ARGOS

AGRICULTURE RESEARCH GROUP ON SUSTAINABILITY

A1 6.9 Stakeholder Report: September 2005

ARGOS Annual Sheep/Beef Sector Report

Compiled by Dave Lucock, ARGOS

The AgriBusiness Group™

Lincoln University
Te Whare Wānaka o Aoraki

UNIVERSITY of OTAGO
SAPERE AUDE
Te Whare Wānanga o Otāgo

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1.0 Introduction

ARGOS is an unincorporated joint venture between Lincoln University, The University of Otago and The Agribusiness Development Group Ltd. The research, being undertaken by ARGOS, is funded by the Foundation for Research and Technology (FRST), and industry partners. ARGOS is undertaking a scientific longitudinal study to investigate the environmental, social and economic consequences of different farming systems in a number of sectors including kiwifruit, sheep & beef, high country, dairy and Ngai Tahu Land Holdings. The null hypothesis, for this study, is that there are no environmental, social and economic differences between management systems. The management systems in participating sheep/beef farms in ARGOS are:

i. Organic
ii. Integrated
iii. Conventional

The farm have been partitioned into 12 clusters (a group in close geographic proximity), of three farms per cluster. A cluster has one farm of each management type (organic, integrated and conventional). The geographical spread of the clusters is illustrated in figure 1. This report has been prepared to provide you with further information on the ARGOS project, as well as provide an update of some of the recent sheep/beef results.

This Sheep/beef sector report will be updated annually and will be complemented by other information gathered by the ARGOS team. This will include information about the social, economic and ecological indicators being measured throughout the course of the research.

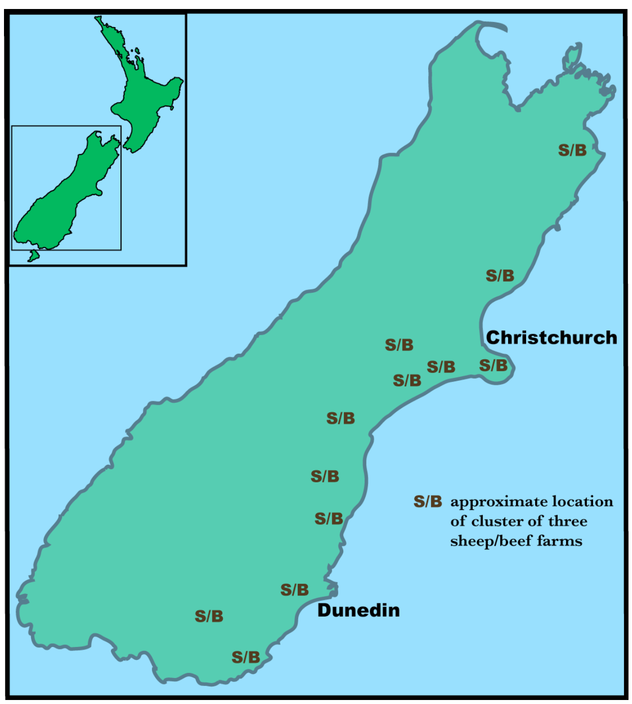

Figure 1. Geographic spread of sheep/beef farm clusters in ARGOS

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2.0 2004/05 Results

2.1 Introduction

This section provides some of the results obtained from the ARGOS research programme over 2004/05. It is the second year of monitoring and though it is still too early to identify many differences between farms and farming systems, there are some interesting trends emerging which will be subject for further analysis.

This section of the report provides results under the following headings;

- Economic
- Environmental
- Farm Management
- Social

Though these headings reflect the different disciplines involved in this project, in future there will be more collaboration in the analysis of results to identify possible relationships between the different disciplines.

Table 1 provides a summary of the monitoring activity over the last 12 months.

Table 1 ARGOS Activity 2004/05

Sheep/Beef	Activity and Output	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Farm Management	Baseline farmer report												
	Annual farmer survey												
	Soil sampling												
	6 monthly ARGOS newsletters												
	Cameo studies												
	Livestock representative reports												
	Piloted Stockpol with one cluster												
	ARGOS website maintenance/update												
Economic	Annual farmer report												
	Sheep/Beef sector report												
	Annual farm survey												
Energy	Data collection												
Environment	Annual farmer survey-Birds, Bats & Fish												
	Birds, Bats & Fish - Survey report												
	Farm mapping												
Social	First qualitative interview												
	Quantitative survey												

Key:

Objective responsible for outcomes
Farm Management
Economic
Environment
Social

2.2 Economic

2.2.1 Introduction

New Zealand is unique as a developed country, relying on agricultural production and trade for most of its foreign exchange earnings. This, of course has had its problems, not least, difficulties of access into the main, high value markets around the world. However, given the latest agreement at the WTO, this may begin to change with the gradual removal of trade distorting support from the main markets. While direct trade barriers will be removed, other restrictions on trade may start to be applied more stringently, such as the method by which the food is produced, i.e. a greater focus on food safety and concern over the environment. Whilst NZ has some real advantages in these areas, it needs to be able to meet these new market demands and consider its' production methods as well as marketing.

The main focus of the economics objective in ARGOS is therefore, the relationship between agricultural markets and resource allocation in New Zealand. This includes a detailed understanding of the economics at farm level, industry level, as well as on a world trade level. As the ARGOS programme progresses, economic issues will be linked with social and environmental issues, across each of these levels.

At the farm level, the research activities to date have been focused on collecting and analyzing farm financial accounts. The analysis of the first year financial data has resulted in some benchmarking data, relayed back to the farmers, and has formed the background to the development of further hypotheses. The results have also instigated the deployment of a farm survey that provided more detailed information, for example on labour use and energy use.

On the other end of the spatial spectrum, global (and local) market aspects, the focus has been on a series of reviews, among others; a review of international agricultural trade policy, a review of factors influencing farm gate returns, and a review of eco-labelling and analysis of the markets for eco-label products including organics. These reviews form the basis for understanding the agricultural markets and have been used for economic trade modelling with the Lincoln Trade and Environment Model (LTEM). Some trade scenarios relating to organic production were presented a conference in February 2005. Furthermore, the LTEM has been updated and expanded; the data has been updated to base year 2000 and thus now has predictions to 2013; updated trade policy data; and China has been added as a new country in the model.

2.2.2 Financial Results

Introduction

The farm accounts for the ARGOS farms have been collected for 2003/04 and reviewed. Table 2 provides results for ARGOS farms. Results from the MAF Farm Monitoring farm have also been included to provide a broader basis for comparing performance.

Table 2: Comparison between Organic, Integrated, Conventional, MAF and all ARGOS farms for the 2003/04 financial year

*all figures on a per hectare basis unless otherwise stated

	All ARGOS		Organic		Integrated		Conventional		MAF 03/04
	Average	**Median**	**Average**	**Median**	**Average**	**Median**	**Average**	**Median**	**Average**
Area (h.a)	386.3	322.5	345.3	320.0	444.8	328.0	367.0	325.0	636.3
Revenue									
Sheep	417.4	406.8	383.9	385.6	441.9	460.2	430.6	383.7	295.9
Wool	80.4	81.5	61.1	59.4	88.0	102.7	98.2	88.5	80.7
Cattle	144.1	90.8	92.1	73.9	161.7	64.4	195.9	138.3	218.1
Deer/Crops	273.8	0.0	333.2	14.5	259.4	10.2	206.3	0.0	0.0
Sundry	83.0	12.9	53.6	10.4	118.4	18.9	74.1	14.2	23.5
Sum Revenue	**998.7**	**755.2**	**923.9**	**741.7**	**1069.4**	**744.2**	**1005.0**	**781.8**	**618.3**
Expenditure									
Wages & Contracting									
Permanent wages	63.9	27.0	86.1	43.7	57.1	23.1	40.7	28.9	16.7
Casual wages	4.6	0.0	3.1	0.0	8.4	0.0	1.2	0.0	12.2
ACC	6.3	4.2	5.6	5.0	7.7	4.2	5.2	5.0	7.4
Agricultural contracting	29.2	10.3	40.2	13.1	25.4	2.7	18.6	12.9	n/a
Shearing costs	29.0	30.2	10.1	24.2	32.3	36.5	34.3	33.1	26.2
	133.0	71.6	145.0	86.1	130.9	66.4	100.0	79.9	62.5
Animal Expenditure									
Animal health	24.9	17.7	10.1	10.4	33.5	34.0	34.3	33.5	23.8
Breeding	5.0	0.0	0.9	0.0	1.7	0.0	16.0	6.7	1.9
	29.9	17.7	11.0	10.4	35.2	34.0	50.3	40.2	25.6
Feed									
Feed (hay and silage)	14.1	7.0	12.0	2.1	15.2	10.6	15.6	7.0	8.1
Feed (grazing)	21.5	0.0	12.9	0.2	25.8	0.0	28.0	2.5	2.2
Feed (other)	6.9	1.8	1.9	0.4	14.4	3.1	3.3	3.8	4.8
	42.6	8.8	26.8	2.7	55.4	13.6	46.9		15.1
Pasture Improvements									
Fertiliser	83.9	56.9	45.2	11.5	112.4	62.4	99.1	75.2	56.8
Lime	1.4	0.0	0.8	0.0	1.1	0.0	2.8	0.0	3.8
Regrassing costs (contractors)	8.6	11.7	18.3	10.2	4.0	0.0	0.9	8.0	4.8
Seeds	30.0	11.9	22.3	6.5	39.9	17.9	26.5	11.9	6.7
Weed and pest control	34.6	6.8	7.1	0.1	51.4	9.2	50.5	24.9	8.4
	158.4	87.3	93.7	28.2	208.9	89.5	179.7	120.0	80.4
Vehicle & Fuel									
Fuel	27.4	23.2	25.6	20.6	30.3	26.9	25.5	23.2	10.4
Vehicle costs (excluding fuel)	35.7	31.0	32.0	31.6	37.2	27.1	39.2	35.3	10.0
	63.1	54.2	57.6	52.2	67.5	53.9	64.7		20.5
Repairs & Maintenance									
Repairs & Maintenance	62.9	45.9	66.2	40.6	52.9	42.4	72.6	81.3	28.2
	62.9	45.9	66.2	40.6	52.9	42.4	72.6		28.2
Admin & Other									
Electricity	19.2	5.5	14.1	4.9	26.5	5.4	16.0	5.5	5.6
Farm forestry costs	2.2	0.0	2.8	0.6	3.0	0.0	0.4	0.0	1.6
Freight (not elsewhere deducted)	29.0	11.7	31.8	10.2	31.6	15.0	21.0	8.0	7.8
Rates	15.0	14.2	15.4	14.3	15.2	16.2	14.0	13.3	11.1
Comunication costs	6.5	4.8	7.5	5.2	7.1	5.3	4.1	3.4	3.6
Insurance	15.0	13.4	15.2	12.7	16.1	12.2	13.0	14.3	6.8
Accountancy	8.6	7.8	9.0	10.0	9.6	6.8	6.6	7.5	5.1
Legal and consultancy	4.1	0.1	2.4	0.1	7.5	3.7	1.6	0.0	3.0
Other administration	17.9	4.7	15.3	9.6	9.8	3.8	34.0	3.9	3.4
Other expenditure	10.0	2.9	9.0	2.3	14.1	3.1	5.2	2.3	4.3
	127.5	65.1	122.4	69.9	140.4	71.5	115.9	58.2	52.2
Total Working Expenditures	**618.7**	**458.0**	**534.7**	**376.3**	**691.1**	**458.0**	**630.0**	**523.2**	**284.5**
	Organic per ha ($)			**Integrated per ha ($)**			**Conventional per ha ($)**		
	2002/03	2003/04	% change	2002/03	2003/04	% change	2002/03	2003/04	% change
Revenue	908.1	923.9	1.7%	997.3	1069.4	7.2%	1217.5	1005.0	-17.4%
Gross Farm Revenue	897.7	912.0	1.6%	986.2	1061.8	7.7%	1163.6	897.6	-22.9%
Cash Farm Expenditure	526.3	534.7	1.6%	650.2	691.1	6.3%	703.8	630.4	-10.4%
Operating Surplus	371.4	377.2	1.6%	336.0	370.7	10.3%	459.8	267.2	-41.9%
Economic Farm Surplus	n/a	152.6	n/a	n/a	134.2	n/a	n/a	96.8	n/a
Cash Farm Expenditure/GFR	58.6%	58.6%	0.0%	65.9%	65.1%	-1.3%	60.5%	70.2%	16.1%

Analysis

There is no significant difference in the economic performance of the three farming systems under study. This is partially as a result of the short period that data has been collected and the associated difficulty of being able to identify any clear trends – as well as the possible similar overall performance of the farms. Further analysis will be undertaken to identify any significant differences between economic and a broader range of farm performance indicators e.g., farm outputs which will be reported in a supplementary report at the end of 2005. Additionally, further research will be undertaken with national (and global) sheep/beef economic data series to identify major trends and processes. The more detailed ARGOS data will then provide better contextualization, but real benefits from this are still some time away.

2.2.3 Energy Results

Introduction

There are several key drivers for wanting to improve our knowledge on energy efficiency and related climate change issues:

1. To improve profitability - identifying ways to enhance overall energy efficiency and decrease energy input costs (particularly as energy costs continue to soar)
2. To protect and enhance NZ's 'clean green image'
3. Market access issues – the amount of energy required to produce and transport food (food miles) is emerging as a potentially significant issue in relation to access of some markets e.g., European Union.
4. To assist New Zealand to meet its Kyoto Protocol obligations.

Total energy use, including not only fuel but the energy embodied in the manufacture of all farm inputs, particularly nitrogen fertiliser, is an important measure of a farms overall sustainability. Benchmarking performance can highlight areas for improvement (particularly around irrigation efficiency and tillage practices) as well as gaining a better understanding of the on-farm environmental impact compared to other parts of the food chain, for example, transport and processing.

Results from the current analysis, which are summarised in Table 3, do not take cropping outputs into account. Ways of partitioning the inputs based on outputs, will be investigated next.

Terminology

<u>Direct energy</u> is that energy used directly by the operation and is most easily recognised as energy e.g. diesel, petrol and electricity.

<u>Indirect energy</u> is that energy which is embodied in agrichemicals and fertilisers. Indirect energy is calculated using previously determined coefficients. For example, the production of nitrogen fertiliser requires large quantities of energy for its synthesis from natural gas which must be included in a farms overall energy use in order to determine the true total energy input.

<u>Capital energy</u> is that energy in structural material form, such as machinery, fences and buildings.

It is important to know the <u>total energy</u> use (the sum of the direct, indirect and capital energy) to get a true picture of the energy flows in and out of the farm. This data is then available for comparing farm performance between similar farms and between growing systems e.g. conventional versus organic or internationally between countries.

Results

Table 3 Energy Use for ARGOS Farms in the 2003/2004 financial year

Energy Use on an area basis

	Organic	Integrated	Conventional	
Direct Energy Use				
Diesel (self)	26.2	26.9	42.7	litres/ha
Diesel (contractors)	2.3	3.6	3.9	litres/ha
Total diesel	28.5	30.4	46.6	litres/ha
Electricity	-	-	-	kWhr/ha
Indirect Energy Use (Consumables)				
Nitrogen	0.0	27.1	12.0	kg/ha
Phosphorous	4.5	25.0	23.5	kg/ha
Potassium	0.7	0.5	2.3	kg/ha
Sulphur	1.4	32.4	24.3	kg/ha
Magnesium	2.1	2.1	3.6	kg/ha
Lime	174.0	187.5	74.8	kg/ha
AgriChemicals	0.0	1.8	1.2	kg/ha
Capital Energy Use				
Vehicles	1.9	3.1	2.1	kg/ha
Buildings	0.1	0.1	0.1	m^2/ha
Steel	-	-	-	
Wood	-	-	-	
PVC	-	-	-	
PE	-	-	-	

Energy Use on a production basis

Direct Energy Use	Organic	Integrated	Conventional	
Diesel (self)	4.8	2.5	4.4	litres/SU
Diesel (contractors)	0.2	0.5	0.4	litres/SU
Total diesel	5.1	3.0	4.8	litres/SU
Electricity	-	-	-	kWhr/SU
Indirect Energy Use (Consumables)				
Nitrogen	0.0	4.7	1.3	kg/SU
Phosphorous	0.6	4.1	2.4	kg/SU
Potassium	0.1	0.0	0.2	kg/SU
Sulphur	0.2	4.3	2.4	kg/SU
Magnesium	0.3	0.2	0.4	kg/SU
Lime	19.7	15.9	8.7	kg/SU
AgriChemicals	0.0	0.2	0.1	kg/SU
Capital Energy Use				
Vehicles	0.3	0.3	0.2	kg/SU
Buildings	0.0	0.0	0.0	m^2/SU
Steel	-	-	-	
Wood	-	-	-	
PVC	-	-	-	
PE	-	-	-	

Please note that the number of farms included in each energy input category (direct, indirect and capital) varies depending on which farms have completed different parts of the survey. For example some farms may be included in the average direct input figure but not the indirect and consequently are also excluded from the total.

A gigajoule (GJ) is equal to 1,000 megajoules (MJ). A litre of diesel contains 35 MJ of energy. For example, a farm with an energy input of 250 MJ/SU is equivalent to 7 litres of diesel per SU.

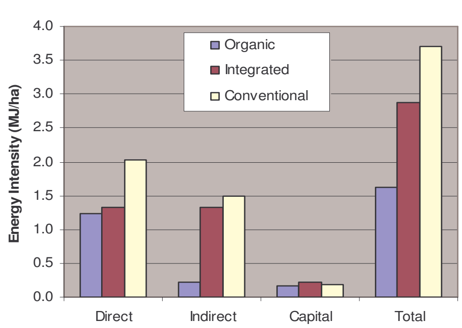

Figure 2. Energy intensity (direct, indirect, capital & total) in MJ/ha

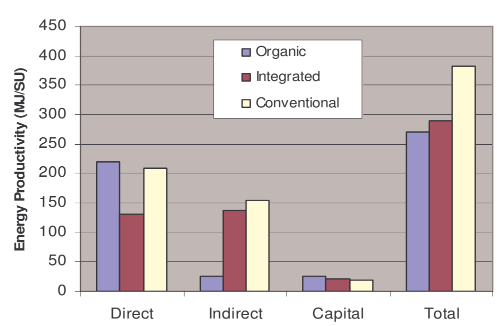

Figure 3. Energy Productivity (direct, indirect, capital & total) in MJ/SU

Analysis

Overall the energy input per hectare is lower on organic farms compared with integrated and conventional systems; this is almost solely driven by lower fertiliser inputs. However on a production basis, all three management systems are very similar.

The data analysis phase of ARGOS has just begun; however two key aspects have already emerged. Firstly, because of the small sample size involved, minimising the number of data gaps is absolutely vital. Secondly, sheep and beef farms are extremely complex and unlike dairy farms or kiwifruit orchards, where there is just one dominant output, a large number of livestock and crop mixes need to be taken into account. At this stage we have described energy use on a hectare and stock unit basis, neither of which adequately accounts for cropping practices. One method to help address this problem may be to develop an overall energy ratio by assigning all farm outputs an energy value. A figure greater than one would show a farm that requires more energy inputs than it produces, and likewise a figure less than one would show that a farm is capturing the suns' free energy and producing more energy than is being supplied as fossil fuel. Together with the comparison of management systems, international comparisons can also be made.

2.3 Environmental

2.3.1 Introduction

The environmental research programme on ARGOS farms aims to clarify the environmental impacts of different farming systems. This will assist in the identification and subsequent implementation of more sustainable and resilient farming systems. Over this year, a baseline ecological survey of the ARGOS farms has been undertaken which identified landforms and habitats. This was supplemented by biodiversity surveys of bats, birds, lizards, frogs, fish, insects, soil biota and plants. These surveys acted as a test for monitoring methods and the information obtained will assist in the selection of a small group of 'focal species' for efficient long-term monitoring. These are species judged to be particularly important to farming and ecological processes in farmscapes, for example, species that provide ecosystem services (pollination, soil formation, predator biocontrol, seed dispersal), ones that are important pests, or ones that are especially valued by the farmers or kaitiaki ('flagship' or 'taonga' species). As we can not possibly measure all biodiversity on farms, it has been important that we choose focal species that are practical to measure, reasonably common and widespread, and particularly sensitive indicators to ecological practice. A check for threatened species was also undertaken and if they were identified, special monitoring and management was suggested to support farmers to find ways to nurture the populations without undue disruption to normal farming practice.

This research programme recognises that ecological processes and biodiversity on New Zealand's farmed landscapes have received very little study so far. In addition to monitoring the effects of different farming systems this research will also examine general ecological processes in farm agro-ecosystems. The research will also provide an understanding of why the indicators are or are not changing. Identifying the reasons for the observed changes or lack of them, is the key to better advice on how to bring the desired improvements in sustainability and resilience.

The environmental research team aims to help farmers assert their rightful place as stewards of the land and build their capacity to make a contribution to reducing the present decline of indigenous biota. ARGOS will also focus on defusing a damaging divide between some regulatory agencies and farmers by facilitating dialogue, sharing information and creating tools that build mutual respect and co-operation between land owners and regional councils and national institutions (MAF, DoC, and MfE).

2.3.2 Landform Surveys

Initial surveys of the ARGOS sheep/beef farms to identify landforms and habitats has been completed with the information obtained used to create maps of each participating farm and key features (shelterbelts, fences, houses, drains and streams etc.). This information will provide baselines from which to monitor future changes. Remote sensing (satellite) imagery will be 'ground-truthed' and then used to derive long-term indices of habitat complexity and diversity. A Geographic Information System (GIS) and database of all ecological descriptors is under development and will facilitate consistent long-term monitoring and analysis of environmental changes of farms. Copies of the aerial photos/maps will be provided to each farmer participant as, and when they are completed.

2.3.3 Soils

Introduction

Soil health monitoring and research is a very high priority in the ARGOS monitoring programme. This is because good soil quality is the key to sustaining production, livelihoods and diverse and abundant ecological communities on farms. Soils, their associated microbes and other biota are also the fundamental basis for all farming sectors and farming systems. Therefore, the soil provides a common ground to compare all the ARGOS farms. Standard soil physical and chemical measures of topsoils were undertaken and supplemented with Visual Soil Assessments to track general changes in soil condition. Assays of microbial activity that index the vitality of soil cycling processes are currently being undertaken.

Results

Soil test results for farms, from the sampling undertaken this year, were sent, to each participating farm, earlier this year.

Outlined below are some of soil results from the comparisons between the three sheep/beef farming systems.

Soil Physical and Biological Properties – Measured from a visual soil assessment
Soil porosity, discolouration by mottles or gleying, and aggregation (1-4 scale 1=good, 4=poor))
The proportion of scores of 2 or greater did not differ significantly between the different management systems.

Soil bulk density and earthworm populations
There was no difference between management systems in soil bulk density at either depth. Earthworm populations were not normally distributed and required logarithmic transformation before analysis of variance was performed. Back-transformed averages are presented for this variable. Earthworm populations were lower under organic management than conventional management.

Table 4. Soil bulk density and earthworm populations.

Management	Soil bulk density 0-7.5 cm (g/cm3)	Soil bulk density 7.5-15 cm (g/cm3)	Earthworms (no./m3)
Conventional	1.16	1.29	1411
Integrated	1.13	1.25	1187
Organic	1.12	1.28	1025
Significance	NS	NS	NS
LSD 0.05	0.08	0.06	LSR0.05 = 1.33

Soil chemical properties
These measurements are conducted at the paddock (management unit) level. The samples were collected using random transects across the paddock, rather than composite samples collected from the soil monitoring sites.

Soil pH, Olsen P and P retention
There was no effect of management system on soil pH, and soil pH was in the normal range for pastoral soils. There was no difference between management systems on phosphorus retention. Phosphorus retention is related to the amount and type of soil minerals and soil pH, and is unlikely to be effected directly by a management system.

Soil Olsen P was not normally distributed and required logarithmic transformation before analysis of variance was performed. Back-transformed averages are presented for this variable. Olsen P was less on organic farms than on conventional or integrated farms, and this could be due to the types of phosphate fertilisers used. Organic phosphate fertilisers (e.g. reactive phosphate rock) tend to release phosphorus over a long period of time, and the Olsen test for phosphate does not measure this slowly available phosphorus. Olsen P for organic farms is less than the normal range for pastoral soils of 20 to 30 µg/ml.

Table 5. Soil pH, Olsen P (µg/ml) and phosphorus retention (%).

Management	Soil pH	Olsen P (µg/ml)	P Retention (%)
Conventional	6.0	24	27
Integrated	5.9	24	26
Organic	6.0	14	28
Significance	NS	P<0.001	NS
LSD 0.05	0.1	LSR0.05 = 1.25	5

Exchangeable calcium, magnesium and potassium
There was no effect of management system on any of the exchangeable cations. The levels of calcium, magnesium and potassium are within the normal range for pastoral soils.

Sulphate sulphur, cation exchange capacity (CEC) and total base saturation
Sulphur levels were less under organic management than conventional and integrated management, and this difference is most likely to be due to differences in fertiliser applications.

There was no effect of management on either CEC or total base saturation. CEC is a function of soil mineralogy and organic matter content and the sampling system using geographic clusters should reduce the effect of differences in soil mineralogy. Base saturation is the total of exchangeable base cations ($Ca2+$, $Mg2+$, $K+$, $Na+$) as a proportion of CEC, all of which showed no effect of farm management.

Potentially mineralisable nitrogen, organic carbon and total nitrogen
There is no difference in potentially mineralisable N between the management systems. There was no effect of management on soil organic carbon or total nitrogen. As there was no management affect on either variable, the carbon to nitrogen ratio (average of 12.1) was also unaffected by management system.

Analysis

Few soil parameters show any difference between management systems. The main difference between management systems is soil Olsen P, which is significantly lower on organic properties. A review of fertiliser inputs is necessary to confirm the difference in soil phosphorus is due to different fertiliser inputs.

Pasture production is strongly effected by soil phosphorus levels. Assessments of pasture production will be conducted to determine if lower soil phosphorus levels on organic properties is effecting pasture production and organic matter inputs. If soil phosphorus is effecting organic matter inputs, this may in turn effect other soil factors which are sensitive to change in organic matter inputs, such as soil organic carbon and soil biological properties.

No difference in soil organic carbon between management systems was determined, but this test represents both the inert and active pools of soil carbon, and large changes in organic matter inputs are required before significant shifts in soil organic carbon levels can be detected. Earthworms are sensitive to changes in management practices and populations were lower under organic management than conventional management. Measurements of other biological properties (microbial biomass carbon and basal respiration) were not conducted.

2.3.4 Bird Survey

Introduction

The distribution and abundance of different bird species tend to be associated with the type of habitat that is in an area. Production landscapes, with their generally lower habitat diversity and complexity and lower levels of native flora are widely hypothesized to support introduced granivorous (those feeding on grains or seeds) species such as chaffinches, redpolls and starlings, whereas areas of native forest and scrubland are more likely to contain native frugivorous/omnivorous (those feeding on fruit/vegetables and meat, alive or dead) and insectivorous species such as bellbirds, kereru, fantails and grey warblers. In addition, different farm management practices and strategies (ie organic, integrated and conventional) may also impact on avian species richness and abundance, although there have been no specific investigations of the avifauna associated with different management approaches. However, none of these questions have been extensively studied in New Zealand.

Three objectives of this farm study were:

1. To quantify the diversity and abundance of bird species present on sheep/beef farms.
2. To compare the avian communities present on sheep/beef farms with those found in natural habitats (native forest, pine plantations and scrubland).
3. To compare the avian communities found on organic, IM and conventional sheep/beef farms.

Methods

Distance sampling and 5-minute bird counts were the two sampling techniques to quantify the bird communities found on ARGOS farms. Distance sampling involved walking 5-11 transect lines across the farms and recording the identity and distance of all birds seen or heard (and from this information, densities of birds per ha can be calculated). Six to twelve 5-minute bird counts on each farm were completed, where an observer stood at a random point and counted all birds seen or heard. Five-minute counts have been widely used in natural habitats in NZ, and so allowed the comparison of bird communities found on ARGOS farms with other habitats. For comparison, we collected 5-minute count data from 31 other studies in areas of native or pine forest and manuka/kanuka scrub, and compared the bird communities present in these different habitats with those found on the ARGOS farms.

Results

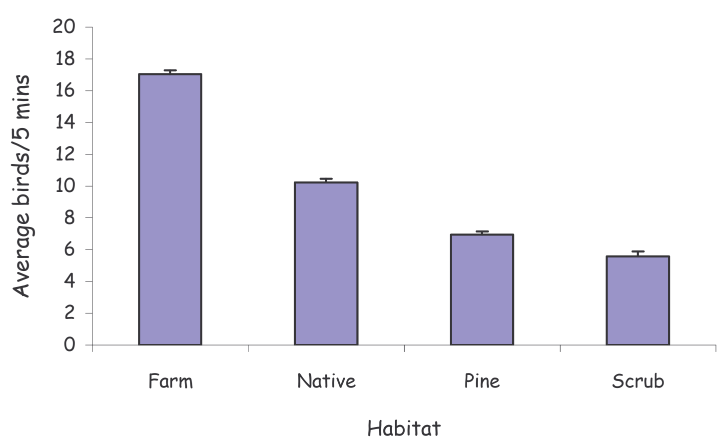

Figure 4. Abundance of birds on farms versus natural habitats

Abundance of birds on farms versus natural habitats
Total abundance of birds, irrespective of species, was significantly higher on the ARGOS farms than in any of the natural habitats. Farms had an average of 15 birds recorded per 5 minutes, compared to 9 per 5 minutes in native bush, 7 per 5 minutes in pine forest and 6.3 per 5 minutes in scrub.

Number of species on farms versus natural habitats.
Farms, native bush and pine forests had similar numbers of species (an average of 15 species per farm or site), all of which were significantly higher than scrubland (average 9 species per site).

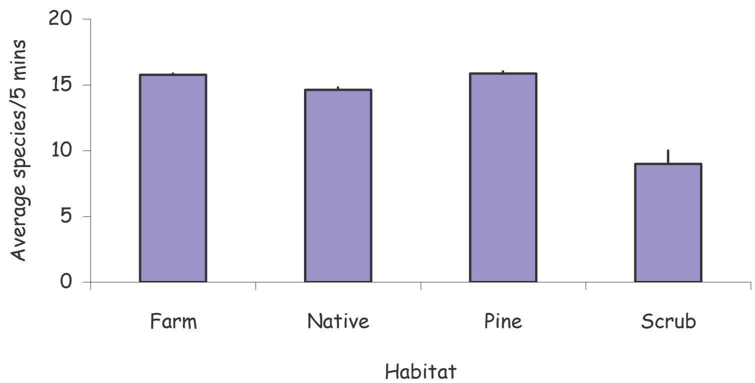

Figure 5. Number of species on farms versus natural habitats.

Proportion of species on farms versus natural habitats.
The proportion of native species was significantly lower on the farms, with only around 20% of species being native. Note however, that only 50-60% of the birds recorded in studies in natural habitats were native. The introduced species present in natural habitats included species such as blackbirds, thrushes, chaffinches and house sparrows.

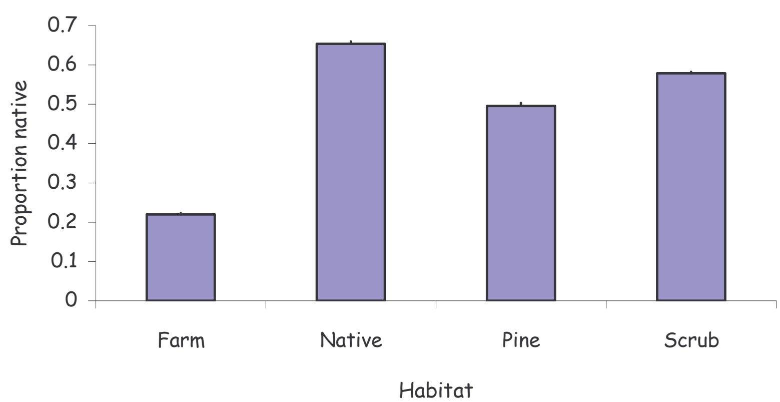

Figure 6. Proportion of species on farms versus natural habitats.

Table 6. Bird Survey Results

Birds found on ARGOS farms - January 2005

Species red = native, blue = introduced	Organic	Integrated	Conventional	All Farms
bellbird (nectar)	38	37	31	106
black billed gull (omnivore)	0	4	3	7
black shag (fish eater)	0	2	0	2
blackbird (omnivore)	152	132	181	457
california quail (seeds/vegetation)	1	5	6	8
chaffinch (weed seeds/fruit/insects)	125	99	138	367
cirl bunting (seeds/insects)	0	3	2	5
duck (assorted spp) (vegetation)	10	15	13	32
dunnock (insects)	27	33	32	86
falcon (carnivore)	0	2	0	2
fantail (insects)	11	15	24	49
feral pigeon (crop seeds/some insects)	17	23	40	74
goldfinch (weed seeds/insects)	208	189	242	600
greenfinch (seeds/fruit/insects)	159	205	241	580
grey duck (seeds/aquatic vegetation)	0	1	5	6
grey warbler (insects)	35	24	40	99
harrier hawk (carnivore)	32	28	24	85
house sparrow (seeds/frui/insects)	157	121	226	450
NZ wood pigeon (seeds fruit)	3	3	2	8
kingfisher (insects/fish)	0	4	4	6
little owl (insects/birds/mice)	0	1	0	1
magpie (seeds/insects/carrion)	153	207	228	589
mallard duck (aquatic vegetation/crop seeds)	7	22	10	38
morepork (insects/birds/mice)	1	0	0	1
paradise shelduck (aquatic vegetation/seeds/crops)	34	18	22	72
pheasent (seeds/fruit/insects)	0	1	1	1
pied oystercatcher (insects/worms/grass grub)	30	33	37	109
pied stilt (insects)	4	8	8	20
pipit (insects/some seeds)	1	0	0	1
poultry (seeds/vegetation)	8	5	9	15
pukeko (vegetation/insects)	4	0	2	6
redpoll (seeds/fruit/insects)	320	212	237	775
rifleman (insects)	0	6	1	7
robin (insects/small fruit)	2	0	1	3
shining cuckoo (insects)	1	0	0	1
silvereye (insects/fruit/nectar)	18	41	27	81
skylark (weed and crop seeds/insects)	489	664	549	1644
song thrush (insects/fruit)	77	91	112	278
southern black backed gull (omnivore)	66	44	65	174
spur winged plover (insects/some seeds)	60	105	103	252
starling (insects/fruit)	143	193	190	507
tomtit (insects)	7	6	2	15
tui (nectar/some fruit)	0	2	10	11
turkey (leaves/some insects)	2	2	0	4
welcome swallow (insects)	44	49	40	132
white faced heron (fish/frogs/insects/mice)	5	10	7	20
yellowhammer (seeds/insects)	237	253	272	729
Grand Tot.	**2646**	**2918**	**3162**	**8519**
Number of Species	**37**	**42**	**40**	

Analysis

The bird communities found on the ARGOS sheep/beef farms were significantly different from those found in natural habitats, with significantly more introduced species found on the farms. The native species that were recorded on the farms had characteristics that allowed them to successfully exploit the habitats there. For example, pied oystercatchers and black-backed gulls were frequently found in ploughed or recently harvested paddocks, while small bush remnants commonly contained the opportunistic fantail and grey warbler.

Within the farms, properties with more native vegetation and more diversity of habitats had greater abundance and diversity of bird species. They also had more native species present, although this proportion was still much lower than in scrublands, or pine or native forest.

The findings suggest that any farm management actions undertaken that increase habitat diversity will also increase bird species diversity, particularly native species diversity. For example, planting of stream banks and gullies for soil stabilization can also be expected, over time, to the numbers of species such as fantails, silvereyes, and grey warblers, and ultimately tui, bellbirds, and wood pigeons. It should be noted however, that if the aim is to increase numbers of species such as wood pigeons and bellbirds, additional actions may be required, such as mammalian predator control, or the planting of favoured species, such as kowhai.

No detectible differences were found in the bird communities on organic, IM and conventional farms. Aspects of on-farm and wider-landscape topography, vegetation type and structure seem to be very important in determining what bird species are present. With respect to the effects of farm management, it may be that the influences of different management actions are fairly minor compared to the broad effects of vegetation structure and diversity. It is also possible that the time since conversion to integrated or organic management has not been long enough for any differences to become apparent, as they have in studies of the effects of farm management on bird communities in the U.K. We may best find these possibly subtle effects by focusing on introduced species, which have evolved in open grassland or woodland, rather than in our native species, which tend to be more closely tied to native forest habitats.

Conclusion

•Introduced passerines such as yellowhammers, greenfinches and goldfinches are commonly associated with farms.
•Farms with more intensive landuse had higher densities of introduced passerines (e.g. house sparrows, greenfinches)
•Most native birds found in natural habitats, such as tomtits, riflemen, brown creepers, kaka, and kakariki, were uncommon on farms.
•Native species on farms include tui, bellbird, grey warblers, fantails, pied oystercatchers
•Farms with more native habitat (e.g. Owaka and Banks Peninsula) had significantly different bird communities with more native birds (bellbirds, grey warblers, fantails)
•Farms with more habitat diversity (eg mix of shelter belts, bush, rough faces, ploughed and open paddocks) had higher bird diversity
•Actions that increase structure for other reasons (eg planting for erosion control) should benefit native biodiversity on farms
•**There were no differences in bird communities between farms with different management practices**

Note:
It should just be noted here that the surveys missed some species that the farmers knew were present on their farms. An obvious example of this is the morepork, which daytime surveys would not have picked up (although previous studies from natural habitats were similarly conducted during the day and would have also missed moreporks). There were other cases where a farmer may have told the survey team of species that they knew were present, but which our survey teams missed. This could be due to seasonal differences or diurnal variation on the farm. This is acknowledged to be a potential limiting factor of the study, but the surveys still provide a relative comparison of the bird communities found on the ARGOS farms.

Bat survey on ARGOS farms

Introduction
Bats have a special importance in New Zealand conservation because they are the only native terrestrial mammals. Both the long-tailed and short-tailed bat are considered threatened and now occupy a much smaller area than previously, although some of this distribution does include farmland (e.g. in the Geraldine region in South Canterbury). However, surveys of bat distribution in New Zealand farmland landscapes are sparse and incomplete and it is unclear how frequently bats roost or forage in farmland. Additionally, the bats are cryptic unless specialised 'bat detectors' are used to convert their ultrasonic echo-location calls into audible signals. Consequently, it was decided that searches for both long-tailed and short-tailed bats should be made on all ARGOS farms as part of the baseline biodiversity surveys, with research only being intensified in later years if bats were detected.

Results
There were no bats found on any ARGOS Sheep/Beef farms.

2.3.5 Freshwater fish and frog survey of ARGOS farms

Introduction
There is a large body of evidence linking freshwater biodiversity and physio-chemical properties to adjacent land use, and there is an increasing awareness of the role aquatic ecosystem health and function can perform as indicators of the sustainability of surrounding land use. Freshwater fish have been widely used as bio-indicators of overall stream function, because they are:

1. Relatively easily identified
2. Of widespread aesthetic and commercial value
3. Primarily affected by macro-environmental variables such as those operating on whole-farm scales
4. Relatively long-lived and thus good integrators of long-term stressors or influences, and
5. Often at the apex of aquatic food webs, and therefore integrate many trophic ecological interactions.

The majority of these points also apply to frogs in wetlands and still-water environments often found on farms.

A contributing factor in the decision to survey fish and frogs as part of the biodiversity surveys was that the ARGOS team had no information on the types and abundance of aquatic ecosystems on the participating farms, and the information gathered during the biodiversity surveys would provide a useful baseline for more detailed stream and wetland surveys planned as part of the wider ARGOS programme.

The objectives of the stream and wetland surveys were to 1) gain a broad understanding of the aquatic ecosystems present on the participating ARGOS farms, and 2) to conduct a rapid assessment of the fish, frogs and crustaceans (the freshwater crayfish, or koura (*Paranephrops planifrons*) present on the farms to gain information on their distribution and relative abundance.

Method

Prior to the first farm visit, known and potential waterways were identified using the TUMONZ GIS software and aerial photographs, and these and any other waterways were then confirmed with the landholder at the time of the survey. The surveys aimed to survey 200-400 m of representative waterways on each farm. Potential sites for the survey were visited during daylight and the chosen sites were surveyed in the first two hours of darkness, concurrent with the bat surveys.

Upon reaching the survey site, the latitude and longitude of the transect start was recorded using a Garmin eTrex GPS unit, and the same weather conditions recorded in the bird and bat surveys were taken. Observed fish were either identified in-stream, or were caught in hand nets for identification if their identity was unclear. A small number of species (particularly small individuals of several non-migratory galaxiids) can not be identified in the field, and must be examined microscopically. For these species, individuals were preserved in 90% ethanol and returned to the laboratory for identification.

Surveys continued until at least 200m of stream had been surveyed, at which point the end latitude and longitude were recorded, and a range of physical and environmental characteristics were recorded. Mean water depth was the average of three measurements taken at equidistant points along the reach surveyed, and the mean width was the average of the wetted area width at the three survey points. The percentage of pool, riffle, run, rapid, still water and backwater was estimated over the surveyed reach. Riffles were defined as areas of fast shallow water with a broken surface, pools as slow flowing, deep water with a smooth appearance, and runs as intermediate in character. The characteristics of the stream channel were recorded as the percentage (to the nearest 5%) of over-stream cover, undercut banks, in-stream debris, exposed bed and aquatic macrophytes, and the riparian strip (defined as 5 m either side of the stream banks) was recorded as the percentage of riparian cover that was native or exotic forest, willows, pasture, raupo (*Typha orientalis*) and exposed bed. The embeddedness of the stream substrate was also estimated, with a score of 1 indicating fine sand or gravel that was easily moved by foot, and 4 indicating bedrock or large cobbles that could not be moved by hand.

A small number of ponds were present on the sheep/beef farms, and in all cases they were small and largely free of macrophytes. Consequently they were also surveyed for fish, using spotlighting. On the majority of farms, all ponds were surveyed, although on one farm, a large number of ponds were present, and consequently a representative subset was surveyed. The locations of the ponds were recorded using Gramin eTrex GPS units and the same habitat variables used for the streams were recorded. Frogs were surveyed at ponds and wetlands during the fish surveys using call cues. Two introduced Australian frog species were likely to be encountered on the farms, the whistling tree frog (*Litoria ewingii*), and the southern bell frog (*L. raniformis)*. The two species can be easily distinguished by their calls, with the whistling frog having a high-pitched incessant call, while the southern bell frog has a deeper more intermittent call.

Results

A wide range of streams, wetlands and ponds were present on the ARGOS farms, ranging from small rocky streams surrounded by bush in areas like Banks Peninsula and the Catlins, to water races around Christchurch and Canterbury, to a couple of farms with no running water at all at the time of the surveys. This diversity in stream/waterway types was reflected in the range of fish species that were recorded. Small rocky streams that had native bush present in their catchments tended to have more fish species in them, with most of these being native species, such as redfin bullies (Figure 7), giant bullies, banded kokopu (adults of one of the whitebait species, see Figure 8), and koura, the freshwater crayfish. The more open streams and water races that are present on the majority of ARGOS farms held slightly fewer species, with most streams being home to either long- or short-fin eels and crans bullies, with occasional records of brown trout, koura and introduced frogs.

This preliminary survey found no consistent differences in fish species found in different farming systems. Instead, the surveys highlighted the same broad landscape and habitat influences found in the bird surveys, with larger differences in stream type and species present existing between clusters than between farm management type. Nevertheless, the survey was an extremely valuable exercise for the research team, and provided important information on the range of aquatic systems found on ARGOS farms that will help build the understanding of whole farm sustainability over the course of the research programme.

Figure 7: **Redfin bully (*Gobiomorphus huttoni*).**
One of seven species of freshwater bullies, redfin bullies are locally common in small, rocky streams with a good amount of shading. They grow to 4-5 cm in length and are very good swimmers and climbers, being found at altitudes of up to 400m above sea level and up to 260 km inland. Their larvae hatch in the stream and are washed out to sea where they feed for several months before returning to rivers when they are 1-2 cm long. They are often caught amongst whitebait and are known as “whalefeed” or “Dan Doolin spawn”.

Figure 8: **Banded kokopu (*Galaxias fasciatus*).**
One of five native species that make up the whitebait run. Adults are nocturnal and live in small, rocky, shaded streams at altitudes up to 550m above sea level and 170 km inland. They can reach 20-25 cm in length when fully grown. As with the redfin bully, their larvae hatch in the stream before being washed out to sea and returning after 3-4 months as whitebait. Unlike salmon, whitebait don't return to the stream they were born in, but will swim up the first stream or river they come to when they return.

2.4 Farm Management

2.4.1 Introduction

The farm management component of the ARGOS programme acts as the link between the ARGOS farmers and the other research objectives by facilitating the collection of information via the Field Research Managers and contributing to its analysis. It also acts to investigate some topics that fall outside the primary scope of these other research objectives. This year the focus has been on obtaining information on a large number of farm performance factors and establishing any relationships between farm inputs and outputs across the ARGOS farms. This information will assist in the identification of best management practices or approaches which will then be shared with the ARGOS farmers and the broader farming community.

This section of the report provides data on farm performance and compares that against the results from other panels (all organic, or all integrated, or all conventional management systems), and across all ARGOS farms. In due course ongoing data collection will enable a more in depth study of these topics. The information reported on here is based on data collected including the February 2005 economic/energy/farm management survey. It contains:

- Basic farm descriptors:
    - Area
    - Soil
    - Number of stock units
    - Lambing percentage for 2004.
- Fertiliser usage
- Farm Labour

2.4.2 Farm Production

Results

Table 7: Physical information comparing ARGOS farms under different management systems, and all ARGOS farms

Physical Information	Organic	Integrated	Conventional	All farms
Total farm area - ha	370	470	399	412
Total effective area - ha	334	445	367	381
% farm area eff. - ha	92%	96%	93%	93%
Total Stock units	2673	3544	3655	3477
Stock Units/ha	7	9	10	9
Total number of sheep	1854	2768	2625	2401
Total Sheep Stock units	2352	3088	2925	2780
Lambing %	125%	125%	107%	130%

Soils	Organic	Integrated	Conventional	All farms
Av. Kg N/ha/yr	0	25	10	12
Av. Kg P/ha/yr	15	25	18	19
Av. Kg N/su/yr	0.0	1	1	1.9
Av. Kg P/su/yr	4.5	4	2	2.4
Base Saturation	71%	72%	72%	72%

Prime Lamb Production	Organic	Integrated	Conventional	All farms
Mean lambing date	17-Sep-04	8-Sep-04	21-Sep-04	9-Sep-04
Median lamb kill date	2-Mar-05	19-Feb-05	6-Mar-05	7-Feb-05
No. of days between mean lbg date & median kill date	169	166	155	165
Average dressed weight (lamb)	17	18	18	17.5
Average weight gain-(g/day dressed weight)	88	101	107	86.0
Average Liveweight	40	42	43	41.4
Average weight gain-(g/day liveweight)	215	237	257	229.0
% of lambs with Disease 04/05	9%	11%	14%	12%

Farm Labour	Organic	Integrated	Conventional	All farms
Labour hours/week	104	101	116	107
Labour hours/week/100ha	35	28	33	32
Labour hours/week/1000S.U	58	35	35	40
Contractors-Hours/year	40	97	38	58
Contractors-Hours/week	0.8	2	1	1.1
Total (Labour + Contractor)-hours/week	104	103	117	108
Total hours/week/100 ha	35	29	33	32
Total hours/week/1000 S.U	58	36	36	41

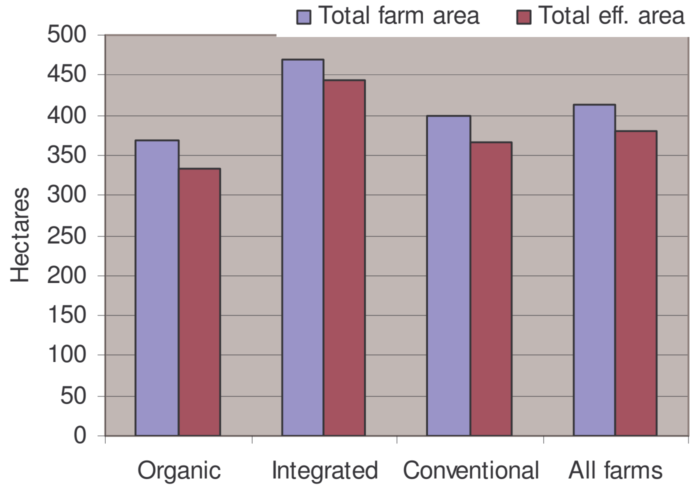

Figure 9. Total and effective farm areas between different management systems on ARGOS farms

Total and effective farm area - a cost is involved in owning ineffective land and this is paid for from annual earnings derived from the effective area. However the ineffective land may be non-productive and still be a source of income for the farmer in the future, such as a forestry block or a bush block. The bush block may enhance other aspects of the farming business, whether it is for aesthetic reasons (thus adding capital value) or to harbour species that enhance the management of the farm. Therefore the percentage of effective farm area is included in table 7.

Stock units - are derived from the effective area and have been worked out using the Cornforth & Sinclair method. This method uses the animal's productiveness to determine the number of stock units it equates to. For instance, a 65 kg ewe rearing 1.3 lambs, equates to 1.25 stock units.

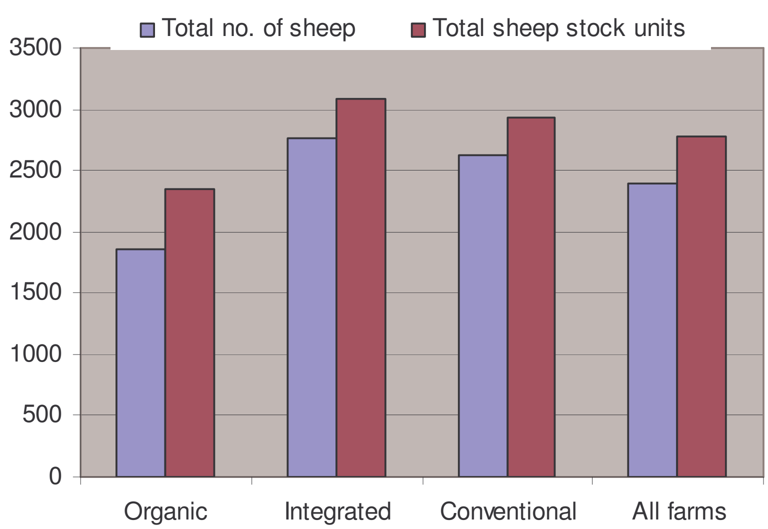

Figure 10. Total number of sheep and total sheep stock units, between different management systems, on ARGOS farms

2.4.3 Soils and Fertiliser Use

Introduction

A comprehensive soil testing programme was undertaken last winter and is currently being repeated. Aligned with this, the timing, volume and types of fertiliser input were identified in the various surveys over the last 12 months. Over time this information will provide insights into the relative nutrient efficiencies and the relative performance of various fertiliser management practices. This information will also be linked with broader performance information to establish any other possible relationships e.g., economic or environmental.

Results

Soil test results from the sampling undertaken this year were analysed. Table 7 shows the difference between farm management systems for Nitrogen and Phosphate applied during the 2003/2004 financial year. The figures relate to the Nitrogen or Phosphate content of various fertilisers. In some cases, both may have been applied in a single fertiliser (e.g., DAP or Cropmaster).

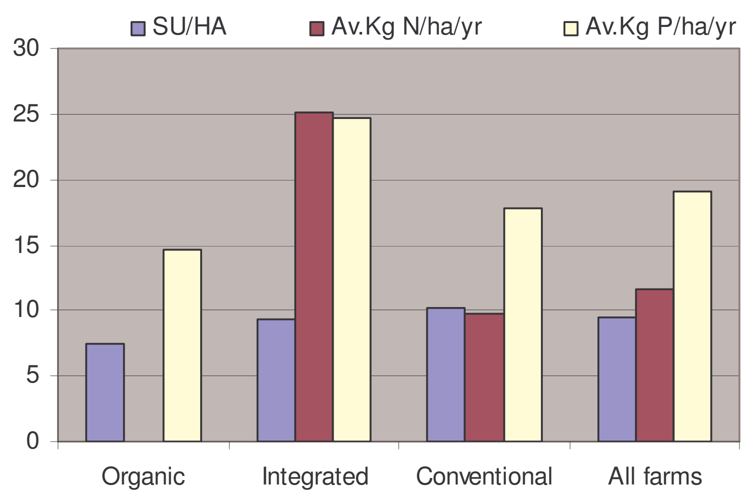

Figure 11. Nitrogen and Phosphate application rates for the 2003/2004 financial year in addition to stock units per hectare.

Analysis

The choice of fertiliser continues to increase, as are the number of experts ready to offer their product of choice. Nitrogen and Phosphate rates are given on a kilogram per hectare and per stock unit basis to give farmers an idea of the range of application rates and where they fit in this range. Achieving correct soil conditions is paramount to good pasture growth. Hence, Base Saturation percentages are included in Table 7. The base saturation percentages are derived from the cation exchange capacity (CEC).

CEC describes the ability of the soil to hold onto cations. Cations are positively charged molecules such as Ca^{2+}, Mg^{2+}, K^{+}, Na^{+}. Cations are held on the soil particles by negative charges present on clay minerals and organic matter. CEC is the number of positive charges held by 100 grams of soil. In general, sandy soils with low organic matter and clay content have low CEC levels. CEC is a soil property that changes very little, as the charge on clay minerals is mainly permanent. However the charge on soil organic matter is pH dependent (increases with increasing pH) so CEC will change with the pH of the soil.

Total base saturation is the sum of the base cations (Ca + Mg + K + Na) as a % of CEC. Some base cations are held by the soil more strongly than others. The cations with a higher charge (Ca2+ and Mg2+) are held more strongly than those with a weaker charge (K+ and Na+). As a result, large applications of Ca2+ or Mg2+ can suppress the availability of weaker cations, particularly K+. Base saturation is affected by soil pH. Soil pH is driven by the amount of acidic cations (mainly H^+). As pH declines, there are more acidic cations and less basic (non-acidic) cations, so the proportion of base cations in relation to CEC declines, and so will base saturation. The normal range of base saturation for different cations, and the total base saturation appear in table 8.

Table 8. Normal range of base saturation for different cations and the total base saturation

Cations	% of CEC
Calcium (Ca^{2t})	60 - 70
Magnesium (Mg^{2t})	10 - 15
Potassium (K^t)	3 - 7
Sodium (Na^t)	> 1
Total Base Saturation	**70 - 90**

2.4.6 Farm Labour

Introduction

The amount, type and source of labour inputs on sheep/beef farms vary greatly between farms and have changed significantly overtime. Limitations on labour availability, the need for greater skills and increasing costs has resulted in a large number of responses by sheep/beef farmers on this critical resource. This will be a continued area of research focus in the ARGOS programme, with the aim of providing strategies to optimise the levels of labour productivity, utilisation and participation.

Results

Table 9. Labour, contractor and total hours worked (on average) comparing farms under different management systems and all ARGOS farms.

Farm Labour	Organic	Integrated	Conventional	All ARGOS farms
Labour hours/week	104	101	116	107
Labour hours/week/100ha	35	28	33	32
Labour hours/week/1000S.U	58	35	35	40
Contractors-Hours/year	40	97	38	58
Contractors-Hours/week	0.8	2	1	1.1
Total (Labour + Contractor)-hours/week	104	103	117	108
Total hours/week/100 ha	35	29	33	32
Total hours/week/1000 S.U	58	36	36	41

Table 9 describes the number of hours worked to manage the farm workload. This includes the number of hours worked by paid and unpaid workers. The total hours required to manage the farm from a 'labour only' perspective are presented along with the labour hours per 100 hectares and labour hours per 1000 stock units. The number of hours that contractors spend on the farm is then added and this is broken down to a weekly basis. It should be noted that this only includes the 'number of hours' that contractors worked and does not include work that they did on a per hectare basis. Labour plus contractor hours were then added together to arrive at the total hours spent working per 100 hectares and per 1000 stock units.

It should also be noted that the figures used were derived from estimates only. However, it is still a constructive way to assist in the analysis of an important part of the farm system.

Analysis

One third of ARGOS sheep/beef farms employ fulltime labour and the balance have a diverse range of systems in place to manage their workload. This ranges from part time labour to contractors doing some or almost all farm work. Managing the workload can have a financial impact on the profitability of the farm and there is often a balance required between how much time the farm owner can spend working on the farm and social and long term economic consequences if not enough time is spent away from farm work. Therefore, the system that farmers adopt to manage their workload, is one that requires careful consideration. Data collected on farm labour will continue to be analysed

2.5 Social

2.5.1 Introduction

Improving the sustainability of farming involves social, as well as economic and environmental, dimensions. For example, while it is possible to assess the relative viability of farm incomes, the earning potential of a given farm household may reflect issues of succession, retirement objectives, ethical decisions or pressures exerted by family or society more generally. Similarly, whereas the promotion of more bio-diverse farmscapes may appear to involve relatively straight forward decisions regarding resource management, the influence of shared ideas of appropriate farm management or the availability of sufficient skills and labour may limit the feasibility of such decisions. The social research component of the ARGOS programme is designed to examine a range of social features, including those identified above, that have been shown to impact the way in which farmers approach farm management and engage with issues of sustainability.

During the past year we initiated our data gathering programme, employing a variety of social research methods. Dr. Lesley Hunt has met with every participant in ARGOS' Sheep and Beef sector in order to conduct the first of our qualitative interviews. Additionally, farmers should also have received (and responded to) the first sectoral survey. Soon, they will be asked to complete a 'causal map' under the guidance of Dr. John Fairweather. A second round of interviews focused on the constraints to farm management is planned for early summer. In the meantime, Dr. Hugh Campbell will meet with and interview industry representatives from the meat packing, dairy and kiwifruit sectors. With this range of information, we will develop a more comprehensive understanding of the social dimensions of agricultural production. This knowledge, in turn, will contribute to our assessment of sustainable farm management in New Zealand.

2.5.2 Initial Results

While we are rapidly expanding the data and information available to contribute to analysis of social dimensions of sustainability, the considerable volume and depth of that data has resulted in a slow process of analysis. To date full analysis and reporting of the initial interviews have been completed for the kiwifruit, although not for the sheep and beef, sector. The completed work does, however, indicate the potential contribution of the interviews to the social research goals. In the following section, we review the expected results of the analysis of the interviews based on our experience with the kiwifruit sector. The remaining research projects are at a similar initial stage or, as yet, not fully implemented. Because of the relatively limited scope of current results, we will provide a limited review of each below or in the section on future research objectives.

Initial qualitative interviews

The initial qualitative interviews elicited a wide range of information from farm households on identity; visions and constraints; environmental, economic and social wellbeing; and managing well. Analysis of the resulting data involves identifying themes in the discussion of the interview topics. The extent to which these themes represent individual perspectives or are shared within a given geographic cluster, management panel, or industry sector provides an indication of the influence of various social factors on management at the farm level. Evidence from the kiwifruit sector interviews suggests that we can construct 'ideal farmer types' based on this analysis as depicted in figure 12. Our analysis of the responses of kiwifruit growers indicated that they share many 'core' characteristics as a result of similar experiences with orchard management and the kiwifruit industry. It was possible, however, to suggest several factors or characteristics which drew an orchard owner toward the employment of certain management systems (in the case of kiwifruit orchards, Green, Organic Green, or Gold kiwifruit). In addition, distinct relationships with, or understandings of, the orchard that was generally shared within each of the three panels was identified. The resulting 'ideal types' are not representative of better or more appropriate management nor can they encompass the characteristics of any single individual. They do, however, allow for some generalisation across the diversity of response provided in the interviews. We expect to eventually develop a similar typology from the sheep and beef interviews in order to identify differences between the conventional, integrated and organic panels. Eventually, the construction of farmer types may help in the development of targeted extension and promotion more sustainable management practices.

Sketch maps (as part of interviews): A large part of the initial interview was devoted to the drawing of a sketch map of each participant's farm. Participants were asked to represent those features of their farm that were important to their management of it. The resulting maps varied greatly in their level of detail and generally reflected the drawing ability of an individual. Because much of the drawing involved verbal explanations, the assessment of the maps included an analysis of the transcript of that part of the interview. Findings will be based largely on tabulation of features noted on each map with expected comparison between panels.

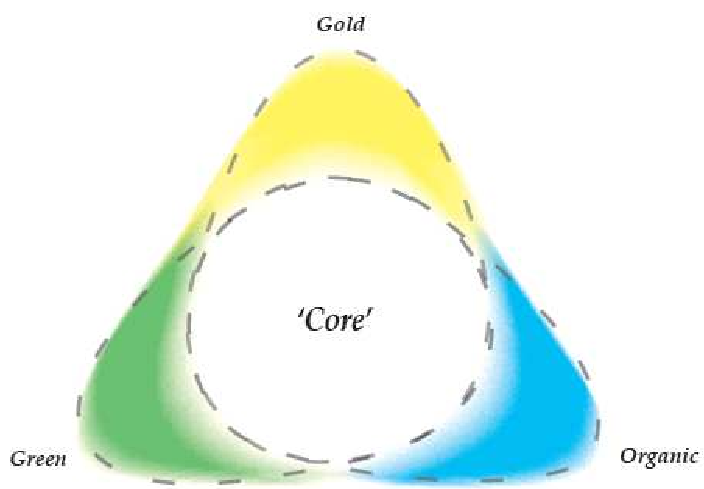

Figure 12: Ideal types as conceived in the analysis of the first qualitative interview.

Surveys

The social research team is currently processing response to mail surveys sent to farmers in late autumn of this year. One survey was sent to all ARGOS participants, while the second (largely similar to the first) was sent to a sample of farmers (including targeted batches to organic farmers and those in ARGOS sectors) throughout New Zealand. The intent of the surveys is both to develop a data base that facilitates generalization and comparison across and within sectors as well as to determine the extent to which ARGOS farmers are representative of the sectors more generally. As such, the surveys requested information on the farmers' background, their use of management systems and practices, their relationship to land, their Maori connections, their perceptions of wetlands and nature more generally, and their farming and personal information. To date, we can report a 35% response rate (higher among ARGOS farmers) with 550 surveys (or 18%) of responses entered into a statistical analysis database. This early response suggests that differences among panels as well as some differences that relate to the geographic location of the respondent will be made. Among the early results, those indicating more significant responses include:

1) a moderately strong intent (2.3 on a 5-point scale with 1 being strongly positive, 3 neutral and 5 strongly negative) to use some type of standardised management system with intent to employ organic or integrated management standards at 2.8 and 2.3, respectively. In other words farmers are not necessarily against employing organic or integrated management systems, but are open to these ideas.

2) a moderately negative response (3.6) to the use of GMOs;

3) on average, 20% of household food came from on-farm sources and 7% from hunting, fishing or gathering;

4) in the rating of practices important to management (in this case, 5 being the most important), average scores greater than 4 were recorded for developing practical skills, using local knowledge, attention to social responsibility, and working with the environment;

5) receiving scores of 3.4 and 3.5, respectively, maintaining diversity and supporting the local market ranked relatively low (a score of 3 is considered neutral).

Because these results are based on a very low percentage of response to date, they are very tentative and likely to change as more data are collected. Also, it is not possible to differentiate among sectors or panels until a greater number of responses have been collected and entered into the data base.

Causal Maps

Causal Maps are a method of obtaining information on how participants think about managing the farm. The method is described by practitioners as "multi-step, fuzzy cognitive mapping" in which the resulting maps "are qualitative models of a system, consisting of variables and causal relations between variables" (Ozesmi and Ozesmi 2004). It involves an activity in which the farmer is asked to reflect on factors that are important to farm management and to, then, indicate any sort of relationship between a given set of variables–for example, the influence of fertiliser applications on paddock health. Each relationship identified is further assigned a direction (*which factor will exert an influence on the other?*) and a weight (*what is the extent of the influence exerted?*). The primary value of the maps is derived from the potential to convert them into models. It is, for example, possible to combine the maps of individuals (say, those belonging to a given panel in ARGOS) and compare the impact of policy or changes on the management system for different groups. To date, the method has shown promising results with ARGOS participants from the kiwifruit sector and will be extended to include all ARGOS farmers.

2.5.3 Future research objectives

As is evident in the presentation of the results for the social research component, we have great expectations for developing future analyses. Most importantly, we expect to complete our analysis of the initial interviews with the sheep and beef sector and write a report on our findings by the end of the calendar year. A more complete analysis of the quantitative surveys will involve a similar timeframe. We are, however, also actively planning further data gathering activities that will allow us to further develop our insights to the social dimensions of New Zealand agriculture and sustainable farm management. At this point, these activities include two sets of interviews (one with industry representatives, the other with farmers and growers), a further quantitative survey, and the documentation of visual images of ARGOS farmscapes. Each of these will be discussed briefly in the following sections.

Strategic interviews

The relative sustainability of the farm management systems included in the ARGOS programme is as much a reflection of the industries as it is the farmers involved. In order to gain a broader perspective on the social dimensions of sustainable practice, we will interview representatives of each participant industry (these interviews are described as strategic because they do not involve a random sample of participants. In other words, we have chosen representatives according to our assessment of their influence on ARGOS sectors and panels). The interviews are designed to facilitate an analysis of the potential for each industry to influence sustainable farm management. Due to the norms and standards of practice they establish, audit systems (including both organics and environmental management systems) provide an important focus for these interviews.

Second round of qualitative interviews

the analysis of the initial qualitative interviews, we noticed some constraints recognised by ARGOS participants. In particular, we noted the frequency with which labour and audit systems were cited as constraints. As social researchers, we refer to these as structural constraints because they are strongly determined by established rules and norms that govern social interactions. The nature of the first interview (with its focus on the farm level) did not, however, allow for a full examination of the role and nature of such constraints. Thus, the second round of qualitative interviews will focus more specifically on constraints on farm management.

Images of farmscapes

In addition to the interview on constraints, farmers will be asked to document important elements of their farm with the use of photographic images. Once again, in the first interview a great deal was learned about what participants thought about the landscapes they are managing. What was unable to document was how this thinking became a part of, or changed, the landscape. By using images to document these aspects of farm management, it is intended to establish a catalogue of information that can contribute to the comparison of the panels and sectors involved in the programme. Furthermore, this activity will be repeated after several years in order to see the extent to which interaction with the ARGOS programme may have affected the visible farmscape.

Surveys

In addition to the more qualitative methods discussed above, the social research component also involves annual repetitions of the ARGOS and national surveys. These surveys will continue to help in attempts to generalise across the diverse data collected in the interviews, as well as to compare ARGOS farms with others in the same sector and in New Zealand. The exact nature of the questions has yet to be determined as it will incorporate both the knowledge gained from the first survey as well as the input of the remaining components of the ARGOS programme.

3.0 2005/06 Plan

A full programme of further monitoring and analysis is planned for 2005/06 by the ARGOS research team. Table 12 provides an outline of the proposed programme this year.

Table 12. ARGOS Planned Activity 2005/06 **Key**: Objective responsible for outcomes

Farm Management **Economic** **Environment** **Social**

Sheep/Beef	Activity and Output	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Farm Management	Annual farmer report	■											
	Soil, Grass Grub & Porina sampling	■	■										■
	Pasture sampling					■	■						
	Annual farmer survey								■	■			
	2 monthly ARGOS update			■		■		■		■		■	
	6 monthly ARGOS newsletters	■						■					
	Cameo studies					■	■	■					
	Livestock representative reports			■									■
	ARGOS website maintenance	■	■	■	■	■	■	■	■	■	■	■	■
Economic	Annual farmer report	■											
	Sheep/Beef sector report	■											
	Annual farm survey								■	■			
Energy	Annual farmer report	■											
Environment	Annual farmer report-Birds, Bats, Fish	■											
	Farm survey-Weeds and streams					■	■					■	■
	Farm report-Weeds and streams												■
	Farm maps returned to farmers						■						
Social	Report-First qualitative interview						■						
	Report-Quantitative survey						■						
	Causal mapping survey								■	■			
	Second qualitative interview					■	■						

4.0 Acknowledgments, Resources and References

4.2 Acknowledgements

The ARGOS programme has been designed and implemented with the intention of providing quality information to both farmers and their associated industries to ensure that they are broadly sustainable, internationally competitive and profitable. To facilitate this, we greatly value the input provided by the farmers and industry partners to enable us to undertake the research and ensure that our outputs are relevant.

To also assist us in this process we have an Oversight Committee which typically meets twice a year to review progress and provide suggestions on how we can enhance our overall performance. The members of the Oversight Committee are;

Dr Neil Clark
Dr Scott Champion (New Zealand Merino Company Ltd)
Simon Langley
Dave Lucock (ARGOS Sheep Beef Field Officer)
Claire Mulcock (Merino NZ Inc)
Patrick Nelson (ARGOS farmer)
Mark Stevenson (ARGOS High Country Field Officer/NZ Merino Company)
Jon Manhire (ARGOS Programme Manager)

Thank you for your support and input.

4.2 References

Summary of Research Outputs

Listed below are reports, research papers, ARGOS notes and other publications that have been produced by the ARGOS team on the ARGOS programme or aligned topics.

ARGOS Reports
AI2 - Transdisciplinary

AI 3 – Economic

Economics Rationale for ARGOS - Working Paper 3

AI 4 – Environmental

Environmental Research Rationale

AI 5 – Maori

Discussion paper
He Whenua Whakatipu Rationale for ARGOS - Working Paper 4
Scoping Report for monitoring and evaluation processes within ARGOS- Working Paper 5

AI 6 - On-farm Management

AI 6.1 Rationale for selection of Kiwifruit Orchards
AI 6.2 Rationale for selection of Sheep and Beef farms
AI 6.3 High Country Review and Plan
AI 6.4 Dairy Review and Plan
A1 6.5 Baseline report for Sheep/beef participants 2004
A1 6.6 Baseline report for Kiwifruit participants 2004
A1 6.7 Baseline report for High Country participants 2005
A1 6.8 Baseline report for Dairy participants 2005
A1 6.9 Sheep/beef Stakeholder Report 2005
A1 6.10 Kiwifruit Stakeholder Report 2005

AI 7 - Social

Social Dimensions of Sustainable Agriculture: a Rationale for Social Research in ARGOS - Working Paper 1

Social Research Compendium: Key Questions on Social Dimensions of Agricultural Sustainability - Working Paper 2

ARGOS Research Papers

Transdisciplinary

Economic

05/04 Food Markets, Trade Risks and Trends, by Caroline Saunders, Gareth Allison, Anita Wreford and Martin Emanuelsson, May 2005

Environmental

05/02 Soil quality on ARGOS kiwifruit orchards, 2004-2005, by Andrea Pearson, Jeff Reid , Jayson Benge and Henrik Moller, June 2005

05/03 Soil quality on ARGOS sheep & beef farms, 2004-2005, by Andrea Pearson, Jeff Reid, and Dave Lucock, June 2005

05/05 ARGOS biodiversity surveys on Kiwifruit Orchards and Sheep & beef farms in summer 2004-2005: rationale, focal taxa and methodology, by Grant Blackwell, Stephen Rate and Henrik Moller, June 2005

05/06 Bird community composition and relative abundance in production and natural habitats of New Zealand, by Grant Blackwell, Erin O'Neill, Francesca Buzzi, Dean Clarke, Tracey Dearlove, Marcia Green, Henrik Moller, Stephen Rate and Joanna Wright, June 2005

05/07 Interspecific interaction and habitat use by Australian magpies (Gymnorhina tibicen) on sheep and beef farms, South Island, New Zealand. Marcia Green, Erin O'Neil, Joanna Wright, Grant Blackwell and Henrik Moller, July 2005.

Maori

A draft farm-based sustainability monitoring system for Maori in the Ngai Tahu takiwa

On-farm Management

Social

05/01 Understanding Approaches to Kiwifruit Production in New Zealand : Report on First Qualitative Interviews of ARGOS Kiwifruit Participants, by Lesley Hunt, Chris Rosin, Carmen McLeod, Marion Read, John Fairweather and Hugh Campbell, June 2005.

ARGOS Research Notes

Research Note 1- Background to the ARGOS Programme June 2004
Research Note 2 –
Research Note 3 – ARGOS Transdisciplinary research
Research Note 4 - Cicadas in Kiwifruit Orchards
Research Note 5 – Market developments for NZ agricultural produce
Research Note 6 – Spiders in Kiwifruit Orchards
Research Note 7 – Organic Kiwifruit Survey
Research Note 8 - Analysis of ZESPRIs organic kiwifruit databases
Research Note 9 - Kiwifruit Orchardists
Research Note 10 - Kiwifruit Orchardists and their vision for the orchard

Research Note 11 - Sketch Map Results : Kiwifruit Sector
Research Note 12 - Sketch Map Results: Sheep/Beef Sector

ARGOS Newsletters

1. June 2004
2. January 2005
3. July 2005

ARGOnoteS

ARGOnoteS 1: Outline of BACI design, October 2003
ARGOnoteS 2: Some BACI design points, January 2004
ARGOnoteS 3: Threats to validity in BACI design, February 2004
ARGOnoteS 4: Matching Social and Economic variables in BACI design, February 2004
ARGOnoteS 5: BACI postponed, March 2004
ARGOnoteS 6: Panels, not Cohorts, January 2005
ARGOnoteS 7: Causation and BACI, February 2004
ARGOnoteS 8: Broadening Research Focus and strengthening ethical safeguards in ARGOS, April 2004
ARGOnoteS 9: Towards Transdisciplinary Research within ARGOS: an ecologist's suggestions for process and research priority setting, July 2004
ARGOnoteS 10: Monitoring the relative abundance of lizards in AROGS kiwifruit orchards
ARGOnoteS 11: Kiwifruit Property reports, June 2005
ARGOnoteS 12:
ARGOnoteS 13: Qualitative research methodology, July 2005

Aligned Research Reports and Papers

Transdisciplinary

Economic

Saunders, C.M. (2005): Implications of changed EU agricultural polices for Australian and New Zealand farmers. Farm Policy Journal 2(2) pp23-31.

Saunders, C.M. (2004): The Implications for NZ Trade of Change in EU Agricultural Policy, in Particular the Development of Agri-environmental Policy in New Zealand and Europe: Connections and Comparisons Editor(s) of Book: Bernadette Luciano & David Mayes Rodopi, Netherlands.

Saunders, C.M. and Cagatay, S. (2004): Trade and the environment: economic and environmental impacts of global dairy trade liberalization. Journal of Environmental Assessment Policy and Management Vol 6 (3) pp 1-27.

Saunders, C.M. and Kaye Blake, B. (2003): Economic impacts on NZ of GM crops: Results from partial equilibrium modelling. NZ Biotechnology Association Journal 58 pp 69-80.

Saunders, C.M. (2003): Changes in EU Agricultural Policy and their potential impacts on Australia, New Zealand and Japanese Dairy Sectors. Asia-Pacific Journal of EU Studies (1) 2 pp 161-177.

Saunders, C. and Cagatay S., (2003): Commercial Release of GM Food Products in New Zealand: Using a Partial Equilibrium Trade Model to Assess the Impact on Producer Returns in NZ, *Australian Journal of Agricultural and Resource Economics 47(2).*

Saunders, C and Emanuelsson M. (2005): Modelling the implications for NZ trade and producer returns from different scenarios relating to the demand and supply of organic products.

Environmental

Intensification of New Zealand agriculture since 1960 and its implications for biodiversity conservation, by Catriona MacLeod and Henrik Moller.

A System View of Farming in New Zealand: Multiple Functions lead to Multiple Benefits, by Chris J. K. Perley, University of Otago.

Maori

Indigenous Knowledge is not a construct – The challenge of incorporating indigenous knowledge into multidisciplinary discussion, by John Reid.

On-farm Management

Social

An Analysis of Zespri's 2003 Organic Kiwifruit Database: Factors Affecting Production, by Lesley Hunt and John Fairweather, AERU, Lincoln University 2004

Results from a Survey of Organic Kiwifruit Growers: Problems and Practices that affect Production, by Andrew Cook, Lesley Hunt and John Fairweather, AERU, Lincoln University 2004.

Cook A. J. and Fairweather J. R. (2004), Farmer and Grower Intentions to Use Gene Technology: Results from a Resurvey. AgBioForum 6 (3): 120-127. http://www.agbioforum.missouri.edu

EUREP-GAP, Agri-Food System Governance and Organic Food Exports from New Zealand, by Hugh Campbell, Carmen McLeod and Chris Rosin.

Auditing sustainability: the impact of EurepGAP on organic farming in New Zealand, Hugh Campbell, Carmen McLeod & Chris Rosin.

Audit Cultures and the Antipodes: the Implications of EUREP-GAP for New Zealand and Australian Agri-food Industries. Hugh Campbell, The University of Otago, New Zealand, Geoffrey Lawrence and Kiah Smith, The University of Queensland, Australia. Chapter submitted to Murdoch. J. and Marsden, T. (eds.) Between the local and the global: An institutional perspective on food. Elsevier. (forthcoming – 2006).

Disciplining the Organic Commodity, By Hugh Campbell and Annie Stuart. Chapter in Higgins, V. and Lawrence, G. (eds.) Agricultural Governance: Globalization and the New Politics of Regulation, London: Routledge (forthcoming 2005).

Green Protectionism Part 2: EUREP-GAP, Agri-Food Systems Governance and the Decline of Organic Exporting from New Zealand, Assoc Prof Hugh Campbell, University of Otago.