AGRICULTURE RESEARCH GROUP ON SUSTAINABILITY

A1 6.13 Stakeholder Report: January 2007

ARGOS Comparative Dairy Research - an update

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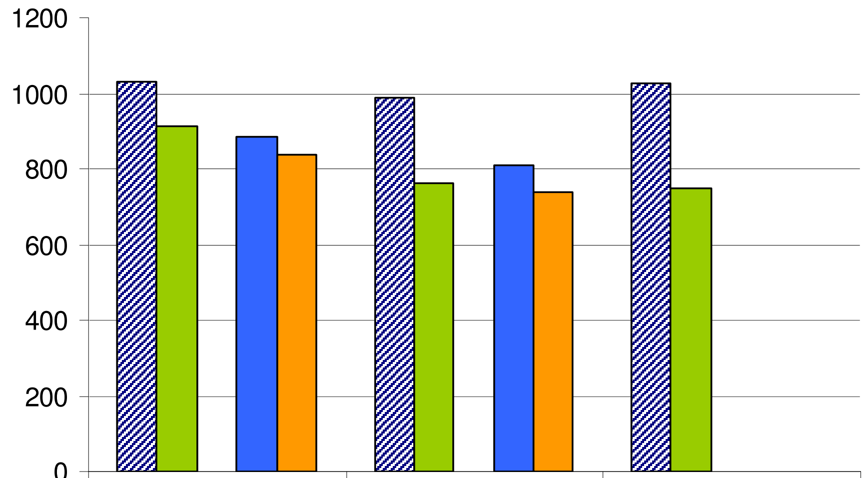
Gratitude is extended to the 24 participating dairy farmers involved in the project.

Executive Summary

This report should be read as a complement to Stakeholder Report A1 6.11: April 2006, *ARGOS Comparative Dairy Research*, by Amanda Phillips, Peter Carey, Glen Greer and Martin Emanuelsson.

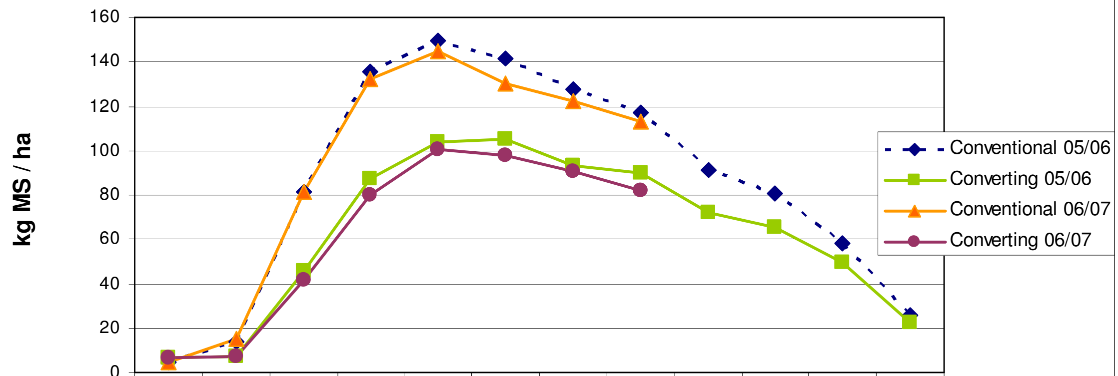
Economic monitoring and milk production

The operating profit per hectare is not statistically significant different between conventional and converting farms in the 2004/05 season. These results suggest that the converting farms compensate for reduced milk production with reduced input costs. This will be further investigated when the 2005-06 accounts are analysed this year which will include the 7% incentive payment for converting to organic production.



	FY 04 (06/03-05/04)	FY 05 (06/04-05/05)	FY 06 (06/05-05/06)
Conventional Production (kgMS/ha)	1029	988	1026
Converting Production (kgMS/ha)	913	761	748
Conventional Operating Profit ($/ha)	886	809	
Converting Operating Profit ($/ha)	840	737	

The difference in milk production (kg MS/ha) was statistically significant for the 2003/04, 2004/05, and 2005/06 seasons. The farms that have joined the Fonterra organic supply scheme were most likely running a low input system already in 2003/04. The monthly production graph illustrates the greater and faster increase in milk production for the conventional farms in the earlier part of the season. This is most likely due to the combined effect of the use of urea on the conventional farms to stimulate early pasture growth and the lower stocking rate and later start of calving on the converting farms.



	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Conventional 05/06	4.56	13.85	81.21	135.75	149.52	141.21	127.37	116.71	91.4	80.61	58.27	25.59
Converting 05/06	6.48	7.29	45.46	87.31	104	104.91	93.43	90.09	72.05	65.69	49.42	22.79
Conventional 06/07	4.9	15.4	81.1	132.2	145.1	129.9	122.5	113.1				
Converting 06/07	6.5	7.6	41.7	80.3	100.2	97.6	90.3	82.3				

Month

Environmental Monitoring - Stream Survey

One of the most important environmental issues surrounding agriculture is the impact of intensive agricultural production on water resources.

The study had three specific aims;

1. Provide baseline data on waterway quality and ecosystem function;
2. Identify the relative impacts of converting to organic and conventional farming systems on water quality and aquatic ecosystem function at the farm scale; and
3. Develop customised stream care management strategies for each participating farmer for incorporation into long-term farm management plans.

We measured physical parameters, nutrient and sediment levels, and periphyton and aquatic macro-invertebrate communities at upstream and downstream sites in streams on dairy farms in summer 2005/2006. Key findings include:

- Our findings are consistent with other studies and research demonstrating that water chemistry, community structure and ecosystem functioning are vastly different between agricultural waterways and those in unmodified habitats.
- We found evidence that water quality and stream conditions can decrease or improve at the farm scale.
- Our findings suggest that there is potential for landholders to implement management actions that can result in protected or improved water quality within their own property boundaries, as well providing downstream benefits to other stakeholders.
- We found evidence of different levels of pollution in different farming sectors, with higher levels of nutrients in waterways on dairy farms than on sheep/beef properties.
- We did not consistently find larger relative increases in nutrients or other pollutants across individual dairy farms. In some cases, management actions to prevent harmful impacts on streams, such as fencing to exclude stock, were more common in the dairy sector than on sheep/beef farms.

- We found very few differences in stream state or functioning between different farm management systems, with most differences instead relating to individual farm management decisions.
- Water quality on a number of the surveyed farms breach national standards.
    i. The average levels of *E. coli* and fecal coliforms in waterways on dairy farms were 4.6 and 6.3 times respectively the accepted levels for recreational water use.
    ii. Ten dairy farms exceeded minimum water clarity standards (turbidity measurements) under the Resource Management Act.
    iii. No dairy farms exceeded the National Standards of nitrate and nitrite for Drinking, but five dairy farms exceeded the Australian and New Zealand Environment and Conservation Council guidelines for nitrate and nitrite for minimising impacts to aquatic ecosystems.

The tentative results of this first survey has been disseminated to each farmer, including the state of waterways on their own farm, comparison data from other farms in the sector, and information on what factors or actions are affecting these results. With the addition of data from surveys in summer 2006/07, we can begin to work with individual farmers, to ensure they have cost effective ways to manage waterways on their farms that provide social, economic and environmental benefits.

Social Monitoring

The social research has been by means of qualitative interviews (ARGOS participants only) and a mail-in survey (ARGOS participants plus a stratified random sample of New Zealand farmers). From this wealth of data, the first focus for analysis has been on the examination of attempts to promote a conversion to organic practices.

Farmer Selection:

- 21% of farmers have attitudes that could be more consistent with organic practises;
    - Existing management practices are more in line with organic practises.
    - More favourable attitudes towards sustainability and alternative farming practices.
    - Higher willingness to invest the time and energy associated with change.
- 79% committed to existing conventional practices and philosophies;
    - Significantly more effort is required on this group to move them into the “immediate potential” group.
    - Farmers committed to conventional farming are unlikely to convert to organics in the absence of a “crisis” in the dairy sector. They are adverse to adopting organic practices. Education and confidence is the key to moving this group of farmers into “potential converters”.

Market Confidence

- Fonterra has an important role in increasing the confidence among existing organic suppliers and those that are considering converting to organics. Farmers identified several communications required by Fonterra to achieve this:
  - Long term commitment to the organics business; clear statement from the Chairman, Directors, CEO and senior management regarding the importance of organic milk and organic milk products (as with other speciality milks) in Fonterra's value added strategy.
  - Clear strategy (marketing and business plan) to be able to sell the product. Farmers get concerned when they see organic milk collected and processed as conventional.
  - Farmers want reassurance that after the initial 6 year contracts future organic contracts will be available to them.

Farmer Confidence

- Farmers converting or considering converting to organics recognise it will require change. Change in attitude, family considerations and in their farming system. With change comes:
  - An increased level of risk.
  - Increased investment in time and effort.
  - A new period of extended learning and re-education.
  - Possible lower economic returns (at least in the short term).
- Organic milk incentive payments provide farmers with the financial security to take the final step to organic certification.
- There is a need for industry to develop and communicate appropriate KPI's for organic farming which emphasise quality characteristics associated specifically with organic products in addition to those of milk solid production and hygiene. To ensure organic farmers are meeting a standard to be viewed as "good farmers" by all. These KPI's are in addition to financial performance which is considered extremely important.

Extension, work in progress, and next 6 months

- Combined Fonterra - ARGOS organic field days were held on the properties of three participating farmers in the ARGOS project who are in the process of converting to certified organic production. These field days will included a farm walk, talk by the host farmer, marketing presentation, and research updates from the ARGOS sustainability project on economics and stream health.

- The first major field work in the ARGOS project for 2007 is a repeat of the stream monitoring in 2006. This survey to monitor stream health will commence in January and finish in February. A riparian management and stream health questionnaire is planned for March – April, 2007.

- Further analysis of milk production and profitability for the 2006/07 season between the farming systems will be completed. A financial and economic survey generic to the ARGOS project will be conducted with participating farmers. Financial accounts will also be collected and analysed in the next few months so that a comparison can be made and presented at the 2007 Fonterra Organic Conference in May. A summary of the latest farm management findings will also be prepared and made available to farmers looking to convert to organic production.

1.0 Introduction

This report complements and updates an earlier report provided by ARGOS to Fonterra1. Please refer to the earlier report for a background to ARGOS, previous research completed, the experimental setup of clustered farms, and how ARGOS links in with Fonterra strategies. The structure of this report follows the 'triple bottom line' approach with three sections; economic, environmental and social monitoring.

2.0 Economic Monitoring

2.1 Milk Production

The production data of participating farms has been reported on a monthly basis and analysed with a focus on detecting statistically significant between farming systems, and the longer term trends associated with these differences. Data from previous years on milk production provides a solid baseline and already in this data we find statistically significant differences.

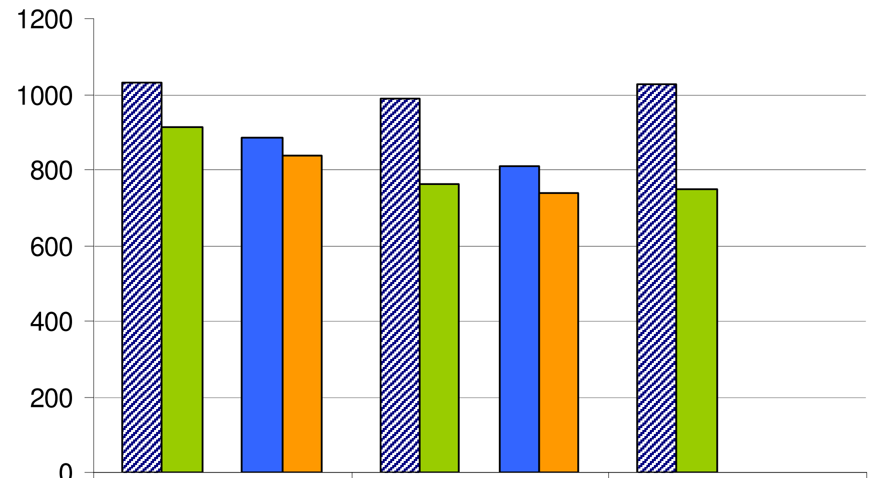


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Figure 1: Comparison of milk production (kg MS/ha) on conventional and converting farms.

The difference in milk production (kg MS/ha) between the 12 conventional and the 12 converting ARGOS farms is statistically significant (P<0.01) for three individual time periods; the 2003/04, 2004/05, and 2905/06 season. As the farms only officially entered organic

[1] Stakeholder Report A1 6.11: April 2006, ARGOS Comparative Dairy Research, by Amanda Phillips, Peter Carey, Glen Greer and Martin Emanuelsson

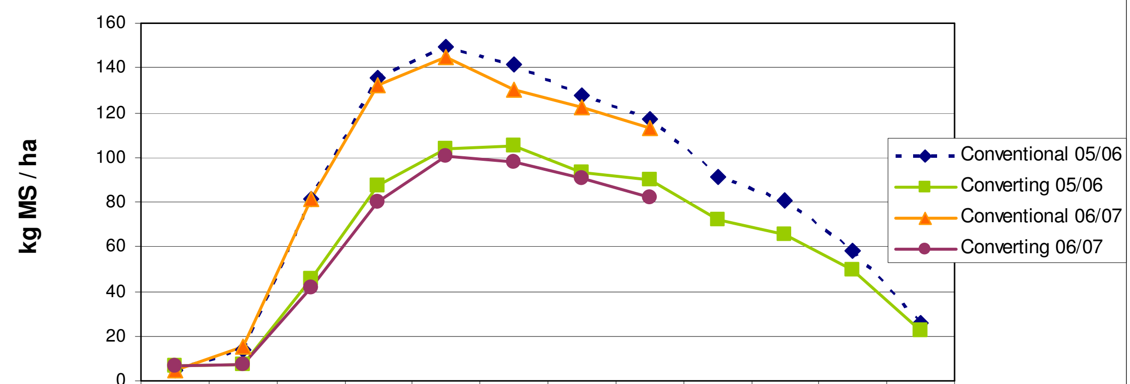
certification (BioGro / AgriQuality) from the start of the 05/06 season we can not yet conclude that the differences are an organic versus conventional induced difference. The farms that have joined the Fonterra organic supply scheme had consistently lower milk production as far back as 2003/04, due mostly to running low input systems.

The difference between management systems percentage wise are 11% lower for converting farms in 2003/04, 23% in 2004/05, and 27% for the 2005/06 season, indicating a trend of increasing differences between conventional and converting farms.

The differences between the farm systems in per cow milk production were not significant for the 2003/04 and the 2004/05 seasons, however the difference in the 05/06 season was significant. The milk production difference between management systems was less on a per cow basis than a per hectare basis, (14% versus 27%).

2.1.1 Monthly milk production trends

There is a distinct difference between conventional and converting at individual times (management effect). Converting farms seem to peak later in the season and then taper off more gradually than conventional farms (Figure 2). This is most likely due to the combined effect of the use of urea on the conventional farms to stimulate early pasture growth and the lower stocking rates and later start of calving on the converting farms[2].



	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
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Converting 06/07	6.5	7.6	41.7	80.3	100.2	97.6	90.3	82.3				

Month

Figure 2. Monthly milk production (kg MS/ha) for conventional and converting farms.

2.1.2 Milk Quality

The average somatic cell count per ml for the conventional and converting farms was 158,821 and 226,108, respectively for the season to date (June 2006 - January 2007).

[2] See Stakeholder Report A1 6.11: April 2006, ARGOS Comparative Dairy Research, by Amanda Phillips, Peter Carey, Glen Greer and Martin Emanuelsson for stocking rate data.

2.2 Financial Results

Where possible, the 2004/05 and 2003/04 data for the comparative farms has been collected to establish a baseline and provide background data. The financial results of the eight share milking operations (4 conventional and 4 converting in FY 04 and 4 conventional and 3 converting in FY 05) included among the ARGOS farms have been excluded from the economic summaries presented. Consequently, the KPIs and financial summaries are average values from the fifteen owner-operated farms.

Although there are differences in individual expense and income categories, the overall conclusion must be that for the 2004/05 year there is no consistent overall difference in profitability (Total Operating Profit/Ha) between converting and conventional farms. The 2005/06 financial data, which pertains to the first year of official conversion, will be available for statistical analysis within the next six months. At this stage we expect to find that there will be a similar reduction in milk production on the converting farms; however this is likely to be counterbalanced with a reduction in farm operating expenses and the 7% incentive payment for farmers converting to organic production.

Table 1. Key performance indicators

ARGOS	Panel Key Performance Indicators	
Numbers in Panels	8	7
PHYSICAL	**2004-05**	
	Conventional	**Organic**
Stocking rate:	2.87	2.48
Kg Milk solids/ha:	900	779
Kg Milk solids/cow:	313	315
PROFITABILITY	**2004-05**	
	Conventional	**Organic**
Dairy:	-	
Gross Farm Revenue/ha:	4,135	3,519
Operating Expenses/ha:	3,326	2,782
Operating Profit (EFS)/ha	809	737
Gross Farm Revenue/Kg MS	4.54	4.53
Operating Expenses/Kg MS	3.64	3.56
Operating Profit (EFS)/Kg MS	0.90	0.97
FWE/Kg MS	2.59	2.49
Operating Profit Margin %	18.2%	19.5%
Interest and Rent/GFR	15.8%	24.7%
Interest and Rent/Kg MS	0.77	1.09
LIQUIDITY	**2004-05**	
	Conventional	**Organic**
Net Cash Income:	429,968	428,256
Farm Working Expenses:	244,530	243,826
Cash Operating Surplus:	185,438	184,430

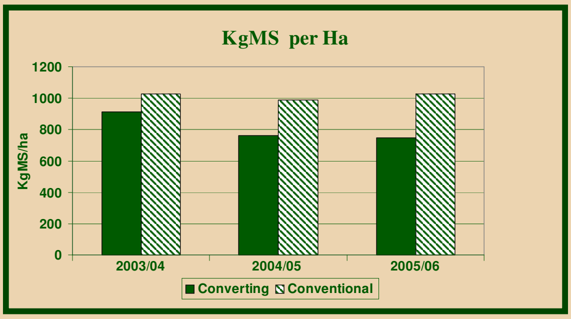
Economic Performance of ARGOS Dairy Farms 2004/05

Glen Greer, AERU, PO Box 84 Lincoln University

Farm Size and Production Levels:

Relative to the conventional farms in the ARGOS programme, on average the converting organic farms:

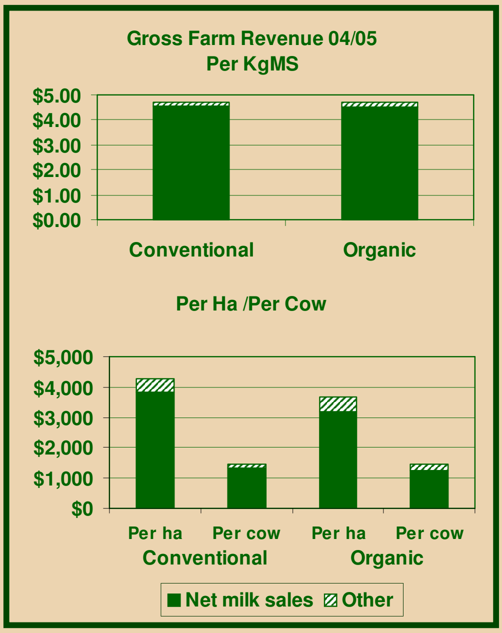
- are larger (119 cf. 105 ha)
- have lower stocking rates (2.48 cf. 2.87 cows per ha)
- have similar milk solids production per cow (315 cf. 313)
- have had lower milk production per hectare for the last three seasons



Farm Incomes:

In 2004/05:

- gross farm income per KgMS similar in both farm systems
- GFI on conventional farms was higher per cow and per hectare
- conventional farmers received a higher (6 cents per KgMS) price on average for milk



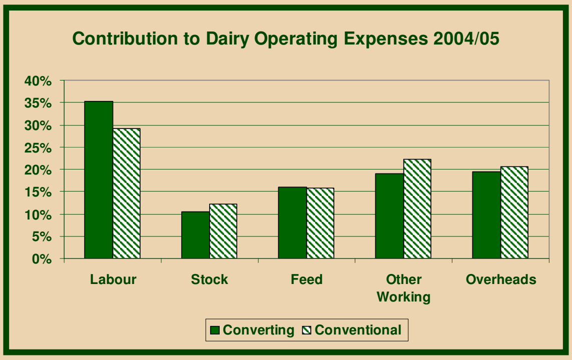
Farm Costs:

On the converting organic farms:

- dairy farm operating expenses are lower
- labour comprises a higher proportion of the total cost
- lower fertiliser costs mean that "other working costs" are a lower proportion of total costs

Operating Costs 2004/05

	$ per KgMS		$ per cow		$ per ha	
	Organic	Conv.	Organic	Conv.	Organic	Conv.
Dairy operating exp.	3.56	3.64	1073	1145	2782	3326
Total operating exp.	3.56	3.88	1074	1227	2783	3602



Economic Farm Surplus:

- EFS does not differ significantly between conventional and converting to organic farms.
- Converting organic farms have slightly higher EFS per kgMS and per cow

KPI Summary	2004-05	
	Organic	Conventional
Gross Farm Revenue/ha:	3,519	4,135
Operating Expenses/ha:	2,782	3,326
Operating Profit (EFS)/ha	737	809
Gross Farm Revenue/Kg MS	4.53	4.54
Operating Expenses/Kg MS	3.56	3.64
Operating Profit (EFS)/Kg MS	0.97	0.90
FWE/Kg MS	2.49	2.59
Operating Profit Margin %	19.5%	18.2%
Asset Turnover %	24.7%	15.8%
Interest and Rent/GFR	24.7%	15.8%
Interest and Rent/Kg MS	1.09	0.77

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2.3 Discussion and Conclusions

Although, there is substantially lower milk production (27%) on the converting farms than on the conventional farms, the lower operating expenses seem to compensate for most of the loss in revenue. This is without the organic premium of 7% whilst in the first three years of conversion which later increases to 20%, once full organic certification is gained.

Plate 1: Milk being collected on a converting to organic farm in the Manawatu.

3.0 Environmental Monitoring

The previous report focused on soils. This update focuses on streams and stream health.

3.1 Stream Survey[3]

Stream health[4] and riparian assessments were conducted in the summer 2005/06 on 24 North Island dairy farms and 36 South Island sheep and beef farms (results not reported here) that had stream channels within the property boundaries. The main objective of the study was to isolate the effects of farm management on streams at the farm scale. The study had three specific aims:

- Provide baseline data on waterway quality and ecosystem function on sheep/beef and dairy farms, from which future trends in stream health can be determined;
- Identify the relative impacts of organic conversion and conventional farming systems on water quality and aquatic ecosystem function on dairy farms; and
- Develop customized stream care management strategies for each participating farmer for incorporation into long-term whole-farm management plans.

Two 10m-long study sites were selected on each farm; an upstream site where the stream either entered the property, or at the source if it arose within the farm boundaries; and a downstream site where the stream left the property.

A comprehensive assessment of stream functioning and health was made at each site, using a combination of the Stream Health Monitoring and Assessment Kit (SHMAK) assessment protocol and additional water quality and riparian habitat measurements. The combined approach was taken to allow the comparison of the indices from the SHMAK protocol and more standard analytical techniques in assessing stream status and functioning.

Table 2: Parameters recorded in the Stream Health Monitoring and Assessment Kit (SHMAK).

Parameter	Units	Method of recording
Stream width	Metres	Average of width at bottom, middle and top of survey site
Stream depth	Metres	Average of depth at true left bank, centre, and true right bank at the bottom, middle and top of the study site
Flow velocity	Metres/second	Average time for a floating object to travel the length of the survey site (three replicates)
Water temperature	Degrees centigrade	Bulb thermometer temperature of water in the middle of the channel at the upstream end
pH	$-\log_{10}(H^+$ ion concentration)	Merck Neutralit pH strips in a container of stream water for 10 minutes

[3] For a full description of survey methodology and results, please refer to; Research Report: Number 06/03, *Cleaner streams and improved stream health on North Island dairy and South Island sheep/beef farms*, by Grant Blackwell, Mark Haggerty, Suzanne Burns, Louise Davidson, Gaia Gnanalingam and Henrik Moller. The report can be downloaded at www.argos.org.nz

[4] We follow the definition of Karr, J. R. (1999). Defining and measuring river health. *Freshwater Biology* **41**: 221-234., who defines stream health as . the ability to sustainably supply the goods and services of both human and non-human residents (stakeholders).

Parameter	Units	Method of recording
Water conductivity	Microseimens cm^{-1}	EUTECH Cybernetics TDScan 3 hand-held conductivity meter in a container of stream water
Water clarity	Detection distance (metres)	Distance at which a black disc can be detected along a 1-metre length clear acrylic tube filled with stream water (three replicates)
Stream bed	Index between -20 - +20	Percentage cover of different substrate types, weighted by their ecological function
Riparian vegetation	Index between -10 - +10	Percentage cover of different vegetation types, weighted by their ecological function
Deposits	Index between -10 - +10	Qualitative assessment of the extent of substrate covered by sediment and other deposits
Invertebrates	Index between 0 - 10	Abundance of different stream invertebrates weighted by their ecological requirements and sensitivity to stream modification
Periphyton	Index between 0 - 10	Percentage cover of different algae taxa weighted by their ecological requirements and sensitivity to enrichment

To help test the accuracy of the SHMAK kit, additional data was also collected on water clarity and quality and stream biota. A YSI 556 MPS (Multi Probe System) was used to record water temperature (degrees centigrade), dissolved oxygen (mg/L), conductivity (Microseimens cm-1), salinity (parts per million), pH and total dissolved solids.

The following nutrients were also analysed for each site:

- Ammonium ions (NH_4^+ ug/L)
- Total nitrogen (TN ug/L) and total phosphate (TP ug/L)
- Dissolved Reactive Phosphate (DRP ug/L)
- Nitrate and Nitrite (NO_3 + NO_2 ug/L)
- Total organic carbon (TOC)
- Turbidity
- Organic stream deposits
- Faecal coliform
- *Escherichia coli*

In addition to the riparian habitat assessments conducted at each SHMAK sampling site, a further eight sites were identified for riparian assessments along each selected stream reach.

3.1.1 Statistical analysis

Differences between clusters of farms, management systems (panels), and the effect of stream and vegetation characteristics on stream health were investigated using a number of statistical tools in GENSTAT Version 8 (VSN International Ltd). Methods used include;

- One-way randomized block analysis of variance where the different clusters were the randomized blocks and panels and were the fixed factors of interest.
- Principal Components Analysis (PCA) was used to look for overall differences in percentage changes of water clarity and nutrient levels on individual farms.
- Overall macro-invertebrate and periphyton community composition and differences between clusters and panels for the sheep/beef and dairy sector were examined using two related multivariate techniques: discriminant function analysis (DFA) and multivariate analysis of variance (MANOVA).
- Generalized linear models (GLM.s) were used for the model selection to link stream quality measures to farm land use predictions.

Table 3*:* Variables used in the predictive model selection process to identify links between stream health and farm management.

Predictor variable	Variable levels	Explanation
Panel	Dairy: Organic and Conventional Sheep/beef Organic, IM and Conventional	Alternative farming systems may have different levels of inputs or stock or farm management practices that could affect water quality
Bank vegetation	Index from -10 (little or sparse vegetation) to +10 (extensive cover of woody vegetation and a dense understory)	A weighted average riparian vegetation cover score for each farm. Weightings based on ecological function (see text)
Fencing	Index from 0 (no fencing) to 10 (both sides fenced for whole length of waterway)	Effective fences can prevent direct stock access into the stream bed and can prevent grazing of riparian vegetation, allowing denser ground cover to develop that is more effective at stopping sediment and nutrient inputs.
Stock access	Index from 0 (free stock access to whole waterway) to 10 (effective fencing or barriers that prevent stock access)	Stock in the waterway can lead to increased bank erosion and sediment loading and increased nutrient levels through direct inputs of waste.
Stream bed	Index from -20 (unstable silty/sandy or man-made surfaces) to +20 (stable bed of cobbles and boulders)	The stream bed type can partially determine what plants and animals can persist in the stream, as well as playing a role in sediment deposition and nutrient transport and retention rates.
Additional vegetation predictors		
Vegetation PCA Axis 1	PCA Axis scores (Relative ranking)	A multivariate indicator of overall vegetation cover at a site, but without the weightings inherent in the SHMAK Bank vegetation index

Predictor variable	Variable levels	Explanation
Vegetation PCA Axis 2	PCA Axis scores (Relative ranking)	A second multivariate indicator (uncorrelated with PCA Axis 1) of overall vegetation cover at a site, but without the weightings inherent in the SHMAK Bank vegetation index
Bare ground	Average percentage cover in the riparian strip	Bare ground can increase infiltration rates of rainwater, sediment and nutrients into waterways
Pasture	Average percentage cover in the riparian strip	Short pasture offers little barrier to sediment transport into waterways, while the shallow root zone is not a very effective nutrient filter. Longer ungrazed pasture can act as an effective sediment trap.
Scrub	Average percentage cover in the riparian strip	Scrub (low woody vegetation) can offer a good barrier to sediment and nutrients, provide some shade and habitat for terrestrial species
Trees	Average percentage cover in the riparian strip	Trees can provide good nutrient filtering through the root zone, shading of the channel, an energy input from leaf-fall, and habitat for terrestrial species.
Tussock	Average percentage cover in the riparian strip	Tussock (and long rank grass) can act as effective sediment traps, reducing sediment and associated nutrient or microbe inputs.

3.1.2 Results

The results below are excerpts from the full report. Please refer to ARGOS Research Report: Number 06/03, *Cleaner streams and improved stream health on North Island dairy and South Island sheep/beef farms*, by Grant Blackwell *et al.* (2006).

Average values in dairy farms

Waterways on dairy farms in the ARGOS project were fairly narrow, shallow and slow moving. The predominant vegetation cover was pasture, contributing to the predominantly negative SHMAK bank vegetation scores. Five of the 19 (26 %) survey sites were completely fenced on both sides, although 9 sites (47 %) had no fencing at all. Levels of NO_3 + NO_2 (mean of 1288.53 ug/L) were the highest of the measured nutrients. Levels of NH_4^+ and DRP were similar to each other (mean of 215.3 ug/L and 225.06 ug/L respectively).

Waterways on organic conversion farms tended to be wider, shallower, warmer and faster flowing than those on conventional dairy farms. Organic conversion farms also tended to have higher levels of NO_3 + NO_2 and DRP in the waterway, and significantly higher levels of organic sediment ($P = 0.007$). Conventional dairy farms tended to have better water clarity tube readings, higher dissolved oxygen levels, NH_4^+ concentrations and conductivities, and lower sediment loads.

Percentage change across dairy farms

The average percentage change in measured water clarity and quality indicators across ARGOS dairy farms (difference between upstream site and downstream site) were highly variable. Some parameters, such as organic and total sediment and concentrations of *E. coli* and fecal coliforms were highly variable, with values ranging from -80% to +10,330 % for total sediment, and from -87 % to + 15,900 % for *E. coli*.

There were no consistent directions or significant differences between the panels, although the differences did approach formal statistical significance for NH_4^+, organic and total sediment, and turbidity. There were larger relative increases in NH_4^+, NO_3 + NO_2, DRP and total phosphorous on organic conversion then conventional farms, while the relative increases in organic and total sediment were greater on conventional dairy farms. Relative invertebrate and periphyton scores decreased on organic conversion farms, while both indices increased on conventional farms. In comparison, relative increases in *E. coli* and fecal coliforms were much larger on conventional farms than on organic conversion farms, although the data was highly variable and the differences were not significant.

Nutrients

The levels of nutrients and sediment in waterways were highly variable between individual farms, clusters and farming sectors. Average levels of NH_4^+, NO_3 + NO_2, DRP and TP were higher on dairy farms than sheep/beef farms, a finding consistent with the results from other studies. Nevertheless, within the dairy farms, no farms exceeded the National Standards of nitrate and nitrite for Drinking Water of 11.3 mg/L although one farm had levels (7.5 mg/L) that exceeded the limits for increased monitoring requirements (set at 5.65 mg/L). Five dairy farms exceeded the Australian and New Zealand Environment and Conservation Council guidelines for nitrate and nitrite for minimizing impacts to aquatic ecosystems of 444 ug/L, two farms exceeded the limit of 30 ug/L for DRP and all farms exceeded the standard for NH_4^+ of 21 ug/L (ANZECC 2000).

Water clarity

Ten dairy farms exceeded minimum water clarity standards (turbidity measurements) under the Resource Management Act, and four dairy properties exceeded the thresholds set for minimizing impacts on aquatic life.

Micro-organisms

The average levels of *E. coli* and fecal coliforms in waterways on the dairy farms were 4.6 and 6.3 times respectively the accepted levels for recreational water use (medium value 126 cfu/100 ml. Concentrations of *E. coli* and coliforms were highly variable between farms, but in some cases were over 2,500 cfu/100 ml, 20 times the accepted limit. Concentrations of *E. coli* of between 200 - 500 cfu/100 ml were recorded on 72 % of the farms, levels that have been shown to be positively associated with significantly elevated concentrations of Campylobacter, the most common cause of gastroenteritis in humans.

Predicting water quality change on ARGOS dairy farms

The predictive models tested on the data generated the following results;

- There was a significant positive relationship between the stock access score and water clarity, with sites with less stock in the waterway/riparian area having greater percent increases in sediment levels (with no disturbance, sediment can drop out of the water column) and water clarity across the farm.

- Sites with more recorded stock access had greater increases in organic sediment.
- There was a significant negative relationship between bank vegetation value and percentage change in total phosphorus (TP), that is, sites with more dense, complex vegetation had relatively smaller increases in TP.
- There was a significant positive relationship between the bank vegetation score and percent increase in total organic sediment; that is, sites with more trees and scrub had relatively higher deposition rates of organic sediment already in the stream.
- There was a positive relationship between the stock access score and percent increase in organic sediment; that is, sites with less stock in the channel had relatively greater rates of organic sediment deposition.
- Farm system was a significant predictor of percent *E. coli* increases, with conventional farms has significantly greater increases in concentrations than organic conversion farms.
- Sites with more complex vegetation (trees and shrubs) had smaller increases in *E. coli*.
- Sites with more stock in the waterway had relatively larger increases in *E. coli* concentration.
- Farm system was a significant predictor of percent faecal coliform increases, with conventional farms having significantly greater increases in concentrations than organic conversion farms. Sites with more complex vegetation (trees and shrubs) had smaller increases in coliforms, and sites with more stock in the waterway had relatively larger increases in coliform concentration.

3.2 Discussion and Conclusion

Water quality on a number of the surveyed farms breached national standards. Significant relationships exist between on-farm management and deteriorating water quality. For example, increased stock access to streams is associated with increasing nutrient loads at the farm scale. However, encouraging results include positive relationships between riparian vegetation and water clarity, and the high number of dairy farms with significant stream segments fenced from stock access harboring healthy riparian planting.

Despite these and other clear findings of general stream health, tremendous variability exists between individual farm data, and few clear differences appear between management systems.

Our findings are consistent with other studies and research demonstrating that water chemistry, community structure and ecosystem functioning are vastly different between agricultural waterways and those in unmodified habitats. However, we also found evidence that water quality and instream conditions can change and improve at the farm scale. Our findings suggest that there is potential for landholders to implement management actions that can result in protected or improved water quality within their own property boundaries, as well providing downstream benefits to other stakeholders.

In our study of water quality and aquatic ecosystem functioning on ARGOS sheep/beef and dairy farms, we found evidence of different levels of pollution in different farming sectors, with higher levels of nutrients in waterways on dairy farms than on sheep/beef properties. This reflects more intensive practices in the dairy sector, with higher fertiliser inputs, stocking rates and production. However, we did not consistently find larger relative increases in nutrients or other pollutants across individual dairy farms. In some cases, management actions to prevent harmful impacts on streams, such as fencing to exclude stock, were more common in the dairy sector than sheep/beef farms. Additionally, we found very few differences in stream state or functioning between different farm management systems, with most differences instead relating to individual farm management decisions.

The conclusions from this study are only tentative, as they are based on only one survey per farm, and with information lacking on several potentially important variables. A second round of sampling in summer 2006/07 will allow us to have better control for inter-annual variation in water quality measurements, and provide greater statistical power to detect the mechanisms driving improvements or declines in stream health and functioning. Additional variables will also be added to future analyses, including information on stock rotations preceding, and at the time of the survey, and the presence of subsurface drains on the sampled waterways. The inclusion of these variables will allow us to both re-evaluate the results of this current survey, and better understand the factors affecting waterways on farms in the future.

One of the most crucial parts of the entire project is the continuation of dialogue between the researchers and the individual farmers in the project. The third specific aim of the study is to combine scientific information on the state and functioning of the waterway, with the social, economic and environmental objectives of the farmer, to ensure the ongoing sustainability of the entire farming operation. The results of this first survey will be disseminated to each farmer, including the state of waterways on their own farm, comparison data from other farms in the sector, and information on what factors or actions are affecting these results. With the addition of data from the surveys in summer 2006/07, we can begin to work with individual farmers, to ensure they have cost effective ways to manage waterways on their farms that provide social, economic and environmental benefits.

Plate 2: Waterway and surrounding vegetation on a converting to organic farm.

4.0 Social monitoring

The initial engagement of the social objective of ARGOS with farmers has been by means of qualitative interviews (ARGOS participants only) and a survey (ARGOS participants plus a stratified random sample of New Zealand farmers). From this wealth of data, this report focuses more specifically on the examination of attempts to promote a conversion of dairy farmers to organic practices.

4.1 Structural context of organic management in dairy sector

The implementation of incentives to promote organic management practices in the dairy sector is faced with unique challenges. Many of these challenges are associated with structural factors — that is, factors which affect response but are beyond the immediate capacity of individuals to change. Such structural factors include existing understandings of 'good' farming practice, the lack of readily identifiable marketing objectives or targets, and a general orientation toward increasing production within the sector.

The response of conventional dairy farmers to the national sustainability survey provides some indication of the extent to which the precepts of organic management are recognised as acceptable as a general principle. The expressed preferences of farmers regarding a variety of management practices associated with organic management (as shown in Table 6) provide the basis for developing a scale that reflects farmers' attitudes. By applying a Principal Component Analysis to the data, a common factor (accounting for 52% of the variance) was identified which suggested a strong pattern in the responses to twelve of the questions in Table 6.

The resulting scales/scores were then compared to responses to the remaining survey questions using ANOVAs. The calculation of statistically significant differences in several of the ANOVA analyses pointed to the emergence of two clusters among the dairy farmers – Cluster One containing 21 cases and Cluster Two containing 79 cases (Figure 4).

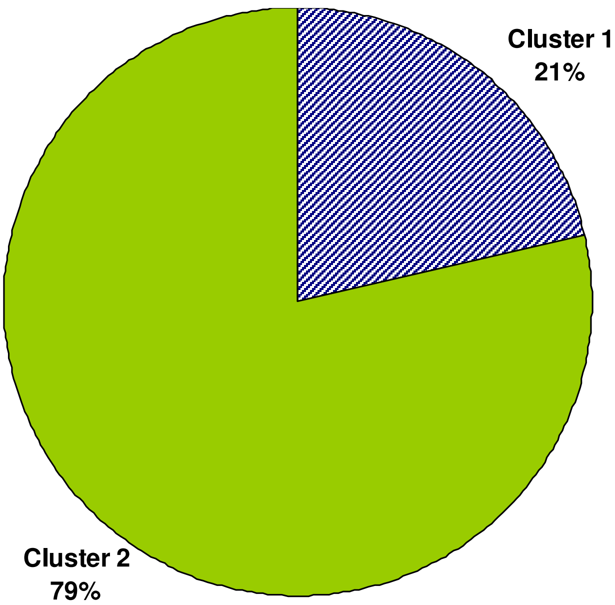

Figure 4: Clustering of dairy farmers

The members of Cluster One are less likely to intend to use GE, more likely to use organics or integrated management, more dependent on organic remedies to control pests and weeds, and observe a greater improvement in their farms' soil health. Cluster Two members can be considered committed productivist farmers while Cluster One members appear to be moving more toward organic systems (while not being actually certified organic). Based on this analysis, it appears that the 21% of dairy farmers with an inclination toward organic management are more willing to experiment with organic remedies than the productivist farmers. In addition, significant differentiation among the first cluster in such factors as risk aversion, family life cycle, or farm development cycle likely effect the willingness to seek organic certification.

Table 4* & 5: Comparison of mean cluster response regarding use of alternative practices, dependency on inputs, impact on soil health, and management intentions.

Cluster Number	Intend using GE (all mean values)[1]	Intend using organics[1]	Intend using Integrated Management[1]	Depend on organic remedies to control pests/parasites[2]	Depend on organic remedies to control weeds[2]	Change in Soil Health over five years[3]
1	3.81	2.14	1.86	2.00	1.76	-1.30
2	3.06	3.45	2.68	1.01	1.01	-0.49

* All differences statistically significant
1. For Intention to Use – 1- Strong intention to use to 5- Strong intention not to use
2. For Dependence – 1 – Not dependent at all to 5 – Extremely Dependent
3. For change in soil health - -4 – Large positive change to 4 –Large negative change

Cluster Number	Committed Conventional (all mean values)	Pragmatic Conventional	Environmentally Conscious but not Organic	Pragmatic Organic	Committed Organic
1	2.71	3.35	3.10*	3.19	2.62
2	3.65	3.96	2.76*	2.50	1.99

* Not significantly different
1- Strongly Disagree to 5 – Strongly Agree

Table 6: Dairy farmer assessment of management practices according to their relative importance.

	Very Unim-portant % (1)	Unim-portant % (2)	Neither % (3)	Important % (4)	Very Important % (5)	Not Applicable % (0)	N	Mean
A. Developing farming skills based on specific knowledge, observation and experience of my own land	8.7	1.6	0.8	35.7	53.2	0	126	4.23
B. Managing in a way that is compatible with natural cycles, including unpredictable events	6.3	2.4	7.9	45.7	36.2	1	126	4.05
C. Returning microbial plant or animal material to the soil to improve it	4.8	1.6	12.8	54.4	26.4	0	125	3.96
D. Achieving pest control by protecting natural enemies and pest	3.9	7.1	26.8	47.2	11.8	2	125	3.58
E. Achieving a balance between crop production and animal husbandry	3.1	2.4	13.4	44.9	25.2	10	125	3.97
F. Maintaining and promoting diversity by increasing the number of crop and plant varieties and/or animal breeds	2.4	15.0	33.1	30.7	10.2	6	123	3.34
G. Respecting the physiological and behavioural needs of livestock and/or plants	3.2	1.6	10.4	56.0	28.8	0	125	4.06
H. Achieving social responsibility in production and processing	3.9	0.8	5	48	42.6	2	124	4.24
I. Using local knowledge in farming practice	3.2	0	5.6	47.2	44.0	0	125	4.29
J. Developing knowledge of the ecosystem on my farm	4.9	0.8	16.4	54.9	23.0	0	122	3.90
K. Using varieties and species adapted to local conditions	3.1	1.6	13	46	34.6	1	125	4.10
L. Using skills and knowledge to avoid dependency on external inputs such as fertilizers, chemicals, or expertise	5.5	6.3	38	30	17.3	1	123	3.49
M. Supporting local and regional markets with the produce from my farm or orchard	8.3	16.5	21.5	30.6	9.1	14.0	121	3.18
N. Supporting and enhancing the things that positively influence ecosystem quality	3.2	0.8	21.0	54.0	21.0	0.8	125	3.89
O. Keeping good relations with neighboring farmers	3.2	0	8.8	48.8	39.2	0	125	4.21

4.2 Individual response to promotion of organic management

The context within which dairy farmers consider and evaluate the implications of adopting organic management practice appears to be relatively adverse. Analysis of responses in the qualitative interviews provides some insight to the range of dairy farmers' responses to and understandings of organic management practice.

The assessment of qualitative interviews with individual farmers indicates that the structural issues identified in the survey exert strong influences on responses to the promotion of organic management practice in the dairy sector. The semi-structured interviews with 23 dairy farmers participating in the ARGOS study[5] during May 2006 addressed a range of topics including: farmer identity and positioning; the farmer's assessment of environmental, economic and social wellbeing; the identification and mitigation of constraints to farming; and the farmer's vision for both the farm household and the farm. This format provided various opportunities for farmers to express their attitudes toward conventional and organic practice as well as to provide an account of their management activities relative to these practices. While differences between conventional and converting farmers regarding attitudes toward organic practice and the definition of organic were not unexpected, the examination of the respective responses provides substantial insight to existing barriers to further adoption of organic certification.

4.2.1 Making the system work

Most farmers recognised that the adoption of organic management involved a certain amount of re-structuring of their farming system – alternative pasture species, new grazing rotations, etc. Such factors accentuated the uncertainties, effort and stress involved in the pursuit of organic certification. This re-structuring was associated with an extended period of learning, mitigated for those with access to organic producer groups that facilitated valuable interactions with others who had already gone through the process. The risk involved with initiating a new period of learning was exacerbated by the realisation that one could no longer rely on chemical solutions:

> Female: "*In principal, we wanted to [use organic practices] anyway — regardless of whether there was any incentive or increased payout. But to go the next step you had to be certified. So then we had to say, "Well look, are we going to do these other things?"*
>
> Male: "*Yeah because before you could do so much and then play around and you had a backstop. If it didn't work, you could go back to something else. Once you actually commit to converting, you sort of need to… "*(Organic)

Those who have recently purchased a farm could face further disadvantages if the land had not been well tended by previous owners:

> *"Well you know we have got to get our soil healthy we have got most I suppose at the moment, what is hard to manage at the moment is production, our soil fertility is quite low, our base saturation and calcium magnesium are very low and …in an biological system, we have to get that up and you can't substitute with chemicals to get us up and going and once we do we will be away … we have got a way to go but with our use of biology and lime, we are hoping we should probably get there in a couple of years rather than in about five so in that way, going down the organic sector, we are probably going to get*

[5] One of the farm households in the study was not interviewed due to the imminent change in management of the farm.

> *there quicker than what we would have if we were conventional."* (Organic)

The converting farmers were also more likely to accept the possibility of lower economic returns. In some cases, this was identified as a limiting factor to earlier adoption of organic practice:

> *"So my partner had those inclinations [when he left varsity]. And I liked the idea then. Then we got a mortgage and we had to pay the mortgage so the best way to pay the mortgage was to go the conventional way."* (Organic)

For farm households that had spent considerable time and effort developing a conventional farm, conversion to organic management was viewed as a step backwards. Conversion would involve renewed development efforts to fit the farm to the system. The following farm wife is very concerned that her partner would be encouraged to convert to organics through his participation in ARGOS.

> *"No, my only [concern] is actually my partner, you know, him actually changing his farming practice to [organic]. I mean, we have just dry-cowed the whole herd. I mean, obviously all those things are not going to happen... For me, it is more him being able to change his [mindset]. He is the one that does it and it is his decision really at the end of the day; but that is my concern, that he would actually do that [change to organic]."* (Conventional)

These types of reflections on the process of converting to certified organic management suggest that decisions are strongly influenced by the life cycle stage of the farm household or the development stage of the farm. The challenge of conversion involves not only the risks associated with unfamiliar practices, but also the awareness of the time and effort involved in developing a new farm system (be it conventional or organic) to the point that it operates smoothly.

4.2.2 Ambivalence in the dairy industry:

A further complicating (structural) factor involves Fonterra's ambivalent position in regard to organic practice. Despite offering a substantial price premium for organic milk, Fonterra continues to promote standards of 'good' farming that underpin conventional practice. In particular, daily reporting of milk solid production reinforces the emphasis on production levels (a standard which contradicts the input restraints recognised by organic producers) driving conventional farming. As a result, farmers feel some pressure to maintain a solid commitment to increasing production on their farms. Currently popular means of achieving this increase involve the introduction of feeding supplements (especially molasses and palm kernel meal) which are often difficult to locate from certified organic sources. Furthermore, reliance on such external inputs runs counter to more general precepts of organic management as discussed below. In a different manner, the emphasis placed on hygienic standards to establish milk quality (while still an important characteristic of organic milk) provides a similar disincentive for organic production. In order to establish the status of organic milk among the products Fonterra markets, it must be possible to distinguish additional quality characteristics that define organic milk as a separate product. It is also important that the characteristics be benchmarked so that organic producers have similar feedback regarding the quality of their production.

Misinformation regarding both conditions of certification and marketing of organic product has also caused some farmers to question Fonterra's commitment to organic milk as an alternative product. In some cases, rumours suggesting that more stringent standards were to be enforced discouraged farmers from pursuing certification and subsequently delayed the development of a farming system that was compatible with organic practices:

> *"What actually did put us off… probably set us back two years. There was some information that'd come out in the paper, saying that Fonterra wanted all their [organic] suppliers to be USDA [compliant]. And they said that any animal that had ever had dry cow antibiotics in their life were to be eliminated straight off. We had used [dry cow therapy] in the herd the year before and we thought that means, that [we would have to cull those cows]. We had lots of pet cows. We thought we couldn't do that and then it turns out that that wasn't actually the regulations at all. But I mean that sort of put us off.* "(Organic)

Uncertainties regarding Fonterra's intentions for the organic milk raised further doubts concerning the future viability of the alternative system. The following farmer, when asked if he knew where Fonterra intended to sell his organic milk, indicated the extent of confusion among some farmers.

> *"Not at this stage. They've told me they haven't got a market for it; but don't change because we might get a market. So they want me to carry on the same. And it could well be that they'll pay me the organic rate; but just put it into ordinary milk bottles. And they'll just do whatever suits them at the time."* (Organic)

Overall, the role of organic milk production within Fonterra's marketing strategy (at least from the perspective of the farmers interviewed) appears poorly defined. As such, it is perceived there is no strong indication of longer term commitment to the product. This situation likely undermines attempts to promote organic certification by increasing the long-term risks associated with conversion.

4.2.3 Representing organic management:

Arguably the greatest influence on a farmer's capacity to undertake conversion to organic management is the way in which organic practice is represented and understood within the sector. The extent to which organic management is perceived as a diametrically positioned alternative to conventional management is readily apparent in the interview responses. The opposition between organic and conventional management involves not just a change in practice, but also the acceptance of a radically different approach to farming. At its most extreme, organic practice is represented as morally and technically superior to conventional management. As this debate is aired in a public arena — predicated in part by the offer of a price premium for organic milk — it has elicited a strong scepticism among those committed to conventional production systems. In the following citations, a farmer contemplates his own position in regard to organic management and concludes by challenging the criteria used to distinguish organic practices.

> *"I went to [an] organic versus in-organic presentation. So, we went to the farms and had a look. And I kept on thinking, "Why am I going to this?", because I'm not that sort of farmer… I've got a thing on my wall about what I got from it actually. Professor Holmes, Colin Holmes, he spoke and he said [that] his biggest concern is mastitis because that seems to be a major problem and you can't solve it with antibiotics. The other thing is the production from both of these farms. The difference between them was that nitrogen had never gone on one. So if things can get solved for those two things, You know, I wonder how they decided what's organic and what's in-organic? What's artificial going into the system? Urea, because it's artificially produced, is*

> *deemed to be in-organic. But at the end of the day, it goes into the soil and it breaks down to ammonium, which is exactly the same as compost breaking down and producing nitrogen. At the end of the day you end up with the same thing. If the plants could speak they'd say, "Ah, I'm not sure why [urea is in-organic]".*
>
> *It always amuses me when I hear about an organic farm that's dug up the soil and they've got so many worms there. But I'd also like to see data of these people… before they've gone organic. I know people in the local district here and they're using a ton of fertiliser, you know organic fertilisers or whatever; but I know that these people wouldn't have given a toss about what was there before. It's just stirred up their interest and that. So it's like when you start to look for a certain type of car on the road, you see them everywhere. If you start looking for these things, you will find them."* (Conventional)

Previously, this same farmer also indicated that he had been influenced by a co-worker who, as the owner of a large horticultural operation, claimed that organic production could never achieve more than a niche status in markets where customers chose according to price. Another farmer who was converting to organic was challenged by a family member who believed that organic management inevitably led to growing weed populations and decreased grass – and overall – production: "What I was trying to get across to you was you may get 20% extra [price premium] but are you going to lose that 20% by loss of pasture" (Organic). From the perspective of the conventional farming ethos, the justification of organic management failed to meet traditional measures or standards of 'good' farming.

Beyond the more pragmatic questioning of the status of organic as a distinct approach to farm management, many farmers (both conventional and converting) suggested that the typical organic farmer was judged differently from his conventional peers. The perceived association of jandals, dread-locks, and laziness with organic farmers who maintain untidy and weedy farms with sick cows remains a strong deterrent to pursuing certification. For example, the following farmer is converting to organic certification, but expresses his concern over his inability to maintain tidy waterways and drains.

> *"People have been organic for ages. They say they let [blackberries] grow and then they just dig it out, you know. They just clean their drains more often and deal with it that way. So, you know, it's just one of those things we've got to get used to perhaps. We're used to it looking like this and now we have to get used to it looking [less tidy]."* (Organic)

The farmer is not so much concerned about the technical ability to control weeds, but the impression that the state of his drains will leave in the community. The ability to maintain the respect of neighbouring farmers is challenged by the altered landscape of the organic farm. The following farmer expresses a similar concern about the control of mastitis in his organic herd.

> *"Probably a 'stresser' is [that] there are animal health issues that happen and I'm going, "Ugh, am I doing the right thing here just treating it this way. Should I be going straight to antibiotics and that can be stressful. I've got a cow now that's got foot rot and it's been sort of four or five days. She's not limping anymore but her foot is still swollen and I'm still treating it but I'm sort of thinking, if I'd used antibiotics it probably would've gone by now. So it's that sort of issue that can cause some background stress. And sometimes it can be very prominent".* (Organic)

Despite having achieved good results with homeopathic remedies, this farmer remains concerned that unhealthy cows (besides challenging his moral response to the welfare of his animals) will distinguish him as a bad farmer.

The tendency to disparage organic farms is also evident in off-hand comments and the less than serious signs of interest in conditions on organic farms. For some conventional farmers, an organic farm offers a more appealing environment to insect pests as well as worms:

> *"Yeah well, we see grass grub in the ground. Black beetle, they're quite a pest. I think everybody, no matter what you do, you're always going to have those sorts of pests. They probably really love organic dairy farms."* (Conventional)

The tendency to not take the benefits of organic management seriously can also negatively affect the organic farmers' sense of wellbeing and accomplishment:

> *"Yeah, [my conventional neighbours] probably push me for a reaction or tease or… I can't really explain it, but it's very interesting the contrast between male and female. The guys, they'll quiz me about a few things, but it's more of a joking nature. They don't want to get into it. Whereas my partner's female friends, they all eyeball you and really get into it… [It's] depressing."* (Organic)

Another farmer indicated that the ability for the organic farmer to assert a claim to being a 'good' farmer extended to traditional assessments of production as well.

> *"I think we've done leaps and bounds. But it's the whole kind of transfer from conventional farming to organics… There's all those kinds of things which, when you are comparing yourself to the top 10% in the country – which is what you're supposed to be doing – it makes it a little bit depressing to kind of even see."* (Organic)

The potential to engage in self-doubt indicates the extent to which organic farmers face challenges to the perceived 'goodness' of their practice based in existing understandings (embedded in established conventional farming practice) of the standards by which a farmer's practice is evaluated.

In response to the negative representations of organic farms and farmers common within the dairy sector, some converting farmers construct similarly negative representations of conventional management practices. The following farmer also finds the need to imbue what his neighbours refer to as weeds with aesthetic values:

> "*… they are all into this, you know, throw some nitrogen on, throw some more sulphur on and that is the way they farm. And just churn and burn stuff… And we have never been into that. Probably cost us production; but that is life. [And it] is not the case [that organic farms have more weeds]. Some of the crops of plantain and chicory, they look beautiful! Look, you know, it is a hell of a lot better than just rye grass and clover. Really."* (Organic)

Adoption of an organic mindset was not, however, always a blind pursuit of the higher ideals of a new farming philosophy. Many converting farmers remained aware of the added labour and time required of their decision:

> *"It's been a whirlwind couple of years learning about organics and learning about farming and thinking. In a lot of respects, I've had it easier than a lot of farmers that are converting because I don't have preconceived notions about how things should go. I'm just learning this way and it seems fine. I can understand why people seek conventional solutions, especially when you are in your fifth or sixth*

> *week of straight ragwort grubbing. It gets old. You wouldn't mind spraying it; but that's not part of the programme."* (Organic)

Such responses provide an indication of the ability for conventional standards of 'good' farming to influence the conversion decisions. They also demonstrate the need for converting farmers to develop their own standards of practice.

Despite the challenges posed to the ability of organic farmers to maintain their status among their peers, the promised price premiums have encouraged some dairy farmers to seek organic certification. The common characteristics among these adopters include either a strong belief in the superiority of organic management or a commitment to eliminating chemicals from their management system due to experience with pesticide or nitrate poisoning. In former case, the predilection toward organic practice often involved a separation from the overwhelming emphasis on (increasing) production prevalent in the dairy sector. This can be expressed as a desire to remain a small, family run farming operation:

> *"Sometimes people ask you about the organic thing and sometimes they don't. They [ask], you know, about the weed thing and the penicillin thing. That's what they always ask. So yeah, we're just small dairy farmers that like to do it ourselves. We've had the lease block and …the workers, [but] we just like to do it ourselves. And we're happy to be small dairy farmers."* (Organic)

Alternatively, and perhaps in an effort to provide a justification that is more acceptable in a sector dedicated to the *business* of milk production, farmers like the one cited below argued that organic practice facilitates a more efficient use of inputs:

> *"For us, the decision to go organic was based a little bit on philosophy and a lot on how do you make a small farm work economically. And I think economic sustainability translates into the environmental sustainability area and the other types of sustainability. If it's not working from a money stand point, it's not going to work; but being just a small farm we wanted to figure out how to reduce the costs and increase the revenue. Organics seems like the best path for that."* (Organic)

The concern for health often involved personal experience but could extend to the health of the family, especially young children, and to the use of homeopathic remedies such as Arnica. In all these cases, the converting dairy farmers subscribe to standards of 'good' farming practice that diverge from the general production orientation which appears to predominate in the sector. They are able to overcome the aspersions directed at organic farmers by reference to justifications (efficient application of inputs or general wellbeing or health) that may or may not be influenced by the offer of price premiums. In fact, the price premium is more likely to encourage farmers already committed to lower input systems to take the final step toward certification – removing the technical 'crutch' of chemical remedies for extreme conditions.

4.3 Discussion and conclusion

The evidence drawn from the National Farm Survey and the Qualitative Interviews indicates that the decision to pursue organic certification involves much more than the risks associated with unfamiliar management of weeds, disease and soil fertility. Similarly, farmers' choices can not be reduced to a simple assessment of the offered price premium. This was particularly evident in the patterns identified in farmers' attitudes toward normative management practices.

Through an analysis of the responses recorded in the national survey, conventional dairy farmers could be designated as belonging to one of two clusters. The larger of the two groups appears highly unlikely to voluntarily convert to organic practice, especially in the absence of crisis[6] in the dairy sector. This group is characterised not only by an expressed aversion to organic practice, but also the embracing of practices and objectives that contradict principles of organic philosophy. The second smaller group is more likely to consider the potential of organic remedies, but is still dependent on chemical inputs to mitigate risks associated with their position within a production oriented sector. Whereas members of this latter cluster would more likely respond positively to a price incentive, a variety of factors constrain the wholesale conversion to certified organic management.

Examination of the interviews with both conventional and converting dairy farmers uncovers many of the additional impediments to the adoption of organic practice they experience. The first type of impediment involves the full implications of adopting organic management practices. The farmers interviewed appear to be well aware of the time and effort involved in conversion. These are viewed as commitments that will interrupt progress toward the development of a stable and more easily managed production system. In addition, the interviews suggested that Fonterra could more clearly articulate the role of organic milk in its portfolio of products, and the long-term security of the organic market. This perceived ambivalence heightens the uncertainties surrounding a commitment to pursuing organic certification.

Finally it is apparent from the interviews that—at the present time—the farmers opting to pursue organic certification are relatively unique among their peers. These farmers all demonstrate a willingness to challenge existing standards of ‘good’ farming as represented by fellow farmers, research organisations, and the industry more generally. Instead, they have developed their own means of valuing a farmer's actions and achievements that is subject to distinct sets of standards ranging from exposure to chemicals to efficient self-sufficiency. The capacity for the existing conventional standards of ‘good’ farming to impede adoption of organic management is evident in the struggles described by the converting farmers as they search for means to justify their decisions.

The findings taken from the national survey and the qualitative interviews suggest several means for more effectively promoting the production of organic milk. All of these factors contribute to establishing organic production as a viable and important aspect of the dairy sector. Perhaps most importantly, there is a need to represent organic management not so much as a superior alternative to conventional management as an alternative which provides certain quality characteristics that meet consumer demands. Such a representation of organic practice would diminish the strength of challenges to the ‘goodness’ of organic management rooted in a competitive comparison to conventional practices. The recognition of organic practice as an ‘equally good’ approach to farm management would need to be reinforced by the development of reporting standards that emphasise quality characteristics associated specifically with organic products in addition to those of milk solid production and hygiene.

Furthermore, the reduction of the competitive comparison of organic and conventional production would facilitate the introduction of environmentally beneficial standards and practices such as the Clean Streams Accord and riparian planting as these are more easily justified as features of more general definitions of ‘good’ farming practice.

[6] The issue of crisis has been identified as an important factor in the successful promotion of alternative management practices (i.e., Integrated Pest Management protocols) in the kiwifruit sector. Poor market conditions for kiwifruit in the early 1990s facilitated the enforced abandonment of scheduled spray regimes that were associated with excess chemical use (and residue rates) at the time.

5.0 Extension

In December, 2006 a series of Fonterra - ARGOS organic field days were held on the properties of three participating farmers in the ARGOS project in the process of converting to certified organic production. These field days included a farm walk, talk by the host farmer, Fonterra marketing presentation, and research updates from the ARGOS sustainability project on economics and stream health.

The two main objectives of the field days in Cambridge, Stratford and Ashhurst were to promote organic dairy farming to encourage more farmers to convert to organic production and provide information to new and existing farmers in the Fonterra organic programme.

Plate 3: Farmers attending the field day in Taranaki

Plate 4: Attendees at the field day in Cambridge

6.0 Work in progress and the next 6 months

The first major field work in the ARGOS project for 2007 is a repeat of the stream monitoring done in 2006. This survey to monitor stream health will commence in January and be completed in February. This stream health survey includes: monitoring of recent flow conditions, habitat quality, water - pH / temperature / conductivity / clarity, composition of stream bed, deposits on stream bottom and bank vegetation. Nutrient concentrations will be measured from water samples collected at each survey site. This will allow correlation of the biodiversity indices to nutrient measures taken at the same place. Water samples will be collected and tested for the presence of faecal coliforms and *E. coli*.

A riparian management and stream health questionnaire is planned for March – April, 2007. This includes questions on how farmers rate and manage (fencing, weeds in riparian zones) the environmental health (water quality, ecosystem health) of the streams on their farms. There are several initiatives to help protect waterways and farmers will be asked if they are aware of these guidelines and whether they participate in schemes such as the Clean Streams Accord, Fertiliser Code of Practice, Fertiliser Spreading Code of Practice, and QE II covenanting of gullies or stream margins.

A financial survey generic to the ARGOS project will be conducted with participating farmers. Financial accounts will also be collected and analysed in the next few months so that a comparison can be made and presented at the 2007 Fonterra Organic Conference in May. A summary of the latest farm management findings will also be prepared and made available to farmers looking to convert to organic production.