

Progress Report

Current status

Project Title:	Targeted nitrogen mitigation
Project Number:	10/088
Report for Period Ending:	29 February 2012

Note: If any material supplied in, or attached to, this report contains confidential information, or is otherwise unsuitable for wider dissemination, please clearly mark accordingly and highlight directly with your Project Adviser (including the reason for wishing to treat the material in this manner).

1. Overall Progress

Milestone Summary Table

Milestone Number	Milestone [As per SFF contract schedule]	Completion Date		Percent Complete
		Original	Est. or Actual	
1	Completion of Year 1 DCD application on 3 sites, with soil testing, cost: benefit and N modelling evaluations completed and reported to farmers and funders.	April 2011	April 2011	100
2	Work with Overseer [®] developers to draft a protocol for obtaining and delivering Targeted DCD input data into Overseer [®] nutrient budgets to enable inclusion of the strategy within the model by 2013	June 2011	June 2013	20
3	Completion of Year 2 DCD application on at least 3 sites, based on a refined protocol, with soil testing, cost: benefit and N modelling evaluations completed and reported to farmers and funders	April 2012	June 2012	80
4	Minimum of 3 discussion group meetings including a visit to at least one case study site; at least 1 further meeting of Project team	30 June 2011	30 June 2011	100
5	Minimum of 3 discussion group meetings including a visit to at least one case study site; at least 1 further meeting with Project team	30 June 2012	30 June 2012	70
6	Develop a detailed protocol for extending the first two years of findings to dairy farmers and a new case study site in the catchment area of the Rotorua Lakes.	30 June 2012	Variation to contract requested (below)	0
7	Paper presented at FLRC conference	Feb 2011	Feb 2011	100
8	Paper presented at Resource Managers conference	Nov 2012	June 2012	0

9	Paper presented at FLRC conference	Feb 2013		0
10	Written progress reports sent to all interested parties and funders	Oct '10		Y
		Mar '11		Y
		Jun '11		Y
11	Written progress reports sent to all interested parties and funders	Nov '11		Y
		Mar '12		Y
		Jun '12		
12	Written progress reports sent to all interested parties and funders	Oct '12~ Mar '13		
13	Overseer [®] has been modified to accept <i>Targeted DCD</i> input data, assuming no funding is required by the development team	Jun 2013		0

Project Summary Outline

The first year's trial work went most successfully with farmers easily applying DCD as requested, submitting data to and receiving summaries back from the GIS database that records all farm activities related to the project. Soil sampling was successful and indicated that DCD did elevate ammonium N in the top soil. Stock number and management details from one farm were modelled within the model APSIM, to generate a cost-effectiveness assessment of Targeted DCD. This was shown to be economically beneficial to Taupo farmers working under a N cap.

In conjunction with the Taupo Beef+Lamb Monitor Farm programme, our project was discussed at every opportunity (7 meetings) and farmers saw the application of DCD by one of our case study farmers.

We had initial discussions with a potential new entrant to this project for winter 2011 but due to reluctance of the new party and to pressure of work in the existing project and other non-SFF-related work demands, this new work did not proceed this year. Under this contract we are required to bring in a new participant in 2012.

The 2011-12 programme is continuing on one of the same farms as last year, but due to lack of feed in autumn the second farm could not guarantee to have cattle on the property for the duration of this year's winter DCD applications. Consequently, *Hurakia Station* [Waihaha 4 Hurakia Trust], near Tihoi, was introduced to the project. The farm manager and his wife, Andy and Rachael Mitchell, have won environmental awards at their previous farm and were most willing to join this *Targeted DCD* project. Work commenced on *Hurakia* in early July 2011.

Regrettably, three farm staff were sick or injured and the farm ran on very reduced staffing over winter 2011. This resulted in DCD being applied only once to several grazed pastures before they "pulled the plug" on this part of the project. Ten cows were fitted with GPS collars for 14 days while grazing typical hill pastures in two ~20 ha paddocks. Excellent data on when and where the cows moved around these

adjoining paddocks which had the connecting gate open.

So, as one purpose of this study was to assess practical issues related to farmers implementing a targeted-DCD strategy to mitigate nitrogen (N) leaching, this has been achieved. Once a farmer has a resource consent that includes the use of Targeted-DCD then he will be required to deliver to this no matter what problems are encountered. Potentially, issues relating to insufficient or unavailable labour might be overcome by employing a local contractor using a Quad bike with GPS tracking to apply targeted DCD to critical source areas.

Under the Variation 5 agreement, once an NDA has been assigned to a property that remains in place and the version of Overseer used to create that NDA must be used thereafter, until and agreed time has lapsed. This could create problems in the short term for farmers who want to benefit from the DCD strategy. However, at farmer meetings it appears that few, if any, farming activities are currently constrained by the N cap.

At our February 2012 strategy meeting arranged by TLC, it was agreed that the primary activity in the final year should be to validate methods for predicting where stock camps will be found within paddocks. This will draw on findings from this project, previous FRST work, and an existing on-going project for the Ministry of Science and Innovation.

There was no need seen to repeat the same work of the previous two winters. The committee confirmed that being able to predict and then treat critical source areas with a nitrification inhibitor was the key component that a regulatory body would need convincing evidence of, before accepting this strategy. This work is now being put in place for the final year.

Another strong message was that working in another region was not worth pursuing since the principles developed in the first two year's work would obviously apply throughout NZ. However, a visit to a Farming Group in the Lake Rotorua catchment, with Mike Manning (Ravensdown), is planned for April 2012, so that they can learn first-hand of this new N leaching mitigation strategy that would have direct application in their catchment.

Another factor contributing to the changed plan is that the Bay of Plenty Regional Council is not contributing funds to the work in Year 3.

2. This Period

Milestone Progress

Milestone Number	Activities and Progress
2	The Overseer Development team repeatedly says that we only need to see them once we have the definitive evidence that the targeted DCD strategy will work. Independently of this, they are upgrading Overseer to deal with small blocks and, DCD is already an option within Overseer, so there is therefore little worry that the <i>Targeted DCD</i> strategy can be quickly implemented into a new version of Overseer. It is envisaged that

	<p>the sum of critical source areas targeted with DCD would become a “block” within Overseer.</p> <p>As mentioned elsewhere, it is less certain how Taupo farmers will benefit from this new strategy given that they are locked into using an early version of Overseer. In time, this will stop being a constraint upon the farmer.</p>
3	Field work has been completed, but modelling using these most recent data has yet to be completed.
5	All Monitor Farm Days in the catchment have been attended with discussions on this project initiated when required.

Progress against Key Performance Indicators

KPI Description	Progress this Period
1. Farmers implementing the strategy on critical source areas will, based on simplistic modelling, generate a 10+% return on money invested in this strategy. This is based on 50% of cattle urine patches being treated during the winter period, to provide a 20% reduction in N leaching and a 20% reduction in nitrous oxide emissions at the farm scale (Monaghan et al., 2007).	No new work in Q3 2012
2. All Taupo farmers will be able to access <i>Targeted DCD</i> updates and reports at a web site by October 2010.	All reports are available on the MAF web site. This has been advised to all Taupo Lake Care farmers in the Lake Taupo catchment.

Project Management & Governance

*List all management meetings held in this period (including dates and locations).
 Outline any significant management decisions taken in this period.*

The last management meeting was held in November at the home of Jocelyn Reeve.

Keith Betteridge met with FertResearch on 9 February 2012 to outline and discuss work for the next 12 months.

Project Communications, Connections and Extension

For this reporting period, comment on progress with respect to:

- ∞ Liaison with key stakeholders / groups.
- ∞ New or on-going linkages with other projects or research programmes
- ∞ Information dissemination

Include information on the impact / success of these events (e.g., numbers attending a meeting or field day, feedback received, impact achieved, etc).

Please **append any key outputs to this report** — include any commissioned reports (e.g., technical / R&D reports), publications, presentations, posters, media articles, etc.

Stakeholders attend most Beef+Lamb NZ Monitor Farm meetings at which our results are discussed and debated. Typically 30-50 farmers are present at these meetings. Only one meeting was held during Q3 2012.

Within an MSI-funded *Clean Water Productive Land* programme, Keith Betteridge et al., are developing a model to predict where livestock will camp in large, hill paddocks. The model was presented at the Fertiliser and Lime Research Centre Conference at Massey University, in February 2012. This will form the basis of the validation of predicted campsites in this SFF project in Year 3. Collaboration with a Japanese scientist is strengthening this interpretation through funding from the MSI Japan-New Zealand science collaboration fund.

Any other matters [if applicable]

Highlight any other issues relevant to this project.

3. Next Period — Proposed Activities

Outline key activities planned for the next reporting period, including dates/venues of key field days or other extension initiatives.

By 20 April, a protocol will be presented to the management committee outlining the work to be undertaken in Year 3. This variation to the project will be have been presented to the SFF for their approval. Modelling work, using data from 2012 will have been completed by 30 June.

4. Variations to Milestones [if applicable]

Approval is requested to amend the following project milestones: NIL

Milestone Number	Proposed Revised Milestone	Reason for Variation
6	On at least two farms in the Lake Taupo catchment, 10 paddocks will be selected and the digital elevation model (GIS map of slope, elevation and aspect) will be	Little will be gained by continuing what has taken place in the first 2 years. We know that DCD can be successfully targeted at CSAs.

	<p>purchased. We will predict where the cattle will camp within these paddocks and then physically inspect the selected sites after a paddock is grazed and take soil samples (0-75 mm depth) from these sites and other non-camp sites to confirm the long-term use of these sites as campsites.</p>	<p>We predict that any regional council will want confirmation that CSAs can be predicted objectively so that DCD can be targeted at them. This aspect of the study will complement the <i>Clean Water Production Land</i> MSI project and vice versa.</p> <p>One aspect of the original contract required that Keith Betteridge promote this project in another region (BoPRC). This will be done, but FertResearch was adamant that there is little need for a couple farmers to “try this out” in that region while validation of the prediction model of campsite locations is so important.</p>
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5. Financial Update

Comment on current status of the project’s budget.

- ∞ *If finances are in-line with contracted projections please simply note: ‘On Track’.*
- ∞ *Highlight the amount, reason and proposed remedy for any significant current, or anticipated, variations to the budget. If necessary, attach a proposed revised budget.*
- ∞ *Reasons for any payments being requested in advance.*

On track

6. Report Confirmation

Name [<i>Project Manager</i>]	Confirmation	Date
Graham Law	I hereby confirm the above information is true and correct: <input type="checkbox"/>	

Submission Note — By the due dates Progress Reports should be sent:

1. Electronically to the SFF Fund Administrator and copy/cc. your Project Adviser (usually in the same e-mail as the completed Request for Payment (R4P) form for the reporting period).

Please ensure you put your project number in the e-mail’s subject line:
e.g., 06/999 Reporting: Period 2, 2007.

2. In hardcopy, together with any associated attachments, to both the Fund Administrator and your Project Adviser.

Appendix 1. Web Update

Please provide an update on your project's progress that is suitable for inclusion on the SFF's web site. If you wish to use the same text as in Section 1: "Project Summary Outline", please copy and paste this text into the section below.

It is important that you provide meaningful, and user-friendly, information on your project's findings and progress as the SFF web site is a widely used resource.

For guidance on writing effectively for web-based communication please see the SFF Project Management Guidelines: <http://www.maf.govt.nz/sff/project-management-guidelines/index.htm>

Project 10/088 [Up-dated March 2012]

In February a paper on the *Targeted Nitrogen Mitigation* project was presented at the Fertiliser and Lime Research Centre Conference in Palmerston North. This outlined the work done using nitrification inhibitors by Alex Richardson using (ecoN[®]) and Jo Gates (Rangiatea Station) (DCn[®]) on their winter, intensively-grazed crops and pasture areas. This strip-grazing was additional to the concept of using targeted DCD (the inhibitor) on hill country stock camps.

Soil sampling clearly showed that the DCD did indeed elevate the ammonium-N levels in the top soil while nitrate levels remained low. Leaching of nitrate-N down the soil profile was evident, but there was little movement of ammonium-N. The GPS collars on cows grazing hill pastures failed to identify stock camps, most likely because the paddocks used were not steep enough.

Using the winter grazing information from one farm, and assuming that there were only beef cattle on the 129 ha of easy contour land, we estimated 32 kg N/ha/yr leached over the whole-farm. By targeting DCD only at strip-grazed areas on the farm (23% of the farm), over winter, whole-farm N leaching was 9% lower. There was thus a saving of 77% of the DCD cost, had it been uniformly applied over the whole farm, as currently recommended. This reduction in N leaching allowed an additional 170 sheep stock units (SU) to be carried on the farm without exceeding the base-level of 32 kg N leached/ha/yr. Assuming (a) the additional stocking capacity was used to run more cattle, (b) that these had a gross margin of \$65/su and (c) that DCD was applied to only 23% of the farm, this farm had a \$7200 net return resulting from use of the targeted nitrification inhibitor strategy.

Results were discussed with FertResearch and a planning meeting was held with the Taupo Lake Care steering committee in February 2011.

A presentation of this research project on the targeted DCD project was given to the Environment Waikato Dry-Stock Farmers meeting at Otorohanga in March 2011.

In late autumn 2011, Alex Richardson started applying the granulated DCN on pastures being strip-grazed by cows and crops strip-grazed by yearlings and R2 cattle. Last year he used econ-n, so we will be able to get farmer feedback on issues and benefits relating to application methods of the two contrasting products.

Rangiatea withdrew from the project this year as they were unsure if they would have cattle back

on the farm in time for the DCD treatments. The farm was heavily destocked earlier in the year because of a shortage of feed due to drought conditions. *Hurakia Station* [Waihaha 4 Hurakia Trust], now managed by Andy Mitchell, has joined the project and started applying eco-n in early July. He is also treating strip-grazed autumn-saved pasture and winter strip-grazed crops with DCD applied a few days before and up to 14 days after a feed break has been eaten off.

To identify where cattle prefer to camp on steeper land, 10 cows were fitted with GPS collars in winter 2011. Contour maps of these two paddocks are overlaid with the animal tracking data to help determine the importance, or otherwise, of micro-contour in the cow's decision on where to camp in these relatively broken and steep paddocks. Considerable night-time walking was noted, presumably accompanied by some grazing. This has been seen elsewhere, but only on some occasions. This aspect of the study links to the larger *Clean Water, Productive Land* project, funded by the Ministry of Science and Innovation. In that work, a model is being developed that predicts where livestock camp so that nutrient and faecal contaminant losses close to waterways can be managed with appropriate mitigation strategies. Targeted DCD is one such strategy to reduce nitrogen leaching to groundwater and nitrous oxide emissions to the atmosphere.

In the third year of the trial we will be validating a model that we developed to predict where animals will camp and excrete much of their urine (we call these critical source areas). This model, described at the Fertiliser and Lime Research Centre Conference, February 2102, uses land contour as the proxy for campsites of cattle in hill country. Validation of 20 paddocks in the Lake Taupo catchment will be by visual inspection for and GPS mapping of concentrations of faeces across the whole paddock since, like urine, faeces are most prevalent in stock camps. Soil testing for elevated nutrient load (especially P) will be used to confirm that the campsites were well predicted, compared to lower P levels in areas not selected by the model.

Keith Betteridge
AgResearch Grasslands
Palmerston North