land. At some point it will become untenable, and either the regulators or the bankers will call a halt. It is likely that the regulators will be the first to react as the environmental effects are already past the point of social acceptability. So many of you will be in the front line of forcing the issue.

The opportunity is there for our farming leaders to take up the challenge and take control of the redesign of farming systems in a sustainable model. Hopefully they will take the message seriously and we will all work together to produce a better future for farming.

For NZARM members, it will be important to stay well informed of the larger picture of farming and be ready to play your role in contributing where you can influence the discussion. You can download a copy of the report at [www.pce.govt.nz](http://www.pce.govt.nz) or email for a copy to [report@pcce.govt.nz](mailto:report@pcce.govt.nz). It’s a good read with a huge amount of information in it that will act as a great reference document.

## **Forest Industry Workshop Days**

### **Joe Davenport**

In August 2002 the Southern area of the Gisborne District Council (GDC) and down to the Mahia Peninsular was hit by a localized cyclonic event which deposited in excess of 350mm of rain in a twenty four hour period on a fairly narrow (5km) but much longer band within the regions. It appears that a 'high intensity rain cell' extended from the inland hills of the southern GDC area into the headwaters of the Kopuawhara Stream, which flows into the Hawkes Bay Regional Council's (HBRC) area. Within the headwaters, and extending into GDC there are areas of forest that had been felled over the proceeding three years by two forestry companies.

The storm resulted in much forest debris being dislodged from slopes and from around some skid sites. It was eventually deposited onto the nearest alluvial flats that were being farmed. Not unnaturally there was an outcry from the farmers affected. A series of public meetings, where issues were raised and discussed, were held at the time involving the local communities, local councils, federated farmers and forestry companies. One of the forestry companies contributed a digger for some of the immediate culvert clearance that was required.

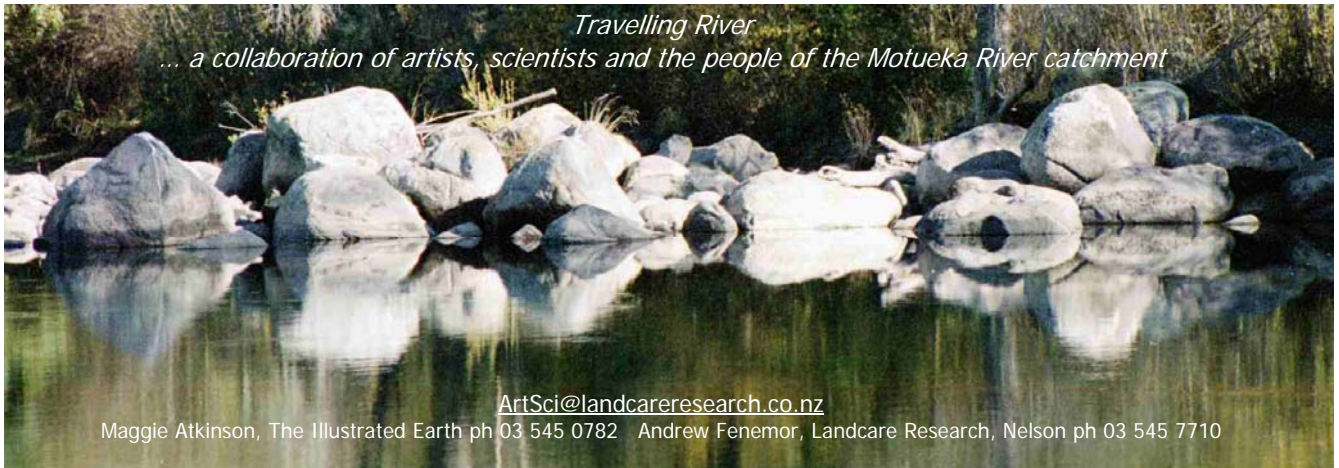
An aerial inspection by GDC and HBRC staff showed that much of the debris had originated within the forest boundaries. Mid-slope collapses, collapsing road and skid site benches and large growing *P.radiata* trees all contributed significant amounts of debris that caused the downstream problems. An onsite inspection with forest managers and engineers highlighted several areas of concern regarding the techniques that were being utilised for road and skid site construction.

As a result of this it was decided that the two councils would co-host an information day to reinforce some fairly basic – but very sound – engineering techniques used in forest road and skid site construction. The first such day was held in Wairoa and was attended by twenty eight forest company harvest planners, roading engineers, construction supervisors and contractors and their foremen. After a short session from both councils regarding the local rules and resource consent issues the remainder of the day was conducted by Don Robinson – an ex Forest Research Institute lecturer on forest roads. The day was held indoors with breaks and a variety of different presentations with plenty of feed back time allowed for. The purpose of the day was to reinforce the councils concerns and requirements with a chance of sharing improved techniques within the industry. The participation by those who attended was excellent and a later survey of the participants showed that they were very keen to have another to keep in touch with councils and to help share ideas within the industry. Many commented that with all of the changes of company ownership it was getting difficult to continue the sharing of ideas as many of their own industry training days were now held by individual companies rather than together.

Following the positive feed back from that a second day was again organised and co-hosted by the two councils in May of this year. It was held in Napier and followed a similar format in the morning with a field trip in the afternoon to two 'super skid' sites – one still currently operating. The main presenters were the well-known duo of Andy Woolhouse and Glenn Sutton. This time the focus was on water tables and water control - to ensure that the roads stayed where they were originally put. Again just reinforcing and sharing some fairly basic techniques with plenty of

discussion about what were good or better approaches to some universal problems. Thirty-nine forest industry employees attended the second day and again there has been very positive feedback regarding the benefits to the companies. It has reinforced the approach taken that the councils are willing to discuss problems and issues that arise with the 'on ground practioners' and the companies are willing to commit considerable time and staff to participate in such days.

It is hoped that next years day will be held in Gisborne and that a similar attendance can be expected. It is an excellent opportunity to inter act directly with the people who are in the field for both the councils and the forest companies. The benefits to both parties are considerable and the sharing of knowledge assists all. We hope that with these days continuing, the opportunity to seek changes in some forest practices by education and advocacy will help to have better outcomes for all when the next event occurs – and we know that it will.



***Travelling River*** is an art-science exhibition combining over 250 community photographs, science images and stories from the Motueka catchment. The exhibition opened to the public at Nelson's Suter Art Gallery 7 – 31 August 2004, and is now exhibited at the Motueka Museum 1 November – 10 December 2004. Parts were also exhibited at the Ngatimoti Settlers Reunion at Labour Weekend.

The Exhibition and its catalogue explore life and science in the Motueka River catchment and out into Tasman Bay, where the impacts of the Motueka River are still felt. Twenty-four panels each present intersections of community photographs and a chosen science theme, organized around extracts from *Motueka Song*, a poem by Montana Book Award winner Cliff Fell. The Exhibition also includes a soundscape about the Motueka River created by Cliff Fell.

***Travelling River*** weaves from the ridgetops to the sea, from the micro to the macro, from the old days to the new... Narratives from over 60 community and environmental science contributors are visually and conceptually interwoven, to highlight the links between everyday life and the environmental sciences in a fascinating watershed.

Also available at the exhibition (\$25) and by mail order (\$29.95) is the ***Travelling River*** catalogue, a full-colour A4 reproduction of all the images and stories of the exhibition, including an introductory essay by Cliff Fell, and a waiata from Nelson composer Ian MacDonald. Curators for the exhibition and the catalogue are Andrew Fenemor (leader of the Motueka Integrated Catchment Management research programme) and Maggie Atkinson and Suzie Peacock (Nelson artists).

***Travelling River*** is the outcome of an art-science collaboration, *Mountains to the Sea*, funded initially as a pilot project under the Smash Palace Collaborations Fund, and by Manaaki Whenua Landcare Research. In 2004, funding for the exhibition and catalogue have been generously provided by the Arts Board of Creative NZ and Manaaki Whenua Landcare Research.

The catalogue is for sale from the Suter Gallery or P&P paid from Manaaki Whenua Press ([www.mwpress.co.nz](http://www.mwpress.co.nz)). For exhibition details and photos, check out this web link: <http://www.landcareresearch.co.nz/research/rurallanduse/travellingriver/>  
*Rivers are roads which move, and which carry us whither we desire to go.* Pascal, Pensées, 1670.  
 Travelling River curators' contact details:

Maggie Atkinson, The Illustrated Earth, [toddsvalley@xtra.co.nz](mailto:toddsvalley@xtra.co.nz)  
 Andrew Fenemor, Manaaki Whenua Landcare Research, [fenemora@landcareresearch.co.nz](mailto:fenemora@landcareresearch.co.nz)  
 Suzie Peacock, Nelson Marlborough Institute of Technology, [speacock@nmit.ac.nz](mailto:speacock@nmit.ac.nz)

## COMING EVENTS - CALENDAR

(from Royal Society NZ Alert)

<b>29 March -1 April 2005</b>	<p>EIANZ Conference (Environment Institute of Australia and New Zealand)</p> <p>Working on the Frontier: Environmental Sustainability in Practice” will be the first NZ conference, being hosted by the NZ Chapter of the Institute. Over 300 participants are expected with the majority from Australia.</p> <p>Hotel Grand Chancellor, Cashel Street, Christchurch, New Zealand.</p> <p>REGISTRATION <a href="http://www.conferenceteam.co.nz/eianz">http://www.conferenceteam.co.nz/eianz</a></p>
<b>October 2005</b>	<p>NZARM Annual Conference</p> <p>Hawke’s Bay (watch this space or the web site <a href="http://www.nzarm.org.nz">www.nzarm.org.nz</a> )</p>