Information, Decision and Action

The Factors that Determine Farmers Environmental Decision-making

A Contract Report for MAF

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EXECUTIVE SUMMARY

This report examines the psychological, social and other factors that determine farmers' different responses to environmental change. In particular, it is designed to explain why some farmers implement environmental strategies but others remain intransigent and resistant to change.

A random sample of 40 Waikato dairy farmers and interviews with 5 representatives of regional institutions and national organisations were used to provide an empirical basis for the report. The research and subsequent findings are grounded in a review and analysis of the literature concerning technology change and innovation. Particular attention is paid to the recent literature on the adoption of environmental technologies.

The report identifies four paradoxes in farmers values, attitudes and behaviours and explains these within a simple model framework. This is then used to support the need for a new research agenda which gives greater priority to social and cultural structures, institutional arrangements and policy and economic incentives. It is argued that it is only through greater attention to these contextual factors that the necessary value shift and behavioural changes to support the development of a more sustainable agriculture will occur.

1. INTRODUCTION

1.1 Introduction

The overall goal of this study was to identify the psychological, social and other factors that determine farmers' different responses to environmental change. In particular, the study aims to determine why some farmers implement land management policies for long-term sustainability while others remain intransigent and resistant to change.

It is generally accepted that in anticipation of climate change farmers will be required to modify their land management policies to secure sustainability in an increasingly unstable environment. Earlier work has suggested that such modification in North Island hill country is unrelated to income levels (Rhodes, Willis and Smith, 2000). However, the values that underpin appropriate behaviour remain unclear. In New Zealand, since 1984, the common policy assumption has been that market signals determine land use change. At the same time, however, market signals do not properly incorporate environmental costs.

Reliance on legislative approaches (eg the Resource Management Act) is cumbersome and costly. At the same time, while much previous farm extension work has relied on issues of cost saving and profitability to promote change, climate change will require persuading farmers to do what they do not necessarily want to do. Indeed, at least to the farmers concerned, the changes required may seem counter-intuitive and even counter to short-term profitability. It is important, therefore, that there is a better understanding of those factors which motivate farmers' environmental decision-making. Such understanding could then provide support for climate change policies at both national and regional levels.

This report uses the example of dairy farmers in the Waikato to investigate farmers' values and behaviour, and develop an approach that could provide a springboard for future research on farmers' environmental decision-making. Dairying was specifically selected for investigation as a major economic growth sector and one with recognised and significant environmental impacts. The Waikato was selected for several reasons. The region carries the country's largest dairy herd some 1.669 million head of cattle and accounts for some 30% of New Zealand's total dairy production (Statistics New Zealand, 2007). The intensive nature of dairy land use in the region has

exposed substantial environmental problems which are being addressed by the regional council (Environment Waikato). The region was also subjected to an unusually extended and severe drought in the early months of 2008 which it was believed might have influenced farmers decision making and highlighted their awareness both with respect to shorter-term environmental needs and longer-term environmental change.

1.2 Objectives

Within this broad context, three specific objectives were explored: farmers' land management values; farmers' attitudes to climate change; and the theorising of adoptive behaviour. Understanding values requires an understanding of farmers' ethics and priorities. These in turn may reflect upbringing, culture, family circumstances and social context. Values, therefore, provide a baseline for understanding long-term decision-making, as they are borne of combined experience and applied recognising the inherent risks in fulfilling personal goals.

It remains unclear the extent to which farmers' acceptance, or rejection of specific management techniques are linked to their attitudes and beliefs relating to long-term environmental change. Most extension work traditionally focussed on short to medium-term profitability or cost reduction. The need to implement longer-term thinking is more complex and requires a deeper understanding of the relationship between attitudes and behaviour and in particular the link between behavioural change and assessment of long-term uncertainty and risk.

Drawing on both the evidence generated regarding farmers' values and attitudes to long-term climate change the third objective of the report is to develop a model or theoretical framework to explain how values and attitudes underpin sustainable practices. While there is an extensive literature on behavioural change and adoption with respect to technological change (for a comprehensive survey, see Rogers, 1962; 1983; Rogers and Shoemaker, 1971) there is little theoretical understanding of farmers' decision-making processes with respect to long-term environmental needs. Empirical evidence remains fragmentary and incomplete. Conceptualising farmers' environmental decision-making is a necessary basis for strategic policy development if current policy commitments are to be met and farms (and farmers) better proofed against climate change.

2. UNDERSTANDING THE DRIVERS OF FARMERS' ENVIRONMENTAL BEHAVIOUR?

By the early 1950s there was a broad consensus among scientists and extension officials that the process of behavioural change, in particular the process of technology transfer or "innovation diffusion" was well understood. By the mid-l970s this consensus was crumbling. Today, in the early 21st century, there is renewed questioning of our understanding and capacity to effectively promote technology change. This section reviews the shifts in understanding of technological change since the 1950s and attempts to identify and highlight our current understanding of technology change in agriculture with specific reference to environmental practices.

The consensus evident in the mid 20th century centred on an acceptance that the speed and direction of change across a landscape was primarily determined by distance, level of interaction among the various actors concerned, and by the psychological and other characteristics of land users. Multiple studies showed and confirmed the importance of factors such as age, marital status and family structure, financial resources, years of formal education, off-farm work experience, and number of journals read in the speed of adoption (see for example Emery and Oser, 1958). Confidence in such interpretations was further confirmed by the repeated identification of "Bell" and "S" shaped curves in graphing the spread of an innovation among a population. Personality characteristics were "fitted" to such curves and the result was the establishment of statistical groups or categories of adopters on the basis of their responsiveness to change. In such groupings labels such as "early innovators" and "laggards" highlighted the inherent assumption that change was "good" and that the responsibility and capacity to change resided firmly with the respondents (farmers) themselves (Jones, 1967).

The capacity to match personality traits and characteristics with a statistical distribution, on hindsight at least, resulted in the assumption that a causal relationship had been established, and is a useful cautionary tale that statistics don't equal science and that a statistical correlation is not necessarily evidence of a causal relationship. Ultimately, empirical evidence forced a re-interpretation of innovation theory, and by the 1970s there was increasing acceptance that while the characteristics of recipients were an important component in explaining the process of change, the strategy, skills and behaviour of the diffusers of new knowledge played a crucial role in the

speed and direction of change (Brown, 1981). Thus it was accepted that those with the know-how might direct change, favouring a specific group or community, or actively block access to information by others. For example, in a study of Quebec farmers and the adoption of hybrid maize, it was found that the spread could only be explained in terms of the goals and priorities of the (corporate) group that spread the information (Smith, 1973). Reliance on extension workers who only spoke English effectively barred the rapid adoption of maize by the majority of unilingual, French speaking farmers. Seed was only provided to farms above a certain size threshold. Specific communities were targeted to ensure that resultant publicity would imply a wide geographic spread. Again it was possible to graph the spread of the innovation (in this case maize) and generate Bell and S shaped curves, but the interpretation of these curves begged a deeper explanation.

The net result of this re-interpretation of the diffusion process and a re-branding of innovation diffusion as "technological change" involved a fundamental re-conceptualising of innovation and change; a rejection of diffusion as a linear process, and an acceptance that this process is better viewed as a complex and iterative system. Traditional assumptions that change equates with progress also have been questioned, and in particular the belief that any beneficial scientific advance will automatically be adopted by recipients has been demonstrably shown to be false (Levine, 1980).

These changes in thinking as to extension and technological change in farming have, directly or indirectly, seen parallel shifts in the institutional frameworks within which extension is done and in the research processes used to develop improved land use practices. In New Zealand there has been a dramatic dismantling of traditional, state supported, extension services (Journeaux and Stevens, 1997). Comparable shifts have occurred in other countries. Many of these changes have occurred within the rubric of neo-liberalism, but they also reflect a more specific questioning of the process of technological change in line with the debate described above. From a research perspective, the shift in understanding has resulted in a broad move by research funding bodies (including FRST) to encourage scientists to work with farmers from the early development of their ideas through to their final application (commonly described as some form of participatory approach).

Despite this shift in understanding of the diffusion process and the resultant emphasis on "adult education" and with it a wider recognition of farmers as autonomous, self-directed learners, much effort in the area of extension remains bound to an effective categorisation of farmers as used in the 1950s and 1960s, although the pejorative language of "laggards" and the like has gone. Characteristics of individual farmers in terms of their age, formal education, financial resources, family structure and the like are all used by extension workers to identify "opinion leaders" or role models for the community as a whole. This has caused some commentators (see, for example Dunn, 1997) to express concern at the continued reliance on an otherwise out-moded paradigm which assumes some universal behavioural characteristics to explain adoption/non-adoption, and views technology transfer as a simple linear progression.

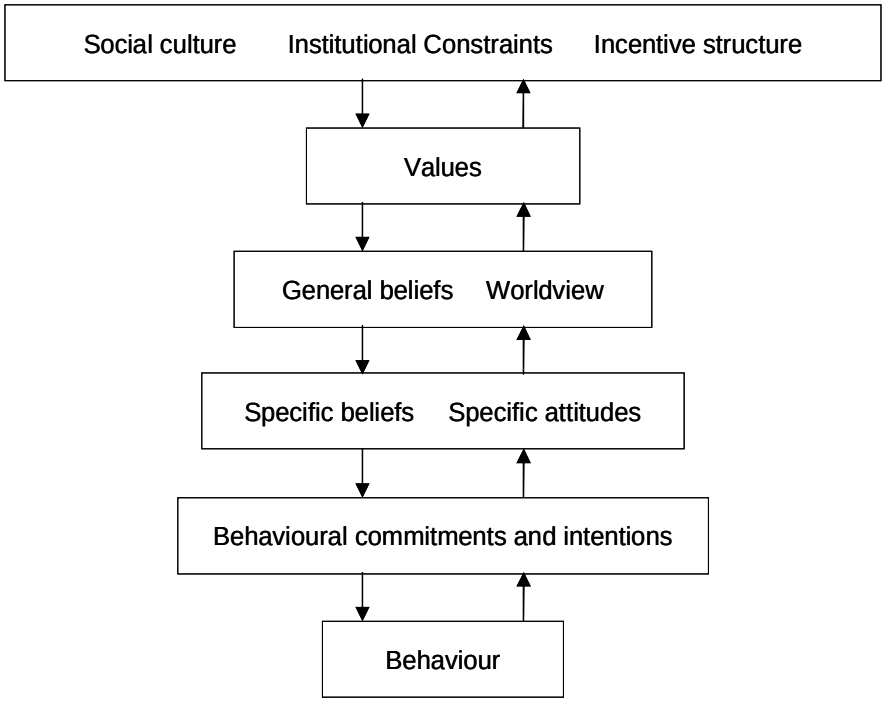
Yet the continued use of categories of farmers to promote innovations and to measure success in terms of the speed of adoption is understandable as it provides a relatively simple framework that allows easy evaluation of "success", arguably too, "it works". Efforts to promote technological change by boosting farmers' self-reliance, challenge the traditional "superiority" of the extension worker/scientists, and redefines their role to that of "helping professional" rather than "expert". Nor is the development of farmers' self-reliance either cheap, easy or fast.

The tension between the two approaches has been heightened since the late 1980s by the essential rejection and cessation of state funding for much tradition farm extension work which has effectively been redefined as a private (cf. public) good (see, Rivera, 1992; 1993). Consequently, the private sector has for the most part been given prime responsibility to promote these technologies and management approaches that have a clear economic benefit to land holders. The promotion of environmental technologies, commonly viewed as generating a public good, has remained largely in the hands of government authorities. In New Zealand at least, there is some evidence that this new reliance on the market to promote technologies geared to boost productivity and profits has been successful (Hall and Scobie, 2006). How best to promote environmental technologies where the return to the land holder may be less evident than the return to the public remains in doubt.

The success of the early model of extension rested on the identification of opinion leaders and the subsequent adoption of an innovation by the rest of the community. The paradigm which has emerged since the 1970s rests on a stronger partnership between farmer/scientists and extension worker but still tends to assume that the farmer recognises the prospect of a clear cash return. This return has commonly been expressed in terms of increased profitability. Farmers have been viewed as profit driven with a primary concern for costs and prices. The promotion of environmental technologies where the return to the individual farmer may be less clear challenges established extension methodologies.[2]

In this context, a better understanding of the linkages between environmental values, environmental attitudes and pro-environmental behaviour may be useful. Work by Stern and a number of collaborators has developed a hierarchical conceptualisation of these interactions (Stern, 1992; Stern and Dietz, 1994; Stern, Dietz, Kalof and Guagnano, 1995). Cary, Webb and Barr (2002) have extended this work in developing a diagrammatic representation of these interactions (Figure 2.1).

Figure 2.1 A framework for environmental concern



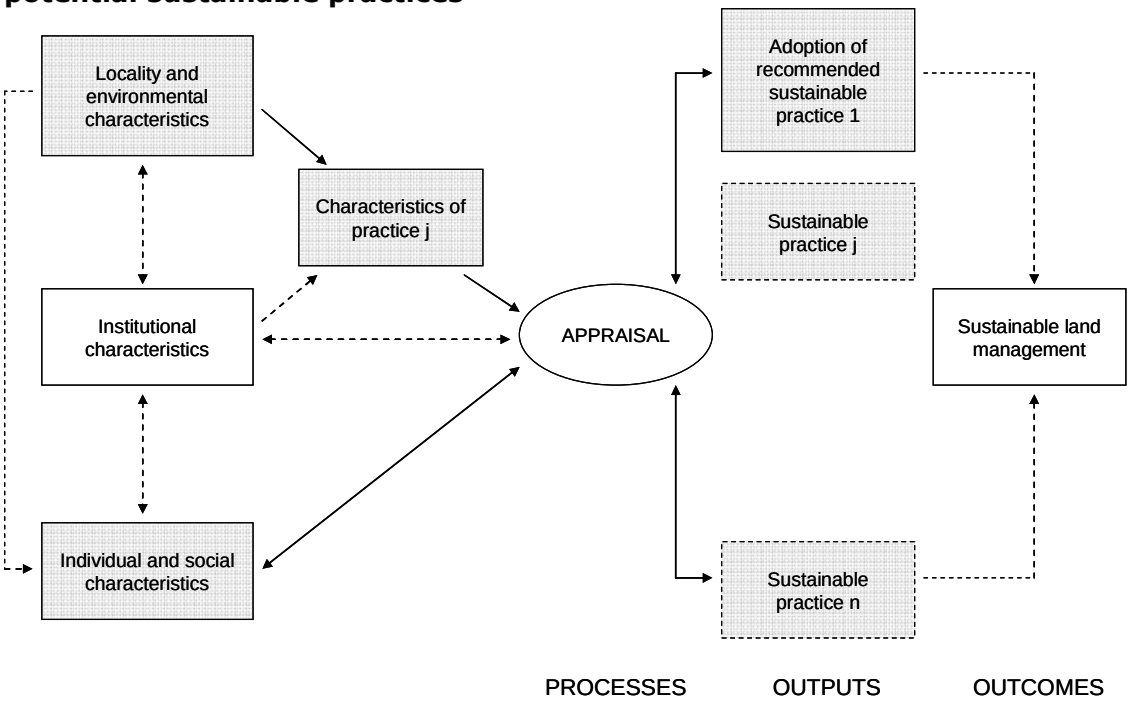
Source: Cary, Webb and Barr (2002)

[2] Cary, Webb and Barr (2002) provide a comprehensive and insightful analysis of technology change with respect to farmers and environmental needs. Their work provided an invaluable resource for this current report and is fully acknowledged.

As expressed in Figure 2.1 the relationships between values, attitudes and behaviour are mediated through the social context within which an individual operates. Within this context, values are conceptualised as a bed-rock of decision-making, formed through early family socialisation but which remain relatively stable in adulthood (Stern and Dietz, 1994). The authors divide beliefs and attitudes between the general and the specific, the former relating to an individual's broader understanding of social processes, the latter being attuned to assessing specific, often novel issues. The split itself is based on the understanding that an individual's response to a specific issue is heavily influenced by their general attitudes or beliefs. The final level of this conceptualisation divides behaviour between commitments and intentions, and the action itself.

Fenton, Macgregor and Cary (2000) have developed a model to describe how a farmer might appraise a sustainable practice and decide either to adopt or reject the new practice (Figure 2.2). The model identifies the importance of the locality and environmental characteristics of the property; institutional factors, which include the regulatory environment, government policies, land ownership arrangements and wider social links (eg voluntary associations); and individual and social characteristics, including age, family structure, education levels and the like. To this extent the model incorporates all those factors customarily addressed within earlier paradigms for extension programmes. However, the model highlights the fact that the process of appraisal involves a series of potentially simultaneous actions leading to adoption or non-adoption. Within this process, the precise weight or importance given to different factors, including trust in government, environmental values, and attitude to the specific practice in question all play an (unknown) part. In effect, appraisal is mediated through a lens made-up of individual, social, institutional and contextual variables all of which interact in multiple ways and are difficult to measure.

Figure 2.2 Model of appraisal of sustainable land management and of potential sustainable practices



Source: adapted from Cary, Webb and Barr (2002)

The model is in effect a complex adaptive system incorporating not only the physical environment but the institutional and social environment within which farmers operate. This system evolves over time as information accumulates. It is designed to respond to uncertainty and geared to improvement rather than optimisation.

Importantly, in contrast to the "traditional" promotion of technological innovations designed to increase land-holders' returns, and which usually provide a relatively quick feedback message to the landholder, sustainable practices more often may generate no quick, measurable return to the adopter, and any direct return to the landholder may be subject to a prolonged time lag. A visible return may be evident from properties where the practice has been longer established. In effect, however, and more importantly, adoption may require farmers to have more trust in those urging adoption, than in more conventional innovation situations.

The characteristics of innovations that have been adopted by farmers highlights those dimensions of sustainable technologies that may encourage or discourage adoption. Cary, Webb and Barr (2002) summarise the work of Rogers (1962; 1971; and 1983) who presented the findings of multiple diffusion studies and identifies a range of important characteristics, including

relative advantage; complexity; compatability; trialability, and the observability of the practice in question.

- Relative advantage is usually expressed in terms of profitability – the financial advantage to the adopter. All the evidence suggests that those sustainable practices that yield the greatest financial return are those most likely to be quickly adopted. Profitability is the best predictor of adoption. Innovations involving a net financial cost are rarely adopted.
- There is no reason to believe that an environmental innovation is any different from any other innovation in generating a differential return related to the specific geographical location concerned. Consequently, the appropriateness and relative advantage of an environmental innovation is likely to have a significant geographical or spatial component.
- All change involves some element of risk. Most farmers modify their efforts to maximise returns in favour of security and quality of life.
- Superficially, what may appear to be a relatively simple change may require substantial alteration to the total farm system and increase the fear (or risk) of failure. Complexity, ease of use and reliability all influence willingness to adopt.
- Adoption of an innovation is commonly subject to its compatibility with existing farm practices and the values the farmer attaches to his existing system, as well as the extent to which an innovation meets wider community or social norms. In other words an innovation is most rapidly adopted when it supports what is accepted as "good farming" or the image of a "good farm".
- Changes which are possible on a small scale are the most readily adopted. Such changes allow farmers to "test" the results from any management change while minimising risk. While such small scale testing is usually possible with a new seed variety or stock management practice, many environmental technologies require a shift that impacts across all of the farm. Such technologies may also require a major capital investment, the returns from which may not be evident for many years or decades.

- Linked to trialability is observablity. Positive visual evidence of the improvements resulting from an innovation are a powerful incentive for adoption.

These characteristics of innovations which have been adopted provide pointers that should be considered in any attempt to explain the challenge of promoting environmental technologies and may throw some light on current findings.

3. METHODOLOGY

3.1 Introduction

The approach adopted had two main components. Firstly, a review of current understanding of how values and attitudes interact to influence land-management practices, particularly with respect to environmental needs and policy goals. This review (Section 2) highlights the broad cultural, family, and social factors which must seriously modify any traditional assumptions that farm households are primarily driven by economic objectives. The review also includes some of the grey literature on land management/environmental management associated with dairying in the Waikato. This work allowed the development of a questionnaire/interview schedule for face-to-face interviews with approximately 40 farm households in the Waikato Region (Appendix II).

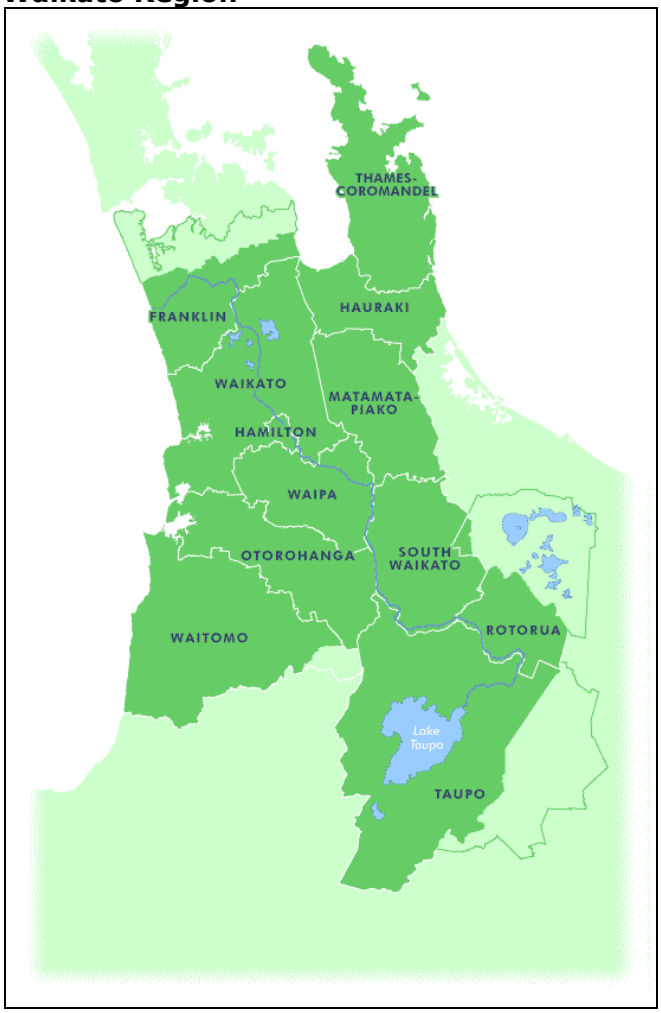
Face-to-face interviews are inevitably labour intensive and time consuming but this proposal was designed (as noted above) as a case-study to generate empirical data that might provide the basis for a subsequent, more extensive, wide ranging study. Initial plans to develop a stratified sample from information provided by Environment Waikato, Fonterra and other dairy groups was stymied by the confidentiality constraints imposed on these organisations. As a result, a random sample (the characteristics of the sample are presented and discussed in Section 4.1) was generated as a sub-contract for this study by AsureQuality New Zealand. A sequence of additional unstructured interviews were also carried out with officials in Environment Waikato, dairy farm industry representatives and representatives of Federated Farmers, to provide further context for this work.

3.2 Waikato: Regional Context

The Waikato region (Figure 3.1), in general, encompasses some of the most diverse landscapes in the country and provides abundant examples of conflict over environmental resources. Although embracing a wide range of diverse agricultural activities, the region is primarily known for its extensive, productive dairy industry. The area has the largest concentration of dairying in New Zealand, generating 50% of the total national production from over 4,000 farms. The Waikato dairy industry has exhibited strong growth since 1990 and cow numbers have increased significantly, from just over 2.4 million to a current total of over 4 million (Tony Petch, Environment Waikato, *pers.com.,* 2007). Average stocking rates are estimated at 3.1 cows per

hectare and the region has the reputation of having some of the most expensive dairying land in the country.

Figure 3.1 The Waikato Region



Source: www.ew.govt.nz

In response to high land values and increasing global demand, recent years have seen a massive intensification of dairy farming mainly through the increased use of external inputs. In particular, Nitrogen use has increased six-fold on Waikato dairy farms since 1992. Sixty-eight percent of Nitrogen entering Waikato waterways comes from dairy farms. At the same time, phosphorous trends have also increased and 84% of samples taken by Environment Waikato now exhibit excessive levels of fertility. In addition, there is substantial evidence of soil degradation, including compaction, and metal accumulation. These problems are commonly summarised in the public mind in terms of water quality issues. The Regional Council and national authorities, with support at least to some extent from industrial groups (eg Fonterra, Clean Stream Accord) are using a range of strategies to ensure a

healthy, successful agricultural industry, and better match environmental practices to public expectations and market needs. These strategies include extension and educational activities, voluntary agreements, financial incentives, market based instruments, and regulation.

The success and productivity record of the Waikato dairy industry rests in some part of the combination of a relatively high, usually reliable rainfall and mild temperatures conducive to good grass growth. However, the perception that the region is naturally well suited for dairying may generate complacency and deflect attention from the extent to which the dairy industry in the region is dependent on sophisticated management practices and substantial purchased inputs.

The vulnerability of the industry to adverse weather events was highlighted over the summer of 2007-2008 when the region was officially declared a drought zone. This was the first ever declaration of drought in the region. This posed huge challenges to farmers, reducing cash flows, putting pressure on feed supplies to maintain cow conditions, and forced many dairy farmers to slaughter stock with consequences for the industry which will extend over several seasons, placing potential pressure on farmers whether to return as quickly as possible to their established practices, or re-think their management approach to adapt to the increased threat of more frequent droughts driven by climate change.

3.3 Survey Design

The questionnaire was broken into six sections and involved a combination of open ended and Likert scale questions (see Appendix I). The latter were designed to gauge the respondent's level of agreement with specific statements using a five stage scale, ranging from no support through to strong support[3]. Section One sought basic statistical information on the size and nature of the farm business. Section Two was designed to explore respondents' values in relation to the environment, from "deep green" to "utilitarian" perspectives The questions also addressed farmers' "world views" as well as their necessariy more pragmatic attitude to their own farm. Section Three extended this argument to examine attitudes to environmental change employing the same combination of open ended and Likert scale response

[3] These five stages were given a numerical value (1 for low levels of agreement, through to 5 for strong agreement) to provide data for analysis. These data are presented in Section 4.

questions. The subsequent section explored farmers' understanding of management practices as a means to modify climate change. Farmer decision making was contextualised in Section Five using the specific circumstances of the 2008 drought as a frame of reference. Section Six, the final section, rounded off the interview by obtaining bibliographic information and by encouraging farmers to discuss their perspectives on the longer term environmental challenges facing their farm.

4. RESULTS

4.1 Sample Summary

Table 4.1 highlights some of the key characteristics of those farms included in the sample. Although randomly selected, the average farm size of respondents, at 215 hectares, was almost double that of the Waikato average in 2007 and the average herd size, at 643 cows, compares to an average size in the Waikato of 326 (White and Wilson, 2007). As the table indicates, relatively few respondents were in the younger age group and years of farm experience, was subsequently high.

Table 4.1 Sample Farms

Index	Average[1]	Median[1]	Range[1]
Age	50	49	25-73
Years Farming	30	28	10-52
Milking platform (ha)	215	136	65 - 1275
Cows milked	643	450	120 - 3950[2]
Cows per ha	209	3.0	1.1 – 5.6[2]
Milk solids production	205,000	151,000	35,000 – 925,000
Milk solids per cow	340	335	234 – 545
Milk solids per ha	1002	1006	324 - 2137

Note[1]: one dry stock farm is omitted
Note[2]: data from a farm with high levels of feed supplementation
Not shown in the table, is the fact that two of the farms surveyed were organic.

4.2 Farmers' values and priorities regarding land management

The bio-physical environment in which we live, work or relax is most acutely noticed on first experience, and unless a conscious effort is made to reconnect, features of the bio-physical environment commonly become inextricably intertwined in the fudge of everyday life. With farmers whose daily life and work focuses on one and the same biophysical environment this problem can be particularly acute. On the one hand, farmers may find it deeply satisfying and pleasurable to experience the results of their work, whether a major planting, retirement or environmental protection programme. However, equally, farmers whose families have been on a property for several generations may find it difficult to observe incremental

environmental changes and the consequential impact of their actions across the landscape.

The farmers surveyed differed greatly in their ability to articulate their description of the environmental quality of their farm. However, the overall message was up-beat. Farmers described the environmental quality of their farm in terms such as *"reasonable", "good", "very good", "excellent", "sustainable"* and qualified these with comment around the actions they have taken or changes they have made to their farm operations to meet environmental needs.

Only two farmers offered objective indicators to support their views. One justified his self-assessment as "excellent" by the fact that he had won Nutrient Management and Waterways Protection awards in the Ballance Environment Awards programme. The other, whose son is a water quality consultant, supported his "excellent" self-assesment on the basis of the oversight and scientific feedback his son provides.

Most farmers (93%) assessed the environmental quality of their farm as at least equal to, or better, than the average dairy farm in the Waikato. One farmer who assessed his position to be "slightly behind", explained this as a consequence of the impact of the previous owner, but provided specific plans, now being actioned, to improve the situation. Only one farmer specifically noted that he "didn't really know how others operate", but thought his farm might be "a shade above average". In effect, where environmental problems were acknowledged they were "other people's business".

Many respondents acknowledged that the intensity of modern dairying tends to create more environmental issues than for example, sheep and beef. However, several preferred a comparison with cropping, which they judged to have a greater negative impact on the environment. Many farmers noted the difficulty of comparing any one farm system across different landscapes and soils. Several expressed concern at the apparent indifference shown by dry stock farmers in allowing cattle direct access to streams and waterways and the consequences for water quality, and compared this to the demands on them to fence stock out of permanent water courses.

Perhaps this defensiveness on the part of dairy farmers is an inevitable response to the adverse publicity which has highlighted "dirty dairying". An inevitable confusion appears to have arisen over popular concern at the

nature of modern, intensive dairy farming and farmers' perception that dairying *per se* is under attack rather than a specific set of management techniques or technologies applied within a given system of production or a particular location.

Opinion among farm respondents on how the quality of the New Zealand agricultural environment compares with to that elsewhere in the world varied widely. A small number of respondents drew on their personal experience overseas, and argued that given the lack of subsidies and financial incentives available to farmers in this country, New Zealand is performing well. However, such an interpretation, when the profitability of dairying is currently so high is difficult to support. To non-farmers it smacks more of an established myth that farmers are solely driven by costs and that the adoption of land management strategies more attuned to environmental needs is dependent on higher returns. Lacking any internationally accepted yardstick to compare their performance encouraged most respondents to describe their own farm, and farming in the Waikato as a whole, in a highly positive light.

When the farmers were questioned in an attempt to understand how they value the environment, the responses evidenced a high level of consistency across all categories. Thus, when asked to consider why the agricultural environment should be protected, the majority of farmers agreed that *"It is of value in its own right – not just for pleasure/value to me"* (average Likert rating 4.41). At the same time, similar ratings were obtained in response to the statement that *"It is beautiful – something to be appreciated and enjoyed"* (4.35), and to the view that *"It is useful – meets practical needs"* (4.19). This is interesting. It is consistent with the point raised earlier that farmers both live and work in the one location. It is consistent too with the New Zealand farmer's traditional self-perception that they are stewards of the land. However, as subsequent investigation revealed this consistency hides a tension between many farmers' values and behaviour and attitudes to climate change.

A somewhat different set of responses were generated to farmers responsibility for environmental quality. On the one hand, there was a general perception that their farm practices did not have a significant impact on environmental quality (average Likert scale rating 3.48). However, they

expressed a greater responsibility for the quality of the environment in a more generic sense (average Likert scale rating 4.19). This difference in perception may be due to the inherent belief amongst respondents that the environmental quality on their own farm is better than average and that consequently any adverse effects resulting from their farm practices are minimal. In a more abstract sense, the difference suggests a disconnect between farmers' environmental values and their beliefs as to the effect of their practices on the environment.

Bad press, which exaggerates the severity of environmental problems is considered by many farmers to unfairly damage their image. While several farmers acknowledged that there are indeed examples of bad performance, and some have first hand experience of this, the overwhelming view was that there is a great need to better publicise examples of good performance and positive farmer action. Understandably, most farmers don't like bad publicity. Projections of a poor image of farming in the media is recognised by farmers as damaging rural-urban relations. Somewhat defensively the solution is viewed by farmers more as a need to pressure the media to change rather than accept and address, where appropriate, the cause of the negative coverage. While some farmers concede that improved environmental management is required, they would prefer (and believe) this is better achieved through encouragement and good will rather than by negative branding and legal sanction.

4.3 Farmers' attitudes to climate change

Efforts to discuss climate change teased out a wide range of opinions, attitudes, and beliefs. Most respondents, directly impacted by short-term weather events, and well aware of government initiatives to mitigate livestock-induced green house gas emissions, are aware of climate change, and able to describe specific elements of the phenomenon. However, the complexity of climate change, its multiple interactions and its myriad of contributing factors generate some difficulty for farmers in separating locationally specific environmental problems form issues associated with long-term climate change. Equally, while there was a general acceptance of climate change as an abstract concept, many farmers' remained unconvinced that their farm practices were a contributory factor. As a result, many respondents did not recognise that any change they made to their management strategies could lessen the impact of climate change. The

management changes that many farmers have made in response to the drought of 2008 were consequently viewed as completely independent of any adaptation in the face of climate change.

For the most part, those farmers best able to articulate their understanding of climate change were also those who expressed most concern about its potential impact on their business. This could suggest that greater knowledge and understanding of climate change could promote a greater appreciation of the potential impact and consequences of climate change for farming. Many farmers did indeed identify a range of actions they had taken to address the potential threats to their farm business. These include destocking, reducing urea use, maintaining greater feed stock for dry periods, using nitrification inhibitors, planting trees, ceasing burning balage wrap, recycling, using council landfill sites in preference to on-farm disposal, and purchase of additional land to enable off-farm wintering away from a sensitive catchment.

However, these actions were for the most part driven by short-term environmental needs. Most farmers remain uncertain as to their capacity to significantly affect the long-term consequences of climate change. Consequently, many moves by farmers to address environmental issues appear to remain narrowly "issues based" rather than part of a longer-term, comprehensive strategy to boost resilience. For many farmers climate change remains too big and complex an issue for them to "get their heads around".

Perhaps understandably in a farm sector that is presented as a major success story in conventional economic terms, and a key player in global markets, most respondents viewed processors and suppliers, and global market pressures as the most powerful forces in forcing them to recognise the need for better environmental management (average Likert ratings of 3.8 and 3.8 respectively). Equally, Fonterra, and industry aligned groups such as Dexcel, and DairyNZ were all identified as key sources of information on environmental issues and improved management techniques.

While most respondents acknowledged global market pressures as relayed through markets and suppliers as key drivers of management change, national political pressures and local social responsibilities were described as of much less importance in driving environmental change. (average Likert scale ranking of 2.5). In effect, while open to arguments that market returns required environmental compliance, the rationale that the local community,

Council or others had valid environmental demands was rarely accepted. While those farmers that have made major strides to meet environmental needs provide potential role models, there remains a massive educational need if dairy farmers are to appreciate that they are subject not only to global market demands but to national and local community values, and that they must recognise that market signals (prices) are themselves indicators of changing community understanding and shifting values.

4.4 Action for Climate Change

As noted above, most farmers had difficulty separating any response to long-term climate change for their response to site-specific environmental needs. Most farmers could identify a number of different actions they had taken to reduce the environmental impact of their dairy enterprise. Thirty-two percent of respondents identified four or more strategies they had implemented (Table 4.2).

Table 4.2 Number of strategies implemented

Number of Strategies Implemented	Farms	Proportion
1	4	13%
2	7	23%
3	10	32%
4 or more	10	32%

The strategies identified included:

- Improvements in effluent storage and disposal
- Measures to reduce nitrification/nutrification
- Establishing wetlands or woodland planting.
- Improving energy and resource efficiency
- Protecting waterways and watercourses

Despite the apparently extensive adoption of better environmental practices, most farmers claimed that they were unconvinced of the beneficial effect of their actions. In effect, they appear to be responding largely to "pressure" – whether legislative or a consequence of market demand (price) – but remain largely unconvinced of the scientific evidence or public support for a stronger commitment to the environment.

However, although some farmers argued the lack of reliability, confidence and robustness of the scientific evidence underpinning recommended

environmental technologies, the most frequently identified barriers to the adoption of new practices were cost and time. However, a minority bluntly stated that *"cost is not an excuse any more as returns are too good to be a barrier"*, and argued that there were no barriers. However, the relatively high cost of planting native species compared to *Pinus radiata* was mentioned, the latter being subsidised by Regional Council assistance. Underpinning all this are issues of trust – who to believe – thus some farmers expressed concern at a possible conflict of interest between the extension/advisory role and the regulatory/enforcement role of the Regional Council while apparently retaining a trust in market signals, at least as long as these are backed by hard cash.

It comes as little surprise that respondents favoured economic incentives as their preferred mechanism to promote more effective environmental management practices (Table 4.3). Nor is it surprising that regulation, whether by central or regional government ranks low as a preferred technique (average Likert scale ratings of 3.4 and 3.4 respectively). Yet, penalising those who do not meet required environmental standards is also strongly supported, perhaps a reflection of the extent to which most respondents remain confident that they are managing their land in an appropriate way, even if others are not.

Table 4.3 Farmers Preferred Methods for Incentivisation

Drivers	Preference Rating
Economic incentives from buyers	4.0
Economic punishment from buyers	3.4
Regulatory interventions by regional councils	3.4
Economic penalties from regional councils	3.9
Regulatory interventions by central government	3.4
Taxation of polluting activities	3.5

4.5 Situational factors in farmers' decision-making

Environmental Hazards – Drought

Some farmers (17%) believe that there are more extreme climatic events occurring and that 1-in-100 year events now seem to be more common place. The 2008 drought has encouraged many farmers to take steps to reduce the effect of hazardous events. Strategies adopted include earlier calving and

bringing forward peak production, reducing stock numbers, securing or growing additional supplement, holding larger feed stocks, and more active monitoring of feed stock levels. Many farmers are also considering the need for irrigation. However, while many could specify actions they have taken to reduce their vulnerability to future adverse events and in response to the 2008 drought, they rejected the idea that the drought was other than a one-off or that their management changes were part of a long-term adaptation to climate change.

It remains unclear the extent to which these short-term strategies will become an integral part of farmers' long-term management plans. If more adverse events do not occur over the next few years and farmers persist in rejecting ideas of climate change a reversal to established practices designed to maximise short-term economic gains seems likely but it is hard to conclude otherwise than that the responses to the drought of 2008, unless reinforced by more frequent droughts, will soon be dropped in favour of short term profitability.

The impact of the drought as a driver for change was minimised by the high payout for milk during the 2008 season. This again confirms the view that change is more easily secured in hard times that in good. Certainly, those interviewed agreed that the financial impact of the drought had been high. The result was expressed in reduced stock numbers, poor cow condition, increased expense to rebuilding feed stocks and deferred payout. The effects will continue to be felt in subsequent seasons, but if milk prices remain high costs imposed will be relatively easily absorbed.

Stress as a result of the drought compounded its impact on farm families. Because the farm business is also the farm home, there was no respite from the visual and emotional impact of the drought. Parched pastures, stock that daily required feeding and the visible evidence of lowered production levels and the inevitably increased costs of operation imposed a toll. For the most part this toll was expressed as financial stress, and income losses of often over 20% were repeatedly quoted. However, again high returns from milk were recognised as providing a substantial cushion. Work loads (often for farm women) were increased, but only one respondent noted the need to cut-back planned expenditure (a family holiday) while others, because of the

stress of the drought, and backed by a good income, made plans for a holiday to compensate for the stresses suffered.

However, the repeated message was that as long as the 2008 drought remains a "one-off" its impact may be slight. As several farmers noted, if another drought were to occur in the next few years significant management/land use changes would have to be explored and they would be more inclined to believe in climate change. One farmer, a recent conversion to dairying, even stated that a further drought would encourage a switch to dry stock farming.

4.6 Conclusion

The results presented above, raise a number of questions regarding traditional conceptualisations of farmers' environmental decision making. In particular, they suggest a series of inconsistencies and disconnections relating to farmers' stated values, attitudes and behaviours that must be explained. These contestations may be related to earlier ideas found in the literature and may provide guidelines for future research and policy development.

5. MODELLING FARMER DECISION-MAKING

5.1 Introduction

At face value, the findings presented in the previous section are inconsistent, even confusing. Equally, the evidence presented is demonstrably limited, although there is no reason to suppose that the findings might not be replicated elsewhere, since the processes of information, decision and action are almost universal in modern agricultural economies. The remainder of this section attempts to trace a pathway through the empirical findings using the theoretical framework established in Section 2. This framework is then used to identify both policy implications and longer term research needs.

5.2 Reassessing a model of environmental concern

The hierarchical model presented earlier (Figure 2.2) representing the interaction of values, attitudes and behaviours for environmental decision making seems at odds with the empirical evidence. Specifically, while the model implies a unidirectional sequence from values, through attitudes to behaviours, the evidence presented here suggests a much more complex, iterative process in which the ongoing processes of knowledge accumulation may significantly modify subsequent decisions.

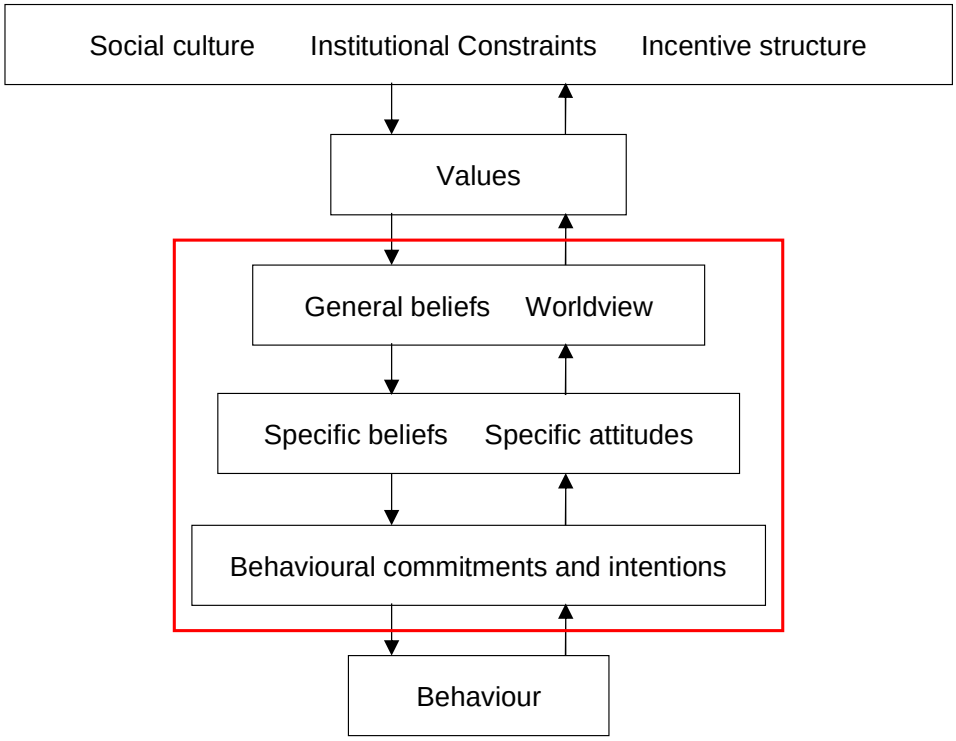
The key findings of the research may be framed as four paradoxes:

- Waikato dairy farmers feel responsible for the environment and consider themselves good environmental stewards, but are unwilling to accept that their practices have environmental implications.
- Respondents were sceptical as to the importance of climate change and of their capacity as land users to influence such change, but acknowledged the importance of the management changes they had made to lessen the impact of future droughts.
- Farmers valued the environment more highly for its own value, both aesthetically and as a moral "good", than as a utilitarian concept. However, they explain their decision making solely on the basis of its utilitarian worth.
- Farmers view themselves as rational problem-solvers. However, this rationality is narrowly defined in economic terms. They remain unwilling to accept or be influenced by other "expertise" whether in the form of scientific data or regional/national policies.

These paradoxes highlights the fact that a hierarchical model of environmental concern links values, attitudes and behaviours, these linkages are rarely straightforward. Consequently, while the hierarchical model has an appeal based on its inherent persuasive simplicity, its explanatory power is seriously constrained by its neglect of the temporal component in any process of learning and the inherent disparities evident among individuals (and households) within any specific population.

The paradoxes identified suggest that while farmers' values and attitudes and behaviours are aligned in response to site-specific, visible and immediate, environmental problems (see Section 4.4), this is not the case when they are confronted with the long-term impacts of climate change. The concept of climate change remains largely outside farmers' terms of reference and subject to the high level of scepticism they express both towards science and government authorities. As a result, the relationship between values, attitudes and behaviours appears disjointed and the formation of attitudes and beliefs becomes a site of contestation often independent from the values which underpin them, and the behaviours which result from them (Figure 5.1).

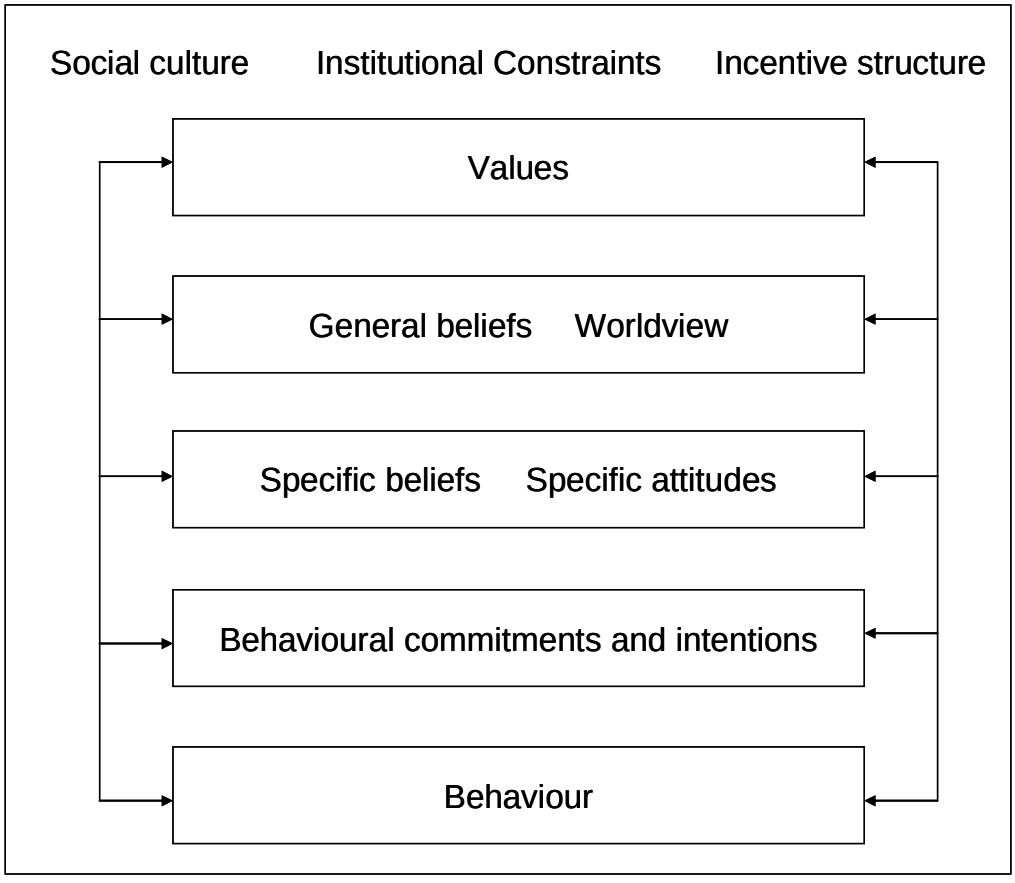
Figure 5.1 Questioning a framework for environmental concern



Source: after Cary, Webb and Barr (2002)

The linear structure of the original diagram minimises the inherent temporal dimension of technological change and the need to recognise that acceptance of sustainability takes time. The farmers' response to relatively simple, site specific issues is in line not only with their own values, but with the values and ethos of existing community needs and institutional arrangements. This alignment is less evident in support of the necessary paradigm shift required if NZ is to adapt to climate change. In effect, while it is relatively easy for farmers to address current environmental problems as some sort of "technological fix" within their current frame of reference, longer-term adaptation to climate change will require a more fundamental rethink of agriculture and its role in the national psyche. This implies and requires change within the broader New Zealand community and in the structure of institutional arrangements, as well as among farmers themselves. Such a change will also require a targeting of effort on the public at large as it is at that level that the political pressure necessary to generate a paradigm shift must occur.

Figure 5.2 A "new" model of environmental concern



Source: after Cary, Webb and Barr (2002)

Figure 5.2 conceptualises such a paradigm shift. It emphasises the iterative nature and feedback loops inherent in the relationship between values and behaviour. In particular, however, it expresses the importance of situating the decision-making process within the context of social and cultural structures, institutional arrangements and policy and economic incentives.

5.3 Conclusions and needs

The evidence presented highlights that farmers can not reasonably be expected to take the risks and respond effectively with investment and the major management shifts required in response to concepts in which they have not fully bought-in. At the same time, there is evidence that farmers are willing to change where presented with evidence or arguments in which they believe. Farmers' response to the many immediate environmental problems which they face still may not be as rapid as the broader community may wish but the range of strategies used by the farm industry, industrial/professional groups, and local and central government do appear to be working. Even fiscal sanctions on those who do not respond appear to have stronger farmer support than one might expect.

This does not obviate the need for more radical long-term change. Unless this is achieved with a shift in farmers' values and the better alignment of these values with community needs, change will become increasingly dependent on litigious action with its associated costs and social stress. As highlighted here, farmers' increasingly appear to see themselves as part of a beleaguered minority and closely defines itself as an occupational group that rather than as members of a community that includes other rural residents, or indeed the urban population. Consequently, environmentalism is still perceived as an external, antagonistic force promoted by uncertain science and a politically driven legislative agenda. There is an urgent need for reconciliation.

As explained, there is ground for qualified optimism over the moves in place to address the key site-specific environmental issues associated with modern farming practices. Most such issues are amenable to some technological mediation or solution. This does not negate the need for further research on the effectiveness of existing mechanisms to promote and facilitate more rapid change. However, as our understanding of environmental issues increases and as public expectations regarding environmental quality, environmental health and social responsibility also increase, priorities shift. Whereas

research to date has focused on relatively simple acute environmental concerns the new research agenda is now required to address the more complex long-term and chronic problems associated with climate change that demand an urgent policy response.

As argued these priorities are directed at the general population and designed to address the key contextual components of social and cultural structures, institutional arrangements, and policy and economic incentives.

Social and Cultural Structures

- The current relationship between farmers and the broader community is highly confrontational and divisive and positions farmers as a beleaguered minority. Addressing this requires a better understanding of farmers sense of community, both as part of an immediate locality and as part of a broader national community. It also requires a better appreciation of the "hollowing out" of rural communities and the implications of community decline.

Institutional Arrangements

- Farmers are responding positively to advice on the need for better environmental management from their industry but such advice is understood and defined in narrow economic terms. There is little evidence of a similar level of institutional support to address domestic needs or to respond to scientific evidence of continued environmental degradation. Related to this is an absence of trust in information sources from institutions other than farmers' own industrial and professional groups. Securing sustainability requires a better understanding of institutional arrangements to better align these arrangements in industry, government and science with farmers' and wider community needs.

Policy and Economic Incentives

- The political acceptance of sustainability has not been translated into an acceptance that environmental needs as an integral part of good business. Environmental problems continue to be viewed by farmers and others as externalities. This view is reinforced by "environmentalists" who continue to champion concern for consequences of mis-management rather than for the drivers of environmental change. It is equally supported by moves to identify the benefits of good environmental

practice solely as a public good, obviating much individual responsibility. There is an urgent need for further research to explore the impact of existing economic incentives and policy measures (including financial other legal penalties) on behavioural change and environmental understanding.

The achievements that have been made to improve agricultural land management based on traditional lines of inquiry in agricultural and environmental research are substantial. More research is urgently needed. However, as this report has argued, long-term success is now dependent on the development of a new research agenda based on our increased understanding of those factors which determine farmers' environmental decision making.

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APPENDICES

Appendix I: Farm Questionnaire

Environmental Behaviour University of Auckland

Section One: Farm Information

1. How would you describe your farming operation?

2. What is your role on the farm? _____

3. When was this farm established as a dairy farm? _____

4. What is the size of your farm?

a Total Hectares/acres

b Head of milking cows

c Annual production (kg of milk solids)

d Land-use other than dairy cows (Hectares/%farm)

5. Do you use, or have access to, other land for grazing, drying-off cattle? If so, please explain.

6. How many people work on the farm, including yourself?:

a Full-time

b Part-time

c Family

d Contracting

7. Is this farm:

Owner-occupied ☐ Corporation ☐

Family trust ☐ Other: _____

8. Is the farm certified by any of the following organisations?

AgriQuality New Zealand Ltd. ☐ Bio-Gro New Zealand Inc. ☐

Biodynamic Farming and Gardening Association (Demeter New Zealand) ☐

Other: _____

Section Two: Land management values

9. How would you describe the environmental quality of your farm?

10. How do you think the environmental quality of your farm compares to other dairy farms in the Waikato?

11. How do you think the environmental quality of dairy farms stacks up against other farm types in New Zealand?

12. How do you think the environmental quality of New Zealand agriculture compares to agricultural land use in other developed countries?

13. To what extent does **each** of the following statements describe your views as to why the environment should be protected:

	Strongly disagree		Somewhat agree		Strongly Agree
It is useful – meets practical needs	☐	☐	☐	☐	☐
It is beautiful – something to be appreciated and enjoyed	☐	☐	☐	☐	☐
It is of value in its own right – not just for pleasure/value to me	☐	☐	☐	☐	☐

14. To what extent do you feel your farm practices influence environmental quality?

No influence		Some influence		Strong influence
☐	☐	☐	☐	☐

15. To what extent do you as a farmer feel responsible for the quality of the environment?

Not responsible		Somewhat responsible		Very responsible
☐	☐	☐	☐	☐

16. Do you believe that environmental problems are exaggerated? Please explain.

17. Are you a member of any farm or land management group (eg Possum control, Landcare, etc)?

Section Three: Attitudes to Environmental Change

18. What do you understand by the term climate change?

19. How concerned are you about the impact of environmental change/climate change on your business?

Unconcerned		Somewhat concerned		Very Concerned
☐	☐	☐	☐	☐

20. How is the current popular debate on environmental change/climate change impacting on how you farm?

21. To what extent do you believe environmental concerns are an issue for farmers due to:

	Little influence		Some influence		Strong influence
Local social pressures	☐	☐	☐	☐	☐
National political pressures	☐	☐	☐	☐	☐
Global market pressures	☐	☐	☐	☐	☐
Processor/supplier driven pressures	☐	☐	☐	☐	☐

Section Four: Action for Climate Change

22. Do you believe that changes to your farming practices could reduce the impact of dairying on the environment? Please explain?

23. Nutrient pollution is a key problem associated with dairy farming. How many different management strategies are you aware of to address this issue, and how have you implemented them on your farm?:

24. Over the past 15 years, have you taken any action to reduce the environmental impact of your farm operation? Please explain.

25. What plans do you have for the next 15 years?

26. What are the key barriers to your adoption of more environmentally sensitive management practices:

27. What incentives would best encourage you to adopt new environmental management practices?

28. To what extent would the following drivers alter your farm practices in relation to the environment?

	Little impact		Some impact		Strong impact
Economic incentives from buyers	☐	☐	☐	☐	☐
Economic punishment from buyers	☐	☐	☐	☐	☐
Regulatory interventions by regional councils	☐	☐	☐	☐	☐
Economic penalties from regional council	☐	☐	☐	☐	☐
Regulatory interventions by central government	☐	☐	☐	☐	☐
Taxation of polluting activities	☐	☐	☐	☐	☐

Section Five: Environmental hazards - Drought

29. Has the drought changed your attitude to your farm and the environment? Please explain.

30. Has the drought changed your attitude in respect to long-term climate change? Please explain.

31. How has the recent drought impacted on your farm/farm household?

32. How has the drought influenced your planning to reduce the impact of adverse weather events on your farm? Please explain.

33. What help and information have you sought/received to address the impact of the drought?

Section Six: Biographical Information

Age: _____

Gender: Male ☐ Female ☐

Which ethnic group do you belong to? (Circle the option or options that apply)

New Zealand European ☐

Maori ☐

Other (please state): ☐

_____

What is your highest level of formal education?

No Formal Education	☐	University degree/diploma	☐
High School Qualification	☐	Advanced degree	☐
Non-University degree/diploma	☐	Other	☐

How many years have you been involved in farming? _____

Have previous generations of your family been farmers? _____

How many of your family live on the farm?

Spouse/Partner	_____	Children	_____
Parents	_____	Other	_____

Discussion Question

How do you see your farm in ten years time? What problems do you think you will have to address?