



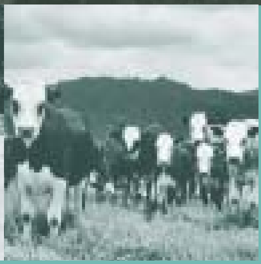

Incentives for intensification

A report based on farmer case studies

Prepared for the Parliamentary Commissioner for the Environment
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This paper was written for the Parliamentary Commissioner for the Environment (PCE) by external consultants and the views expressed in this paper do not necessarily reflect those of the PCE.

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Executive summary

This study used 12 in-depth case studies to assess the economic drivers for agricultural intensification. The analysis covered the period from 1990 to 2010. Whilst farm profitability is subject to a range of risk factors, the period from 1990 to 2003 showed huge productivity gains for both dairy and sheep and beef farmers. For example, over the period milksolids per hectare increased by 34 percent and lambing percentage from 100 percent to 118 percent.

The data on wealth generation is even more impressive. For the 13 years to 2003 the average participant increased their net worth by a factor of five times, largely driven by land value increases. The compound rate of growth of 14 percent per annum is comparable to dairy industry average data.

This study finds that there is substantial potential for further intensification. Average farmers still lag top 10 percent performers by significant margins, for example by 21 percent in lambing performance and 16 percent in per hectare milk production. And the financial rewards of lifting productivity from average to top 10 percent levels are significant – $753 per hectare to $1940 per hectare for dairy (2003) and from $15.68 per stock unit to $27.59 per stock unit for sheep and beef (2002 data).

Case study participants have an intensification focus through to 2010. The dairy farmers involved aim to i˙ßrease milk production per hectare by 30 percent. Sheep and beef farmers aim to increase nitrogen (N) use, lift stocking rate and lift lambing percentages and carcass weights. Arable farmers are interested in lifting crop yields. Only vegetable growers (Pukekohe) were focused on profit margins rather than increasing yields, because vegetable prices are very sensitive to increases in supply.

Research suggests that New Zealand farmers' decision-making is largely dominated by financial factors. This work found that, for all case study farms, investment in new infrastructure and technology is dominated by the need to intensify and lift profitability.

Decisions to intensify are affected by the business strategy a farmer adopts – each strategy has an impact on the level of intensification undertaken. The following are a sample of these:

- Most case study farmers have gone through one or more periods of *development*. Development of the farm infrastructure and/or land resource will result in an intensification of the farm system with corresponding improvements in future cashflows and the capital value of the farming business. Case study farmers in the profitable sectors of dairy, sheep and beef, and arable intend to continue this cycle of reinvestment.
- *Intensification* tends to follow development and is the process of lifting profitability through attaining higher levels of productivity. However, economic theory and farm system trials show that maximum profit does not coincide with maximum production – this is especially true with varying product prices. At least one case study participant appears to be operating at levels of intensity that are beyond the level of profit maximisation with potential impacts on their financial viability and the environment.
- *Enoughness* is the state whereby farmers are happy to accept current levels of profitability – and may divert resources to improve the environmental sustainability of their business. However, this state may be temporary if economic considerations (e.g. impending retirement) require increased levels of return.

Two key technologies of intensification investigated in this study are the place of nitrogen fertiliser and the demand for water for irrigation.

Case study farmers intend to use nitrogen in increasing amounts. This use is underwritten by a trend of improving ratios of farm product prices versus the cost of nitrogen. An analysis presented in this paper suggests that with the current price/cost ratios, nitrogen use will continue to increase on both dairy and sheep and beef farms. It is noted that the current price of nitrogen would have to increase by one third to have a significant impact on nitrogen use. And with current product price/nitrogen cost ratios it is likely that sheep and beef farmers will lift their current levels of nitrogen significantly.

The four case study participants from Canterbury have increased, or are in the process of increasing, their use of irrigation. Despite the prospect of escalating electricity prices, returns from irrigation are relatively insensitive to these costs.

In terms of their environmental performance, eleven of the twelve participants in this study have a positive view of the environment and their role as a steward of the land. They have made the necessary investments in infrastructure to improve effluent management, reduce soil erosion and improve soil quality and will increasingly adopt nutrient budgets. However, it should be noted that conducting a nutrient budget in itself does not mitigate or minimise environmental effects – it simply quantifies them.

Whilst this positive motivation towards environmental sustainability is admirable, there appears to be little understanding that environmental sustainability and continued intensification may not be compatible. The question therefore remains:

> **Are current farming systems environmentally sustainable and what changes do we need to make to our management practices or the technology that we use to enable further performance improvements from both an economic and environmental perspective?**

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CHAPTER 1 | Introduction

1.1 Report purpose

The purpose of this work is to contribute to the understanding of the economic drivers of agricultural intensification. It is part of the Parliamentary Commissioner for the Environment's study into the environmental sustainability of New Zealand agriculture.

This research has focused on a small number of in-depth case studies addressing 'producer motives' for business growth and development, the range of strategies used by the study participants, and the underlying pressures for intensification.

The case studies are designed to provide an insight into past trends and current management strategies, and the key drivers for these. It is hoped they will provide a framework to assess predicted future scenarios regarding market conditions and the potential effects of changing compliance requirements for environmental objectives.

1.2 Methodology

Twelve case studies were completed to build an understanding of the motives (or incentives) for business growth and development. Properties were selected through discussion with people in the agriculture service sector (farm accountants) and farmer representatives to include a range of farm intensification strategies.

The analysis period was from 1990[1] through to 2010. The study uses actual data through to the end of the 2003 financial year, budget data for 2004, and estimates of future returns and costs for 2010.

The case study design focused on the incentives and motives behind current trends. There was a range of alternative approaches available for the assessment of these past trends, from assessment of the financial records from accounts analysis through to unstructured interviews that sought to reveal the story behind any change in business investment and performance. This case study methodology adopted a combination of both these approaches.

This approach allowed the determination of perceptions of risks, personal goals, priorities and ability to respond to issues that may be reflected within the farm financial statements and show through farm decision-making. The case studies identified and formed conclusions on:

1. Issues affecting economic performance
2. Drivers for intensification
3. Potential responses
4. The effect of changing product prices, inputs and returns as part of the strategies adopted and how these are reflected in the financial returns of the business
5. The incentives to use technologies and inputs such as nitrogen and irrigation
6. Farmer perceptions about their contribution to environmental risks and how they perceive these risks being manifest back to their business
7. The level of investment into improving or maintaining environmental health of natural capital and what strategies or factors they use to "leave the land in better condition than when they took it over".

A copy of the survey form is included as Attachment 1.

1.3 Results

Summary data for the farm businesses is shown in Attachment 2.

In general participants tended to be farming larger farms than average for their region and are farming at higher performance levels (compared to MAF monitor farm data) (see Table 1.1).

Table 1.1 Farm size for case study participants (hectares)

	North Island		South Island	
	Case study	MAF monitor farm average	Case study	MAF monitor farm average
Dairy[2]	118	94	343	174
Arable	-	-	321	265
Sheep and beef	850	508	-	-

CHAPTER 2 Financial returns from farming

2.1 The economic environment for farmers

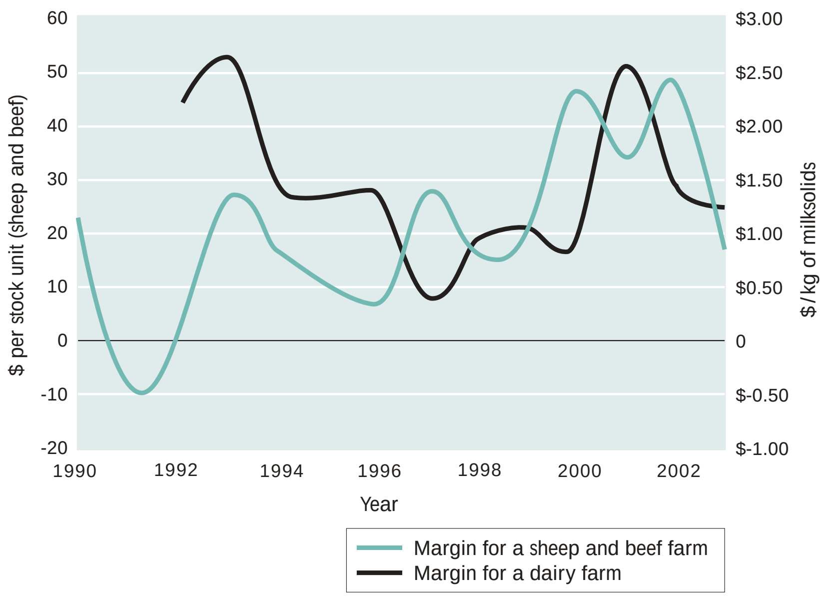
Despite the year-by-year profitability of New Zealand agriculture being subject to a range of risks, the 1990s and early 2000s has been a period of enormous wealth generation for farmers. Periods of favourable product prices, the introduction of new technology on-farm, and appreciation in land values have led participants in this study to increase their equity fivefold during the 13 years assessed from 1990 to 2003.

The following sections describe the economic environment for farmers in greater detail.

2.2 Variable margins

Analysis of case study financial data shows that the business of farming is variable, affected by commodity price cycle risks, exchange rate risks and weather extremes. Figure 2.1 shows typical margins earned (income less farm working costs) for a sheep farmer (Participant F) and a dairy farmer (Participant L).

Figure 2.1 Margins earned (income less farm working costs) for a dairy farm and a sheep and beef farm



The variability in returns shown from case study data is supported (but probably underestimated) by industry data. Whilst the annual reviews of the sheep and beef industry (Meat and Wool Innovation Ltd, 2000 and 2003) show farm profits fluctuating from $23,000 to $113,000 per annum, individual farm profits are likely to vary by a wider margin (Cumberworth and Jarvis, 1994).

Despite this variability, the failure rate of farm businesses is reported to be very low by trading banks (Blair, Westpac Banking Corporation, pers. comm., 2004), a fact supported by strongly appreciating asset prices.

2.3 Generating wealth

Farming is perceived as the 'old economy': producing commodity products with little prospect for individual or national wealth generation. This stereotype misses reality by a wide margin, particularly over the survey period from 1990 to 2003 (MAF, 2003a, pp16). Returns have been generated from increasing productivity *and* increasing asset value appreciation.

2.3.1. Increasing production efficiency

New Zealand farmers have increased their productivity over the survey period. Dairy farmers have, on average, increased productivity by 1.4 percent per annum for the period from 1992/93 to 2001/02 (Dexcel, 2002, pp 16).

Table 2.1 illustrates production comparisons in sheep farming between 1990/91 and 2001/02 (Davidson, 2002a).

Table 2.1 Productivity comparisons between 1990/91 and 2001/02 in sheep farming

	1990/91	2001/02
Lambing percentage	100.4	118.7
Average lamb weight (kg)	14.50	16.90
Lamb kg yield/head	11.23	13.81

High productivity sheep farming now stacks up well against beef, deer and dairy in terms of return on capital (Ward, 2003).

2.3.2 Increasing land prices

Pastoral farmers have benefited from appreciating land prices. The following sales data for farms of ≥40 hectare show that grazing land (sheep, beef and deer) has appreciated by 98 percent and dairy land has appreciated by 176 percent compared to an inflation benchmark of 32 percent for the same period (Table 2.2).

Table 2.2 Land values 1990-2003

	Grazing land	Dairy land
	$ per hectare	
1990	$1,589	$6,946
1991	$1,932	$7,039
1992	$2,166	$8,186
1993	$2,123	$10,907
1994	$2,155	$12,696
1995	$2,057	$13,497
1996	$1,836	$14,169
1997	$1,924	$12,248
1998	$1,743	$12,379
1999	$1,890	$12,063
2000	$2,210	$12,766
2001	$2,181	$16,088
2002	$2,600	$17,397
2003	$3,142	$19,188
% change	**98**	**176**

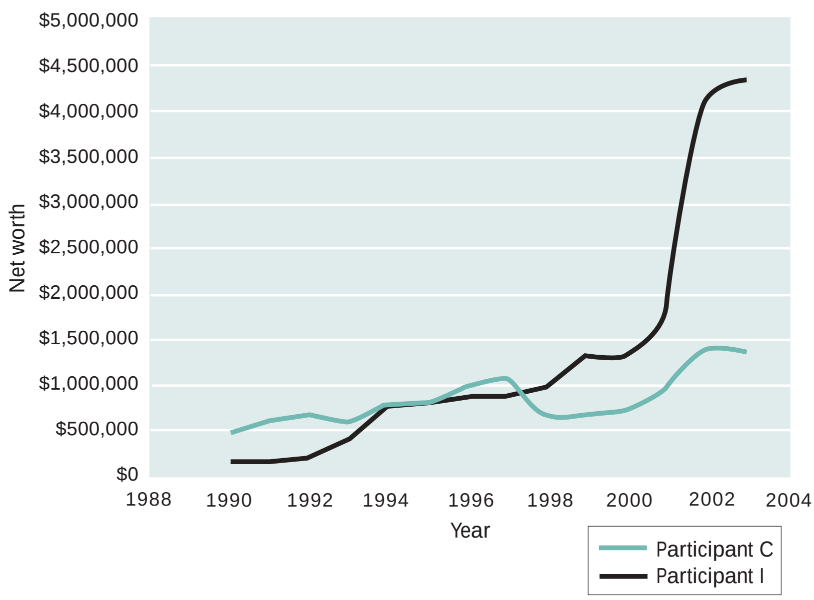
Source: Quotable Value New Zealand.

2.3.3 Case study data

Despite some periods of industry stagnation (e.g. 1990-1998 for meat, 1994-1999 for dairy) brought about by unfavourable product prices and exchange rates, case study participants increased their net worth[3], by nearly five times over the study period. The average participant had equity of $650,000 in 1990. Through expansion, increases in productivity and a dramatic lift in land values, their net worth grew to just under $3.6 million by 2003. This equates to a compound annual growth rate of 14 percent and compares to a 10.4 percent rate of return (cash plus capital appreciation) for average dairy farmers from 1990 to 2002 (Dexcel, 2002, pp. 15).

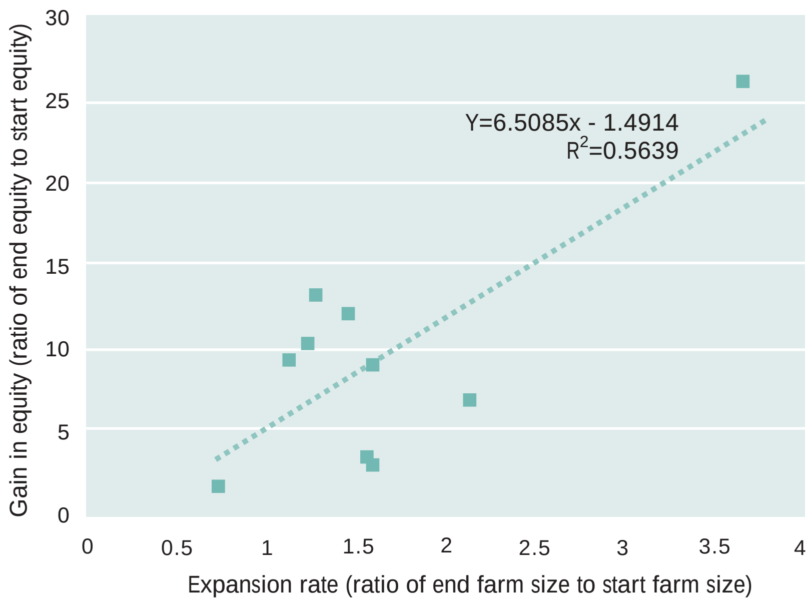
The case study analysis, summarised in Figure 2.2, demonstrates that Participant I has increased net worth by a factor of 14 times through increasing their farm business from 80 hectares to 302 hectares throughout the study period. By comparison, Participant C increased from 47 to 88 hectares and (only) increased wealth by three times.

Figure 2.2 Net worth accumulation from expansion of two dairy farms



The relationship between the participant's rate of expansion of owned land area and the gain in equity is shown in Figure 2.3. The relationship has a correlation of 0.56.

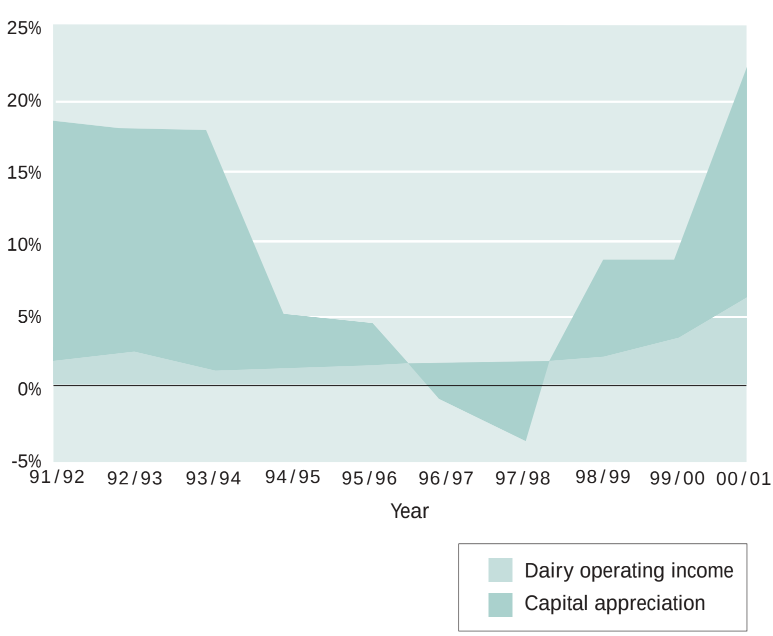
Figure 2.3 Gain in equity versus expansion rate of owned farmland for case study participants from 1990-2003



Industry data supports the thesis that expansion has been relatively more profitable than intensification. During the period from 1990 to 2002, the majority of wealth generated has come from asset appreciation rather than cash profits as shown in Figure 2.4 (Dexcel, 2003).

Data for the sheep and beef industry (Neal, 2003) also support the importance of land value appreciation in the wealth accumulation that has occurred.

Figure 2.4 Rolling three year returns split into cash and capital



CHAPTER 3

Drivers of intensification

3.1 How farmers make decisions

Producer motives are a key driver of on-farm intensification.

Research on how farmers make decisions is summarised in Bennett *et al.* (1999). The economic model of decision-making assumes that farmers make decisions that maximise profits. Becker (1996) extends the traditional economic model by including the influences of personal capital (knowledge derived from past experiences) and social capital (the influence of an individual's social network).

A criticism of the economic model is that it fails to link psychological processes to economic decision-making. The behavioural psychology model concentrates on understanding and predicting behaviour through the study of attitude formation. This model considers that decisions are made within a framework that recognises a) economic values that maximise self-interest, b) social values that seek to maximise societal interest and, c) universal values that contribute to the 'health of the world'. The balancing of these values in a given situation will determine the attitude of the individual in that situation.

Previous research has shown that New Zealand farmers tend to be primarily economically motivated (Wilkinson, 1996; Townsley *et al.*, 1997). The market-based systems fostered since the mid-1980s have created incentives for innovation that encourage producers to decrease costs and/or increase outputs. The outcome is that producers strive to maximise their productive efficiency (Saunders and Ross, 2004).

This case study analysis supports this finding but with some interesting examples of the effect of social and universal values on decision-making.

3.2 The profit motive

Farmers have enjoyed substantial wealth creation through the study period. As previously noted, survey participants increased their net worth by five times over a 13-year period to 2003. Results suggest that there are similar opportunities for most farmers over the next 10 years.

Firstly, there is substantial opportunity for production system performance improvements with the productivity of average farmers significantly lagging the top 10 percent. In the sheep industry, for example, the top 10 percent of operators enjoy a lambing rate 21 percent higher than average farmers on medium hill country farms in the North Island (Davidson, 2002b). For dairy farms with top 10 percent profitability, milksolids production is 1,012 kilograms per hectare (kg/ha) versus 868 kg/ha for average properties (MAF, 2003b, pp 50).

Secondly, at current estimates of future product prices, there are strong financial incentives to increase farming efficiency towards top 10 percent performance levels. In 2002/03, top 10 percent dairy farmers had a net trading profit of $1940 per hectare versus $753 per hectare for average participants (MAF, 2003b). Top quartile North Island hill country farms earned $27.59 per stock unit in 1999/00 versus $15.68 per stock unit for average farms (Davidson, 2002b).

This incentive is reinforced by the more than 40 percent increase in land prices since the late 1990s (Quotable Value New Zealand). To cover the cost of equity and debt capital, purchasers of farms have to operate at top quartile levels if they wish to continue to grow their business. At the same time, existing farmers have significant balance sheet strength to fund expansion and intensification.

3.3 Business strategies

From a production system and business strategy perspective, study participants displayed a range of common business strategies. These include:

1. Development – increasing a property's productive capacity.
2. Asset growth – a focus on business expansion.
3. Profit maximisation – a focus on optimising inputs and outputs. Productivity is generally between the top 25 percent and top 10 percent for their respective districts.
4. Production maximisation – e.g. aiming for top 5 percent production.

5. 'Enoughness' – the business is operated as a cash cow to fund debt repayment or lifestyle choices.
6. Sustainable production – the farm production system is operated with a bias toward operating within an owner's definition of sustainable limits taking account of societal and universal considerations, and implying some limitations on stocking rate and inputs.

Each of these strategies has different implications for the degree of intensification being undertaken on a property. Of particular note are the on-farm development process and the question of 'how far to intensify?'

3.3.1 The process of farm development

The process of farm development is a key driver of intensification. Through development a farm owner can increase the productive capacity of their property, increasing both future cash flows and the capital value of their farming business. Farms go through lifecycles of development depending on the availability of new technology (e.g. efficient irrigation systems) and where a farm owner sits within their own personal investment cycle.

On taking control of a property, a farm owner will generally implement a development plan to lift the farm's productivity. In pastoral industries, this development phase involves the land resource, animal resource, and farm infrastructure.

Land resource-related development focuses on increasing the proportion of the farm that is effective for grazing livestock or cropping, and improves the potential (pasture) production of those areas already effective. Development includes drainage, land contouring, pasture renovation, irrigation and addressing soil fertility.

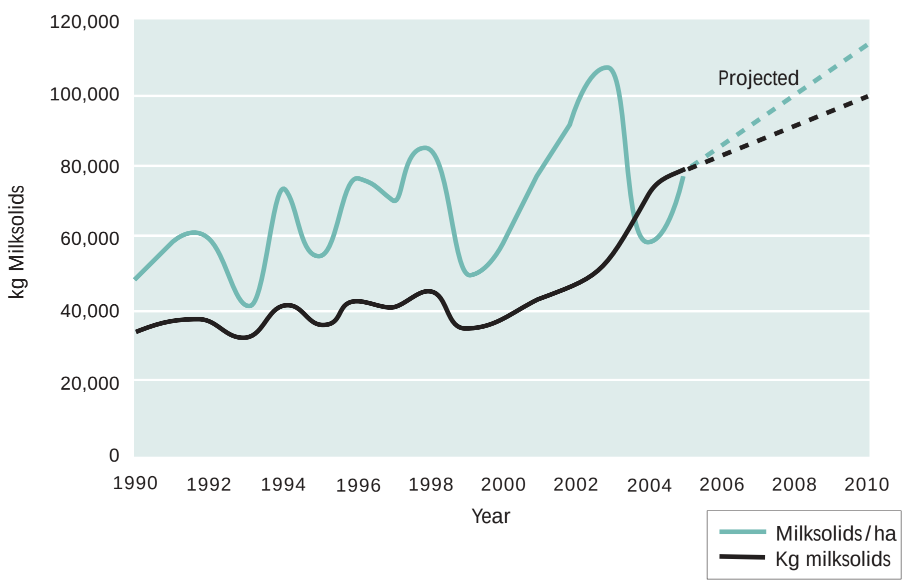
Animal resource development focuses on matching stocking rate to feed supply during a development phase of increasing land area or when increased dry matter is being grown. An increase in animal numbers may require retention of additional female replacements or the purchase of additional stock. Whilst animal resource improvement is an ongoing process subject to normal breeding cycles, there may be an abnormal development phase that affects productivity.

Farm infrastructure development is industry specific, but common themes recur. Farm sub-division and the development of laneways or races to facilitate intra-farm access both improve grazing management and pasture utilisation.

The process will take differing periods depending on the profitability of the production system, the attitudes of the farm owner, the ability of farm owner to fund the development, the returns from development compared to investment in further land resources or other industries, and the capacity of rural service providers and the labour force to conduct the work. Development programmes will vary from one to two years (the 'throw money at it solution') to a lifetime of work and investment.

Figure 3.1 and the text following provide an example of the development process for one case study participant.

Figure 3.1 A career of development on a dairy farm



Participant C (see Figure 3.1) purchased a property in 1978, and over time increased milksolids productivity from 728 kg/ha to 1106 kg/ha, a 51 percent increase over 13 years. At the end of the 2003 season they purchased a neighbouring property – increasing total milksolids production from 52,000 kilograms to in excess of 70,000 kilograms, but reducing per hectare efficiency to 860 kg/ha. However, the plan for 2010 is to increase milksolids production to 100,000 kilograms (or 1126 kg/ha) with the planned development to include:

- building a new cowshed, increasing the number of milking machines from 16 a-side to 28 a-side
- drainage of a 5 hectare wet area of the farm
- increasing soil fertility on the newly purchased property
- some re-subdivision.

Through consolidating farm ownership and implementing modern management practices across the combined farm area, productivity should increase from approximately 85,000 kilograms of milksolids for the two properties to 100,000 kilograms, an increase of 15 percent.

3.3.2 Beyond development – how far to intensify?

3.3.2.1 The past 13 years

Most farmers have an objective to improve the financial performance of their farm (Townsley *et al*., 1997). This usually requires an investment to enhance a property's physical improvements (development) and the production system's biological performance (intensification).

But a question that should be valid to many farmers is how far should they intensify in order to maximise profitability?

Economic theory suggests that for (agricultural) systems maximum profit does not coincide with maximum production. For pastoral systems, as production increases, marginal costs increase with the requirement to introduce more feed and fertiliser, and with the need to develop additional farm infrastructure. At some point, dependent on the product prices being received, marginal costs increase beyond marginal revenue resulting in a reduction in profitability.

The theory that maximum farm profit is achieved at a point less than maximum production is demonstrated by numerous farm systems trials. Table 3.1, reproduced from Penno (1998), shows optimum profits are achieved at less than maximum production under a dairy systems environment. Similar effects are likely under sheep and beef farm systems.

Table 3.1 Stocking rates for optimum economic farm surplus for Dairying Research Corporation No 2 Dairy

Breed		**Jersey**			**Friesian**	
Stocking rate	Low	**Optimum**	High	Low	**Optimum**	High
Cows/ha	3.6	**3.5**	4.5	3.0	**2.7**	4.0
Liveweight (kg/ha)	1346	**1300**	1667	1456	**1250**	1815
Stocking rate (kg LW/t DM*)	84	**81**	104	91	**78**	113
Milksolids (kg/cow)	334	**342**	271	372	**409**	268
Milksolids (kg/ha)	*1193*	***1180***	*1227*	*1123*	***1100***	*1067*
Income ($/ha)	4350	**4300**	4490	4110	**3990**	3890
Expenses ($/ha)	2590	**2530**	3000	2320	**2170**	2710
Economic farm surplus ($/ha)	*1760*	***1770***	*1490*	*1790*	***1820***	*1180*

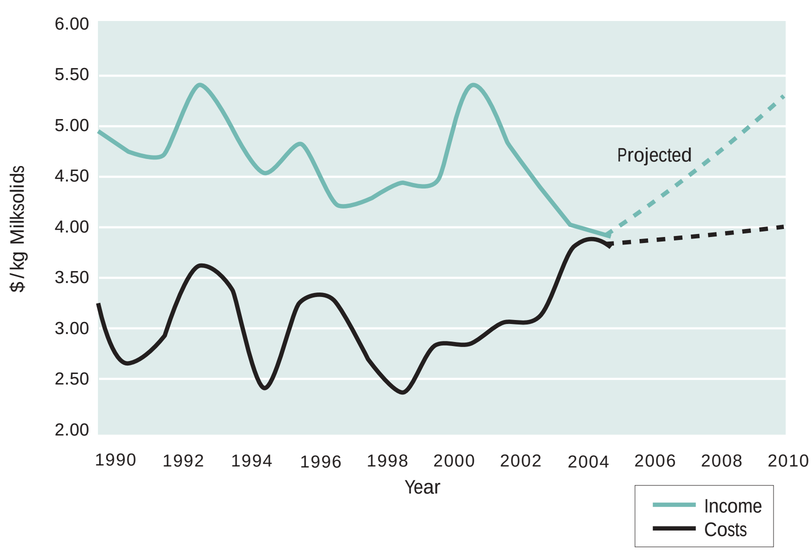
*Kilograms of liveweight per tonne of dry matter.
Note: Assumes cost/price relationships and economic farm surplus (EFS) calculation outlined by Penno and Clark (1997).

However, this premise is tested by more than one case study participant, who appear to favour production maximisation rather than profit maximisation.

A South Island participant (D) bought his first farm in 1978, then sold and bought a bigger farm in 2002. Their case study shows a development phase from 1990 to 1999, increasing milksolids production from 700 kg/ha to a theoretical optimum[4] of approximately 1300-1400 kg/ha. However, the property has continued to intensify, increasing stocking rate from 3.2 cows per hectare to four cows per hectare. The requirement for additional feed has been met by utilising high rates of nitrogen (350 kg N/ha) and the use of irrigation.

Figure 3.2 shows the challenges posed by this kind of approach. For the period from 1990 through to 2001, the margin between income and costs per kilogram of milksolids averaged $1.57. From 2001 to 2004 (budget), the margin is only $0.25 per kilogram of milksolids. Whilst this is partially due to a falling payout and some development costs, the trend is toward a higher output, higher cost, and lower margin system with higher demands on the environment and with greater financial risk.

Figure 3.2 The emergence of a high output, lower margin system on a dairy farm

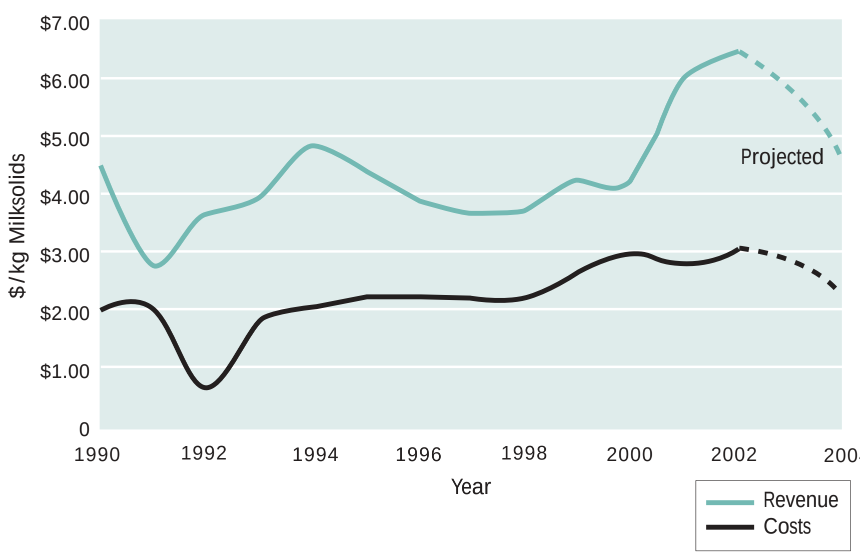


The intent for Participant D is to, 'if payout allows', maintain or increase nitrogen use and to bring in up to 25 percent of the feed resource as bought in feed, enabling the farm to milk 5.5 cows per hectare and produce 2250 kilograms of milksolids per hectare.

The inclination for farmers to respond to increasing prices through increasing inputs and production outputs appears to be widespread. Variable farm expenses have increased from $1139 per hectare in 1992/93 to $1578 per hectare in 2001/02 for dairy farmers (Dexcel, 2002). Sheep and beef farmers have seen farm working expenses increase from $39 to $50 per stock unit between 1998/99 and 2002/03 (Meat and Wool Innovation Ltd, 2003).

A counterpoint to the 'push the boundaries' approach was provided by a Waikato dairy farmer, Participant J. The desire to maximise profit rather than production is shown in Figure 3.3. At the interview they stated that they were aiming to 'maximise profit from a grass-based system', only utilising grass silage procured from a runoff.[5] Although the margins they earn, shown in the following chart, are variable reflecting the effect of lower payouts (1994-1999, 2003) and drought (1997 and 1998), their motive is to operate a high-performance system that is sustainable from a resource use and economic viewpoint. Whilst they are largely motivated by economic considerations, social (children's schooling, local community support) and universal considerations (the need to upgrade the effluent system, fence off streams prior to these activities becoming 'required') are apparent.

Figure 3.3 Maximising profits on a dairy farm



At the time of completing the case studies, ten of the twelve participants were operating profitable systems. One exception is Participant K, earning margins from their vegetable crops (Figure 3.4, grower's own data) that are insufficient to sustain business profitability. This has been the case for the past three years.[6] The process of 'trying to find profitability' has had two effects relevant to the environment. Firstly, they have adopted best practice fertiliser use recommendations involving rigorous plant tissue testing regimes *and* precision agriculture fertiliser application methods, resulting in approximately 25 percent less fertiliser being applied. These effects are win-win. However, the second effect was on the grower's ability to return paddocks to pasture to allow the build up of organic matter. According to the vegetable growers interviewed, paddocks needed to be spelled from cropping for five years in twenty, but both admitted that this was difficult to achieve. They were thus mining natural capital in an attempt to achieve profitability.

Figure 3.4 Margins by crop type for a Pukekohe grower

Participant K's view was that technology changes are rapidly implemented, but if they result in a lowering of the costs of production, the benefits are largely passed on to (supermarket) buyers. This latter view is consistent with the tendency for the commoditisation of products as noted by Saunders and Ross (2004), and results in the reduction of margins available for producers, processors and retailers.

In summary, intensification as a valid strategy has an optimum point – beyond which returns will reduce. At high product prices, however, there is a small proportion of the farming population who will test boundaries lifting stocking rates and inputs to a level that, to maintain profitability, requires superb cost control and advanced environmental management techniques.

3.3.2.2 Intensification intentions to 2010

Case study participants appear to develop their farming systems based on a mixture of information on current returns and future estimates of returns. At the time of the study (October and November 2003) these expectations were relatively bright.

For example, dairy farm participants projected earnings of between $4 and $5 per kilogram of milksolids for the year 2010, and sheep and beef farmers projected earnings of between $80 and $100 per standard stock unit. As a result, this farming group clearly believes that there are profits from continued intensification. Attachment 3 summarises participants' intentions to intensify over the period from 2003 to 2010. In summary:

- the dairy farmers aim to increase milksolids production by a further 30 percent
- the sheep farmers aim to increase stocking rate, lambing percentage and carcass weights
- arable farmers were interested in increasing crop yields, but were also interested in efficiency.

The farmers interviewed are planning to implement farm production systems that operate profitably at the levels of projected earnings mentioned above, yet some commentators are currently predicting much lower product prices than those contemplated by farmers at the time. For example, Alexander (2004) projects milksolids prices to be as low as $2.50 to $2.80 per kilogram and the Ministry of Agriculture and Forestry's SONZA Report (2003a) suggests lamb prices will fall 17 percent between 2002 and 2005.

The above dairy product prices will pose some concern – particularly for South Island farmers who tend to have higher levels of indebtedness (MAF, 2003b) (Table 3.2).

Table 3.2 Breakeven prices for dairy farming

	Waikato[7]	Lower North Island	Canterbury	Southland	New Zealand
Milk income per kilogram of milksolids ($)	2.84	3.01	3.20	3.62	3.26

As noted previously, when the level of product prices falls there is good evidence that farm systems achieve maximum profitability at lower productivity levels. The data in Table 3.3 is based on 'Udder' computer optimisation analysis[8] on the author's own property, which shows that at a milksolids payout of $3.50 per kilogram, a low production, low cost, 'self-contained' system is most profitable.

Table 3.3 'Udder' simulation model returns at different levels of intensity

System	Status quo	High input	Self-contained
Cow numbers	240	260	200
Young stock	On	Off	On
Milksolids production (kg)	89,094	93,485	76,825
Bought in feed (tonnes)	209	159	14
Income ($)	313,395	328,696	268,609
Variable costs ($)	169,840	178,627	101,111
Gross margin ($)	**143,554**	**149,868**	**167,497**

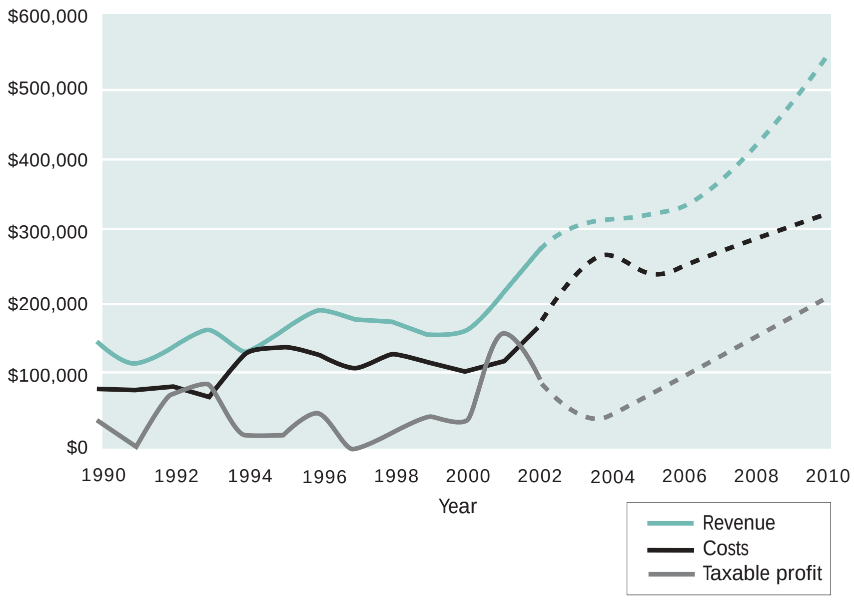
This analysis suggests that farmers need to be aware of their cost structure and be flexible in determining their production system.

3.4 'Enoughness'

There is a stage of business development that, for want of a better term, can be called 'enoughness' – that point where current profit is sufficient (or satisfactory) and social or universal values become more important. This state is not necessarily static – farmers at this point in their career will still aim to improve marginal performance, and will welcome profit upturns in response to good seasons or commodity prices. But this state means that they are unlikely to spend significant new capital on development or expansion. Quite simply, there are now other more important priorities.

Participant C demonstrates 'enoughness'. Through the 1990s the priority was their children's schooling and community activities. However, it is interesting to note that in this case, what was 'enough' becomes insufficient. If the farming business is to support the owners in their future retirement plus the returned-home son, the scale of the business needs to increase. In this case, the need for more 'enoughness' resulted in the purchase of the neighbouring farm and the development outlined in section 3.3.1. This scenario is depicted in Figure 3.5.

Figure 3.5 'Enoughness' on a dairy farm … for a while



3.5 Sustainable production

There is no financial incentive for New Zealand farmers to aim for sustainable production (Bennett *et al.*, 1997). And there are few definitions of sustainable production for New Zealand agriculture; those available (e.g. Table 3.4) appear to provide direction rather than definition.

Table 3.4 The New Zealand sustainability picture as defined by the Sustainable Farming Fund Project, 'Developing supply capability for sustainable production'

- In-step with nature
- Pastureland being managed in accordance with nature's standards
- Happy, healthy animals grazing outdoors on a balanced mix of pasture
- Animals growing and reproducing well
- Landscapes being farmed with pride, and a plan to ensure that the land remains in good heart for the generations to come

Organic producers market their ability to operate a sustainable production system. Whether or not the organic system is environmentally sustainable will depend not only on inputs to the farming system (as constrained by most organic certification bodies) but also on stocking rate, nutrient access to waterways, etc.

The lack of a definition system or an obvious reward system doesn't prevent individual producers making efforts to improve their environmental sustainability. Most participants were making some attempt to address their production system's impact on the environment (Attachment 6).

3.6 Limitations to intensification

Participants noted a number of limitations to their business performance within the context of family farming operations.

Availability of suitability qualified labour was an issue for some. They acknowledged the increasing levels of skill and education required to operate at high performance levels and had experienced some difficulty in sourcing these skills in the past. However, industry efforts to address this issue were noted.

The Resource Management Act, the 'unreasonable demands on consent applicants' and 'lack of common sense' were mentioned.

The availability of business and community services to support the farming business were not noted as particular issues affecting current or future business performance.

CHAPTER 4

The technologies of intensification

4.1 Intensification trends

Over time, stocking rates, the production of milk or meat, and the use of inputs have increased. All of these activities, sensible from an economic perspective, have placed increasing demands on the environment. One good proxy for environmental pressure is the change in nitrate leachate from farm systems.

Table 4.1 shows estimates of nitrate leaching[9] on an average Waikato dairy farm for the past two decades and projects those losses forward, assuming average productivity in 2010 is at current top 10 percent levels.

Table 4.1. Trends in productivity and nitrate leaching

Year	Stocking rate (cows/ha)	Kilograms of milksolids per hectare	Nitrogen use (kg/ha)	Nitrate leaching (kg/ha)
1980	2.2	550	0	17
1990	2.4	675	10	19
2000	2.7	850	80	28[10]
2010	2.8	1080	130	37

Long term, these estimates of nitrate leaching are likely to be underestimates, as eventually the soil's ability to fix excess nitrogen within soil organic matter will decrease (S. Ledgard, AgResearch, pers. comm., 2003).

4.2 The nitrogen story

4.2.1 The influence of nitrogen on the environment

In general terms, as the application of nitrogen increases, nitrogen losses increase. Whilst the soil can act as a nitrogen sink by immobilising or absorbing nitrogen, increasing amounts are lost as nitrate leachate. For example, as nitrogen applications increase from 0 to 200 kg N/ha on an average Waikato dairy farm, nitrates leached increase from 15 to 31 kg N/ha.[11] Similarly, applying 400 kg N/ha on hill country sheep and beef properties will increase nitrate leaching from 5 to 30 kg N/ha.

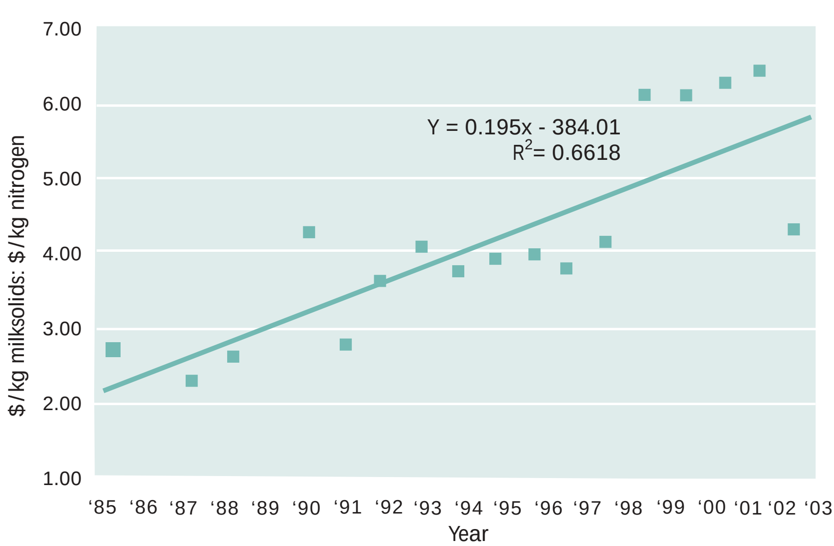
Increasing the levels of nitrate in waterways affects their suitability as a source of drinking water and for recreational purposes.

4.2.2 Nitrogen is becoming more affordable

The use of urea nitrogen to generate additional feed is a relatively new phenomenon. Colin Holmes (1970s) and Bryant (1982) trialled urea use for New Zealand dairying and concluded that 'it was not profitable' at a cost of $1.20 per kilogram of nitrogen and payouts equivalent to $2.20 per kilogram of milksolids. Yet trials in the 1990s, achieving similar dry matter responses showed profits of $100 per hectare for up to 200 kg N/ha.

The reason for the change in profitability is that the real cost of nitrogen fertiliser has fallen relative to product prices. In today's environment dairy farmers are receiving a payout of $4.15 per kilogram of milksolids and are paying less than 90 cents per kilogram of nitrogen. The ratio of milk price to nitrogen price (data sourced for Lincoln University's Financial Budget Manual) has changed by a factor of nearly 2.5 times in favour of nitrogen use over the past 20 years (Figure 4.1).

Figure 4.1 The ratio of milk price to nitrogen cost

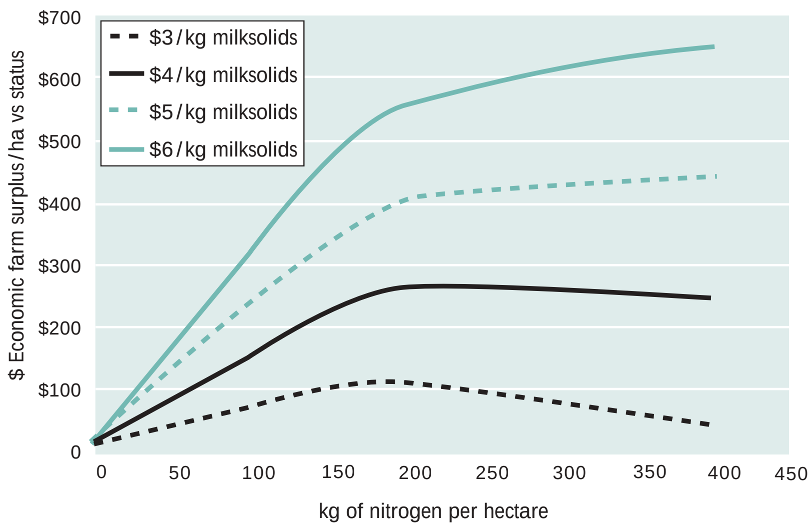


For a standard sheep and beef farm, the change has been more dramatic. In 1982 the average gross income was $27.50 per stock unit, lifting to $67 in 2001/02. The ratio of stock unit income to nitrogen price has moved in favour of nitrogen use by a factor of 3.3 times.

4.2.3 Profitability under dairying

The current nitrogen story under dairying is demonstrated in Figure 4.2 (author's own analysis). At low payouts, strategic nitrogen use[12] is only profitable at low use rates of 50-100 kg N/ha. At payouts of $4 per kilogram of milksolids, 200 kg N/ha becomes profitable and at payouts of over $5 per kilogram, up to 400 kg N/ha can be used profitably.

Figure 4.2 Profit from nitrogen fertiliser use at different milksolids payouts



Using this ratio-based approach, the price of nitrogen would need to increase by one third for the maximum economic rate of nitrogen application to reduce from 200 kg N/ha to 100 kg N/ha at a dairy payout of $4 per kilogram of milksolids.

The trial work for the various nitrogen response studies was conducted in the 1990s, and some Canterbury-based participants indicated (but could not demonstrate) that they obtained profitable responses from utilising 400 kg N/ha at the current $4.15 per kilogram of milksolids. They are farming on irrigated pastures where nitrogen responses are not limited by summer dry (previous experiments have been conducted on non-irrigated Waikato farms) and where newly-imposed intensive grazing systems are resulting in the accelerated accumulation of nitrogen in soil organic matter. Under these conditions, and with an efficient production system, up to 400 kg N/ha may be profitable (J Penno, pers. comm., 2003)

Whereas 200 to 400 kg N/ha may be profitable under dairying, industry data suggests that the average use rate of nitrogen has increased from 56 to 104 kg N/ha during the late 1990s in the Waikato (Singleton, 2003) and may average 85 kg N/ha throughout New Zealand. A question central to environmental concerns relates to the potential for further increases:

- One dairy farm case study participant had been a heavy nitrogen user in the 1990s (150-200 kg N/ha), but responded to observed poor pasture health by cutting nitrogen fertiliser completely. A modified management system has since resulted in one 50 kg N/ha application in early spring.
- The remainder of participants, the majority of whom are identified as above average performers, will hold existing nitrogen use at 100-200 kg N/ha.
- One participant will utilise 400 kg N/ha or more as the payout dictates.

Overall, it is likely that average nitrogen use rates will continue to increase.

4.2.4 Nitrogen and the sheep and beef industry

Traditionally, nitrogen fertiliser has played a very small part in the sheep and beef industry. In the period from 1997/98 to 2001/02, the average farmer applied 8 kg N/ha (Meat and Wool Innovation Ltd, 2003). Yet case study participants and leading researchers are predicting a potential nitrogen revolution. A participant on summer wet hill country intends to use up to 200 kg N/ha to lift his potential stocking rate from 10 to 13 or 14 stock units per hectare. Another participant, on summer dry intensive finishing country, currently uses 75 kg N/ha and intends to use more in future as stocking rate and feed requirements increase.

A sheep grazing trial in the lower Hawkes Bay compared no nitrogen with 400 kg N/ha (Lambert *et al*., 2003). The nitrogen treatment grew an astonishing 17.1 tonnes of dry matter per hectare (DM/ha) compared to the control at 9.2 tonnes DM/ha. However, nitrogen losses to leaching were estimated to increase from approximately 5 kg N/ha to approximately 35 kg N/ha.

Whilst productive farm systems have yet to be matched with these very high rates of nitrogen application, there is obvious potential that leading farmers are likely to exploit. And whilst the nitrate leaching potential for a sheep-based farming system is minimal compared to dairy, the scale of the industry, the difficulty of avoiding waterways with aerial applications, and the location of many farms at the upper reaches of river systems, suggest potential problems. Nutrient-loss models such as Overseer are believed to underestimate nitrate losses over the long term.

4.2.5 Mitigation of nitrate leaching

Different management practices have implications for the efficiency of nitrogen use, and the theoretical rate of nitrate leaching. Whilst in general, a higher stocking rate, higher productivity and higher use of nitrogen fertiliser will result in higher leaching, management can actively reduce these effects (Table 4.2).

Table 4.2 Nitrate leaching and the efficiency of nitrogen use on a Canterbury dairy farm

	No nitrogen	100 kg N/ha	200 kg N/ha	400 kg N/ha
Nitrate leaching - Winter off* (kg/ha)	14	20	31	50
Efficiency of nitrogen use (%)	49	39	32	24
Nitrate leaching - Winter on** (kg/ha)	14	21	41	88
Efficiency of nitrogen use (%)	55	45	35	25

* Winter off – dairy cows are moved off the milking platform and grazed on a runoff block during winter

** Winter on – dairy cows are grazed on the milking platform during winter

The development of new technologies, such as the branded product 'eco-n' which reduces the rate of nitrate loss from any given management system, has some promise for allowing both intensification and reduced environmental impacts.

4.3 Water use on farms

Theory suggests that there is a very good return from converting dry land to irrigated pasture. Attachment 4 shows a rate of return on investment of 29 percent under dairy farming conditions and an increase on the total farming return on investment of 2.6 percent.

Four of the study participants farm in Canterbury and have an on-going interest in water use for irrigation. Their intentions and issues are summarised in Attachment 5. In summary, there is general demand for water for irrigation:

- Participant I has recently obtained additional water from a bore
- Participant E would like more water but has no definite plans
- Participant H had just subscribed to a community scheme for 150 hectare of irrigation at $1400 per hectare

- Participant D has just drilled a new bore so that they are 'fully allocated'.

With the profitability of irrigation shown in Attachment 4, farmers can be expected to continue to invest in new systems where sufficient water is available.

The profitability of irrigation is not particularly sensitive to a ±50 percent change in the cost of electricity at current milk prices.

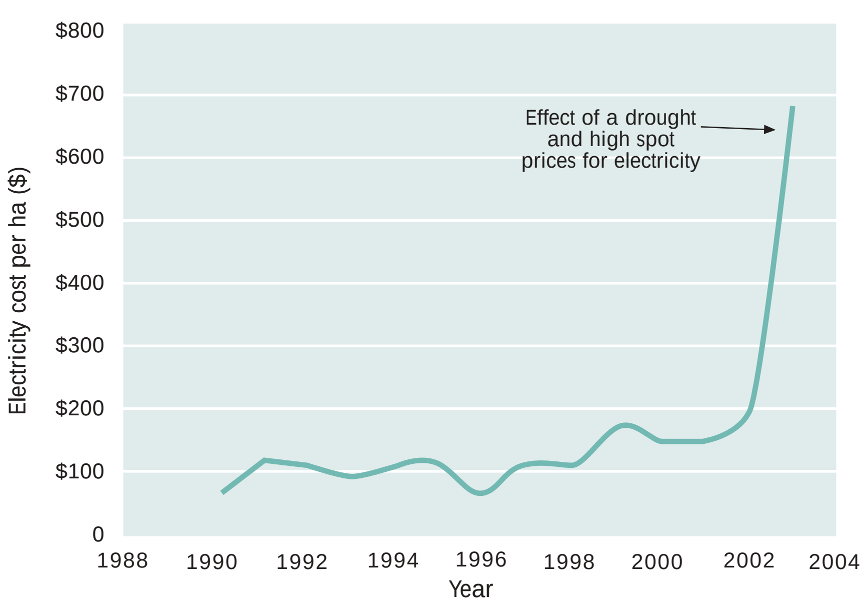
4.4 Electricity price shock on a Canterbury dairy farm

Figure 4.3 shows electricity costs, on a per hectare basis, for a Canterbury dairy farm. This farm's primary use of electricity is for operating the cowshed, for irrigation and for providing water to stock.

During the period from 1990 to 1998, electricity expenditure equated to approximately $100 per hectare, rising to $150 per hectare for the next three seasons. This latter period incorporated the sale of one property and purchase of a new, larger property.

Of note, however, is the marked increase from a cost of $200 per hectare in 2002 to in excess of $650 per hectare in 2003 as a result of the drought and the effect of purchasing electricity on the spot market. The increase in expenditure of approximately $85,000 contributed to a loss for the year of $97,000.

Figure 4.3 Electricity shock on a Canterbury dairy farm



CHAPTER 5

The environment

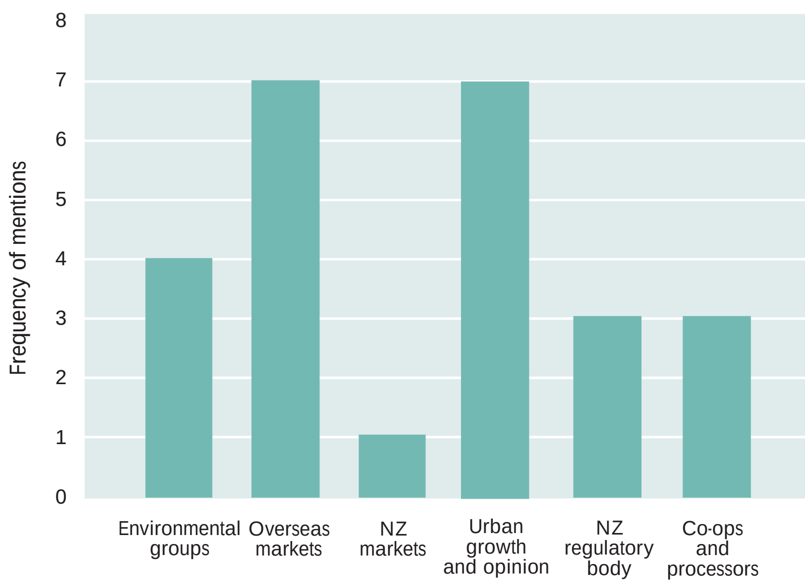
As part of the case study questionnaire, participants were asked questions about their attitude towards the environment. Details of their responses are included as Attachment 6 and summarised below.

In general:

- 11 of the 12 participants (92 percent) had a positive view of the environment and their stewardship role. This corresponds with findings by Bennett *et al*. (1999) who considered farmers' views of their practices on soil quality.
- All participants had adopted improved environmental management practices through, for example, adoption of superior effluent disposal technologies (dairy), use of limited nutrient budgeting, and pole planting on slopes susceptible to erosion.
- It is noticeable that the notion of nutrient budgeting seems to be more about measuring nutrient inputs and outputs rather than controlling those inputs and outputs.
- Farms are trending toward increased nitrogen use.
- One participant recognised environmental concerns, but was dismissive of the effect of his actions on the environment. When faced with the AgResearch data showing higher nitrogen losses with higher stocking rates and nitrogen use, the response was "Bull..., just look at the Lincoln Lysimeter work".

- Key external influences on farmers' future environmental practice are overseas markets, urban communities and environmental groups (Figure 5.1).

Figure 5.1 External influences on environmental practice



- The response to genetic modification was, 9/12 'yes we should proceed along ERMA-approved lines', 2/12 'maybe', 1/12 'genetic modification should not be allowed'.

- Despite improved farmer awareness about environmental best practice, many environmental impacts are unseen in terms of soil and water quality. When questioned further, farmers showed only moderate confidence that their farming practices are sustainable. This compares to Bennett *et al.*'s (1999) findings from a sample of 12 farmers from Marton in the Manawatu region - when asked if they thought they were farming sustainably, 5 answered 'yes', and 6 said that they 'thought so/hoped so'.

Whilst farmers are taking steps to address specific environmental concerns as their finances allow, this does not address the intensification issue. That is, how will farms and their catchments cope with increasing productivity?

About half of the participants in this survey will respond to increasing price by increasing the intensity of their farming operations. Dairy farmers will respond to higher payout with higher stocking rates, higher per cow production and higher bought in feed levels with a proportion developing additional feed and standoff pad infrastructure. Sheep and beef farmers will respond with increasing nitrogen use, increased stocking rates and increasing productivity through improved feeding and genetics.

In summary, these results suggest positive motivation towards environmental sustainability in general, subject to economic concerns. The issue for the agricultural industry is, however:

> **Are current farming systems environmentally sustainable and what changes do we need to make to our management practices or the technology that we use to enable further performance improvements from both an economic and environmental perspective?**

Glossary

Milking platform the area of a dairy farm on which milking dairy cows are grazed (see runoff).

Runoff an area of farmland used to support production on a dairy farm. A runoff may be used to grow winter feed for dairy cows or to graze young, non-milking cows. Dairy cows may be wintered on a runoff block. A runoff is normally located on another farm, but can be on land adjoining the dairy farm that is not suitable for milking cows to graze (see milking platform).

Winter off dairy cows are moved off the milking platform and grazed on a runoff block during winter.

Winter on dairy cows are grazed on the milking platform during winter.

Endnotes

[1] Or when the participants commenced farming.

[2] Case study farm area for dairy farms includes the total area of the milking platform plus associated runoffs, while MAF Farm Monitoring data for dairy farms is effective farm area (i.e. the milking platform) excluding runoffs. A milking platform is the area of a dairy farm on which milking dairy cows are grazed. A runoff is an area of farmland used to support production on a dairy farm, such as growing winter feed or grazing young, non-milking cows. Dairy cows may be wintered on a runoff block.

[3] Net worth equals assets (land and stock at market value, other assets at book value) less liabilities (term debt plus current liabilities).

[4] This optimum is based on theoretical pasture production from a fertile irrigated property in Canterbury.

[5] A runoff is an area of farmland used to support production on a dairy farm. A runoff may be used to grow winter feed for dairy cows or to graze young, non-milking cows. Dairy cows may be wintered on a runoff block. A runoff is normally located on another farm, but can be on land adjoining the dairy farm that is not suitable for milking cows to graze. The area of a dairy farm on which milking dairy cows graze is called the milking platform.

[6] The other grower interviewed (Participant B) was only able to maintain profitability through scale (a business with turnover of NZ$50 million) and vertical integration. The strategies that Participant B adopted included direct contracts with supermarket buyers, ownership of vegetable storage, grading and packing facilities, ownership of a strong brand, and ownership of an export marketing company.

[7] Excluding Tatua suppliers.

[8] A decision support model that predicts the milk production of dairy herds grazing pasture under different management systems.

[9] All calculations use Overseer Nutrient Budgets 2, version 5.0.

[10] This assumes that stock is grazed on-farm during winter. Although it is common practice to graze off with a resulting reduction in nitrate leaching on a milking platform, the cows grazing off will still create an additional nitrate leaching loss.

[11] Using Overseer version 5.0.

[12] That is, where nitrogen is a planned part of the feed budget.

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Attachment 1 - Abridged survey form

Agricultural Investments Limited

This survey is being conducted on behalf of the Parliamentary Commissioner for the Environment, Dr J. Morgan Williams

NAMES of owners plus age range	
OTHER FAMILY (ages)	With an interest in the business: No interest in the business: Aspirations for the business:
FARM DESCRIPTION Size and names of blocks owned or leased (indicate) and major farming enterprises	
CAREER DEVELOPMENT Details of major career and farm purchase steps	
EDUCATION Please give brief details of family qualifications gained, and any other relevant educational courses undertaken relevant to the study.	
OTHER RELEVANT PERSONAL ISSUES Could include health or retirement pending, etc.	

Description of farming career and financial progress. See financial spreadsheets attached for data, but get descriptions of what were the major purchases or development steps and the motivation for these. Also, how were changes in performance achieved, why was fertiliser expenditure changed etc. NOTE ANY OFF-FARM INCOME.

BUDGET/BUSINESS MODEL

Assumptions	**2004 budget**	**2005 forecast**	**2010 forecast**	**2010 20% better**	**2010 20% worse**
Farm area					
Numbers/crop					
Performance					
Bought in feed					
Fertiliser					
Other					
INCOME:					
1.					
2.					
3.					
Total:					
Expenses:					
1. Staff costs					
2. Running costs					
3. Feed costs					
4. Fertiliser					
5. Overheads					
6. Interest					
7.					
Total costs:					
Surplus					
Total assets					
Debt					
Interest rates					
Equity					

OBJECTIVES - THIS SEASON; 2005; 2010

Personal/Family

Business

Other - Succession?

EFFICIENCY CHANGES BY 2010: What management practices might be applicable to your business? Animal Performance: Plant productivity: Feeding systems: Automation: Other:	
HUMAN RESOURCES What staff do you employ and what roles do they fulfil? (include sharemilkers and contract milkers and their staff)	Staff employed 10 years ago: Now: In 2010?:
STAFF RESOURCES Are you happy with the skill and experience of your team of staff?	
STAFF RESOURCES What skills do you think your staff will need in 2010 and are you confident that you will be able to source them? Are current training and recruitment efforts (industry, WINZ, government) satisfactory?	
SERVICE PROVIDERS Are you satisfied with the quality of science and the provision of scientific, technical and business advice?	
COMMUNITY RESOURCES Are you satisfied with the services available to you in your community? Health, education, sports etc.	

NATURAL RESOURCES What were, are and will be the key issues for your farm business in terms of environmental sustainability? Consider off-farm drivers such as markets, return on capital etc.	10 years ago: Now: In 2010:
NATURAL RESOURCES What impacts does your farming system still have on the environment?	Soil quality Soil erosion Water availability Water quality Biological resources
NATURAL RESOURCES What steps have you taken, or can you take (id which) to limit the effect of your business on the environment? What redesign of your farming system do you see as helpful in managing your natural resources more sustainably? Farm plan, tree planting, erosion protection, nutrient use, soil testing, effluent management.	Costs, timeframes etc...
NATURAL RESOURCES Looking forward to 2010, what regulatory requirements might be in place and what technologies or management might be required?	

REGULATORY ENVIRONMENT Do any aspects of the RMA or related environmental legislation affect your ability to carry out your business? Timeframes, costs, ability to develop.	
PRESSURE FOR CHANGE Where is the pressure for improving environmental sustainability coming from? Markets, the public, co-ops?	
GENETIC MODIFICATION Where does GM technology fit in helping your farms environmental and economic sustainability?	
GENERAL Are there any other points that you would like to make about this study or regarding natural resources.	

Attachment 2 - Participant details

Participant	A	B	C	D	E	F	G	H	I	J	K	L
Type	Dairy	Vegetables	Dairy	Dairy	Arable	Sheep & beef	Sheep & beef	Arable	Dairy	Dairy	Vegetables	Dairy
Region	Southland	South Auckland	Waikato	Canterbury	Canterbury	Hawkes Bay	Hawkes Bay	Canterbury	Canterbury	Waikato	South Auckland	Southland
Total area (ha)	444	–	88	284	211	1040	660	430	376	147	144	267
Stock units	7540	–	2175	5754	–	7400	4936	–	7836	3237	–	4840
Total assets ($000)	6,653	53,684	3,095	9,000	2,900	4,100	5,000	3,900	7,800	2,965	7,512	4,950
Gross income ($000)	802	29,458	310	1,317	323	646	409	845	1,387	532	1,880	708
Net profit ($000)	-240	2,469	52	-97	96	120	196	258	66	156	-73	-166
Net profit/ha ($)	-540	–	590	-342	454	115	297	600	175	1064	-500	-621
Equity (%)	–	32	42	44	89	85	95	76	55	46	81	76

Attachment 3 - The intensification and expansion of case study businesses

The data shows participants intended intensification and expansion between the 2003 financial year and 2010.

Industry	Participant	Intensification 1	Intensification 2	Scale growth
Sheep and beef	F	170% to 200% lambing	10 to 14 stock units per ha	800 – 1040 ha
	G	118% to 145% lambing	-	660 – 760 ha
Dairy	J	1143 – 1243 kg milksolids/ha	400 – 435 kg milksolids/cow	140 – 240 ha
	I	1125 – 1500 kg milksolids/ha	365 – 400 kg milksolids/cow	N/A
	D	1673 – 2250 kg milksolids/ha	4.1 – 5.5 cows per hectare	N/A
	A	723 – 1062 kg milksolids/ha	-	N/A
	L	944 – 1200 kg milksolids/ha	450 – 600 kg milksolids/cow	N/A
	C	795 – 1136 kg milksolids/ha	-	N/A
Arable	H	9 – 11.5 tonnes/ha of wheat	-	N/A
	E	Beyond the farm gate investments	-	210 – 300 ha
Vegetables	K	Absolute profitability a concern		
	B	Grown assets from a $4 million business to $39 million in 10 years		

Attachment 4 - Returns from irrigation

Irrigation area	**100 hectares**			
Farm size	**120 hectares**			
Annual irrigation costs	**Total**	**$/ha**		
Irrigation cost		$1,700		
Bore/pump/site works	$50,000	$420		
Consents	$20,000	$167		
Total capital expenditure		**$2,287**		**$228,700**
Interest @ 8%		$183		
Depreciation @ 1/12		$191		
Total capital costs		**$374**		**$37,400**
Repairs & maintenance		$40		$4,000
Electricity		$120		$12,000
Labour - 120 days x 10 Hours		$140		$14,000
Total		**$674**		**$67,400**
Kilograms of dry matter (DM)		**DM/ha**	**Total DM**	**Costs/kg DM**
		4000	400,000	$0.17
Kg DM/kg milksolids (MS) - long run			10	
Costs/kg MS				$1.69
Value of MS				$3.50
Profit/kg MS				**$1.81**
Total kg MS				40,000
Profit				$72,400
Profit/irrigated ha				$724
Profit/total ha				$603
Total asset value/ha prior to irrigation				$22,000
Return on irrigation asset				**31%**
Increase in return on total asset (including co-op shares)				**2.5%**

Attachment 5 - Water use

Participant	Farm type	Irrigated area	Future intentions	Issues	Comments on RMA/Environment Canterbury
Gough	Cropping	140/211 ha	**Would like more water** - no definite plans Could change to more efficient technology	The availability and cost of water May need to install water meters	Issues with the cost and complexity of the process – e.g. even need a consent to drill a bore
Slater	Cropping	0/430 ha	**Just subscribed to 150 ha of irrigation** at $1400/ha Additional $1500/ha to apply water		
Goddard	Dairy	170/178 ha	**Just drilled new bore** as want to be fully allocated. 'It's first in first served'.	Electricity supply is a problem	Difficulties with attitude of Environment Canterbury Difficulties with timeline and process to get consent
Thornton	Dairy	300/310 ha	Received new water recently	Water availability can be concerning – has to coincide with other start ups	Will be need for water meters 12 month process to get consents – then there were restrictions placed on stocking rate Can get a consent to irrigate 'provided you don't put cows on'

Attachment 6 - Comments on the environment

Participant I - Dairy

Issues	Mitigate issues	Future requirements
Effluent disposal	State of art, integrate with irrigation	
Nutrient use	Little and often with 30 kg N/ha	Detailed nutrient budgets
	No more than 200 kg N/ha/annum	Balance the budget – not just complete it!
	Nutrient budgeting	
	Urease inhibitors (Ravensdown)	
Soils	Direct drilling	

- Concerned with checkers checking the checkers. Arguments must be science based.

Participant D - Dairy

Issues	Mitigate issues	Future requirements
Effluent disposal	Effluent through irrigators	
Fertiliser management	Nutrient budgeting	Nitrogen may be limited
	No more than 400 kg N/ha/annum	
Water use	Little and often	
Electricity		Need more generation

- 'Reactive, ill-informed, narrow thinking people'. Need more common sense.
- There are confusing signals. The nitrogen work under lysimeters at Lincoln University shows no leaching.
- Will require more monitoring.

Participant H - Cropping

Issues	Mitigate issues	Future requirements
Nutrient loss	Limit nitrogen to 200 – 250 kg N/ha	Consider carbon status of soils – less cultivation
	Don't leave soils fallow	Accurate fertiliser placement
Soils	Precision farming	Nutrient budgeting
	Soil mapping	
	Drainage, sub-soiling, moling	
	Direct drilling	
	Incorporation of residues	
Shelter		Plant shelter for amenity benefit
Other		High temperature burning of containers

- No problem with regulation – have not had to apply for consent.

Participant J - Dairy

Issues	Mitigate issues	Future requirements
Nutrient loss	Limit nitrogen to 50 kg N/ha	Nutrient budget
	Use maize instead of urea	
	Use 'environment friendly' fertiliser	
Effluent	Ponds hold 12 months of effluent	
	Pump out once per year	
Biodiversity	Part of the Trust creating 'Maungatotari Island', a mainland island for bird life	

- No problem with regulation – have not had to apply for consent.

Participant K - Vegetables

Issues	Mitigate issues	Future requirements
Soil erosion and quality	Franklin Sustainability Project - cover crops - silt traps - bunding	Nutrient budget
	Aim to have longer time in pasture	
Soil borne disease	Swap land with Greens growers	
Nutrients	Reduce fertiliser inputs by 10 – 20 %	
Spray drift, fertiliser dust, mud	Minimise impact on neighbours	
Biodiversity	Part of the Trust creating 'Maungatotari Island', a mainland island for bird life	

- A lot of cost and expense.
- Even minor works require consent (culvert).
- Building consents quite an issue.
- Air and water plans difficult to meet.

Participant F - Sheep and Beef

Issues	Mitigate issues	Future requirements
Erosion	Pole planting – creates shade and stops slips	Nutrient budget
	Avoid treading damage with production cattle	
Biodiversity	Gullies fenced off	
Nutrients	No problems that are aware of	
	Physically can't fence all water ways	
	Nutrient budgets (not looking forward to this)	

- Need science to back up best practice recommendations.
- Had to get consent for dam (after the event).
- Gut feeling is that nitrogen loss will not be an issue.

Participant C - Dairy

Issues	Mitigate issues	Future requirements
Effluent	Use oxidation ponds but empty with a muck trailer weekly	Nutrient budget
Nutrient	Will fence river	
	Annual soil tests	
Soil quality	Standoff cows in winter	
	Drain wet paddocks	

- No issues.

Participant A - Dairy

Issues	Mitigate issues	Future requirements
Effluent	High awareness	Expect tougher rules in the future
Nutrients	Improved fertility	
	Nutrient budget being used	Increased recording and compliance
	Annual soil tests	
	Careful wintering	
	Wetlands and bush all fenced off, may drain and fence some fringe areas.	
Soil quality	Standoff cows in winter	
Other	Tree planting as we can afford it	

- Noted an anti-dairy lobby in Southland.
- Consulting neighbours even for a small change in consent is time consuming.
- Concerned about the implications of Kyoto.

Participant L - Dairy

Issues	Mitigate issues	Future requirements
Effluent	Good systems in place	Improved effluent disposal from wintering pads
		Solids separation from effluent – liquids to paddocks, solids saved up then re-incorporated into paddocks
Nutrients	All water ways are fenced	
	Moderate stocking rate	Stocking rate may be controlled
	Using/thinking of using rock phosphate	
Other	500 m per annum of shelter planting	

- Slowly evolving change.
- Regulatory environment slows down development – consultation with iwi, Fish and Game.

Participant G - Sheep and Beef

Issues	Mitigate issues	Future requirements
Nutrients	Have increased fertility	
	Continue to soil test and apply fertiliser as required	Stocking rate may be controlled
	Small wetland undisturbed	

- No issues.

Participant B - Vegetables

Issues	Mitigate issues	Future requirements
Soil structure and quality	Adopt Franklin Sustainability Project recommendations	
	5 out of 20 years out of pastures	Stocking rate may be controlled
Nutrients	Using 2/3 of the fertiliser of 10 years ago	

- Frustrated with the RMA + noise control and traffic control.

Participant E - Arable

Issues	Mitigate issues	Future requirements
Soil structure and quality	Reduce residue burning	
	Minimum cultivation	Stocking rate may be controlled
Water use	Change to linear or centre pivot or trickle irrigation to increase water use efficiency	Flow meters on bores
	Soil not left fallow – avoid wind erosion	
Nutrients	Annual soil tests, nutrient balancing	

- Currently have less than half of their total required water use – rush on water.
- Permits required for all fires.
- Water applications now require technical information, meaning experts must be employed, adding cost.
- Objectors are not accountable to anybody.